MICRONUTRIENT FORTIFICATION: OVERALL FRAMEWORK AND IMPORTANCE IN ASIA

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GAIN

Outline

• Global Context
  • Population trends
  • Food Prices

• Nutrition Context
  • Micronutrient Malnutrition
  • Importance of food fortification

• Fortification
  • Evidence
  • Challenges
Population Trends

Urbanization - an issue?

Shift in consumption patterns to more processed foods
Income distribution between the rich and poor

Distribution of Family Income - Gini Index

Gini Index:
- Less than 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 or more

Source: Chikklin Graph

GINI Coefficient/Health inequity index:
GINI measures the income distribution of a country's residents. The measure helps defining the gap between the rich and poor. It ranges between 0 and 1 with 0 representing perfect equality.

People living on less than $2 a day...

World Development Indicators, World Bank 2012
Food choices and economic status

Very, very poor

Food prices remain high and volatile despite their relative decline for the third consecutive quarter.

Food Price Index

Price changes in key commodities

<table>
<thead>
<tr>
<th>Indices</th>
<th>Feb 2013–June 2013 (%)</th>
<th>June 2012–June 2013 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td>Grains</td>
<td>-2</td>
<td>5</td>
</tr>
<tr>
<td>Fats and oils</td>
<td>-3</td>
<td>-4</td>
</tr>
<tr>
<td>Other</td>
<td>-1</td>
<td>-4</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>-8</td>
<td>-15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prices</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Meats</td>
<td>-1</td>
<td>12</td>
</tr>
<tr>
<td>Rice (Thai, %)</td>
<td>-6</td>
<td>-13</td>
</tr>
<tr>
<td>Wheat (U.S., FOB)</td>
<td>-2</td>
<td>13</td>
</tr>
<tr>
<td>Sugar (world)</td>
<td>-6</td>
<td>-15</td>
</tr>
<tr>
<td>Soybean oil</td>
<td>-11</td>
<td>-12</td>
</tr>
<tr>
<td>Crude oil, average</td>
<td>-7</td>
<td>10</td>
</tr>
</tbody>
</table>

Note: The Global Food Price Index is a weighted average of prices of a variety of food commodities around the world in U.S. dollar terms, 2005=100.
Micronutrient Malnutrition (VMDs)
What is it?

► Micronutrient Malnutrition: Deficiencies in essential vitamins and minerals required in small amounts by the body including:
  • Iron
  • Vitamin A
  • Iodine
  • Zinc
  • Folic Acid

► Deficiencies caused by:
  • Insufficient, poor or unvaried diets
  • Losses or poor absorption (due to infections like HIV/AIDS, malaria, diarrhea and parasites)

Discovering of five major vitamins

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>A</th>
<th>C</th>
<th>D</th>
<th>Thiamin</th>
<th>Niacin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic studies of deficiency effects in animals</td>
<td>1880s-1920s</td>
<td>1907-1920s</td>
<td>1918-1920s</td>
<td>1897-1920s</td>
<td>1920s-1930s</td>
</tr>
<tr>
<td>Vitamin isolated or crystallized</td>
<td>1937</td>
<td>1932</td>
<td>1931</td>
<td>1926</td>
<td>1911</td>
</tr>
<tr>
<td>Chemical structure described</td>
<td>1931</td>
<td>1937</td>
<td>1936</td>
<td>1936</td>
<td>1870</td>
</tr>
<tr>
<td>Synthesis of vitamin</td>
<td>1947</td>
<td>1937</td>
<td>1924</td>
<td>1936</td>
<td>1870</td>
</tr>
</tbody>
</table>

The health significance of vitamins and minerals (micronutrients)

Micro Nutrients
- needed in small amounts
- vitamins and minerals are needed by the body to perform hundreds of roles
- body cannot manufacture on its own in sufficient amounts
- must be consumed

Some of the roles of micronutrients

Prevalence of Vitamin A and Iodine Deficiencies, Inadequate Zinc Intake, and Iron Deficiency Anaemia
Global hidden hunger: facts and figures


The damage of hidden hunger

A financial burden to the economy

The annual magnitude of malnutrition in nine low-income Asian countries:
• 2.8 million child deaths
• 65,000 maternal deaths
• At least 2-3% GDP loss


