Short-term effects of treatment of acute malnutrition: examples from Uganda and Burkina Faso

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Declaration of potential conflicts of interest

- Has received research grants from ARLA Food for Health, and from Danish Dairy Research Council

- Has research collaboration with food aid manufacturers: GC Rieber Compact, Norway, and Nutriset, France.
Wasting
as defined by weight-for-height Z

**Course**

**Moderate**
- \( RR_{Death} = 3 \)
- Survival

**Severe**
- \( RR_{Death} = 10 \)

**Consequences**

**Short-term**
- Development
- Physical activity
- Immunity
- Metabolism

**Long-term**
- Education
- Working capacity
- Infections
- Chronic diseases

-------- Body composition --------
# Acute malnutrition

<table>
<thead>
<tr>
<th></th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Severe</strong></td>
<td>Weight-height Z &lt; -3 OR Arm circumference (mm) &lt; 115 OR Oedema +</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td>Weight-height Z -3 to -2 OR Arm circumference (mm) 115 to 125 &amp; -</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prevalence</th>
<th>50+ mill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>?</td>
</tr>
</tbody>
</table>
## Acute malnutrition

<table>
<thead>
<tr>
<th></th>
<th>Guidelines</th>
<th>Treatment</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Severe</strong></td>
<td>+</td>
<td>100% of E</td>
<td>F-75/F-100 LNS</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td>-</td>
<td>50% of E?</td>
<td>CSB?/LNS? Local foods?</td>
</tr>
</tbody>
</table>

**CSB:** corn-soy blend, given as porridge  
**LNS:** lipid-based nutrient supplement
SAM treatment
an example from Uganda: the FeedSAM study

- Observational study among 122 children with complicated SAM at Mwanamugimu Nutrition Unit, Uganda
- Aim to study refeeding hypophosphataemia or syndrom
- Serum phosphate used as a marker of phosphorus depletion
- At the time of the study, children with diarrhoea were given rice porridge rather than F75/F100 for some days
Changes in plasma phosphate during in-patient treatment of children with severe acute malnutrition: an observational study in Uganda

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![Graph showing changes in plasma phosphate during in-patient treatment](AJCN, 2016)

- **Rapid normalization on F75/F100**
- **Delayed normalization on rice porridge**
Nutrient composition of F-75, F-100, and the rice porridge used during nutritional rehabilitation of children admitted with severe acute malnutrition

<table>
<thead>
<tr>
<th>Composition</th>
<th>F-75</th>
<th>F-100</th>
<th>Rice porridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy, kcal/L</td>
<td>750</td>
<td>1000</td>
<td>490</td>
</tr>
<tr>
<td>Carbohydrate, % of energy</td>
<td>64</td>
<td>45</td>
<td>89</td>
</tr>
<tr>
<td>Protein, % of energy</td>
<td>5</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Fat, % of energy</td>
<td>31</td>
<td>45</td>
<td>3</td>
</tr>
<tr>
<td>Phosphorus, mg/L</td>
<td>560</td>
<td>579</td>
<td>130</td>
</tr>
</tbody>
</table>

1Nutrition information for F-75 and F-100 (Nutriset, France) was obtained from the packages. Nutrition information for the rice porridge was obtained from foodcomp.dk.

2Rice porridge prepared from 200 g white rice flour and 1500 mL water.
Lack of phosphorus during refeeding may result in refeeding syndrome and death

What happens to survivors given inadequate amounts of P and other growth nutrients

Body composition?
Risk of chronic diseases?
MAM treatment
an example from Burkina Faso: The Treatfood trial

- 2x2x3 factorial trial among 1609 children with MAM
- Aim to estimate effects of key factors in food aid products
- Supplements providing 500 kcal/d for 3 months
  - LNS vs CSB
  - Soy isolate vs dehulled
  - Milk contributing 20 or 50 vs 0% of total protein
- Outcomes
  - Primary: fat-free mass index by deuterium dilution
  - Secondary: iron, physical activity, child development etc
TreatFOOD
2x2x3 factorial

Matrix | Soy quality | Milk (% of protein)
---|---|---

R

CSB

LNS

Dehulled
Isolate

Dehulled
Isolate

A | B | C

D | E | F

G | H | I

J | K | L

(Fabiansen, Plos Med, 2017)
Effectiveness of food supplements in increasing fat-free tissue accretion in children with moderate acute malnutrition: A randomised $2 \times 2 \times 3$ factorial trial in Burkina

Christian Fabiansen$^{1,2}$, Charles W. Yaméogo$^{1,3}$, Ann-Sophie Iuel-Brockdorf$^{1,2}$, Bernardette Cichon$^{1,2}$, Maren J. H. Rytter$^{1}$, Anura Kurpad$^{4}$, Jonathan C. Wells$^{5}$, Christian Ritz$^{1}$, Per Ashorn$^{6}$, Suzanne Filteau$^{7}$, André Briend$^{1,6}$, Susan Shepherd$^{8}$, Vibeke B. Christensen$^{2,9}$, Kim F. Michaelsen$^{1}$, Henrik Friis$^{1,*}$

