PEDIATRIC MALNUTRITION:
PUTTING NEW DEFINITIONS INTO PRACTICE

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FEBRUARY 28, 2016
OBJECTIVES

• Review new consensus guidelines for pediatric malnutrition
• Review KDOQI guidelines for nutrition
• Review subjective global nutrition assessment
• Review nutrition focused physical exam in pediatrics
• Discuss uremic failure to thrive in children
• Compare/contrast
• Recommendations for pediatric renal patients
Acknowledges probable under-recognition of pediatric malnutrition despite reported incidence of 6-51% of hospitalized children.

Cites:
- Lack of uniform definitions
- Lack of continuity among nutrition screening practices
- Failure to prioritize nutrition as part of patient care

Current terminology (protein-energy malnutrition, marasmus, kwashiorkor) does not account for various etiologies or interactions that account for pediatric undernutrition.

Proposed a better definition for Pediatric Malnutrition to achieve 6 goals.
1) Early identification
2) Comparison of prevalence between studies and centers
3) Uniform screening tools
4) Thresholds for interventions
5) Collection of meaningful nutrition data
6) Impact of malnutrition and its treatment on patient outcomes
BASIC DEFINITION

• AN IMBALANCE BETWEEN NUTRIENT REQUIREMENT AND INTAKE RESULTING IN CUMULATIVE DEFICITS OF ENERGY, PROTEIN OR MICRONUTRIENTS THAT MAY NEGATIVELY AFFECT GROWTH, DEVELOPMENT AND OTHER RELEVANT OUTCOMES.
Table 3. Main Classification and Definitions/Characteristics of Pediatric Malnutrition.

<table>
<thead>
<tr>
<th>Class</th>
<th>Definition/Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Illness-related malnutrition</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td><em>Definition:</em> Illness-related malnutrition (disease/trauma specified), caused by nutrient imbalance and may be associated with one or more negative (ie, adverse or dysfunctional) outcomes.&lt;br&gt;&lt;br&gt;<em>Etiology:</em> The associated disease/illness/trauma should be specified. If more than one condition is thought to affect nutrition status, specify the primary and secondary conditions.&lt;br&gt;&lt;br&gt;<em>Severity:</em> The severity of malnutrition is based on the degree of deterioration in key anthropometric markers and may be severe (usually with evidence of severe inflammation&lt;sup&gt;b&lt;/sup&gt;) or moderate (inflammation not severe).&lt;br&gt;&lt;br&gt;<em>Mechanism:</em> Nutrient imbalance resulting from one or more of the following conditions: decreased intake, increased requirement, increased losses, and altered utilization of nutrients.&lt;br&gt;&lt;br&gt;<em>Chronicity:</em> May be acute (duration less than 3 months) or chronic (more than 3 months).</td>
</tr>
<tr>
<td><strong>2. Non–illness-related malnutrition</strong>&lt;sup&gt;a&lt;/sup&gt; caused by environmental/behavioral factors (severe or moderate)</td>
<td><em>Definition:</em> Malnutrition from environmental (starvation/socioeconomic) or behavioral factors, resulting from decreased nutrient intake (lower than required), and may be associated with one or more adverse developmental or physiologic outcomes.&lt;br&gt;&lt;br&gt;<em>Severity:</em> The severity of malnutrition is based on the degree of deterioration in key anthropometric markers and may be severe or moderate.&lt;br&gt;&lt;br&gt;<em>Mechanism:</em> Nutrient imbalance resulting from decreased intake.&lt;br&gt;&lt;br&gt;<em>Chronicity:</em> May be acute (duration less than 3 months) or chronic (more than 3 months).</td>
</tr>
</tbody>
</table>

<sup>a</sup>Severity of malnutrition is determined by anthropometric measurements and the relationship of these parameters with standard/reference charts. The specifics of anthropometric variables and thresholds for classifying the degree of malnutrition will be discussed in a separate document.<br><br><sup>b</sup>The presence or absence of inflammation influences disease-related malnutrition and must be indicated in the definition when improved markers of inflammation become available in the future.
5 DOMAINS FOR LITERATURE SEARCH

1) Anthropometric variables for assessing nutrition status
   • Relevant variables, Reference data, Statistical tests to detect deviation from reference/standard

2) Growth
   • What are objective parameters for abnormal growth?

3) Chronicity of malnutrition
   • Acute or Chronic?

4) Etiology
   • Underlying illness/injury, Malnourished on admit? Inflammation?

5) Impact on functional status
   • Adverse outcomes
Figure 1. Defining malnutrition in hospitalized children: Key concepts.

[Diagram showing the processes involved in defining malnutrition, including parameters, etiology, mechanism, and outcomes.]

Nilesh M. Mehta et al. JPEN J Parenter Enteral Nutr 2013;37:460-481

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ONE YEAR LATER......

ASPEN & AND WORKGROUP ISSUE CONSENSUS GUIDELINES
• CONSENSUS STATEMENT OF THE ACADEMY OF NUTRITION AND DIETETICS/AMERICAN SOCIETY FOR PARENTERAL AND ENTERAL NUTRITION: INDICATORS RECOMMENDED FOR THE IDENTIFICATION AND DOCUMENTATION OF PEDIATRIC MALNUTRITION (UNDERNUTRITION)

Becker P, Carney LN et al.
CONSENSUS GUIDELINES

• Indicators recommended are:
  ✔ Evidence informed and consensus derived
  ✔ Universally available and validated
  ✔ Can be applied inexpensively in multiple settings
  ✔ Can be used with minimal training
  ✔ Can reproducibly identify undernutrition
  ✔ Can quantify severity of undernutrition
  ✔ Can be used to monitor changes in nutritional status
Table 3. Primary Indicators When Single Data Point Available. 

