WFP experience with setting-up local production of LNS at scale

Saskia de Pee, PhD
World Food Programme, Rome
Malnutrition

Inadequate dietary intake

Inadequate access to food

Inadequate care for children and women

Insufficient health services & unhealthy environment

Disease
Proposed recommended nutrient densities for moderately malnourished children

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Michael H. Golden

**TABLE 1.** RNIs for normal children, nutrient contents of F100 and RUTF (used for treating children with severe acute malnutrition [SAM]), and proposed RNIs for children with moderate acute malnutrition (MAM) living in contaminated environments, expressed as nutrient:energy densities (amount of nutrient/1,000 kcal)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Gravimetric unit</th>
<th>RNIs for normal children</th>
<th>F100 and RUTF for SAM</th>
<th>Proposed RNIs for MAM[^a]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FAO</td>
<td>Other[^b]</td>
<td>Food</td>
<td>Supplement</td>
</tr>
<tr>
<td>Protein</td>
<td>g</td>
<td>22.3</td>
<td>28.4</td>
<td>24</td>
</tr>
<tr>
<td>Protein</td>
<td>g</td>
<td>3.6</td>
<td>4.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>g</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>mg</td>
<td>—</td>
<td>978</td>
<td>434</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg</td>
<td>—</td>
<td>1,099</td>
<td>2,400</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg</td>
<td>79</td>
<td>112</td>
<td>175</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg</td>
<td>450</td>
<td>634</td>
<td>762</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>mg</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sulfur[^c]</td>
<td>mg</td>
<td>12.5</td>
<td>16.5</td>
<td>22.3</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg</td>
<td>595</td>
<td>820</td>
<td>1,009</td>
</tr>
<tr>
<td>Calcium</td>
<td>mg</td>
<td>840</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Intake of a Bangladeshi child, 13-15 mo, 7.4 kg, breastfed, WHZ< -2

<table>
<thead>
<tr>
<th>Diet ingredients</th>
<th>Nutrients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breastmilk, 530 g</td>
<td>Protein 136</td>
</tr>
<tr>
<td>Rice, plain, boiled—minimum 150 g</td>
<td>Vitamin A 73</td>
</tr>
<tr>
<td>Potato, cooked</td>
<td>Vitamin E 29</td>
</tr>
<tr>
<td>Spinach, cooked—maximum 40 g</td>
<td>Vitamin C 53</td>
</tr>
<tr>
<td>Onion</td>
<td>Thiamine 77</td>
</tr>
<tr>
<td>Lentil-dhal</td>
<td>Riboflavin 62</td>
</tr>
<tr>
<td>Small fish with bones</td>
<td>Niacin 140</td>
</tr>
<tr>
<td>Fish</td>
<td>Vitamin B₆ 87</td>
</tr>
<tr>
<td>Soybean oil</td>
<td>Folic acid 139</td>
</tr>
<tr>
<td></td>
<td>Vitamin B₁₂ 278</td>
</tr>
<tr>
<td></td>
<td>Pantothenic acid 117</td>
</tr>
<tr>
<td></td>
<td>Calcium 100</td>
</tr>
<tr>
<td></td>
<td>Phosphorus 103</td>
</tr>
<tr>
<td></td>
<td>Magnesium 81</td>
</tr>
<tr>
<td></td>
<td>Potassium 98</td>
</tr>
<tr>
<td></td>
<td>Iron (10% bioavailability) 67</td>
</tr>
<tr>
<td></td>
<td>Zinc (moderate bioavailability) 32</td>
</tr>
<tr>
<td></td>
<td>Copper 111</td>
</tr>
<tr>
<td></td>
<td>Manganese 483</td>
</tr>
</tbody>
</table>

De Pee & Bloem, FNB 2009
Linear Programming – Cost of Diet – Affordability of lowest cost diet for meeting nutrient intake recommendations - Indonesia

% of households that could afford LACON based on total food expenditures

% of households that could afford LACON based on use of 70% of total household expenditures for food

FIG. 1. Proportion of households that could afford the Locally Adapted Cost Optimized Nutritious Diet (LACON) in the four areas

Baldi et al, FNB 2013; 34: S35-S42
FIG. 2. Correlation between proportion of households that could afford the Locally Adapted Cost Optimized Nutritious Diet (LACON) and the prevalence of undernutrition (stunting and underweight); the regression line is also shown.
Introduction of formulated complementary foods - Cambodia example

WF = WinFood (locally produced complementary food with rice + dried fish + spiders + micronutrients)
WF-L = WinFood-Lite (locally produced complementary food with rice + dried fish + micronutrients)
CSB+ = Corn-Soy-Blend + micronutrients
CSB++ = Corn-Soy-Blend + milk powder + micronutrients

