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Protein-Energy Malnutrition

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Section A

Causes, Classifications, and Diagnosis
ARCHIVES OF DISEASE IN CHILDHOOD

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A NUTRITIONAL DISEASE OF CHILDHOOD ASSOCIATED WITH A MAIZE DIET

BY

CICELY D. WILLIAMS, B.M.

(From the Children’s Hospital, Accra, Gold Coast Colony.)
Some Definitions

- **Fasting**
  - Complete cessation of food intake for variable periods of time

- **Starvation**
  - Severe and sustained reduction in food intake, eventually causing functional and structural damage
General Classifications of PEM

- Primary, secondary
- Acute, chronic
- Marasmus, kwashiorkor
- Edematous
- By severity—mild, moderate, severe
Causes

- **Insufficient food intake**
  - Anorexia due to illness
  - Eating disorders
  - Dietary practices or beliefs

- **Insufficient food availability**
  - Civil war, political instability
  - Socio-economic oppression
  - Limited agricultural development
Causes

- Impaired nutrient absorption or excessive losses
  - Malabsorption syndromes
    - Primary or secondary
  - Gastrointestinal diseases
  - Short gut syndrome
The Malnutrition-Infection Cycle

Inadequate intake

Anorexia
Malabsorption
↑ Nutrient losses
↑ Nutrient requirements

Susceptibility to infection

Weight loss
Mucosal damage
Immune deficiency
Impact of Common Infections on Growth Guatemala (L. Mata)

Adapted by CTLT from The Children of Santa Maria Conque: A Perspective Field Study of Health & Growth
Nutrient Losses During Infection

Exposed

°F

+99
+97

gm/Day

+8
+4
0
-4
-8
-12

Nitrogen Balance

Blood

Stool Urine

Balance gm/Total

Cumulative Change from Control Average

Body Weight Lb.

Rickettsemia

Days

0 + + + + + + 0 0 0
Diagnosis of PEM

- **Weight for age**
  - Indicates past or present malnutrition
  - Used as a population indicator of PEM
  - Gomez classification:
    - I 75–90%
    - II 60–74%
    - III <60%
Diagnosis of PEM

- **Weight for height**
  - Indicates present nutritional status (wasting)
  - Waterlow classification
    - Mild: 80–89% (–1 to –2 Z)
    - Moderate: 70–79 (–2 to –3 Z)
    - Severe: <70 (< –3 Z)
Diagnosis of PEM

- Height for age
  - Indicates chronic growth delay (stunting)
    - Mild: 90–94% (−1 to −2 Z)
    - Moderate: 85–89% (−2 to −3 Z)
    - Severe: <85% (< −3 Z)
Prevalence of Stunting (%) and Numbers of Children Affected


<table>
<thead>
<tr>
<th>Region</th>
<th>Prevalence Stunting</th>
<th>Numbers Stunted (in millions)</th>
<th>% Increase (+) or Decrease (-) in Numbers from 1980 to 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td></td>
<td></td>
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<tr>
<td>Near East/North Africa</td>
<td></td>
<td></td>
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<tr>
<td>South Asia</td>
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<tr>
<td>South East Asia</td>
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<tr>
<td>Middle America/Caribbean</td>
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<td></td>
<td></td>
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<tr>
<td>South America</td>
<td></td>
<td></td>
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<tr>
<td>China (1992)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Across all regions (Excluding China)</td>
<td>48.8</td>
<td>45.6</td>
<td>42.5</td>
</tr>
</tbody>
</table>
Section B

Pathophysiology, Management, and Prevention
Major Changes in PEM

- **Reduced protein synthesis**
  - Cessation of growth
  - Loss of LBM
  - Decreased immune response
  - Loss of epithelial integrity
  - Impaired liver function
Major Changes in PEM

- **Negative energy balance**
  - Decreased energy expenditure
  - Loss of fat body mass
  - Apathy, lethargy
Treatment

- Stabilization
  - Rehydration
  - Antimicrobial therapy
Treatment

- **Refeeding**
  - Initial—0.7g/k protein and 60 kcal/k energy, Vitamin A
  - Target—4g/k protein and 150–200 kcal/k energy
  - Iron and other minerals
Treatment

- **Refeeding**
  - Initial—0.7g/k protein and 60 kcal/k energy, Vitamin A
  - Target—4g/k protein and 150–200 kcal/k energy
  - Iron and other minerals
PEM: Indicators of High Risk

- Age < 6 months
- Wt/Ht > 2 Z
- Arm muscle area < 5th percentile
- Serum albumin < 2.5 g/dL
- Serum transferrin < 100 µg/dL
PEM: Indicators of High Risk

- Infection—Pneumonia, measles, sepsis
- Severe dehydration, acidosis
- Stupor, coma
- Hypothermia, hypoglycemia
- Tachycardia, signs of cardiac insufficiency
- Jaundice
Bodyweight Recovery

Adapted by CTLT from Modern Nutrition in Health & Disease, 7th Ed.
Prevention

- Breastfeeding
- Adequate weaning foods
- Control of infections
- Education
- Economic development
- Food and agricultural policies