The Past and Future of Flour Fortification in the Philippines

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October 9 2012
Vitamin A Prevents Blindness

Why Vitamin A?
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Sommer, 1995. Vitamin A Deficiency and its consequences
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Vitamin A Saves Lives

Why Vitamin A?
Treatment with Vitamin A reduces morbidity and mortality in severe measles.

Vitamin A supplementation reduces child mortality by 23 - 35%.

Vitamin A fortification
11% reduction of deaths among infants
45% reduction of deaths among preschool children

Why Vitamin A?

Hussey, 1990; Palmer, 2012; Muhilal, 2988
INTERVENTIONS

• SUPPLEMENTS
• DIVERSE DIET
• FORTIFIED FOODS
  • MSG
  • MARGARINE
• OIL - MANDATED IN PH
• FLOUR - MANDATED IN PH
## VA Fortification

<table>
<thead>
<tr>
<th>OIL / FATS</th>
<th>Year</th>
<th>FLOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark (margarine)</td>
<td>1917</td>
<td></td>
</tr>
<tr>
<td>Newfoundland (margarine)</td>
<td>1944</td>
<td></td>
</tr>
<tr>
<td>Margarine VA (margarine)</td>
<td>1996</td>
<td>VA Wheat Flour Bun</td>
</tr>
<tr>
<td>PL 480 fortified oil</td>
<td>1998</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>VA &amp; Iron Wheat Flour Bun</td>
</tr>
</tbody>
</table>

**Law mandates fortification**

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Surveys</td>
<td>2003</td>
<td>National Surveys</td>
</tr>
<tr>
<td>Implementation of Law</td>
<td>2004</td>
<td>Implementation of Law</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>Effectiveness study in PH</td>
<td>2006</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>National Surveys</td>
<td>2008</td>
<td>National Surveys</td>
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<tr>
<td></td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td></td>
</tr>
<tr>
<td>Review of Law</td>
<td>2012</td>
<td>Review of Law</td>
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</table>
COLLABORATION

- Nutrition Center of the Philippines
- Local Flour Mill
- Johns Hopkins University
- Asian Development Bank through PH Government
- USAID-MOST
Key Questions

How much VA remains in flour?

Organoleptic changes?

Does it work?
Stability & Losses

Vitamin A (RE/100 g) content in flour fortified with VA (FDC Analysis)

Stability & Losses

Vitamin A (RE/100 g) content in flour fortified with VA (RocheAnalysis)

VA (ug/100 g) content in pandesal from hard flour fortified with 3 types of iron and

Solon, et al, 2009
Taste and Appearance

- No organoleptic changes
- Acceptable
Efficacy of VA Flour

- Philippines - 29% versus 15% (fortified) low liver stores
- Bangladesh - 22.5% versus 7.4% (fortified) blood VA

VA FLOUR WORKS
50-60% reduction in VAD
Four Years of Fortification (OIL / FLOUR / VOLUNTARY)

Preschool children 60% reduction in VAD
Other groups : 50 - 70 %

IMR, NMR, U5MR per 1000 live births; Coverage and VAS (%)  
NMR I1986-1989 values for NMR not available, estimated at 1990 values
# 12 Countries with VA Flour

<table>
<thead>
<tr>
<th>Country</th>
<th>Product</th>
<th>Mandated Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>Wheat flour</td>
<td>9.0 ug RAE</td>
</tr>
<tr>
<td>South Africa</td>
<td>Wheat flour (white)</td>
<td>1.68 (5.36)</td>
</tr>
<tr>
<td>Lesotho</td>
<td>Wheat flour</td>
<td>1.784 (5.947)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Noodles</td>
<td></td>
</tr>
<tr>
<td>Palestine</td>
<td>Wheat flour (white)</td>
<td>1.0 (3.333)</td>
</tr>
<tr>
<td>Philippines</td>
<td>Enriched wheat flour</td>
<td>3.0 - 6.5 (10.0 - 217)</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>Wheat flour</td>
<td>7.078 (23.594)</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>Wheat flour</td>
<td>3.3 (11.0)</td>
</tr>
<tr>
<td>Venezuela</td>
<td>Wheat flour</td>
<td>2.85 (9.50)</td>
</tr>
<tr>
<td>Jordan</td>
<td>Wheat flour</td>
<td>1.5 (5.0)</td>
</tr>
<tr>
<td>Ghana</td>
<td>Wheat flour (white)</td>
<td>2.0 (6.666)</td>
</tr>
<tr>
<td>Uganda</td>
<td>Wheat flour</td>
<td>2.52 (8.4)</td>
</tr>
</tbody>
</table>

Klemm, 2010
Countries with VAD

b) Countries and areas with survey data and regression-based estimates

WHO, 2009
Lessons

• INDUSTRY STRUCTURE & PRACTICE
• MODELLING OF DIETARY INTAKE
• COMPARATIVE COSTS OF ALTERNATIVE VEHICLES
• LIMITATION OF ASSAYS
• PROGRAM MANAGEMENT AND REGULATION
INDUSTRY

REGULATION

FLOUR  VA  Iron
SUGAR  VA

INTAKE

OIL  VA
RICE  Iron

TRADE
MODELS CAN PREDICT LEVELS

NATURAL SOURCES

VOLUNTARY FORTIFICATION

DIETARY VA

SUGAR

FLOUR

OIL

RICE

SUPPLEMENTS
COMPARATIVE COSTS

- Losses in flour are greater than oil
- Cost of VA for flour is greater than VA for oil
- ?? Increase VA in oil and reduce VA in flour --- being considered by government
ASSAY LIMITATIONS

- Variability in measuring VA in flour and food products
- Cost of HPLC method - PHP 5,000 per assay
- Alternative methods by Bioanalyt (quantitative)
- Locally developed method based on Carr-Price (qualitative)
REGULATION

MILLERS

DISTRIBUTION

END-USERS

PREMIX SUPPLY

IMPORTS

SMUGGLED FLOUR / OIL
FUTURE PLANS
PROGRAM MANAGEMENT

FUTURE PLANS
FUTURE PLANS

• CONTINUE VA AND IRON IN FLOUR
• CONSIDER FOLIC ACID IN FLOUR
• CONSIDER ADJUSTING LEVELS OF VA IN FLOUR
THANK YOU