Introduction to WHO Recommendations on Wheat and Maize Flour Fortification

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WHO FAO Guidelines on Food Fortification with Micronutrients

- Resource for governments and agencies implementing or considering food fortification
- Source of information for scientists, technologists and the food industry.
- General principles for effective fortification programs
Flour Fortification with Micronutrients

- Fortification of staple foods (i.e. wheat flour) can improve the nutritional status of a large proportion of the population,
  - Requires no changes in dietary patterns
  - Requires no individual decision for compliance

- Worldwide, over 600 million metric tons of wheat and maize flours are milled annually by commercial roller mills

- When appropriately implemented, is effective, simple, and inexpensive strategy for supplying vitamins and minerals to the diets
Statement Development Process

- Statement prepared by the core group led by
  - WHO’s Department of Nutrition for Health and Development in close collaboration with partners
  - The core group evaluated the commissioned scientific reviews prepared by expert working groups for FFI Technical Meeting
  - Approved by WHO Guideline Review Committee in interim period year 2008
  - These recommendations remain valid until December 2010
  - WHO headquarters in Geneva will initiate a review following formal WHO Handbook for Guideline Development procedures in 2010
WHO Recommendations

- Provides guidance on national fortification of wheat and maize flours
- Milled in industrial roller mills (i.e. ≥ 20 metric tons (MT)/day milling capacity)
- Focuses on key nutrients
  - iron
  - folic acid
  - zinc
  - vitamin B₁₂
  - vitamin A
Wheat and Maize Flour Fortification

- Improve iron status among consumers if a sufficient level of bio-available forms of iron is added
- Increase folic acid intake by women and reduces NTDs (folic acid may also have additional public health benefits)
- Could be a feasible approach to improve vitamin B12 status of populations
- Can increase vitamin A intake and improve status
- Improve zinc status among consumers if a sufficient level of zinc is added
Considerations for determining levels of vitamins and minerals to add to flour

- Estimate the per capita consumption of nationally produced and imported flour milled by industrial roller mills.

- Avoid risk of human exposure to excess levels of vitamins and minerals caused by very high consumption of fortified flour products.

- Consider potential sensory and physical effects of added nutrients on flour and flour products.

- Understand that there is much less experience in fortifying maize flours than wheat flours.

- Consider the cost implications of the fortificant premix formulation.
Four Levels of Flour Consumption

- Based on distribution of per capita flour consumption across a number of countries using
  - Food Balance Sheet data from the Food and Agriculture Organization (FAO)
  - World Bank supported Household Income and Expenditure Survey (HIES)
Estimated percentile distributions of per capita wheat flour availability (g/day) from the Household Income Expenditure Surveys for countries stratified by ranges of per capita wheat flour availability

<table>
<thead>
<tr>
<th>Percentile of Wheat Flour Availability</th>
<th>Ranges of Daily Per Capita Availability of Wheat Flour (g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th</td>
<td>&lt;75  75-149  150-300  &gt;300&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>50&lt;sup&gt;th&lt;/sup&gt;</td>
<td>7.5  15    30   60</td>
</tr>
<tr>
<td>95&lt;sup&gt;th&lt;/sup&gt;</td>
<td>50   100   200  400</td>
</tr>
<tr>
<td></td>
<td>150  300   600  800</td>
</tr>
</tbody>
</table>

Few countries have per capita consumption of >300 grams per day.  

<sup>1</sup>
Recommendations on Wheat and Maize Flour Fortification Meeting Report: Interim Consensus Statement

Available in UN languages
- English
- Russian
- Chinese
- Spanish
- French
- Arabic

Suggested citation
Recommendations on Wheat and Maize Flour Fortification
Meeting Report: Interim Consensus Statement

This joint statement reflects the position of:

• World Health Organization (WHO)

• Food and Agriculture Organization of the United Nations (FAO)

• The United Nations Children’s Fund (UNICEF)

• Global Alliance for Improved Nutrition (GAIN)

• The Micronutrient Initiative (MI) and

• Flour Fortification Initiative (above+ other partners)
Wheat and maize flour fortification

- Is a preventive food-based approach to improve micronutrient status of populations over time
- Can be integrated with other interventions in the efforts to reduce vitamin and mineral deficiencies
- Should be considered when industrially produced flour is regularly consumed by large population groups
- Most effective if mandated at the national level
Nutrients to add: decisions

- Nutritional needs and deficiencies of the population
- Usual consumption profile of “fortifiable” flour
- Sensory and physical effects of the fortificant nutrients on flour and flour products
- Fortification of other food vehicles
- Consumption of vitamin and mineral supplements
- Costs
Flour Fortification Programs

- Should include appropriate Quality Assurance and Quality Control (QA/QC) systems at mills
- Regulatory and public health monitoring of the nutrient content of fortified foods
- Assessment of the nutritional/health impacts of the fortification strategies.
Average levels of some nutrients to consider adding to fortified wheat flour

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Flour Extraction Rate</th>
<th>Compound</th>
<th>Level of nutrient to be added in parts per million (ppm) by estimated average per capita wheat flour availability (g/day)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>&lt;75²</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>NR²</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>Vitamin B₁₂</td>
<td>Low or High</td>
<td>Cyanocobalamin</td>
<td>0.04</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>Low or High</td>
<td>Vitamin A Palmitate</td>
<td>5.9</td>
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<tr>
<td>Zinc³</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>

*based on extraction, fortificant compound, and estimated per capita flour availability
Acknowledgements

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The Government of Luxembourg

Technical support

United Nations Food and Agriculture Organization (FAO)

United Nations Children's Fund (UNICEF)

Centers for Disease Control and Prevention (CDC)

The Micronutrient Initiative (MI)

The Global Alliance for Improved Nutrition (GAIN)

Flour Fortification Initiative (FFI)