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Mild Malnutrition</th>
<th>Moderate Malnutrition</th>
<th>Severe Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight-for-height z score</td>
<td>-1 to -1.9 z score</td>
<td>-2 to -2.9 z score</td>
<td>-3 or greater z score</td>
</tr>
<tr>
<td>BMI-for-age z score</td>
<td>-1 to -1.9 z score</td>
<td>-2 to -2.9 z score</td>
<td>-3 or greater z score</td>
</tr>
<tr>
<td>Length/height-for-age z score</td>
<td>No data</td>
<td>No data</td>
<td>-3 z score</td>
</tr>
<tr>
<td>Mid-upper arm circumference</td>
<td>Greater than or equal to -1 to -1.9 z score</td>
<td>Greater than or equal to -2 to -2.9 z score</td>
<td>Greater than or equal to -3 z score</td>
</tr>
</tbody>
</table>

BMI, body mass index.
<table>
<thead>
<tr>
<th></th>
<th>Mild Malnutrition</th>
<th>Moderate Malnutrition</th>
<th>Severe Malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight gain velocity (&lt;2 years of age)</td>
<td>Less than 75%&lt;sup&gt;a&lt;/sup&gt; of the norm&lt;sup&gt;b&lt;/sup&gt; for expected weight gain</td>
<td>Less than 50%&lt;sup&gt;a&lt;/sup&gt; of the norm&lt;sup&gt;b&lt;/sup&gt; for expected weight gain</td>
<td>Less than 25%&lt;sup&gt;a&lt;/sup&gt; of the norm&lt;sup&gt;b&lt;/sup&gt; for expected weight gain</td>
</tr>
<tr>
<td>Weight loss (2–20 years of age)</td>
<td>5% usual body weight</td>
<td>7.5% usual body weight</td>
<td>10% usual body weight</td>
</tr>
<tr>
<td>Deceleration in weight for length/height z score</td>
<td>Decline of 1 z score</td>
<td>Decline of 2 z score</td>
<td>Decline of 3 z score</td>
</tr>
<tr>
<td>Inadequate nutrient intake</td>
<td>51%–75% estimated energy/protein need</td>
<td>26%–50% estimated energy/protein need</td>
<td>≤25% estimated energy/protein need</td>
</tr>
</tbody>
</table>


Table 1. Resources for Determining z Scores for Anthropometrics.

<table>
<thead>
<tr>
<th>CDC Growth Charts</th>
<th>WHO Growth Charts</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT GrowthCharts (compatible with iPod Touch, iPhone, iPad)</td>
<td>STAT GrowthCharts WHO (compatible with iPod Touch, iPhone, iPad)</td>
</tr>
<tr>
<td>Clinical tools for pediatric providers; growth charts, calculators, etc; mobile compatible</td>
<td>Clinical tools for pediatric providers; growth charts, calculators, etc; mobile compatible</td>
</tr>
</tbody>
</table>

CDC, Centers for Disease Control and Prevention; WHO, World Health Organization.
Mehta et al.

- Wt, Ht, HC (<2), BMI
- Use WHO (<2) & CDC (>2)
- Use corrected age until 3 yrs
- Express anthros as Z scores
- MUAC
- **Consider** TSF, MAMC, HGS
- Define acute as < 3 mo’s
- Define chronic as > 3 mo’s
- Illness related or non-illness
- **Consider** inflammation
- Determine those at highest risk for hospital acquired malnutrition

Consensus Guidelines

- Wt for Ht (Length) Z score
- BMI for age Z score
- Ht/Length for age Z score
- MUAC

If 2 or more data points:

- Wt gain velocity (< 2 )
- Wt loss (2-20)
- Decline in wt for ht(length) Z sc
- Inadequate nutrient intake

**Assigns degree of malnutrition as mild, moderate or severe**
KDOQI NUTRITION GUIDELINES FOR CHILDREN WITH CKD

• Do the KDOQI guidelines include the indicators recommended by Mehta et al and/or Consensus Guidelines?

• Parameters for assessing nutritional status are discussed in Recommendation 1 and 2:
  • Wt (EDW), Ht (length) and HC for age percentile or z score (SDS)
  • Ht (length) Velocity for age percentile or z score (SDS)
  • BMI for height age percentile or z score (SDS)
  • nPCR in HD adolescents
  • Frequency recommendations are included
  • Dietary intake compared to estimated needs
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>False elevation due to fluid overload</td>
</tr>
<tr>
<td>Height</td>
<td>Influenced by alterations of growth hormone axis, delayed puberty, renal osteodystrophy, independent of nutritional state</td>
</tr>
<tr>
<td>MAC and triceps</td>
<td>Can be influenced by altered regional distribution of fat/muscle</td>
</tr>
<tr>
<td>Skin fold thickness</td>
<td></td>
</tr>
<tr>
<td>Bio-impedance</td>
<td>Unpredictable effect on estimation of fat-free mass from total body water in renal failure</td>
</tr>
<tr>
<td>Albumin/pre-albumin</td>
<td>Albumin level associated with outcome, but levels influenced by inflammation and fluid overload; also limited by long half-life. Pre-albumin shorter half-life but influenced by inflammation and fluid overload</td>
</tr>
<tr>
<td>Bone density (DEXA)</td>
<td>Fluid overload can cause overestimation of lean mass</td>
</tr>
<tr>
<td>Normalized protein catabolic rate (nPCR)</td>
<td>Only few studies available but emerging as nutrition marker for children receiving HD</td>
</tr>
</tbody>
</table>

*MAC mid arm circumference*
Consensus

- Wt for Ht (Length) z score
- BMI for age z score
- Ht/Length for age z score
- MUAC

  If 2 or more data points:
  - Wt gain velocity (< 2 )
  - Wt loss (2-20)
  - Decline in wt for ht(length) z sc
  - Inadequate nutrient intake

KDOQI

- No – but implies with BMI
- No – uses BMI for \textbf{ht age} z sc
- Yes
- No
- No – uses Ht velocity for age
- Not specifically*
- No – but implies with BMI
- Yes

*KDOQI does recommend measurement of wt, ht and HC routinely, the use SDS (Z scores) and monitoring changes over time.
Consensus

• Assigns degree of malnutrition:
  o Mild
  o Moderate
  o Severe

KDOQI

• Uses BMI for ht age that is < 5th percentile as definition for malnutrition
  (Recommendation 4.4)
WHY THE DIFFERENCES?

• KDOQI suggests using only BMI’s and not wt for ht measurements. BMI tables are available with WHO growth charts for 0-2. Mehta also recommends using BMI. The use of z scores recommended by all.