Chronic malnutrition incurs a 3% loss in GDP annually which is worse than energy crisis (2% GDP loss)

Strategies addressing the problem of VMD

► Supplementation
► Dietary diversification, other food based approaches (biofortification)
► Public health measures
► Food fortification
Fortification Process

- Fortification can be done at several points:
  - Processing
  - Packaging
  - Consumption

- Fortification can be done with one or multiple vitamins and minerals

Food fortification: not a new idea

<table>
<thead>
<tr>
<th>Micronutrient</th>
<th>Country, year</th>
<th>Food Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iodine</td>
<td>Switzerland, 1923</td>
<td>Salt</td>
</tr>
<tr>
<td></td>
<td>USA, 1930</td>
<td></td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Denmark, 1930</td>
<td>Margarine</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>USA and UK, 1923</td>
<td>Milk</td>
</tr>
<tr>
<td>Iron, vitamin B1, vitamin B2,</td>
<td>Canada, 1933</td>
<td>Wheat flour</td>
</tr>
<tr>
<td>Niacin</td>
<td>USA, 1941</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chile, 1954</td>
<td></td>
</tr>
<tr>
<td>Vitamin A</td>
<td>Denmark, 1918</td>
<td>Margarine</td>
</tr>
<tr>
<td></td>
<td>Central America, 1974</td>
<td>Sugar</td>
</tr>
</tbody>
</table>
Fortification History

- Early 1920s programs – Elimination of single endemic nutrient deficiency, e.g. Goiter in Switzerland
- In 1940s – 50s: Elimination of multiple nutrient deficiencies, e.g. B-vitamin deficiencies in USA, Canada
- In 1960-90s: Early industry voluntary fortification
- In 2000s: Emphasis on effectiveness to show health impacts, with high cost-benefit ratio (MDGs, Copenhagen Consensus)

Large Scale Food Fortification: part of a multi-intervention approach to address malnutrition

- Immediate causes
  - Food / nutrient intake
  - Infection / disease
- Underlying causes
  - Food availability & access
  - Behavior / care practices
  - Environment / health services
- Basic causes
  - Income poverty: employment, assets
  - Lack of capital: financial, human, social, natural
  - Social, economic & political context

Large scale food fortification - adding trace amounts of micronutrients to staple foods - is scalable, sustainable, and very cost-effective public health strategy to deliver up to 30% EAR\(^1\) on a daily basis


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1. Estimated Average Requirement, exception of Iodine in salt provides higher EAR. Calculation from Guidelines for Food Fortification with Micronutrients, WHO/FAO, 2006.
Food Fortification: Selection of Food Vehicles

VALUE ADDED FOODS
beverages, convenience foods, candies

BASIC FOOD PRODUCTS
breads, biscuits, breakfast cereal, dairy products

STAPLE FOODS AND CONDIMENTS
wheat/maize flour, oils, fats, sugar, salt

Multiple fortified products for different lifecycle stages

Staple foods and condiments
Products business led
Large Scale approach

MNP
YYB
FCF
LNS
RUTF

Mixed approach

Targeted approach

Proashile targets and distribution channels
Options for food fortification

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mandatory</th>
<th>Voluntary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public health risk</td>
<td>Higher/more affected</td>
<td>Lower/fewer affected</td>
</tr>
<tr>
<td>Food consumption patterns</td>
<td>Fortified food widely consumed</td>
<td>Variety and accessibility essential</td>
</tr>
<tr>
<td>Government support (safety net programs)</td>
<td>Not necessary</td>
<td>Essential</td>
</tr>
<tr>
<td>Fortification approach</td>
<td>Mass/universal</td>
<td>Market-driven</td>
</tr>
<tr>
<td>Food industry</td>
<td>Centralized, well organized</td>
<td>Smaller, more diverse</td>
</tr>
</tbody>
</table>

Multi-stake holder partnership (public, private and civil sectors) is crucial

Food fortification in selected Asian countries

- Iodized salt – mandatory in most countries in the region
  - relatively high coverage of 73% of households in East Asia and Pacific consuming iodized salt
  - Much lower consumption rates in countries that do not require mandatory fortification
- Wheat flour fortification is mandatory in fewer countries
- Nepal (became mandatory in 2011)
- Planning: Malaysia, Mongolia & Vietnam
- Rice
  - Mandatory in Philippines
  - Planning: Bangladesh, Cambodia, China & Indonesia

