Micronutrients and Food Fortification - Strategic and Practical Issues

Geoffry Smith
President, ILSI SE Asia Region

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ILSI is an international foundation that advances the understanding of scientific issues impacting human health

- Food Safety
- Risk Assessment
- Nutrition
- Environment
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ILSI’s mission is to provide science that improves public health and well-being.

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ASEAN + Australasia

Unique Regional Set up
• 13 countries
• 1 Regional Office
  Singapore
• 5 Country Committees
  Australia, Indonesia, Malaysia, Thailand and Philippines

Widely Diverse Region
ILSI in Asia

- ILSI Focal Point in China
- ILSI India
- ILSI Japan
- ILSI Korea
- ILSI SEAR
- ILSI Taiwan
Micronutrient Deficiencies- Fortification

08:00-08:10 Introduction and Welcome
  Mr. Takashi Togami, ILSI Japan CHP

08:10-08:25 Micronutrients and Food Fortification: Strategic and Practical Issues
  Mr. Geoffrey Smith, ILSI Southeast Asia Region

08:25-08:40 GAIN’s Global Strategy on Food Fortification to Improve Public Health - Asia Highlights
  Dr. Regina Moench-Pfanner, GAIN Singapore

08:40-08:55 China: Iron-fortified Soy Sauce - An Assessment of 10 Years of Policy and Business Development
  Dr. Junshen Huo, China CDC
Micronutrient Deficiencies: Fortification

08:55-09:10 Vietnam: Iron-fortified Fish Sauce - Evaluating and Adopting a Successful Model
Prof. Le Thi Hop, National Institute of Nutrition Vietnam

09:10-09:25 Cambodia: Iron-fortified Fish Sauce – Progress and Development
Dr. Theary Chan, RACHA Cambodia

9:25-09:40 Philippines: Iron-fortified Rice – Lessons Learnt, Opportunities and Challenges
Dr. Mario V. Capanzana, FNRI Philippines

09:40-10:00 Question and Answer (Q&A)/ Discussion
Micronutrient Deficiencies
– Global problem with emphasis on developing world

• Significant health impact
• Intakes can be improved
• Strategies – Improved diet, supplementation, biofortification, food fortification
Micronutrient Deficiencies
- Human toll of vitamin and mineral deficiencies

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<thead>
<tr>
<th>TYPE OF REPERCUSSION</th>
<th>NUMBERS AFFECTED</th>
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<tbody>
<tr>
<td>LIVES LOST ANNUALLY</td>
<td>• 1.1 million children under five die due to vitamin A and zinc deficiencies</td>
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<td>• 136,000 women and children die because of iron-deficiency anaemia</td>
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<td>LIVES IMPAIRED ANNUALLY</td>
<td>• 18 million babies are born mentally impaired because of maternal iodine deficiency</td>
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<td>• 150,000 babies are born with severe birth effects due to inadequate maternal folate intake</td>
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<td>• 350,000 children become blind due to vitamin A deficiency</td>
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<td>LOST PRODUCTIVITY</td>
<td>• 1.6 billion people suffer reduced productive capacity due to anaemia.</td>
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UNICEF, 2009
Micronutrient Deficiencies – Global Iodine deficiency and excess

Micronutrient Deficiencies – Global Vitamin A deficiency

WHO, The global prevalence of vitamin A deficiency, 2009
Micronutrient Deficiencies – Global

Anemia (pre-school children; not all caused by iron deficiency)

Why fortify?

• Supported by WHO as effective approach to reduce micronutrient deficiencies
• Common in western countries in both staple and packaged foods
• Increasingly adopted in developing countries
• Many countries fortifying flour and oil, also condiments
• Fortified foods must be appropriate (foods must be consumed by target population and in sufficient quantities)
Technical issues – fortification not always as easy as it sounds

- Bioavailability
- Organoleptic issues
- M&E
- Scientific developments

WHO, 2006
Technical issues – stakeholders

Figure 1: Components and players in public health food fortification programs

Omar Dary, 2009, Sight and Life
Iodine - success

• WHO recommended salt iodization as early as 1952
• As recently as 1990, only a handful of countries could demonstrate adequate iodine intake
• 1990 World Health Assembly agreed to action and UNICEF took up challenge
• Current data shows adequate iodine intakes in 112 countries, deficient in 30 countries (including industrialized countries)
• However, even mild deficiencies can lead to impaired cognitive development in offspring
Iodine - Importance

