Mandatory Fortification
With Folic Acid

Presented by Scott J. Montgomery
Food Fortification Initiative Director
9 November 2017
What is fortification?

Adding vitamins and minerals during the milling process to produce more nutritious foods.
FFI focuses on industrially milled wheat flour, maize flour, and rice

Industrial mill

Village-type chakki mill

Bühler photo

India photo by David McKee
1996–1998: U.S. and Colombia mandate adding folic acid to grains; Oman reaches national coverage
2017: 81 countries require folic acid in industrially milled wheat flour, maize flour and/or rice.
Benefits of Mandatory Fortification
Legislation leads to high coverage

82% Average percent of industrially milled wheat flour that is fortified in countries with legislation

15% Average percent of industrially milled wheat flour that is fortified in countries without legislation

Food Fortification Initiative database
Nutrient levels increasing in Cameroon

### Among Women in Urban Areas

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Before Fortification</th>
<th>After Fortification</th>
<th>Percent Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma folate* (nmol/L)</td>
<td>15</td>
<td>47</td>
<td>213%</td>
</tr>
<tr>
<td>Plasma B12 (pmol/L)</td>
<td>461</td>
<td>671</td>
<td>46%</td>
</tr>
<tr>
<td>Plasma zinc (μg/dL)</td>
<td>55</td>
<td>65</td>
<td>18%</td>
</tr>
<tr>
<td>Ferritin (μg/L)</td>
<td>37</td>
<td>47</td>
<td>27%</td>
</tr>
</tbody>
</table>

*Plasma/serum folate is a short-term measure and RBC folate concentration is a long-term measure of folate status and is the biomarker used for NTD risk. Correlation between plasma/serum folate concentration and RBC folate concentration is unknown.

Iron, Zinc, Folate, and Vitamin B-12 Status Increased among Women and Children in Yaound’e and Douala, Cameroon, 1 Year after Introducing Fortified Wheat Flour

Folate and other nutrient deficiencies decreasing in Fiji

Percent of Women Age 15–45 Deficient Before and After Flour Fortification, Fiji, N=869

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Percent Deficient Before, 2004</th>
<th>Percent Deficient After, 2010</th>
<th>Cut offs used for deficiency in women¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum folate</td>
<td>8</td>
<td>1</td>
<td>Serum folate &lt;10 nmol/L</td>
</tr>
<tr>
<td>Iron</td>
<td>23</td>
<td>8</td>
<td>Serum ferritin &lt;15 mg/L</td>
</tr>
<tr>
<td>Zinc</td>
<td>39</td>
<td>0</td>
<td>Serum zinc &lt;10.1 mmol/L</td>
</tr>
</tbody>
</table>

In addition, anemia prevalence among this group dropped from 40% to 28%.

Anemia defined as hemoglobin <12g/dL

Only 16.1% of the women had taken nutrient supplements in the six months prior to the survey

National Food and Nutrition Centre 2010 ffinetwork.org/monitor/Documents/Fiji.pdf

¹ World Health Organization apps.who.int/iris/bitstream/10665/161988/1/9789241549042_eng.pdf
Legislation equalizes costs for millers

*Premix cost to fortify 1 metric ton*

**Wheat Flour:**
Average of US$ 3 to fortify with iron, folic acid, and other B vitamins

**Maize Flour:**
Average of US$ 4 to fortify with iron, zinc, vitamin A, folic acid, and other B vitamins

**Rice:**
US$ 6 to US$ 20 to fortify with iron, zinc, vitamin A, folic acid, and other B vitamins

One metric ton of wheat flour is about 2,200 pounds or 1,000 kilograms, as pictured here. FFI photo.
Fortifying with folic acid leads to healthcare savings from preventing spina bifida
Legislation establishes appropriate standards

- Which nutrients
- Type of iron
- Level of nutrients

## Nutrients Added Through Fortification (parts per million)

<table>
<thead>
<tr>
<th></th>
<th>Minerals</th>
<th>B Vitamins</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Iron</td>
<td>Type of Iron</td>
</tr>
<tr>
<td>Wheat</td>
<td>44</td>
<td>Multiple Compounds Allowed</td>
</tr>
</tbody>
</table>

Legislation enables monitoring

**Food Control**
- Internal
- External
- Commercial

**Program**
- Intake
- Impact

http://www.conafor.org/paginas.asp?id=3396&clc=326#WfNB901K198
In summary

Fortification is most effective when it is mandatory because legislation:

• Helps ensure high coverage
• Equalizes costs for millers
• Establishes appropriate standards
• Enables monitoring
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