<table>
<thead>
<tr>
<th>Country</th>
<th>Salt iodization is mandatory</th>
<th>% of households consuming iodized salt (2003-2008)</th>
<th>% of flour which is fortified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>Yes</td>
<td>260 million people</td>
<td>No</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Yes</td>
<td>75%</td>
<td>No</td>
</tr>
<tr>
<td>People's Republic of China</td>
<td>Yes</td>
<td>85%</td>
<td>No</td>
</tr>
<tr>
<td>DPRK</td>
<td>No</td>
<td>40%</td>
<td>No</td>
</tr>
<tr>
<td>Fiji</td>
<td>Yes</td>
<td>31%</td>
<td>Yes</td>
</tr>
<tr>
<td>India</td>
<td>No</td>
<td>51%</td>
<td>Yes</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Yes</td>
<td>64%</td>
<td>Yes</td>
</tr>
<tr>
<td>Laos FPR</td>
<td>Yes</td>
<td>84%</td>
<td>No</td>
</tr>
<tr>
<td>Maldives</td>
<td>No</td>
<td>-</td>
<td>No</td>
</tr>
<tr>
<td>Mongolia</td>
<td>Yes</td>
<td>85%</td>
<td>No</td>
</tr>
<tr>
<td>Nepal</td>
<td>Yes</td>
<td>92%</td>
<td>No</td>
</tr>
<tr>
<td>PNG</td>
<td>Yes</td>
<td>92%</td>
<td>No</td>
</tr>
<tr>
<td>Philippines</td>
<td>Yes</td>
<td>61%</td>
<td>No</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Yes</td>
<td>64%</td>
<td>No</td>
</tr>
<tr>
<td>Thailand</td>
<td>Yes</td>
<td>15%</td>
<td>No</td>
</tr>
<tr>
<td>Timor Leste</td>
<td>No</td>
<td>60%</td>
<td>No</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Yes</td>
<td>91%</td>
<td>No</td>
</tr>
</tbody>
</table>

†UNICEF. UNICEF's partnership with Sansiri for salt iodization in Thailand. [http://www.unicef.org/partners/Partnership_profile_2012_Sansiri_Thailand_V2_approved.pdf](http://www.unicef.org/partners/Partnership_profile_2012_Sansiri_Thailand_V2_approved.pdf)
Percentage of households consuming adequately iodized salt (15 parts per million or more)
UNICEF. Tracking Progress on Child and Maternal Action: A survival and development priority. November 2009
FFI estimates, sources vary, often industry reports
Key findings of a systematic review of 201 quality studies…

- Fortification for children
  - significant ↑ in serum micronutrient concentrations
  - food fortified with vitamin A, iron & multiple micronutrients, ->↑ in hemoglobin concentrations
  - positive trends on height for age, weight for age & weight for height Z scores
- Fortification for women
  - Calcium and vitamin D fortification: significant impacts in the post-menopausal group
  - Iron fortification: significant ↑ in serum ferritin and hemoglobin levels in WRA and pregnant women
  - Folate fortification: significantly reduced the incidence of congenital abnormalities (NTD)
- Lack of evidence of fortification against morbidity and mortality outcomes in women and children

Challenges of food fortification

- Requires an established framework and a Public Health Objective
- Depends on country’s (existing or non-existing) food laws and legislation
  → determines speed of program implementation
- Functioning enforcement process
- A much needed public-private-civil sector partnership to
  - share responsibilities and costs
  - provide cost subsidies
  - to draw attention to VMD problem
- Technical considerations on food fortification
  - guidelines, fortificant choice, upper level limits, etc.
Core Message

- Vitamin and Mineral Deficiencies (VMDs) take a huge toll on health and economic development globally – Asia has the highest burden of VMDs
- Affordability of diversified diet for poor difficult – nutrient gap
- Solutions to the problem exist and are cost-effective
- Staple food and condiment fortification in Asia necessary to provide essential vitamins and minerals
- More consumption data is needed
- Data on impact on morbidity and mortality of food fortification

THANK YOU