Skau et al, Am J Clin Nutr 2014;99:130-8
LNS for prevention and treatment of MAM

• Prevention
  – medium-quantity LNS (<250 kcal/d)
  – lean season / emergencies
  – in communities with low dietary diversity and pre-existing deficiencies

• Treatment
  – large-quantity LNS (500 kcal/d)
  – high incidence of SAM & MAM – avoiding risk of deterioration to SAM / death
WFP procurement of LNS products 2009-2013

Year | Quantity in MT
--- | ---
2009 | 2,025
2010 | 16,153
2011 | 20,351
2012 | 21,657
2013 | 19,136
WFP procurement of Specialized Nutritious Foods 2009-2013
Beneficiaries of special nutritious foods (LNS, SC+, MNP, SC) in 2010-13

![Bar chart showing beneficiaries by year and intervention type]

- **Total Beneficiaries**
  - **2010**: 10,000,000
  - **2011**: 12,000,000
  - **2012**: 14,000,000
  - **2013**: 12,000,000

**Yearly Breakdown**
- **2010**
  - PLW: Treatment and Prevention: 2,000,000
  - Prevention of Acute Malnutrition (6-59 Months): 8,000,000
  - Treatment of MAM (6-59 Months): 2,000,000
- **2011**
  - PLW: Treatment and Prevention: 2,000,000
  - Prevention of Acute Malnutrition (6-59 Months): 10,000,000
  - Treatment of MAM (6-59 Months): 4,000,000
- **2012**
  - PLW: Treatment and Prevention: 2,000,000
  - Prevention of Acute Malnutrition (6-59 Months): 12,000,000
  - Treatment of MAM (6-59 Months): 4,000,000
- **2013**
  - PLW: Treatment and Prevention: 2,000,000
  - Prevention of Acute Malnutrition (6-59 Months): 8,000,000
  - Treatment of MAM (6-59 Months): 4,000,000
Local production

• Reasons:
  – Self-reliance & independent from import
  – Stimulating local farmers, economy, employment
  – Using locally available and common ingredients & preferences

• Requirements:
  – Good quality, safe and nutritious product
  – Competitive price compared to imported product
  – Short lead time
WFP supported local development & production of LNS

- Chickpea LNS: India, Pakistan, Ethiopia
- Peanut LNS: Indonesia
- Almond LNS: Afghanistan
- Rice/lentil and Chickpea LNS: Bangladesh
Origin of LNS products, purchased by WFP

- France + USA
- Other countries

<table>
<thead>
<tr>
<th>Year</th>
<th>France + USA</th>
<th>Other countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>93%</td>
<td>7%</td>
</tr>
<tr>
<td>2011</td>
<td>78%</td>
<td>22%</td>
</tr>
<tr>
<td>2012</td>
<td>72%</td>
<td>28%</td>
</tr>
<tr>
<td>2013</td>
<td>73%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Lessons learnt –

1. Is there a business case?

• Manufacturer’s questions:
  – Who is going to buy; how much; when?
  – What do they want to buy?
  – Where to source raw materials, what price?
  – How to check, store and process raw materials?
  – QA&QC
  – Export? Criteria?
  – Who is willing to invest?
Lessons learnt –

2. Tackling production issues

- From prototype developed in the lab to production at scale, e.g. fluidity / stickiness of product in the production line
- How to prevent oil separation and oil leaking from sachet?
- How to seal sachets tightly?
Lessons learnt – 3. Producing according to stringent microbiological safety criteria – no easy task

- Product is ready-to-eat and provided to vulnerable children – has to be free from pathogens
- Sources of contamination:
  - Raw materials
  - Employees (hygiene measures, human error)
  - Production line (moving half products, cleaning)
- Preventing contamination requires good environmental control, supplier management, HACCP, GMP, QA&QC, minimizing manual handling, heat killing step, continuous monitoring

NB: Prevention requires continued vigilance and is costly
Lessons learnt –
4. Premix cost & shelf-life

• Premix is a costly ingredient and needs to be bought in relatively large amounts as very small amounts are used
• Shelf-life is 12 months, requires good forecasting
• GAIN Premix Facility assists with payment procedures, offering specific credit terms
• Harmonized premix for LQ and MQ LNS being tested (WFP, GAIN, DSM), may extend to SQ
Conclusions & Recommendations

• Product quality and safety criteria are applied regardless of scale of production
• Business case needs to be developed early on for feasibility check of local production
• Regional production where demand in country is limited
• Technological assistance is available
• Consider import while setting up good quality local production