• Fluid overload (and dehydration) will affect wt measurement as well as MUAC and TSF.
325 children (Kenya) between 3 mo’s and 5 yrs admitted for dehydration. Children measured upon admit and again 48 hrs later.
### Potential misclassification in acute malnutrition among dehydrated children

|                  | ALL PATIENTS (6 to 59 months) | EXCLUDING THOSE WHO LOST WEIGHT |
|------------------|-------------------------------|---------------------------------
|                  | Before | After | Children that change category | Before | After | Children that change category |
| **MUAC**         |        |       |                            |        |       |                                |
| Severe           | 48 (16%) | 39 (13%) | -9/48 (-19%) | 40 (18%) | 31 (14%) | -9/40 (-23%) |
| Mod              | 56 (19%) | 60 (21%) | +4/56 (+7%) | 43 (20%) | 45 (21%) | +2/43 (+5%) |
| Normal           | 188 (64%) | 193 (66%) | +5/188 (+3%) | 135 (62%) | 142 (65%) | +7/135 (+5%) |
| **Total**        | 292 (100%) | 292 (100%) |  | 218 (100%) | 218 (100%) |  |
| **WFLz**         |        |       |                            |        |       |                                |
| Severe           | 71 (24%) | 56 (19%) | -15/71 (-21%) | 62 (28%) | 42 (19%) | -20/62 (-32%) |
| Mod              | 80 (27%) | 63 (22%) | -17/80 (-21%) | 63 (29%) | 45 (21%) | -18/63 (-29%) |
| Normal           | 141 (48%) | 173 (59%) | +32/141 (+23%) | 93 (43%) | 131 (60%) | +38/93 (41%) |
| **Total**        | 292 (100%) | 292 (100%) |  | 218 (100%) | 218 (100%) |  |

<table>
<thead>
<tr>
<th>K/DOQI measure</th>
<th>Potential problem in CKD</th>
<th>Effect on assessment of nutritional status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary intake (interview or diary)</td>
<td>Possible underreporting of foods restricted in CKD</td>
<td>Underestimation of calorie or protein intakes</td>
</tr>
<tr>
<td>Serum albumin</td>
<td>Fluid overload dilutes albumin</td>
<td>Underestimation of nutritional status</td>
</tr>
<tr>
<td></td>
<td>Inflammation decreases albumin</td>
<td>Underestimation of nutritional status</td>
</tr>
<tr>
<td>Height or length and SD score</td>
<td>Growth failure may reflect altered growth hormone axis, acidosis, or delayed puberty in CKD unrelated to nutritional status</td>
<td>Underestimation of nutritional status</td>
</tr>
<tr>
<td></td>
<td>Short stature is a late manifestation of malnutrition</td>
<td>Overestimation of nutritional status</td>
</tr>
<tr>
<td>Head circumference</td>
<td>Severe edema in infants</td>
<td>Overestimation of nutritional status</td>
</tr>
<tr>
<td>Estimated dry weight</td>
<td>Fluid overload increases weight</td>
<td>Overestimation of nutritional status</td>
</tr>
<tr>
<td>Weight/height index</td>
<td>Fluid overload increases weight</td>
<td>Overestimation of nutritional status</td>
</tr>
<tr>
<td>Midarm anthropometric measures (MAC, MAMC, and MAMA)</td>
<td>Fluid overload increases weight</td>
<td>Overestimation of nutritional status</td>
</tr>
<tr>
<td></td>
<td>Altered regional distribution of fat mass and lean mass</td>
<td>Overestimation or underestimation of nutritional status</td>
</tr>
<tr>
<td>Skinfold thicknesses</td>
<td>Fluid overload increases subcutaneous tissue</td>
<td>Overestimation of nutritional status</td>
</tr>
<tr>
<td></td>
<td>Altered regional distribution of fat mass</td>
<td>Overestimation or underestimation of nutritional status</td>
</tr>
<tr>
<td>PNA&lt;sup&gt;2&lt;/sup&gt;</td>
<td>None</td>
<td>—</td>
</tr>
</tbody>
</table>

WHY THE DIFFERENCES?

• Fluid overload representing 10% of BW results in BMI z score 0.5-1.0 SD greater than what it would be at dry wt.
  • 5 parameters helpful in determining dry wt.
    • Wt
    • Presence of edema
    • Blood pressure
    • Certain labs (decreased Na, decreased Albumin)
    • Diet interview – rapid wt gain in absence of significant increase in calories or decrease in physical activity.
WHY THE DIFFERENCES?

• In non CKD children a continued decrease in wt velocity resulting from undernutrition can leading to stunting. Stunting therefore is a reasonable definition of long term malnutrition in otherwise healthy children.

• In CKD, there are multifactorial causes of stunting that may not be related to a decrease in wt velocity. Using wt velocity ignores fluid issues and may oversimplify the cause of growth failure in CKD. A decline in ht velocity warrants a thorough evaluation of ALL possible causes which include adequacy of nutrient intake.
MEHTA vs. CONSENSUS vs. KDOQI

• Mehta provides a great framework that is dynamic to evaluate for malnutrition. Many suggestions within Mehta’s framework not included in Consensus indicators to track for determining malnutrition.

• Consensus guidelines use simple easily obtained measurements, and provide a plan for judging severity of malnutrition. BUT – may not go far enough for CKD patients.
MEHTA - CONSENSUS – KDOQI

- KDOQI incorporates many similar measurements suggested by Mehta and Consensus.
- A major omission with KDOQI is the MUAC measurement – if done in a CKD child it must be in context with fluid status.
- Other recommendations in KDOQI – bone disease management, electrolyte management, metabolic acidosis and growth hormone – expands on other reasons for growth (height/length) failure. (More on this later)
Mid-parental height: 176.7 cm (69.6 in)
Interpretation using single data point criteria

13y 5m (161 months), male

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Imperial</th>
<th>%ile</th>
<th>Z-score</th>
<th>50%ile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>27.3</td>
<td>60.2 lb</td>
<td>0%</td>
<td>-3.48</td>
<td>47.8</td>
</tr>
<tr>
<td>Stature (cm)</td>
<td>141</td>
<td>55.5 in</td>
<td>1%</td>
<td>-2.28</td>
<td>159</td>
</tr>
<tr>
<td>Wt-for-stature (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI-for-age</td>
<td>13.7</td>
<td></td>
<td>0%</td>
<td>-3.39</td>
<td>18.7</td>
</tr>
</tbody>
</table>

Ht age is 10 years
BMI for ht age Z score is -1.4

Using chronological age: Meets criteria for Severe Malnutrition
Using ht age: Meets criteria for Mild Malnutrition
Interpretation using single data point

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Imperial</th>
<th>%ile</th>
<th>Z-score</th>
<th>50%ile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>40.824</td>
<td>90 lb</td>
<td>9%</td>
<td>-1.37</td>
<td>51.9</td>
</tr>
<tr>
<td>Stature (cm)</td>
<td>146.1</td>
<td>57.5 in</td>
<td>1%</td>
<td>-2.25</td>
<td>165</td>
</tr>
<tr>
<td>Wt-for-stature (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI-for-age</td>
<td>19.1</td>
<td></td>
<td>48%</td>
<td>-0.06</td>
<td>19.2</td>
</tr>
</tbody>
</table>

