Maternal nutrition – impact on preterm and low birth weight

*PTB/LBW Global Technical Working Group on Implementation Challenges and Solutions*

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MALNUTRITION OF THE MOTHER DIRECTLY INFLUENCES HER CHILD

malnutrition defined as too thin, too short, or too few micronutrients
# Maternal Nutrition

## Short-term consequences of maternal malnutrition

<table>
<thead>
<tr>
<th>Maternal nutritional problem</th>
<th>Associated health consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short maternal status (stunting)</td>
<td>Maternal and neonatal death, SGA</td>
</tr>
<tr>
<td>Underweight</td>
<td>SGA</td>
</tr>
<tr>
<td>Obesity</td>
<td>gestational diabetes, pre-eclampsia, haemorrhage, neonatal and infant death</td>
</tr>
<tr>
<td>Anemia and iron deficiency</td>
<td>LBW, perinatal mortality, maternal mortality</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>LBW, infant mortality</td>
</tr>
<tr>
<td>Zinc</td>
<td>pre-term delivery, delivery complications</td>
</tr>
<tr>
<td>Iodine</td>
<td>lowered IQ, mental retardation, sub-optimal cognitive development and growth</td>
</tr>
<tr>
<td>Folate</td>
<td>neural tube defects</td>
</tr>
<tr>
<td>Calcium &amp; Vitamin D</td>
<td>hypertension during pregnancy, pre-eclampsia, preterm birth and SGA</td>
</tr>
</tbody>
</table>

## Long-term consequences of maternal malnutrition

![Diagram showing the impact of maternal nutrition on fetal development](image)

Both short & long term consequences for mother and child

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Sources: Bhutta et al. Lancet 2013  
Black et al. Lancet 2013
PREGNANCY COMES AT A HIGH NUTRITION COST

<table>
<thead>
<tr>
<th></th>
<th>Europe</th>
<th>Africa / Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Menarche</td>
<td>11 years</td>
<td>12 years</td>
</tr>
<tr>
<td># children</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td># months pregnant</td>
<td>2*9 = 18</td>
<td>4*9 = 36</td>
</tr>
<tr>
<td>Months lactation</td>
<td>2*4 = 8</td>
<td>4*18 = 72</td>
</tr>
<tr>
<td>Age Menopause</td>
<td>54 years</td>
<td>48 years</td>
</tr>
<tr>
<td># months rep life</td>
<td>43*12 = 516</td>
<td>36*12 = 432</td>
</tr>
<tr>
<td>% Rep. activity</td>
<td>(8+18) / 516 = 5%</td>
<td>(36+72) / 432 = 25%</td>
</tr>
<tr>
<td>Total energy cost</td>
<td>275,200 kcal</td>
<td>1,398,800 kcal</td>
</tr>
</tbody>
</table>

Total additional energy cost of
- pregnancy = 77,000 kcal *
- 6 months exclusive breastfeeding = 90,000-120,000 kcal

~2 years worth of food


www.gainhealth.org
Iron-deficient anemia is a risk factor for death due to hemorrhage.

Chronic Energy Deficiency contributes to prolonged labor.

Stunting contributes to obstructed labor.

Micronutrient deficiencies reduce immune response.

Calcium & vit D deficiency contribute to hypertension, pre-eclampsia and eclampsia.
DETERMINANTS OF LOW BIRTH WEIGHT

Born preterm (<37 weeks) VS
– Spontaneous preterm birth - multi-factorial process, 50% unidentified
  • Age at pregnancy, pregnancy spacing, multiple pregnancy
  • Infections*
  • Underlying maternal (chronic) medical condition
• Some nutritional factors
  • Lifestyle/work related – smoking*, stress
  • Maternal psychological health
  • Genetics
  • SES*

Born Small for Gestational Age (SGA) (<10th percentile)
– Proxy for IUGR
  • Low energy intake/low gestational weight gain
  • Low BMI pre-pregnancy
  • Short stature (stunting)
  • Malaria
  • Smoking
  • Pregnancy-induced hypertension
  • Primiparity
  • Congenital anomalies
  • Genetics

NUTRITIONAL DETERMINANTS OF LBW

Pre-term
— Pre-pregnancy weight status:
  • Underweight (↑ risk by 32%)
  • Overweight/obesity
    – Indirectly: hypertension, pre-eclampsia (↑ risk by ~2x)

Figure 5.1.1: Pre pregnancy underweight and risk for preterm birth

Figure 5.1.13: Pre pregnancy overweight and risk for hypertensive disorders of pregnancy