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# Changes during intervention

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th></th>
<th>3-month</th>
<th></th>
<th>Difference</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>n</td>
<td>Mean</td>
<td>n</td>
<td>Mean</td>
</tr>
<tr>
<td><strong>FFM (kg)</strong></td>
<td>1489</td>
<td>5.79 (0.91)</td>
<td>1425</td>
<td>6.61</td>
<td>1328</td>
<td>0.85</td>
</tr>
<tr>
<td><strong>FM (kg)</strong></td>
<td>1489</td>
<td>1.13 (0.39)</td>
<td>1425</td>
<td>1.19</td>
<td>1328</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Weight, (kg)</strong></td>
<td>1609</td>
<td>6.91 (0.93)</td>
<td>1548</td>
<td>7.81</td>
<td>1548</td>
<td>0.90</td>
</tr>
<tr>
<td><strong>Weight-for-height Z</strong></td>
<td>1609</td>
<td>-2.22 (0.51)</td>
<td>1548</td>
<td>-1.53</td>
<td>1548</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>MUAC (mm)</strong></td>
<td>1609</td>
<td>122.6 (4)</td>
<td>1548</td>
<td>130.1</td>
<td>1548</td>
<td>7.5</td>
</tr>
<tr>
<td><strong>Length (cm)</strong></td>
<td>1609</td>
<td>70.4 (5.3)</td>
<td>1548</td>
<td>72.9</td>
<td>1548</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>Height-for-age Z</strong></td>
<td>1609</td>
<td>-1.70 (1.1)</td>
<td>1548</td>
<td>-1.86</td>
<td>1548</td>
<td>-0.17</td>
</tr>
</tbody>
</table>

(Fabiansen, Plos Med, 2017)
### Main effects

<table>
<thead>
<tr>
<th>Matrix</th>
<th>Soy quality</th>
<th>Milk protein (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNS vs CSB</td>
<td>Isolate vs dehulled</td>
<td>20% vs 0%</td>
</tr>
<tr>
<td><strong>FFMI (kg/m²)</strong></td>
<td>0·083 (0·003; 0·163)</td>
<td>0·097 (-0·002; 0·196)</td>
</tr>
<tr>
<td>FMI (kg/m²)</td>
<td>0·038 (-0·042; 0·118)</td>
<td>0·049 (-0·047; 0·146)</td>
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<td>Length (cm)</td>
<td>0·038 (-0·042; 0·118)</td>
<td>0·049 (-0·047; 0·146)</td>
</tr>
<tr>
<td>Weight-height Z</td>
<td>0·11 (0·04; 0·17)</td>
<td>0·05 (-0·01; 0·11)</td>
</tr>
<tr>
<td>Knee-heel (mm)</td>
<td>0·038 (-0·042; 0·118)</td>
<td>0·049 (-0·047; 0·146)</td>
</tr>
<tr>
<td>MUAC (mm)</td>
<td>0·1 (0·5; 1·6)</td>
<td>0·6 (-0·2; 1·3)</td>
</tr>
<tr>
<td>Triceps (mm)</td>
<td>0·16 (0·06; 0·25)</td>
<td>0·7 (-0·052; 1·4)</td>
</tr>
</tbody>
</table>

LNS vs CSB increased fat-free mass index
Marginal significant effect of 20%, but not 50%, vs 0% of protein from milk

(Fabiansen, Plos Med, 2017)
Primary and other outcomes

- **Fat-free mass index**
  - LNS increased fat-free mass index
  - Marginal significant effect of 20%, but not 50%, vs 0% of protein from milk
    (Fabiansen, Plos Med, 2017)

- **Hemoglobin, iron status and inflammation**
  - LNS increased hemoglobin and iron status
  - No effects of soy isolate and milk
    (Cichon, AJCN, 2018)

- **Physical activity**
  - No effects
    (Yameogo, unpublished)

- **Child development**
  - No effects
    (Olsen and Iuel-Brochdorff, unpublished)
Conclusions

❖ SAM treatment
  ❖ Inadequately fortified foods may contribute to mortality
  ❖ **What is the effect among survivors?**
    ❖ Increased fat accretion and risk of chronic disease?

❖ MAM treatment
  ❖ LNS vs CSB yields more fat-free tissue and better iron status, but not accompanied by functional benefits
  ❖ Soy quality had no effects, but the role of milk merits further research

❖ Not possible to assess overall effect of treatment, but ..... 
❖ overall weight gain was predominantly due to fat-free mass
❖ concerns of excessive fat accumulation not justified
Thanks to collaborators ….

Hanifa Namusoke, Esther Babirekere-Iriso, Ezekiel Mupere, Charles Yameogo, Christian Fabiansen, Ann-Sophie Iuel-Brockdorff, Bernardette Cichon, Maren Rytter, Christian Ritz, Mette Frahm Olsen, Kim F Michaelsen, Vibeke B Christensen, André Briend, Anura Kurpad, Jonathan Wells, Suzanne Filteau, Susan Shepherd, Per Ashorn
THANK YOU!