Got baby food?
Understanding the market for packaged complementary foods in developing countries

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Much of the world’s growth faltering is experienced from around 3 to 24 months of age

Mean z scores relative to WHO standards across 54 DHS/MICS surveys, by age (1-59 mo.)

What can explain sudden and severe shortfalls during this period?
3-24 months of age

Weight-for-height
Height-for-age
Weight-for-age

Many factors could cause this pattern of onset and duration

- For example:
  - Exposure to pathogens
  - Expression of earlier deficits
...but also inadequate nutrient intake

### Mean intake as a percentage of WHO recommended needs, by age

<table>
<thead>
<tr>
<th></th>
<th>6–8 months</th>
<th>9–11 months</th>
<th>12–18 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>84%</td>
<td>90%</td>
<td>91%</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>89%</td>
<td>99%</td>
<td>88%</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>66%</td>
<td>69%</td>
<td>78%</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>33%</td>
<td>44%</td>
<td>75%</td>
</tr>
<tr>
<td>Vitamin A (IU)</td>
<td>533%</td>
<td>663%</td>
<td>443%</td>
</tr>
<tr>
<td>Vitamin B1 (mg)</td>
<td>59%</td>
<td>67%</td>
<td>60%</td>
</tr>
<tr>
<td>Vitamin B2 (mg)</td>
<td>48%</td>
<td>50%</td>
<td>35%</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>53%</td>
<td>41%</td>
<td>44%</td>
</tr>
</tbody>
</table>


What could make it difficult to reach nutrient adequacy?

- Total quantity of food needed is very small (<50g/day to start)
  - daily cost of adequate quantity is low, even for poor households
  ...but infants have small stomachs relative to potential growth velocity
  so adequate complementary foods must have different qualities

- What attributes are needed to reach adequate nutrient intake?
  - higher nutrient density and digestibility than family foods
  - more frequent feeding than other family meals

- Every culture has traditional approaches to complementary feeding
  - starchy staples may be germinated, fermented etc. for digestibility
  - other ingredients added for protein, fats and micronutrients

- Getting it right costs more than money
  - time to prepare special foods 3-5 times per day
  - information about which foods have adequate density
How can sufficient nutrient density be reached consistently, given caregivers’ constraints?

Toronto Hospital for Sick Children, 1931

How can sufficient nutrient density be reached consistently, given caregivers’ constraints?

Toronto Hospital for Sick Children, 1931

INCAP, 1961
How can sufficient nutrient density be reached consistently, given caregivers’ constraints?

Various soy blends since 1970s
...and since 2010, SuperCereal+

Home and artisanal production projects, 1980s
Soy blends and SuperCereal+

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How can sufficient nutrient density be reached consistently, given caregivers’ constraints?

Many small-scale millers making infant cereals since 1990s

Cereal-soy blends

Home and artisanal production projects, 1980s

Incap, 1961

SuperCereal+

So what products are most widely available in low-income countries?

Accra, Ghana (2010)
One can find many alternatives out there

In Ghana, generic weanimix

Local grain millers’ brands, e.g. from elsewhere in Africa:

And various multinationals, typically sold in supermarkets and pharmacies:

How do economists explain persistence of fancy brands, when equally-good alternatives are known to exist?

Advertising.

• Fancy brands may signal social status
  – sometimes plausible, but can’t explain private use by the poor

• Fancy brands may be bought by mistake
  – sometimes plausible, but how often can people be fooled?

• Fancy brands provide quality assurance
  – George Akerlof won Nobel in 2001 for this explanation
    • If buyers can’t see qualities that sellers control, they rely on trust
    • Trust is earned through brand identity, which allows persistently high prices
    • Examples include specialized legal or medical services, education etc.
  – Infant foods are subject to this kind of market failure
    • Nutrient densities cannot be seen, even during or after feeding
    • Many confounding factors affect child’s appetite, health and growth

=> The only remedy is 3rd party quality testing and certification
Here is the market I studied first:

<table>
<thead>
<tr>
<th>All infant foods for sale in Bamako, Mali (1999)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand name</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Cérélac (wheat)</td>
</tr>
<tr>
<td>Cérélac (wheat)</td>
</tr>
<tr>
<td>Cérélac (rice)</td>
</tr>
<tr>
<td>Cérélac (wheat/Banana)</td>
</tr>
<tr>
<td>Cérélac (wheat +3 fruits)</td>
</tr>
<tr>
<td>Blédilac** (wheat)</td>
</tr>
<tr>
<td>Blédina** lactée fruits</td>
</tr>
<tr>
<td>Farinor** (maize/soy)</td>
</tr>
<tr>
<td>UCODAL (e.g. Sinba)</td>
</tr>
<tr>
<td>MISOLA</td>
</tr>
</tbody>
</table>

All branded imports charged much more than local products, which could be just as nutritious... but despite low cost had very few sales, except to institutional buyers

Of the branded imports, only Cérélac was widely available.