Ht age is 10y 9m
BMI for ht age is 0.79

Using Chronological age: not malnourished
Using Ht age: well nourished
BUT NO IMPROVEMENT IN GROWTH VELOCITY SINCE REGAINING WT
OTHER NUTRITION ASSESSMENT TOOLS FOR PEDIATRIC MALNUTRITION

Subjective Global Nutrition Assessment (SGNA)
And
Pediatric Nutrition Focused Physical Exam (NFPR)
SUBJECTIVE GLOBAL NUTRITION ASSESSMENT

• Baker et al (1982) – 34 yrs ago showed subjective clinical judgement a valid reproducible technique to evaluate nutritional status in adult

• Subjective Global Assessment (1990-2000) – shown in numerous studies to be a valid structured clinical approach. Recommended in the 2000 KDOQI Nutrition Guidelines for adults

• Secker DJ and Jeejeebhoy KN (2007) – developed and tested in surgical pediatric pts. Used in evaluating 175 children; ages 31 days to 17.9 years
• Secker DJ and Jeejeebhoy KN (2007)
  o Defined 3 classifications
    ✓ Well nourished
    ✓ Moderately malnourished
    ✓ Severely malnourished
  o Found higher rates of infection and longer post-op hospitalization
  o Objective measures: Albumin, transferrin, total lymphocyte count were unable to make these predictions
SGNA

• Secker DJ and Jeejeebhoy KN (2012)
  o Subjective impressions are equally important as objective in determining nutritional status and identifying causes of malnutrition
  o Recommends using SGNA for evaluating baseline nutritional status and not acute changes
  o Considers 7 nutrition focused medical history categories and 3 nutrition focused physical exam categories
PEDIATRIC SGNA RATING FORM

Consider severity and duration of changes, as well as recent progression when rating each item.

<table>
<thead>
<tr>
<th>NUTRITION-FOCUSED MEDICAL HISTORY</th>
<th>SGNA SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
</tr>
</tbody>
</table>

**Appropriateness of Current Height for Age (stunting)**

- Height percentile: 
  - □ □ □ □ at least 3rd centile
  - □ □ □ □ just below 3rd centile
  - □ □ □ □ far below 3rd centile

- b) Appropriate considering mid-parental height*: □ yes □ no

- c) Serial growth*: □ following centiles
  - □ moving upwards on centiles
  - □ moving downwards on centiles (gradually or quickly)

**Appropriateness of Current Weight for Height (wasting)**

- Ideal Body Weight = □ □ kg
- Percent Ideal Body Weight: □ □ (%)
  - □ □ > 90%
  - □ □ 75-90%
  - □ □ < 75%

**Unintentional Changes in Body Weight**

- a) Serial weight*: □ following centiles
  - □ crossed ≥ 1 centile upwards
  - □ crossed ≥ 1 centile downwards

- b) Weight loss: □ □ %
  - □ < 5% usual body weight
  - □ 5-10% usual body weight
  - □ > 10% usual body weight

- c) Change in past 2 weeks: □ no change □ increased □ decreased

**Adequacy of Dietary Intake**

- a) Intake is: □ adequate
  - □ inadequate - hypocaloric
  - □ inadequate - starvation (i.e., taking little of anything)

- b) Current intake versus usual: □ no change □ increased □ decreased

- c) Duration of change: □ < 2 weeks □ ≥ 2 weeks

**Gastrointestinal Symptoms**

- a) □ no symptoms
  - □ one or more symptoms; not daily
  - □ some or all symptoms; daily

- b) Duration of symptoms: □ < 2 weeks □ ≥ 2 weeks

**Functional Capacity (nutritionally related)**

- a) □ no impairment, energetic, able to perform age-appropriate activity
  - □ restricted in physically strenuous activity, but able to perform play and/or school activities in a light or sedentary nature; less energy; tired more often
  - □ little or no play or activities, confined to bed or chair > 50% of waking time; no energy; sleeps often

- b) Function in past 2 weeks: □ no change □ increased □ decreased

**Metabolic Stress of Disease**

- □ no stress □ moderate stress □ severe stress

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*Mid-parental height: Girls: subtract 13 cm from the father’s height and average with the mother’s height. Boys: add 13 cm to the mother’s height and average with the father’s height. Thirteen cm is the average difference in height of women and men. For both girls and boys, 8.5 cm on either side of this calculated value (target height) represents the 3rd to 97th percentiles for anticipated adult height. (29)

**30% of healthy term infants cross one major percentile and 23% cross two major percentiles during the first 2 years of life, typically towards the 50th percentile rather than away from it. This is normal seeking of the growth channel.**
Examples of moderate or severe metabolic stress conditions that should be considered when using the Subjective Global Nutrition Assessment tool for pediatric populations.

<table>
<thead>
<tr>
<th>Moderate metabolic stress</th>
<th>Severe metabolic stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Routine surgery (eg, small resection of bowel)</td>
<td>□ Major organ surgery (eg, stomach, liver, pancreas, lung; open chest; total cholecystectomy; pouch procedures)</td>
</tr>
<tr>
<td>□ Laparoscopic surgery</td>
<td>□ Major bowel resection (≤50 cm remaining)</td>
</tr>
<tr>
<td>□ Exploratory surgery</td>
<td>□ Trauma, multiple injuries/fractures/burns</td>
</tr>
<tr>
<td>□ Fracture</td>
<td>□ Multiorgan failure</td>
</tr>
<tr>
<td>□ Infection (eg, bronchiolitis, gastroenteritis)</td>
<td>□ Severe pancreatitis</td>
</tr>
<tr>
<td>□ Pressure sore/decubitus ulcer</td>
<td>□ Severe sepsis</td>
</tr>
<tr>
<td></td>
<td>□ Severe inflammation</td>
</tr>
<tr>
<td></td>
<td>□ Multiple deep pressure sores/ulcers</td>
</tr>
<tr>
<td></td>
<td>□ Chronic illness with acute deterioration</td>
</tr>
<tr>
<td></td>
<td>□ Current treatment for malignancy</td>
</tr>
<tr>
<td></td>
<td>□ Acquired immunodeficiency syndrome with a secondary infection</td>
</tr>
<tr>
<td></td>
<td>□ Hyperthyroidism</td>
</tr>
<tr>
<td>PHYSICAL EXAM</td>
<td>SGNA SCORE</td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
</tr>
<tr>
<td>Loss of subcutaneous fat</td>
<td>□ no loss in most or all areas</td>
</tr>
<tr>
<td>Muscle Wasting</td>
<td>□ no wasting in most or all areas</td>
</tr>
<tr>
<td>Edema (nutrition-related)</td>
<td>□ no edema</td>
</tr>
</tbody>
</table>

**GUIDELINES FOR AGGREGATING ITEMS INTO GLOBAL SCORE**

In assigning an overall global score, consider all items in the context of each other. Give the most consideration to changes in weight gain and growth, intake, and physical signs of loss of fat or muscle mass. Use the other items to support or strengthen these ratings. Take recent changes in context with the patient’s usual/chronic status. Was the patient starting off in a normal or nutritionally-compromised state?

