GOING FORWARD WITH FLOUR FORTIFICATION IN AFRICA

Filip Van Bockstaele, 28-10-2016, 27th International Conference on Spina Bifida and Hydrocephalus
BASICS OF FORTIFICATION
RATIONALE

- Vitamins and minerals = **micro-nutrients**
  - Low presence in foods
  - Play an essential role in biochemical reactions in human body
- Deficiencies in micronutrients
  - Often related to malnutrition
  - Cause diseases, birth defects, reduced immunity, reduced growth and cognitive development
## RATIONALE

### Levels of deficiencies around the world

<table>
<thead>
<tr>
<th>Country</th>
<th>Neural tube defects per 10,000 births</th>
<th>% Anemia in non-pregnant women of reproductive age</th>
<th>% Anemia in pre-school children</th>
<th>% Population at risk of inadequate zinc intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>20</td>
<td>31</td>
<td>44</td>
<td>20.2</td>
</tr>
<tr>
<td>Belgium</td>
<td>9</td>
<td>18</td>
<td>13</td>
<td>6.8</td>
</tr>
<tr>
<td>Uganda</td>
<td>13</td>
<td>26</td>
<td>56</td>
<td>20.5</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>23</td>
<td>28</td>
<td>59</td>
<td>48.4</td>
</tr>
<tr>
<td>South-Africa</td>
<td>23</td>
<td>27</td>
<td>41</td>
<td>20.0</td>
</tr>
<tr>
<td>USA</td>
<td>4.6</td>
<td>12</td>
<td>6</td>
<td>5.0</td>
</tr>
<tr>
<td>Tanzania</td>
<td>13</td>
<td>38</td>
<td>61</td>
<td>34.1</td>
</tr>
<tr>
<td>DR Congo</td>
<td>20</td>
<td>49</td>
<td>67</td>
<td>54.3</td>
</tr>
<tr>
<td>Brazil</td>
<td>38</td>
<td>19</td>
<td>24</td>
<td>7.3</td>
</tr>
</tbody>
</table>

*SOURCE: http://www.ffinetwork.org/*
<table>
<thead>
<tr>
<th><strong>Solution</strong></th>
<th><strong>Challenge</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Micronutrient supplements for children (A &amp; Zn)</td>
<td>Malnutrition</td>
</tr>
<tr>
<td>2 The Doha development agenda</td>
<td>Trade</td>
</tr>
<tr>
<td>3 <strong>Micronutrient fortification</strong></td>
<td>Malnutrition</td>
</tr>
<tr>
<td>4 Expanded immunization coverage for children</td>
<td>Diseases</td>
</tr>
<tr>
<td>5 Biofortification</td>
<td>Malnutrition</td>
</tr>
<tr>
<td>6 Deworming, other nutrition programs in school</td>
<td>Malnutrition</td>
</tr>
<tr>
<td>7 Lowering the price of schooling</td>
<td>Education</td>
</tr>
<tr>
<td>8 Increase and improve girl’s schooling</td>
<td>Women</td>
</tr>
<tr>
<td>9 Community-based nutrition programs</td>
<td>Malnutrition</td>
</tr>
</tbody>
</table>

*Nobel Prizewinning Economists: Finn Kydland, Robert Mundell, Douglass North, Thomas Schelling, Vernon L. Smith*
FOOD FORTIFICATION

Food fortification has been defined as the addition of one or more essential nutrients to a food, whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups (FAO/WHO 1994).
WHY FOOD FORTIFICATION?

- It works!
  
  eg. NTD’s prevalence reduced with 40% upon folic acid fortification in Chile

- Cost efficient:

  1:12  Chile
  1:30  South Africa
  1:48  United States

FOOD FORTIFICATION VEHICLES

**OIL**
- Vitamin A, E

**MILK**
- Vit A, D
- Ca

**CEREALS**
- Fe, Zn
- Vit. B1, B2, B3, B6
- Folic acid
- Vitamin A

**SALT**
- Iodine

**SUGAR**
- Vitamin A
WHY ARE CEREALS A GOOD VEHICLE?

- Staple food
  - Carbohydrate source
  - Daily consumed
  - High consumption levels
- Cereal processing industry
  - Well established world-wide
  - Large scale operations
GRAIN FORTIFICATION WORLDWIDE

Wheat flour – 66 countries

Rice – 1 country
(Papua New Guinea)

Wheat flour and maize flour – 14 countries

Wheat flour and rice – 3 countries
(Nicaragua, Panama, Philippines)

Wheat flour, maize flour, and rice – 2 countries
(Costa Rica and the United States)

No grain fortification legislation

* Legislation has effect of mandating grain fortification with at least iron or folic acid.
Legislation status from the Food Fortification Initiative (www.FFInetwork.org) May 2016
CEREALS IN THE WORLD

Annual production of major cereals in 2010/2014
(source: faostat.fao.org)

(Million tonnes)

HOW ARE CEREALS FORTIFIED?