How do we know why consumers choose Cérélac?

A market experiment in Bamako, Mali (2000):

The question is,

Why would women buy this?

*Cerelac (400 g. cans)*

1617 FCFA = $2.49

Instead of this?

*Sinba (2 x 200 g. bags)*

2 x 200 FCFA = $0.61

Or just raw ingredients
to mix at home...

How do we know why consumers choose Cerelac?
A market experiment in Bamako, Mali (2000):

In very low income peri-urban areas, used market intercepts to recruit 240 mothers with infants.

We gave participants a can of Cerelac, then offered to swap for increasing quantities of other infant foods.

The experiment allowed people to reveal their preferences one step at a time.

We asked them to compare:

- The well-known brand *(Cerelac, in 400 g. metal canister)*
- A sealed, “certified” mix *(Certilac, in 400 g. plastic bag)*
- An open, unidentified mix *(Anonymous, in open bags)*
- Raw materials in fixed proportions *(Ingredients, in open bags)*

The only difference is:

- Brand & packaging
- Certification
- Processing
To avoid response bias, these were real decisions; respondents took home one of their actual choices.

On average, the mothers in our experiment cared about product certification almost as much as processing.

*Mean willingness to pay for product:*  
- Certilac: 1160 FCFA  
- Generic: 705 FCFA  
- Ingredients: 120 FCFA

*Implied willingness to pay for the difference:*  
- 455 FCFA for certification (= $0.70 per 400 g. bag)  
- 585 FCFA for processing (= $0.90 per 400 g. bag)
We also estimated the cost of certification

- We found that:
  - introducing certification would be worth at least $20 per year per child needing infant foods (between 6 mo. and 2 yrs. of age)
  - this amounts to a value of about $1 million per year for the city of Bamako as a whole
- This is money that they’re still not getting
  - fifteen years later, still no certification systems in place

A decade later in 2010, DFID funded a scoping study to revive the question for Ghana...

- This time, we could address two other questions:
  - Are the locally produced infant foods actually available?
  - Are the locally produced infant foods actually high quality?
- Our economic theory has clear predictions:
  - After start-up the products will be rarely available, because buyers will be skeptical about quality
  - and skepticism will be justified, because quality will be low and variable since the sellers lack motivation to keep it high
Here is the full range of what I bought from diverse vendors around Accra in 2010

Question #1: Are local infant foods as available as Cerelac?

• This is a difficult question...
• To answer in terms of Greater Accra as a whole, we divided the city into quadrants defined like this:
  http://maps.google.com/maps?
  &ll=5.558740,-.253961
  &spn=0.0025,0.0025
  &pw=2

• Then randomly generated latitude and longitude locations and visited each one until we found over 200 shops to judge...
Are local infant foods as available as Cerelac?

No. Cerelac is as ubiquitous as toothpaste and soap, but local foods are often entirely unavailable.


Question #2:
Are local infant foods as good as Cerelac?

- To answer, we took 14 samples and sent them without labels to a commercial lab in Omaha
- We did proximate analysis for macronutrients, plus iron & zinc
Nutrient density often exceeded international benchmarks but often didn’t.

More nutrient-dense than international benchmarks

Less nutrient-dense than international benchmarks

We had visited several of these manufacturers, and were surprised:

This producer’s mix had similar nutrient density to international benchmarks

This product had much lower fat, implying little of the claimed soy content
So...
Locally produced foods *could* be widely available at much lower cost and similar nutrient density as Cerelac

- ...and yet they are not.
  - they are rarely available, and when found their quality is variable
  - certification could help them be more widely sold with higher quality
- There is no demand for quality certification.
  - public agencies do their own inspection and testing, e.g. for SuperCereal+
  - richer households can buy enough of the multinationals
  - potential beneficiaries don’t know it would help them
- This is a classic market failure.
  - the remedy is clear enough, but policy depends on politics
- How were existing quality assurance programs created?
  - public (e.g. FDA) and private (e.g. UL) introduced after scandals
  - international programs (e.g. ISO) used for new attributes
- What might alter policy and grantmaking in this domain?

