Fortified infant cereals in low-income countries

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Infant feeding is surprisingly difficult

• Quantity of food needed is small (<50g/day to start)
  – daily cost of is low, even for poor households
    ...but infants have small stomachs

• For growth and development, infants need:
  – foods with high nutrient density and digestibility
  – fed more frequently than older family members

• Getting it right is surprisingly difficult!
  – time to prepare special foods 3-5 times per day
  – with correct mix of macro- and micro-nutrients
Every child has some kind of baby food but in poor countries, not enough nutrients especially at 6+ months of age

The WHO recommends:
- From 0 to 6 months: breastfeeding
- From 6 to 23 mo.: breastfeeding plus solid foods
  - diverse items of high nutrient density (≥ 4 food groups)
  - fed more often than older children (4-6 times/day)
- From 2 years of age: transition to the family diet

What do kids actually eat? Diet quality surveys find:

Source: Choudhury, Headey & Masters (2018), from DHS data (47 surveys in 39 countries, 2006-2013, total sample size = 67,241)
Every child has some kind of baby food but in poor countries, not enough nutrients especially at 6+ months of age.

Nutritional outcomes fall behind children’s potential mainly during the 6-24 month period. Dietary deficits at that age cause permanent damage beyond deficits in utero and infancy (-9 to 4 months), with few opportunities for later recovery.

Anemia peaks at 9-12 mo. Stunting from 6 to 22 mo. Wasting highest at 6+ mo.

Source: Headey & Masters 2018, using DHS data from 44 countries surveyed between 2006 and 2013, with sample sizes of 296,370 (stunting), 284,784 (wasting), and 139,356 (anemia).
Fortified cereals can help meet infant needs

Switzerland (1870s)

France (1880s)

Home and artisanal production projects, 1980s

Food aid => SuperCereal+

(2010)

Many small-scale millers making premixed cereals since 1990s

Toronto Hosp. for Sick Kids (1931)

INCAP (1961)

Misola (1880s)

Misola (1949)

Weanimix (1990s)

Incorporated Nestlé (1949)

Céréal (1880s)

Céréla (1949)

Phospharine (1880s)

Farine Lactée (1870s)

Nestlé (1931)
Fortified cereals are widely sold

Accra, Ghana (2010)

Also available in stores

From S. Africa

Locally made:

From Brazil
We tested 108 products from 22 countries

Samples are from Africa (18) and Asia (3), plus Haiti

Table 1. Number of samples by country of purchase

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of samples</th>
<th>Country</th>
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<tr>
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<tr>
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<td>Indonesia</td>
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</tbody>
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Total number of countries 22
Total number of samples 108

Source: Masters, Nene and Bell (2016) in Maternal & Child Nutrition
The actual content of fortified cereals is unpredictable and often below standards.

Tested composition of 108 samples from 22 developing countries, relative to zinc and iron content of WFP SuperCereal+

Less than 1/5th (17%) of samples meet or exceed zinc & iron benchmarks.

Most (63%) are below both benchmarks.

These differences turn out to be uncorrelated with what’s on the label about ingredients or nutrients, packaging quality or price.

Source: Masters, Nene and Bell (2016) in Maternal & Child Nutrition
The actual content of “fortified” cereals is often far below what infants need

Modeled deficit (or surplus) of nutrients by age

- **Inadequate fat at 12-24 months**
- **Inadequate iron at 6-9 months**
- **Inadequate zinc at 6 months**

Boxes show 25th-50th-75th percentile; whiskers extend to +/- 1.5 IQR; circles show outliers.

Source: Masters, Nene and Bell (2016) in *Maternal & Child Nutrition*
Pricing of baby foods is also a surprise

For multinational brands, prices are higher in poorer countries

In richer counties, local generics and multinationals have similar prices
Could research lead to introduction and enforcement of new quality standards?

Nutrient composition of premixed and packaged complementary foods for sale in low- and middle-income countries: Lack of standards threatens infant growth

William A. Masters, Marc D. Nene, Winnie Bell

First published: 22 December 2016

DOI: 10.1111/mcn.12421

Global Health | DONALD G. McNEIL, JR.

Baby Food: Ubiquitous but Unpredictable

Children would be healthier if an international agency tested brands and certified them as nutritious, the study's authors argued.

"Some of these products are fine, but some are just awful, and there's no way for consumers to tell the difference," said William A. Masters, an economist with the Friedman School of Nutrition Science and Policy at Tufts University and the study's lead author. "A wonderful food category is languishing for lack of quality certification."

His team tested 108 brands of infant porridge from 22 countries and found that less than a quarter met international standards for fat, protein, iron and zinc. The study is to be published soon in the journal Maternal and Child Nutrition.

It would be relatively easy for a laboratory to collect samples, test them and issue seals of quality that the makers could display on their packages, Dr. Masters said.

His team simply wired $20 payments to friends and colleagues around the world to cover the cost of shipping samples to Boston. On-site plant inspections, of course, would cost more.

Why this problem was not solved long ago is puzzling, Dr. Masters said. A reason, he surmised, "could be prejudice in the public-sector nutrition community."

Nutrition advocates endorse some expensive additives like micronutrient sprinkles and fortified peanut butters, he said. Yet they often demonize packaged foods from private companies, even though they are cheap and popular, because of the extra salt and sugar in adult foods and because of the long battle to keep women breast-feeding instead of using formula from food companies like Nestlé.

As long as porridges are used only to supplement breast-feeding for children over 6 months old, and as long as they contain proper levels of nutrients, he argued, "they can be lifesavers."
New work: Substitution for other foods

When fortified cereals are used, what do they displace?

Research with Norbert Wilson, using discrete choice experiments in Malawi
New work: Fast, cheap field testing kits?

Making nutrient testing easier could boost policymakers’ interest in new quality standards

With Charlie Mace in analytical chemistry

Paper-Based Microfluidics and Chromatography

Source: http://ase.tufts.edu/chemistry/mace
Conclusion: A market ready for disruption

-- Premixed flours can meet infant needs at low cost
  – but they usually don’t

-- To remedy this market failure, would need quality assurance
  – but institutional obstacles are daunting

-- Economics can guide social change, but that’s just a start
  – need stakeholder demand
  – and new technologies can help
Thank you!

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**Co-authors:**
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+ Winnie Bell and Marc Nene (for quality testing)
+ Charlie Mace (for analytical chemistry)