**Normal/Well nourished**
This patient is growing and gaining weight normally, has a grossly adequate intake without gastrointestinal symptoms, shows no or few physical signs of wasting, and exhibits normal functional capacity. Normal ratings in most or all categories, or significant, sustained improvement from a questionable or moderately malnourished state. It is possible to rate a patient as well nourished in spite of some reductions in muscle mass, fat stores, weight and intake. This is based on recent improvement in signs that are mild and inconsistent.

**Moderately malnourished**
This patient has definite signs of a decrease in weight and/or growth, and intake and may or may not have signs of diminished fat stores, muscle mass and functional capacity. This patient is experiencing a downward trend, but started with normal nutritional status. Moderate ratings in most or all categories, with the potential to progress to a severely malnourished state.

**Severely malnourished**
This patient has progressive malnutrition with a downward trend in most or all categories. There are significant physical signs of malnutrition—loss of fat stores, muscle wasting, weight loss >10%—as well as decreased intake, excessive gastrointestinal losses and/or acute metabolic stress, and definite loss of functional capacity. Severe ratings in most or all categories with little or no sign of improvement.

<table>
<thead>
<tr>
<th>OVERALL SGNA RANKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
</tr>
</tbody>
</table>

Donna J. Secker, Khursheed N. Jeejeebhoy. JAND. 2012; 112:424-431
<table>
<thead>
<tr>
<th>Subcutaneous fat (buccal pads)</th>
<th>Special tips</th>
<th>Severe malnutrition</th>
<th>Moderate malnutrition</th>
<th>Well nourished</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial cheeks</td>
<td>Gently palpate pads over cheek</td>
<td>Hollow, narrow face</td>
<td>Flat</td>
<td>Full, round, filled out</td>
</tr>
<tr>
<td>Biceps and triceps</td>
<td>Arm bent; be careful not to include muscle; pinch fat stores and roll between fingers</td>
<td>Very little space between fingers, or fingers touch</td>
<td>Some space between fingers and fat tissue between fingers</td>
<td>Ample or thick fold of fat tissue between fingers</td>
</tr>
<tr>
<td>Ribs</td>
<td>With patient grasping hand against a solid object</td>
<td>Depressions between the ribs very apparent</td>
<td>Ribs can be apparent, depressions less pronounced</td>
<td>Chest is full, round, ribs do not show</td>
</tr>
<tr>
<td>Buttocks</td>
<td>Infant upright or child standing</td>
<td>Wasted, flat or &quot;baggy&quot;. Skin may appear wrinkled.</td>
<td>Slight curve but not round</td>
<td>Full, round</td>
</tr>
</tbody>
</table>

After examining all of these subcutaneous fat areas, subjectively rate the degree of fat loss. Is the amount of fat loss severe in each area? If yes, then the patient should be placed in the severe category. If there is no subcutaneous fat loss, the patient should be classified as normal. If the patient shows signs in some areas, but not others, the inconsistency would place the patient in the moderate category.

**Muscle wasting**

| Clavicle | Look along line of the clavicle. The smaller the muscle mass the more prominent the bone. | Protruding/prominent bone | Some protrusion | May be visible but not prominent |
| Shoulder (deltoid muscles) | Position arms at side and look for prominent bones, shape | Shoulder-to-arm joint looks square. Bones prominent. Acromion prominence quite prominent | Shoulders not square but acromion process may protrude slightly | Rounded, curved at junction between neck and shoulder and at shoulder joint. Able to grasp muscle tissue at shoulder joint |
| Scapula | Look for prominent bones. Have patient push hands forward against a solid object | Prominent, visible bone. Depressions above the scapula, between the scapula and the shoulder joint, and between the scapula and the spine | Degree of wasting variable, in both location and depth. Mild depressions or bone may show slightly in some but not all areas | Scapula bone is not prominent. No depressions around the bone |
| Thigh (quadriceps muscle) (Note: lower body is less sensitive to change) | Have patient sit; prop leg up on low furniture. Grasp quadriceps to differentiate amount of muscle tissue from amount of fat tissue | Quads can be significantly reduced (squeezed). Depression on inner thigh, obviously thin | Slight depressions along inner thigh, thin | Not able to reduce. Well rounded, no depressions |
| Knee | Knee propped as above | Knee bone is square and prominent, no muscle mass | Knee bone is noticeable, little muscle mass around it | Muscle protrudes, bone not prominent |
| Calf (gastrocnemius muscle) | Grasp the calf muscle to determine amount of tissue | Definite muscle reduction. Thin, flat, no muscle definition | Some shape and firmness to tissue | Bulb shape, firm and well developed |

After examining all of these muscle groups, subjectively rate the degree of wasting. Is the amount of muscle loss severe in all or most areas? If yes, the patient should be placed in the severe category. If there is no muscle tissue loss, the patient should be classified as normal. If the patient shows signs in some areas but not others, the inconsistency would place the patient in the moderate category.

**Edema**

| Causes other than malnutrition (renal, liver, heart) | Press on midclavicle to lateral third of distal anterior surface of foot (or over sacrum) for 5 seconds to move fluid out of subcutaneous tissue. Observe for pitting | Rounded contour with a deep depression or pit that persists | Fairly normal to moderately swollen contour with a moderately deep pit that persists | Normal contour with a barely perceptible pit |
| Ankle (mobile patient), sacrum (activity restricted patient) | | | | |
1. a) How much did your baby/toddler weigh at birth? ________
   b) How long (or tall) was your baby/toddler at birth? ________
   c) When was the last time your baby/toddler was measured by a health professional? ________
   d) How much did your baby/toddler weigh then? ________
   e) How long (or tall) was your baby/toddler then? ________
   f) How tall is your child’s mother?: ________
   father?: ________

2. a) What type of milk do you give your baby/toddler? (please check all that apply)
   - ☐ breast milk
   - ☐ formula
   - ☐ cow’s (or goat’s) milk → ☐ homo, whole fat, 3.25% fat ☐ 2% ☐ 1% ☐ skim
   - ☐ other kind of milk (explain) ________
   b) How do you feed milk to your baby/toddler?: (please check all that apply)
   - ☐ breastfeed
   - ☐ bottle feed
   - ☐ cup
   - ☐ feeding tube