• All ages: Goiter
• Increased susceptibility of the thyroid gland to nuclear radiation

• Fetus: Spontaneous abortion
• Stillbirth
• Congenital anomalies
• Perinatal mortality

• Neonate: Infant Mortality
  Endemic cretinism

Iodine - Importance

Child and Adolescent:
- Impaired mental function
- Delayed physical development

Adults:
- Impaired mental function
- Reduced work productivity
- Toxic nodule goiter; iodine-induced hyperthyroidism

Increased occurrence of hyperthyroidism in moderate to severe iodine deficiency

Iodine – Further issues

- Finland, Ireland, Hungary, Italy, Mongolia, Mozambique, New Zealand, Russia and UK all moderately iodine deficient (2013)
- Australia, Belgium, and Norway were all mildly iodine deficient as recently as 2011
- 10 countries have excessive iodine intake (2013, up from 5 in 2011) – also regional issues

Zimmermann, 2011, Iodine deficiency in industrialized countries. Clin Endo
Iodine – Further issues

Effect of inadequate iodine status in UK pregnant women on cognitive outcomes in their children: results from the Avon Longitudinal Study of Parents and Children (ALSPAC)

Sarah C Bath, Colin D Steer, Jean Golding, Pauline Emmett, Margaret P Rayman

• Children of women with an iodine-to-creatinine ratio of less than 150 μg/g were more likely to have scores in the lowest quartile for verbal IQ, reading accuracy, and reading comprehension compared to mothers with ratios of 150 μg/g or more.

• When the less than 150 μg/g group was subdivided, scores worsened at 50–150 μg/g, and further at less than 50 μg/g.
Iron - Project IDEA

- **Iron Deficiency Elimination Action**
- began in 1997 as a focused effort to reduce the global burden of iron deficiency through food fortification
- • Forge partnerships between private and public sectors to combat iron deficiency
- • Assess needs of target communities and population groups
- • Identify appropriate food vehicles and iron fortificants in each country
- • Secure funding for country-specific programs
- • Evaluate impact of iron fortification on iron status of the population
- • Promote educational programs to raise consumer awareness
- • Develop ongoing monitoring and surveillance system
Iron Project IDEA

- Efficacy and effectiveness studies in collaboration with universities and public health institutes
- Peer-reviewed study reports
- Support for JECFA approval of novel, effective iron source
- Implementation in China, Vietnam, Philippines, and Cambodia
- Tens of millions have been reached
- Global spin-off effects (bioavailability)
Challenges in fortification
Risk-Benefits

- **BRAFO** - tiered approach for benefit-risk assessment of food – EU project
- **BRAFO**: Benefit–Risk Analysis for Foods

Fig. 2. A schematic description of the steps within each tier.

Risk-Benefits

Potential applications

- Folic acid and cancer
- Iron and malaria

2012, Hoekstra, op.cit.
Fortification - Uncertainties

- Uncertainties affecting problem formulation
- Uncertainties affecting hazard and benefit identification
- Uncertainties affecting intake assessment
- Uncertainties affecting dose/response relationships estimated from animal data
- Uncertainties affecting dose/response relationships estimated from epidemiological studies
- Uncertainties affecting conversion to a common health currency (e.g. DALY, QALY)
- Uncertainties due to factors not considered in the assessment
Fortification – Uncertainties, detailed

- Uncertainties affecting intake assessment
- Measurement uncertainty in concentration data
- Measurements below the limit of detection, quantification or reporting
- Sampling uncertainty due to limited number of concentration measurements
- Bias due to intentional targeting of monitoring for contaminants
- Uncertainty about correlations between concentrations of different contaminants/nutrients
- Extrapolation of concentrations from measured to unmeasured foods
- Future changes in levels of chemical use or contamination
- Uncertainty in recording of foods and food weights in dietary surveys
- Sampling uncertainty due to limited numbers of persons and days in dietary surveys
- Measurement uncertainty and bias in body weight data (usually minor)
- Uncertainty about degree of uptake of dietary recommendations
- Uncertainty about compensatory changes in existing diet when taking up dietary recommendations
- Assumptions about how the diets of individuals change over long time periods

Fortification – Essentials

- Education
- Legislation and regulation
- Comprehensive strategies
- Financial sustainability
- Technical infrastructure
- Monitoring and Evaluation