- Cereals processing
  - Milling and sieving
  - End products: white flour or meal, bran, germ
  - Intermediate products -> food products
    - Wheat flour -> bread
    - Maize meal -> porridge

Fortification is performed at the level of the flour/meal
HOW ARE CEREALS FORTIFIED?

– Wheat
CEREAL PROCESSING
HOW ARE CEREALS FORTIFIED?

– Wheat mill
HOW ARE CEREALS FORTIFIED?

- Maize/corn

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HOW ARE CEREALS FORTIFIED?

- Roller mills (big): cfr wheat, multistep size reduction+sieving
- Hammer mills (small): 1 step size-reduction of dehulled maize
HOW ARE CEREALS FORTIFIED?

- Flour fortification: large scale operations
HOW ARE CEREALS FORTIFIED?

- Flour or meal fortification: small scale hammer mills
FLOUR FORTIFICATION IN AFRICA
FORTIFICATION: CHALLENGES

- Fortification operation: relatively easy
- Setting up national fortification programmes: challenge!

Legislation
Technical standards
Inspection/control
Information

Quality assurance
Quality control (fast methods)
Premix/feeder technology

fortified

Are products accepted?
Are products bought?
Are products consumed?
Micronutrient status?

=> Continuous monitoring system needed!
SUPPORTING FORTIFICATION IN AFRICA

- Partnership since 2008

- Aim: improve health in Africa through the enrichment of wheat and maize flour with essential vitamins and minerals
SMARTER FUTURES

- Supporting fortification efforts:
  - Development of tools:
    - Fortimas monitoring system
    - Cost benefit tool
    - Millers toolkit
  - Organising trainings and meetings
    - QA/QC of flour fortification
    - Country trainings on tools

Capacity building

Knowledge transfer

Connecting stakeholders
Flour Fortification in Africa: 12 Years of Progress

**Mandatory fortification**: Country has legislation to mandate fortification of wheat flour and/or maize flour (27 countries in May 2016)

**Voluntary fortification**: At least 50% of the industrially milled wheat or maize flour is fortifed through voluntary efforts (5 countries in May 2016)
Makerere University
Kampala, Uganda, May 2016
Regional training

Stakeholders: millers, government and academia: 79 participants (incl. facilitators)
-> 20 student/lecturers from 7 countries: Uganda, Burundi, Rwanda, South-Sudan, Kenya, Tanzania, Mozambique

14 scholarships sponsored by VLIR-UOS (Belgium): Short training initiative (STI)
Knowledge transfer:
- cereal processing
- fortification technology
- legislation & standards
- monitoring
- quality control

Field visits:
- Maize flour mill
- Government analytical lab (UNBS)

Discussion groups:
- Profession groups
- Country teams
=> Developing strategy for fortification
MAIZE FLOUR FORTIFICATION

Maize availability and Fortification Legislation

- Mandatory fortification legislation
- Voluntary legislation
- No availability or legislation data
- 75 or more grams available per person per day
- Less than 75 grams available per person per day
Dar es Salaam, Tanzania
Maize strategy meeting

Stakeholders: millers, government involved from maize producing and consuming countries: 71 participants (incl. facilitators)

Knowledge: maize processing structure overview throughout Africa

Maize fortification technology + field trips to maize mills (large and small)

Declaration of Dar on maize fortification
ONGOING RESEARCH @GHENT UNIVERSITY

- Impact of different iron sources on wheat flour and maize meal functionality

FOOD QUALITY

- Nutritional quality
- Sensorial quality
- Physico-chemical quality
ONGOING RESEARCH @GHENT UNIVERSITY

- Impact of different iron sources on wheat flour and maize meal functionality
ONGOING RESEARCH @GHENT UNIVERSITY

- Impact of different iron sources on wheat flour and maize meal functionality

SuperSun - Iwisa
ONGOING RESEARCH @GHENT UNIVERSITY

- Impact of different iron sources on wheat flour and maize meal functionality

wheat flour, water, yeast, salt, oxidants, emulsifiers, enzymes, vital gluten, other flours

Mixing → Dough rest → 1st fermentation → rounding

Baking → 2nd fermentation → Moulding

Mixing Dough rest 1st fermentation Rounding Baking 2nd fermentation Moulding
ONGOING RESEARCH @GHENT UNIVERSITY

- Fast measuring techniques for fortificants: quality control
CONCLUSIONS
Flour fortification: huge progress in last 10 years
  - Continuous support is needed
    • Capacity building in local universities/institutes
    • Technical support

Maize flour fortification needs some attention:
  • Which flour is fortifiable -> also commercial small hammer mills!

Partnerships strengthen each others efforts
ACKNOWLEDGEMENTS

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– VLIR-UOS

– Supporting partners
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