The Success of Fortification of Sugar

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Vitamin A
Functions

- Vitamin A is essential for
  - Embryogenesis, growth and development
  - Differentiation of cells
  - Vision
  - Immunity
  - Fertility
  - Intact epithelia
Tolerance - Safety and Deficiency

Deficiency symptoms

- Delayed growth and development
- Night-blindness
- Ocular lesions and xerophthalmia
- Cutaneous lesions (dry and rough skin)
- Impaired immune functions
- Destruction of epithelial tissue (i.e. in lungs, intestines)

Diseases strongly associated with Vitamin A deficiency

- measles
- respiratory tract infections
- urinary tract infections
- diarrhea
Deficiency is Still Common in Africa, Asia and some South American Countries (preschool age children)

WHO report 2009
Micronutrient intake in Western countries is not according recommendations.

- **Germany**
- **United States**
- **United Kingdom**
- **The Netherlands**

Source: Troesch et al. BJN 2012

Barbara Troesch, Birgit Hoeft, Michael McBurney, Manfred Eggersdorfer and Peter Weber
Published in British Journal of Nutrition 2012, 108, pp 692-698
What is the impact of Hidden Hunger?

**Annual lives lost**
- 1.1 mio children <5 years
- 600,000 stillbirths
- 115,000 women during pregnancy

**Annual lives impaired**
- 18 mio babies born mentally impaired
- 350,000 children go blind
- 150,000 babies born with neural tube defects

Vit. A & Zinc deficiencies
Iron deficiency anemia
Iron deficiency anemia
Maternal iodine deficiency
Vit. A deficiency
Maternal folate deficiency

Source: WHO, WFP, S&L
‘We cannot be successful nor can we call ourselves successful in a society that fails’

Feike Sijbesma, CEO DSM
From cod liver oil to industrial production
Successes in food fortification

1923: Mandatory iodization of salt in Switzerland.

1933: Mandatory fortification of flour in Canada and virtual elimination of Beriberi in Newfoundland.

1941: Mandatory fortification of flour in the USA and virtual elimination of pellagra

1954: Flour fortified in Chile with B-complex and iron. Country has very low prevalence of Iron Deficiency Anaemia.

1974: Beginning of sugar fortification in Guatemala. VAD diminished to one third. Concomitant improvement of iron parameters in the population.


1998: Folic Acid fortification mandated in the USA. 19% reduction in NTDs achieved.

2000: Folic Acid fortification mandated in Chile. Besides a 41.6% reduction in NTDs, increase in serum folate and decrease in homocysteine were also recorded.
Intended reach and target groups define fortification approach

Choice between mandatory or voluntary fortification depends on national/regional circumstances

Example: mandatory fortified staples with multiple nutrients
Chile: Flour fortification with folic acid diminishes neural tube defects

Hertrampf et al. Nutrition Reviews, Vol. 62, No. 6
Criteria for food fortification

• The food vehicle should be consumed by practically all the population;

• The daily intake of the carrier food should be essentially constant;

• Fortification should not alter the organoleptic characteristics of the vehicle;

• Production and processing of the food vehicle should be centralized;

• The cost of the fortification should be economical;

• The nutrient is stable in the vehicle under normal conditions of storage and use;

• There is reasonable assurance that no excess intake will be induced.

http://archive.unu.edu/unupress/food/V192e/ch07.htm
Sugar Fortification Technology
Sugar premix preparation
Premix addition points
Pre-school Children with low Serum Retinol Levels

Vitamin A Status and Sugar Consumption of Preschoolers (Guatemala, 1995)

Source: Guatemalan National Survey and INCAP intake data. Courtesy Dr. Omar Dary
Nicaragua: Sugar fortification improves vitamin A content in breast milk

Wallace C et al. 2004. XII IVACG meeting.
Effect of vitamin A fortification of sugar on iron metabolism in preschool children in Guatemala

Cost Effectiveness of Vitamin A Intervention Programs

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Annual Cost per Person Covered (USD)</th>
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</thead>
<tbody>
<tr>
<td>Dietary Education and Gardening</td>
<td>3.63</td>
</tr>
<tr>
<td>Supplementation (Only Preschoolers)</td>
<td>1.52</td>
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<tr>
<td>Sugar Fortification &quot;at risk only&quot;</td>
<td>0.98</td>
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<tr>
<td>Sugar Fortification</td>
<td>0.37</td>
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<td>Sugar Fortification &quot;Targeted Approach&quot;</td>
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# Cost-Effectiveness of Micronutrient Interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Region</th>
<th>Cost/Person/Year (USD)</th>
<th>Benefit/Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A Supplementation</td>
<td>S/E Asia, Africa</td>
<td>1.20</td>
<td>17:1</td>
</tr>
<tr>
<td></td>
<td>Central Asia</td>
<td>1.60</td>
<td>13:1</td>
</tr>
<tr>
<td></td>
<td>Latin America</td>
<td>2.60</td>
<td>8:1</td>
</tr>
<tr>
<td>Zinc Supplementation</td>
<td>S/E Asia, Africa</td>
<td>1.00</td>
<td>13.7:1</td>
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<tr>
<td></td>
<td>Central Asia</td>
<td>1.35</td>
<td>10:1</td>
</tr>
<tr>
<td></td>
<td>Latin America</td>
<td>2.20</td>
<td>6:1</td>
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<tr>
<td>Salt Iodization</td>
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<td>0.05</td>
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<tr>
<td>Flour Fortification</td>
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<td>0.12</td>
<td>8:1</td>
</tr>
</tbody>
</table>

Source: Copenhagen consensus 2008.
Lessons learned

- Advocacy and Promotion
  - Nutritional gaps, consequences, stakeholder commitment
- Legislation and Regulations
  - Fortification law, standards of identity, technical regulations
- Technological Development
  - Quest for better compounds and technology
- Quality Assurance and Control
  - Cooperative instead of punitive
- Monitoring and Evaluation
  - Program monitoring and impact evaluation
- Cost Analysis
  - Who pays for investments and fortificant?
- Sustainability of Supply
  - Adequate financial, institutional and political environment
- Sustainability of Demand
  - Awareness of population on benefits of fortification
Micronutrient Impact Through Programs

| Vitamin A                        | 23% reduction in under-five mortality rates |
|                                 | 70% reduction in childhood blindness       |
| Iodine                          | 13-point increase in IQ                     |
| Iron                            | 20% reduction in maternal mortality         |
| Zinc                            | 6% reduction in child mortality             |
|                                 | 27% reduction of diarrhoea incidence in children |
| Folate                          | 50% reduction in severe neural tube birth defects, such as spina bifida |

A united call to action on vitamin and mineral deficiencies (2009)
1+1>2: Multisectorial alliances maximize the chances to unlock human potential