3. Breastfeeding
   a) Is this your first time breastfeeding? ☐ No ☐ Yes
   b) Do you alternate the breast that you start each feed with? ☐ No ☐ Yes
   c) How many times in a 24 hour period do you breastfeed your baby/toddler? ________
   d) How long does it usually take to breastfeed your baby/toddler? ________ (in minutes)
   e) How do you recognize that your baby/toddler is hungry? ________ Full?
   f) Do you have any concerns related to breast-feeding? ☐ No ☐ Yes (explain) ________

Bottle-feeding or Tube-feeding
   a) What is the name of your baby’s feeding or formula? ________
   b) How do you make the feeding or formula? (what are the amounts of expressed breastmilk or formula, water, other things you add?) ________
   c) How many times in a 24 hour period do you feed your baby/toddler? ________
   d) What is the average amount that your baby/toddler takes at each feeding? ________ (in ounces or mL)
   e) How long does it usually take to feed your baby/toddler? ________ (in minutes)
   f) Do you have any concerns related to bottle or tube-feeding? ☐ No ☐ Yes (explain) ________

Cow’s Milk or Other Kinds of Milk
   a) What is the average amount of milk that your baby/toddler drinks in a day? ________ (in ounces or mL)

5. Do you give your baby/toddler other things to drink?
   ☐ No
   ☐ Yes → please fill out the chart below:

<table>
<thead>
<tr>
<th>I give my baby/toddler:</th>
<th>How much of these things does your baby/toddler drink each day? (in ounces or mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ water</td>
<td></td>
</tr>
<tr>
<td>☐ fruit juice or fruit drinks</td>
<td></td>
</tr>
<tr>
<td>☐ tea or herbal drinks</td>
<td></td>
</tr>
<tr>
<td>☐ pcp</td>
<td></td>
</tr>
<tr>
<td>☐ other (explain)</td>
<td></td>
</tr>
</tbody>
</table>

6. a) What kinds of food does your baby/toddler eat each day?: (please check all that apply)

<table>
<thead>
<tr>
<th>Size of the portion eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ cereals and grains (like baby cereal, breakfast cereal, bread, rice, pasta)</td>
</tr>
<tr>
<td>☐ vegetables and fruit</td>
</tr>
<tr>
<td>☐ meat, fish, chicken, or alternatives (like eggs, tolu, lentils, legumes)</td>
</tr>
<tr>
<td>☐ milk products (like cheese, yogurt, pudding, ice cream)</td>
</tr>
</tbody>
</table>
5. What is the texture of the foods your baby/toddler eats?  
- [ ] jarred baby food or homemade foods put in a blender (this is called “pureed”)  
- [ ] chopped into tiny pieces the size of ground meat (this is called “minced”, like hamburger meat)  
- [ ] cut into small pieces or cubes (this is called “diced”)  

7. a) Please pick the word that best describes your baby’s/toddler’s appetite?  
- [ ] excellent  
- [ ] good  
- [ ] fair  
- [ ] poor  

b) Compared to your infant’s/toddler’s usual intake, has your baby’s/toddler’s intake changed recently?  
- [ ] No  
- [ ] Yes → Has it: [ ] increased?  [ ] decreased?  
  How long has it been since it changed? ____________ (in days, weeks, or months)  

8. Do any of the following feeding or eating problems affect your baby’s/toddler’s intake?  
(Please check all that apply)  

<table>
<thead>
<tr>
<th>Problems with sucking, swallowing, chewing, or biting</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crying, choking, coughing, gagging, or retching during a meal or at the sight of food or a bottle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refusing to eat by hiding the chin in the shoulder, arching the back, biting on the spoon, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refusing to swallow food</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refusing to eat food if it has little pieces or chunks in it (a fear or dislike of food with textures)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food allergies, intolerances, special diets (specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other: (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Is anyone else in your family on a special diet?  
- [ ] No  
- [ ] Yes → (explain)  
  Is your baby/toddler also on this diet?  
- [ ] No  
- [ ] Yes  

10. Does your baby/toddler currently have any gastrointestinal problems that restrict his/her drinking or eating? (please check for each problem)  

<table>
<thead>
<tr>
<th>Problem</th>
<th>Never/Almost Never</th>
<th>Every 2-3 days</th>
<th>Daily</th>
<th>How long has your baby/toddler had this problem?</th>
<th>&lt; 2 weeks</th>
<th>≥ 2 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of loss of appetite (anorexia)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Throwing up (vomiting/reflux)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constipation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. a) Please pick the word that best describes your baby’s/toddler’s amount of energy or activity?  
- [ ] high  
- [ ] average  
- [ ] low  

b) Compared to your baby’s/toddler’s usual amount of energy or activity, has it changed recently?  
- [ ] No  
- [ ] Yes → Has it: [ ] increased?  [ ] decreased?  
  How long has it been since it increased or decreased? ____________ (in days, weeks, or months)
SGNA QUESTIONNAIRE - CHILDREN/TEENAGERS

1. a) When was the last time you/your child had your/his or her weight and height measured? ____________
   b) How much did you/your child weigh? ____________
   c) How tall were you/your child? ____________
   d) How tall is your/your child’s; mother?: ____________ father?: ____________

2. a) How many meals do you/your child currently eat each day? □ 3 □ 2 □ 1 □ 0
   b) How many snacks do you/your child currently eat each day? □ 3 □ 2 □ 1 □ 0

3. What kinds of foods do you/your child eat each day? (Please check all that apply):
   □ cereals and grains (like bread or rolls, pita, roti, rice, pasta)
   □ vegetables and fruit
   □ meat, fish, chicken or alternatives (like eggs, soybeans/ tofu, lentils, legumes)
   □ milk and milk products (like cheese, yogurt, pudding, ice cream)

4. a) Please pick the word that best describes your/your child’s appetite:
   □ excellent □ good □ fair □ poor
   b) Compared to your/your child’s usual intake, has your/your child’s intake changed recently?
      □ No
      □ Yes → Has it: □ increased? □ decreased?
      How long has it been since it changed? ____________ (in days, weeks, or months)

5. Do any of the following feeding or eating problems affect your/your child’s intake?
   (Please check all that apply)

<table>
<thead>
<tr>
<th>Problem</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems with chewing, swallowing, choking, coughing, gagging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inappropriate behaviors around food that upset others at mealtimes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*“Don’t feel like eating” / “Just not hungry”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*“Feel full after just a few mouthfuls”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food allergies, intolerances, special diets: (specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If Yes → Could you eat a larger amount of food if you didn’t have these allergies/ special diets?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other: (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Please describe a current, typical day’s intake for you/your child (the foods & drinks you eat, and amounts)