Figure 5.1.14: Pre pregnancy overweight and risk for preeclampsia

Source: Bhutta, et al. (2011a)
NUTRITIONAL DETERMINANTS OF LBW

Pre-term
- Pre-pregnancy weight status:
  - Underweight (↑ risk by 32%)
  - Overweight/obesity
    - Indirectly: hypertension, pre-eclampsia (↑ risk by ~2x)
- Micronutrient deficiencies?
  - Zinc suppl → ↓ 14% pre term
  - Calcium suppl – only if at risk of preeclampsia
  - Multiple micron suppl – risk of pre-eclampsia (27%)
  - Vit D – pre-term (↑ risk by 58%) and pre-eclampsia (~2x)
- Fatty acids? (conflicting results)
- Nutrition related disorders: Diabetes, Gestational hypertensive disorders

Source: Bhutta, et al. (2011)
Black et al., 2013
**Small for Gestational Age (SGA)**

- Pre-pregnancy weight status:
  - Underweight (↑ risk by 64%)
  - Overweight/obesity
- Short stature (stunting)
- Micronutrient deficiencies
  - MN suppl → ↓ 8% IUGR/16% lbw
  - Iron def (Iron suppl → ↓ 20% lbw (+ folic acid suppl → ↓ 30% lbw))
  - Vit A? (ass with lbw)
- Vit D def (↑ risk by 52%)
- Nutrition related diseases
  - Hypertension (Vit D, Calcium)
  - Anemia (M/S) - ↑ risk of SGA

NUTRITIONAL DETERMINANTS OF LBW

Pre-term
- Pre-pregnancy weight status:
  - Underweight
  - Overweight/obesity
    - Indirectly: hypertension, pre-eclampsia
- Micronutrient deficiencies?
  - Zinc suppl
  - Calcium suppl
  - Vit D – pre-term and pre-eclampsia
- Fatty acids?
- Nutrition related disorders

Small for Gestational Age (SGA)
- Pre-pregnancy weight status:
  - Underweight
  - Overweight/obesity
- Short stature (stunting)
- Micronutrient deficiencies
  - Iron def
  - Vit A?
  - Vit D def
- Nutrition related diseases
  - Hypertension (Vit D, Calcium)
  - Anemia (Mod/Sev)

“Where LBW is highly prevalent, most is due to IUGR rather than preterm”

Black et al, 2013
UNDERWEIGHT (BMI < 18.5)

Most recent DHS
STUNTING (<145 CM)

Most recent DHS
ANEMIA (<12.5 MG/L FOR NON PREGNANT; <11.5 MG/L FOR PREGNANT WOMEN)
INTERVENTIONS PRIOR TO CONCEPTION

HEALTHY WOMEN, MOTHERS & BABIES

IMMEDIATE
- Reproductive health & family planning
- Healthy diet, physical activity, micronutrient supplementation
- Screening & management of chronic diseases/infectious diseases (immunization)

INTERMEDIATE
Essential health services
Care for adolescent girls & women
Adequate nutrition

UNDERLYING
Healthy environment & women’s empowerment:
- Financial independence & education
- Preventing violence against women & girls

Must begin in Adolescence if to reduce the rates of prematurity and low birthweight

Adapted from WHO, 2012
Integral part of antenatal care services:

- Weight monitoring
- Nutrition counselling?
- Iron (Folate) supplements
- Other:
  - Supplements (Zn, Ca etc)?
  - Protein/calorie supplements?

Any vs recommended 90+ (may be as low as <5%)

WHO, 2012:
Limited impact on PTBs, some on LBW

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Pre-Term Births</th>
<th>Low Birth Weight</th>
<th>Other MNCH outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balanced Protein Energy Supplementation</td>
<td>Strong Against</td>
<td>Strong</td>
<td>Strong: Infant Mortality</td>
</tr>
<tr>
<td>Multiple Micronutrient Supplementation</td>
<td>Strong Against</td>
<td>Strong</td>
<td>Weak Against: Neonatal Mortality</td>
</tr>
<tr>
<td>Iron Folate Supplementation</td>
<td>Weak Against</td>
<td>Weak Against</td>
<td>Strong: Anemia</td>
</tr>
<tr>
<td>Zinc Supplementation</td>
<td>Weak</td>
<td>Strong Against</td>
<td>Weak</td>
</tr>
<tr>
<td>Magnesium Sulfate Supplementation</td>
<td>Weak Against</td>
<td>Weak Against</td>
<td>Weak: Supplementation &amp; prevention of cerebral palsy</td>
</tr>
<tr>
<td>Calcium Supplementation</td>
<td>Weak</td>
<td>Weak</td>
<td>Strong: Preclampsia</td>
</tr>
<tr>
<td>Supplementation with Fatty Acids</td>
<td>Strong Against</td>
<td>Strong Against</td>
<td>-</td>
</tr>
</tbody>
</table>

Prevent pregnancy in adolescence

Promote birth spacing:
- Continued breastfeeding for 2 years

Optimize pre-pregnancy weight
- Underweight: BCC, food security
- Overweight: availability and access to nutritious foods versus high energy dense foods; BCC

Promote healthy nutrition:
- Supplementation
- Food fortification
### INTEGRATED SERVICE DELIVERY

