Women’s Nutrition and Reproductive Health

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The story of Lila

Lila’s mother was undernourished, and Lila was born small. She grew up into an undernourished woman, and her daughter was LBW, and undernourished as a child. Lila’s daughter is likely to grow into an undernourished woman, and to have LBW babies.

Nutrition during a woman’s life


Menarche and menstruation


Association of height and fatness with age at menarche (n = 213)

Maternal growth in knee height is associated with lower birthweight among multiparous, but not primiparous, adolescents.

Consequences of early pregnancy for the girl herself
- Unprepared for motherhood in terms of social development
  - Leads to poor mothering behavior
- Unprepared for motherhood in terms of physical development
  - Leads to impaired growth (particularly in pelvic size) or progressive malnutrition
  - May lead to “maternal depletion” during or after her childbearing years
  - Increased risk of prolonged labor leading to obstetric injury or death

Consequences of early pregnancy for society
- If the girls survives, she may contribute less to society
  - Lack of completed education
  - Physical disability from obstetric injury
  - Higher population growth than if childbearing starts later
- If she dies, her productivity is lost and she may also leave orphaned children
How do we know how much of a nutrient is needed?

- Experimental animals
  - Feed an “open-formula” diet with the specific nutrient deleted
  - See if evidence of deficiency develops

Can we do this in people?

- Human subjects
  - Feed them more of what might be missing
  - See if their health improves in some perceptible and (better yet) measurable way
Effect of maternal food supplementation during pregnancy on birthweight: Gambia

Seasonal pattern of birthweight in control and intervention villages in Gambia

Nutritional costs of reproduction


*Adjusted for sex, month, parity and gestational age


Effect of prenatal supplementation on perinatal and neonatal death rates among 2,092 births over 5 y in rural Gambia


Effect of iron/folic acid or multiple micronutrient supplements v. folic acid alone among pregnant women by household wealth index: China, n = 5828 (clustered)

Conclusions

- Some women need protein/energy, some micronutrients and some both
- Undernourished pregnant women may benefit from nutritional supplementation by having larger infants and, in some cases, by gaining weight themselves
  - The increase in birthweight is modest
  - Some interventions also reduce stillbirths and/or components of infant mortality

Nutritional costs of reproduction

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>Energy (kcal/d)</th>
<th>Protein (g/d)</th>
<th>Iron (mg/d)</th>
<th>Vitamin A (μg/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-pregnant (19-30 y old)</td>
<td>Formula based on age, height, weight and physical activity*</td>
<td>46</td>
<td>18</td>
<td>700</td>
</tr>
<tr>
<td>Pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st trimester</td>
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<td></td>
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<tr>
<td>2nd trimester</td>
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<tr>
<td>3rd trimester</td>
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<tr>
<td>Lactation</td>
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</tr>
<tr>
<td>0-6 mo</td>
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<tr>
<td>7-12 mo</td>
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</tbody>
</table>

*EER = 350 + (6.67*age [y]) + 9.44*[(9.36*weight[kg]) + 726*height[m]]

**Pregnancy energy deposition

* Milk energy output = weight loss

† Milk energy output

Effect of maternal supplementation from 5-25 weeks postpartum on maternal body weight among undernourished Guatemalan women

<table>
<thead>
<tr>
<th>Duration of lactation (wk)</th>
<th>Maternal weight (kg)</th>
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<tbody>
<tr>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>42</td>
</tr>
<tr>
<td>15</td>
<td>44</td>
</tr>
<tr>
<td>20</td>
<td>46</td>
</tr>
<tr>
<td>25</td>
<td>48</td>
</tr>
</tbody>
</table>

Effect of maternal supplementation from 5-25 weeks postpartum on maternal body weight among undernourished Guatemalan women

**Nutrient Composition of High-Energy (HES) and Low-Energy (LES) Supplements Given to Lactating Guatemalan Women**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>HES</th>
<th>LES</th>
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</thead>
<tbody>
<tr>
<td>Energy (MJ)</td>
<td>2.14</td>
<td>0.60</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>12.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>57.5</td>
<td>21.7</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>26.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Vitamin A (IU)</td>
<td>543</td>
<td>15.2</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Folic Acid (µg)</td>
<td>51.7</td>
<td>14.5</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>2.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>1.5</td>
<td>1.9</td>
</tr>
</tbody>
</table>

*As derived from the following percentage of macronutrients: HES, protein, 5.9%; carbohydrate, 45.1%; fat, 36.9%; LES, protein, 12.3%; carbohydrate, 72%; fat, 15.6%.

Conclusions

• In studies with strong designs, both protein/energy and micronutrient supplements improve lactation performance (e.g. exclusive breastfeeding, nutrients transferred to the baby)
• Maintenance of exclusive breastfeeding is important for the reduction of infection as well as for birth spacing, which promotes both maternal and child health

Nutrition during a woman’s life


Millenium Development Goals

• Reduce by three-quarters the maternal mortality ratio
• Achieve, by 2015, universal access to reproductive health