<table>
<thead>
<tr>
<th></th>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Snack</td>
<td>Snack</td>
<td>Snack</td>
</tr>
</tbody>
</table>

7. Is anyone else in your family on a special diet?
   □ No
   □ Yes → (explain)
   Are you/your child also on this diet? □ No □ Yes

8. Have you tried by yourself to change what you eat and drink?
   □ No
   □ Yes → In what way? ____________
9. Do you/your child currently have any gastrointestinal problems that restrict your drinking and eating? (please check for each symptom)

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Never/Almost never</th>
<th>Every 2-3 days</th>
<th>Daily</th>
<th>How long have you/your child had these problems?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomach pain</td>
<td></td>
<td></td>
<td></td>
<td>&lt; 2 weeks</td>
</tr>
<tr>
<td>Lack or loss of appetite (anorexia)</td>
<td></td>
<td></td>
<td></td>
<td>≥ 2 weeks</td>
</tr>
<tr>
<td>Feeling like throwing up (nausea)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Throwing up (vomiting/reflux)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constipation (↓ frequency; dry, hard stools)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. Please check all the statements that apply to you/your child:
   a) □ V/my child go to school full-time
      □ V/my child go to school part-time: □ because V/my child get tired if I go all day
         □ for other reasons: (explain)
      □ V/my child don’t go to school: □ because V/my child are too tired
         □ for other reasons: (explain)

   b) □ V/my child have lots of energy to run and play games or sports with friends or kids at school
      □ V/my child get tired and cannot keep up if V/my child run or play games or sports with friends or kids at school
      □ V/my child get tired or weak if V/my child have to climb stairs
      □ V/my child can walk around inside our home but V/my child are too weak and tired to walk much outside of our home

   c) □ V/my child am sleeping my normal amount of time
      □ V/my child am sleeping more than my usual amount of time
      □ V/my child need to spend most of the day resting in bed, on the couch, or in a wheelchair

   d) Is this (the answers to a, b) and c) usual for you/your child?
      □ Yes
      □ No → Has it □ increased? □ decreased?
      How long has it been since it increased or decreased? ___________ (in days, weeks or months)
NFPE

- Complete nutrition assessment includes:
  - Medical Record Review
  - Anthropometric Measurements
  - Diet/Nutrition Intake
  - Interview
  - Physical Exam
NFPE

- SGNA focus is on 3 components of physical exam
  - Subcutaneous Fat
  - Muscle Wasting
  - Edema

- NFPA includes these 3 components but goes further by examining skin manifestations that indicate specific micronutrient deficiencies
• Begin by reviewing history, obtaining data.

• Use this information to focus your exam on areas of concern.

• Gather tools: disposable gloves, penlight, tongue depressor
Table 1. Common Pediatric Diagnoses and Possible Nutrient Deficiencies. 24

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Possible Nutrient Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflammatory bowel disease</td>
<td>Iron, folate, selenium, magnesium, zinc, calcium, vitamin D</td>
</tr>
<tr>
<td>Chronic diarrhea</td>
<td>Zinc</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>Fat-soluble vitamins (A, D, E, K), protein-calorie malnutrition</td>
</tr>
<tr>
<td>Congenital heart defects</td>
<td>Protein-calorie malnutrition</td>
</tr>
<tr>
<td>Prematurity</td>
<td>Vitamin D, calcium</td>
</tr>
<tr>
<td>Intestinal failure</td>
<td>With fat malabsorption: fat soluble vitamins (A, D, E, K), zinc, calcium, magnesium</td>
</tr>
<tr>
<td></td>
<td>Ileal resection: vitamin B12</td>
</tr>
<tr>
<td></td>
<td>Duodenal involvement: iron, folate</td>
</tr>
<tr>
<td>Liver disease</td>
<td>Vitamin K, essential fatty acid deficiency</td>
</tr>
<tr>
<td>Chylothorax</td>
<td>Essential fatty acid deficiency, protein deficiency</td>
</tr>
<tr>
<td>Burns</td>
<td>Vitamin C, vitamin A, zinc, protein-calorie malnutrition</td>
</tr>
<tr>
<td>Cancer</td>
<td>Protein-calorie malnutrition</td>
</tr>
<tr>
<td>Poor wound healing</td>
<td>Vitamin C, vitamin A, zinc, protein-calorie malnutrition</td>
</tr>
<tr>
<td>Renal</td>
<td>Zinc, copper, iron, magnesium</td>
</tr>
<tr>
<td></td>
<td>With dialysis: water-soluble vitamins</td>
</tr>
</tbody>
</table>
### Table 2. Nutrition Concerns Based on Physical Examination.

<table>
<thead>
<tr>
<th>Site</th>
<th>Physical Examination</th>
<th>Potential Nutrition/Metabolic Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin integrity</td>
<td>Pallor</td>
<td>Iron, folate, or vitamin B$_{12}$ deficiency</td>
</tr>
<tr>
<td></td>
<td>Dry, scaly skin</td>
<td>Vitamin A or essential fatty acid deficiency</td>
</tr>
<tr>
<td></td>
<td>Dermatitis</td>
<td>Essential fatty acid deficiency; zinc, niacin, riboflavin, or tryptophan deficiency</td>
</tr>
<tr>
<td>Nail</td>
<td>Spoon shape</td>
<td>Iron deficiency</td>
</tr>
<tr>
<td></td>
<td>Lackluster, dull</td>
<td>Protein deficiency</td>
</tr>
<tr>
<td></td>
<td>Mottled, pale, poor blanching</td>
<td>Vitamin A or C deficiency</td>
</tr>
<tr>
<td>Face</td>
<td>Moon face</td>
<td>Protein-calorie deficiency</td>
</tr>
<tr>
<td></td>
<td>Bilateral temporal wasting</td>
<td>Protein-calorie deficiency</td>
</tr>
<tr>
<td>Neck</td>
<td>Enlarged thyroid</td>
<td>Iodine deficiency</td>
</tr>
<tr>
<td>Mouth</td>
<td>Dry, cracked, red lips</td>
<td>Riboflavin, niacin, vitamin B$_{6}$ deficiency</td>
</tr>
<tr>
<td></td>
<td>Bleeding gums</td>
<td>Vitamin C deficiency</td>
</tr>
<tr>
<td></td>
<td>Inflamed mucosa</td>
<td>Vitamin B complex, iron, or vitamin C deficiency</td>
</tr>
<tr>
<td>Tongue</td>
<td>Magenta color</td>
<td>Riboflavin deficiency</td>
</tr>
<tr>
<td></td>
<td>Beefy red color and diminished taste</td>
<td>Niacin, folate, riboflavin, iron, or vitamin B$_{12}$ deficiency</td>
</tr>
<tr>
<td>Eyes</td>
<td>Night blindness; dull dry appearance to sclerae or inner lids; dull milky appearance of the cornea</td>
<td>Vitamin A deficiency</td>
</tr>
<tr>
<td></td>
<td>Cracked, red corners</td>
<td></td>
</tr>
<tr>
<td>Hair</td>
<td>Dull, lackluster, thin, sparse</td>
<td>Protein, iron, zinc, or essential fatty acid deficiency</td>
</tr>
<tr>
<td></td>
<td>Easily pluckable</td>
<td>Protein deficiency</td>
</tr>
<tr>
<td>Dentition</td>
<td>Excessive dental caries</td>
<td>Excessive simple carbohydrate intake</td>
</tr>
</tbody>
</table>