#### CLINICAL
- **Reproductive health & family planning**
- **Childbirth care**
  - E.g. Hygiene, warmth, breastfeeding, resuscitation
- **Emergency newborn care**
- **Emergency childcare**

#### OUTREACH / OUTPATIENT
- **Reproductive healthcare, family planning, nutrition counselling**
- **Antenatal care**
  - Visits, calcium supplementation
- **Postnatal care**
  - E.g. Promotion of healthy behaviours e.g. hygiene, breastfeeding,
- **Child healthcare**
  - E.g. Immunizations, nutrition (Vitamin A supplementation), growth monitoring

#### FAMILY / COMMUNITY
- **- Adolescent nutrition**
- **- Gender violence**
- **- Education & empowerment**
- **- Prevention of STIs & HIV**
- **Counselling & preparation for newborn care**
  - Where skilled care not available, prep for clean birth and immediate newborn care (hygiene, warmth, breastfeeding)
- **Healthy home care**: E.g. Preventative care, newborn care (hygiene, warmth), nutrition (breastfeeding, complementary feeding), family planning/birth spacing

### Source
Adapted from WHO, 2012
INNOVATIONS IN DELIVERY

• Start pre-conception → adolescent girls

• Intervene beyond the health system
  • Workplace
  • Community e.g. Girl centers
  • Schools
  • Sports
  • Social media

• Social change – not only individual behavior change
Nutrition Concurrent Sessions

Join us to find out the difference good nutrition can make in the lives of women and girls all over the world and why we must make it a priority.

Room B3-4
Nutrition: A gateway to achieving the SDGs

Tuesday, May 17
10:30 - 12PM
Share and learn how integrating nutrition in development can help us reach the SDGs.

Room B3-2
Adolescent Girls’ Nutrition: The 2nd window of opportunity

Wednesday, May 18
1:30 - 2:30PM
Learn why nutrition must be part of the agenda to economically and socially empower adolescent girls.

Room B3-4
From Grassroots to Global: Women as nutrition champions

Wednesday, May 18
3 - 4PM
Discover how women everywhere – from the household to the boardroom – can be nutrition champions and advance the cause locally and globally.

Insights on adolescent girls nutrition behaviours
Thursday May 19th 13:05 (speakers corner)
Thank you
## NUTRITIONAL PROBLEMS OVERLAP

<table>
<thead>
<tr>
<th>Overlap/indicator group</th>
<th>Number of countries</th>
<th>Total population (millions)</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRA short stature only</td>
<td>5</td>
<td>232</td>
<td>Cambodia, Congo, Nepal, Pakistan, Sierra Leone</td>
</tr>
<tr>
<td>WRA thinness only</td>
<td>3</td>
<td>110</td>
<td>Chad, Eritrea, Ethiopia</td>
</tr>
<tr>
<td>Adult female overweight only</td>
<td>25</td>
<td>610</td>
<td>Albania, Armenia, Azerbaijan, Brazil, Cameroon, Colombia, Dominican Republic, Egypt, Gabon, Ghana, Jordan, Kazakhstan, Kyrgyzstan, Lesotho, Mauritania, Morocco, Namibia, Republic of Moldova, Sao Tome and Principe, Senegal, Swaziland, Turkey, Turkmenistan, Uzbekistan, Yemen, Zimbabwe</td>
</tr>
<tr>
<td>WRA short stature and WRA thinness only</td>
<td>4</td>
<td>1,415</td>
<td>India, Bangladesh, Madagascar, Timor-Leste</td>
</tr>
<tr>
<td>WRA short stature and adult female overweight only</td>
<td>7</td>
<td>71</td>
<td>Bolivia, Guatemala, Guyana, Honduras, Maldives, Nicaragua, Peru</td>
</tr>
<tr>
<td>Adult female overweight and WRA thinness only</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>WRA short stature, WRA thinness, and adult female overweight</td>
<td>1</td>
<td>24</td>
<td>Yemen</td>
</tr>
<tr>
<td>Below cutoff for all three indicators</td>
<td>22</td>
<td>562</td>
<td>Benin, Burkina Faso, Burundi, Central African Republic, Comoros, Côte d’Ivoire, Democratic Republic of the Congo, Guinea, Haiti, Kenya, Liberia, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Tajikistan, Togo, Uganda, United Republic of Tanzania, Zambia</td>
</tr>
<tr>
<td><strong>Total with data</strong></td>
<td><strong>67</strong></td>
<td><strong>3,025</strong></td>
<td></td>
</tr>
<tr>
<td>Missing data for at least one indicator</td>
<td>126</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>193</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Indicator data are from Demographic and Health Survey Statcompiler (2014; data from 1994–2013) and WHO (2014g; data from 2008). Population data are from United Nations (2013b).
90+ DAYS IFA SUPPLEMENTATION

AVERAGE PROPORTION OF WOMEN RECEIVING IRON–FOLIC ACID SUPPLEMENTS FOR AT LEAST 90 DAYS DURING PREGNANCY BY REGION

Global Nutrition Report 2014