The latest project, funded by IFPRI, with Friedman students Winnie Bell and Marc Nene:

*What’s for sale now, and is it any good?*

- A global catalog of packaged complementary foods:
  - All products found by our collaborators around the world
  - Criterion: sold as complement to breastmilk, for >6 months of age
  - Typical product is precooked, in packages of 100-500g
- Random sampling to test for nutrient composition
  - Budgeted to sample 100 products from 20 countries
  - Test for protein, fats, calories, iron and zinc
  - Actually able to test 108 products from 22 countries
Results from 108 products in 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>
<th>Number of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>5</td>
<td>Kenya</td>
<td>5</td>
</tr>
<tr>
<td>Botswana</td>
<td>5</td>
<td>Madagascar</td>
<td>3</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>5</td>
<td>Malawi</td>
<td>2</td>
</tr>
<tr>
<td>Cameroon</td>
<td>5</td>
<td>Mali</td>
<td>7</td>
</tr>
<tr>
<td>China</td>
<td>1</td>
<td>Mauritania</td>
<td>3</td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>4</td>
<td>Morocco</td>
<td>2</td>
</tr>
<tr>
<td>DR Congo</td>
<td>1</td>
<td>Nepal</td>
<td>5</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>12</td>
<td>Rwanda</td>
<td>6</td>
</tr>
<tr>
<td>Ghana</td>
<td>10</td>
<td>Senegal</td>
<td>4</td>
</tr>
<tr>
<td>Haiti</td>
<td>4</td>
<td>South Africa</td>
<td>6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>8</td>
<td>Uganda</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total number of countries</strong></td>
<td><strong>22</strong></td>
<td><strong>Total number of samples</strong></td>
<td><strong>108</strong></td>
</tr>
</tbody>
</table>

Source: Masters, Nene and Bell (2016), in progress.

Results from 108 products in 22 countries

Greatest variance is in micronutrients
Fat content also varies widely

Table 2. Summary Statistics for 108 complementary foods from 22 countries

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Minimum</th>
<th>Maximum</th>
<th>SCP Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macronutrients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calories (kcal)</td>
<td>419.1</td>
<td>16.0</td>
<td>378.6</td>
<td>466.2</td>
<td>410.0</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>5.7</td>
<td>3.1</td>
<td>0.0</td>
<td>15.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>13.8</td>
<td>3.9</td>
<td>1.5</td>
<td>23.3</td>
<td>16.0</td>
</tr>
<tr>
<td>Carbohydrates (g)</td>
<td>78.1</td>
<td>6.4</td>
<td>62.4</td>
<td>97.5</td>
<td>na</td>
</tr>
<tr>
<td><strong>Micronutrients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>9.9</td>
<td>8.9</td>
<td>0.0</td>
<td>61.3</td>
<td>13.5</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>5.9</td>
<td>4.9</td>
<td>0.0</td>
<td>21.0</td>
<td>8.2</td>
</tr>
<tr>
<td><strong>Other content</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ash (g)</td>
<td>2.4</td>
<td>1.3</td>
<td>0.0</td>
<td>7.1</td>
<td>5.0</td>
</tr>
<tr>
<td>Moisture (g)</td>
<td>5.8</td>
<td>3.1</td>
<td>1.4</td>
<td>17.8</td>
<td>7.0</td>
</tr>
</tbody>
</table>

Note: All data shown are nutrient content per 100 grams of dry matter, except for moisture which is per 100 grams of product as purchased.
Sources: Author's test results from Midwest Laboratories, Lincoln NE, except for the Super Cereal Plus (SCP) standard which is from WFP (2014) and Webb et al. (2011), specifying allowable minimums for each nutrient and maximums for moisture and ash.

Source: Masters, Nene and Bell (2016), in progress.
Many products exceed SuperCereal+ benchmarks, but few meet or exceed for all three macronutrients

Source: Masters, Nene and Bell (2016), in progress.

Micronutrient results

Many products exceed SuperCereal+ benchmarks, but few meet or exceed for both micronutrients

Source: Masters, Nene and Bell (2016), in progress.
Some packages have nutrient fact claims. How accurate are they?

![Graph showing nutrient fact claims](image)

Dashed lines are at 45\(^\circ\) Claims are mostly useless
Solid lines are SCP benchmarks
Claims themselves are basically random

Source: Masters, Nene and Bell (2016), in progress.

What would happen if a child consumed only breastmilk plus these complementary foods?

![Graph showing nutrient inadequacy](image)

Macronutrient inadequacy after 12 months of age
Micronutrient inadequacy in first 12 months

Boxes show 25\(^{th}\)-50\(^{th}\)-75\(^{th}\) percentile; whiskers extend to +/- 1.5 IQR; circles show outliers.

Source: Masters, Nene and Bell (2016), in progress.

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Conclusion:
Locally made packaged complementary foods can have adequate nutrients but they usually don’t

-- To remedy market failure, would need quality assurance

-- Effectiveness could be measured by an RCT
1) Establish an Infant Nutrition Quality Assurance Project (INQAP)
2) Recruit millers to participate, and issue time limited INQAP-OK stickers
3) Roll out billboards and demonstrations at randomly-chosen markets
4) Use surveys and growth monitoring to track food purchases & infant growth
5) Use child’s age at the time of market advertisements to identify causal effect of certification on growth

-- Will keep submitting proposals for research
• But would an RCT showing benefit really cause policy change?
  — what information is most likely to alter policy and grantmaking?
• Research can identify and explain the puzzle, but that’s just a start!

Acknowledgements

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