Recent publications describe skin manifestations to look for in children


These physical manifestations (hair, skin, nails, face, neck mouth, tongue, eyes etc.) are described extensively in the adult literature as well. They are the same!
LET’S GET BACK TO RENAL
UREMIC FAILURE TO THRIVE IN CHILDREN

EXPANDING ON THOSE OTHER REASONS FOR FTT IN CHILDREN WITH CKD
Select panel met during 2006 and issued position paper published in 2008

Considered both adults and *children* with CKD

Cited confusion with multiple definitions and terminology

Purpose was to develop uniform definition for presence of loss of muscle and fat tissues, presence of malnutrition and/or presence of inflammation.
ISRNM

Has been referred to in a variety of ways:

- Uremic malnutrition
- Uremic (renal) cachexia
- Protein-energy malnutrition
- Malnutrition-inflammation atherosclerosis syndrome
- Malnutrition-inflammation complex
- Cachexia syndrome
- Kidney wasting disease
A state of metabolic and nutritional derangement characterized by “decreased body stores of protein and energy fuels (body protein and fat masses)” in both adults and children with chronic kidney disease.
PEW

• Can result from inadequate diet (malnutrition)
• Can also result from conditions not related to reduced nutrient intake
• Recommends using the term cachexia only when PEW is very severe
Schematic representation of the causes and manifestations of the protein–energy wasting syndrome in kidney disease.
PEW

• Recommends including 4 categories for dx of PEW
  1. Biochemical criteria: Alb < 3.8, Prealbumin <30 in HD pts, Chol <100
  2. Low body weight: Low BMI, Unintentional wt loss over time, Body Fat less than 10%
  3. Decrease in muscle mass
  4. Low protein/energy intakes
But does this schematic and criteria really apply to children??

- 528 children (median age 12 yrs) using data from CKid study (CKD stages 1-3)
- Proposed modification to the diagnostic categories from ISRNM to apply to children
- 5 categories were:

1. Biochemical: Chol < 100, Alb < 3.8, Transferrin < 140, CRP >3
2. Reduced body mass: BMI for ht age < 5th or decrease of >10% over 1 yr
3. Reduced muscle mass: MUAC for ht age < 5th percentile or decrease of >10%
4. Decreased appetite: reported as fair, poor or very poor over week before study
5. Poor growth: Ht for age < 3% or decreased growth velocity
• Proposed definition of PEW in children:
  1. Minimal PEW: positive test in greater than or equal to 2 categories 1 through 4
  2. Standard PEW: positive test in greater than or equal to 3 categories 1 through 4
  3. Modified PEW: positive test in greater than or equal to 3 categories 1 through 5
     • Category 5 is growth parameters
Results

A. Incidence

- 20% met minimal PEW definition
- 7% met standard PEW definition
- 15% met modified PEW definition

B. Those meeting the PEW definition were more likely to have lower z score for wt., lower BMI for ht age z score, lower MUAC for ht age z score, protein/creatinine ratio > 2.
The prevalence of indicators of protein-energy wasting (PEW) used to form the three definitions. The prevalence is presented stratified by chronic kidney disease (CKD) stage.
Abraham AG et al. 2014
The prevalence of protein-energy wasting (PEW) as classified using the three definitions adopted in this study:
Abraham AG eta al. 2015.
CONCLUSION

Growth a better standard for diagnosing PEW in children with CKD than weight-based criteria.

Any definition of PEW in children must include growth criteria.

- Editorial commentary agreeing that growth parameters should be used in definition of PEW in children.
- Suggested using the term “Uremic Failure to Thrive” to differentiate criteria used to determine PEW in adults vs the criteria used to determine PEW in children
- Comments that MUAC, BMI for ht age, growth velocity is strongly applicable for measurement Uremic Failure to Thrive.
- Suggests using dietary intake records rather than subjective reporting of appetite
- Made adaptations to the schematic representation of PEW to account for the issues in children
CONCLUSION

- The new Consensus guidelines for Pediatric Malnutrition foster evaluation that is consistent among practitioners and among a variety of health care settings.

- Most of the data points recommended can also be utilized for evaluating children with CKD.

- Data points recommended must be evaluated in the context of fluid status and the concept of “uremic failure to thrive” to determine whether growth failure in children with CKD is truly due to malnutrition.

- The accurate determination of growth failure due to malnutrition or to “uremic failure to thrive” can further guide appropriate care.
CONCLUSION

• Use PES Statements

MALNUTRITION
(Acute/Chronic) (Mild, Moderate, Severe)
RELATED TO
(Medical Illness, Dietary Intake, Socioeconomic factos, Inflammation) (Mechanism: Nutrient intake, Needs, Losses, Altered utilization)
AS EVIDENCED BY
(Z Scores, Growth velocity, Weight loss, NFPE)
CONCLUSION

• Use Preferred Pediatric Malnutrition Codes: ICD 10
  
  • Unspecified severe protein-calorie malnutrition: E43
  
  • Moderate protein-calorie malnutrition: E44.0
  
  • Mild protein-calorie malnutrition: E44.1
  
  • Retarded development following protein-calorie malnutrition: E45
CONCLUSION

• Avoid other malnutrition codes:
  • Kwashiorkor: E40
  • Nutritional marasmus: E41
  • Unspecified protein-calorie malnutrition: E46

WHY?

They do not specify severity!
REFERENCES


REFERENCES


