Nutritional Assessment & Monitoring of Hospitalized Children

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Pakistan Nutrition & Dietetic Society, CNE October, 2011
In Pakistan...

42% of children aged < 5 years are stunted and 14% wasted

http://www.unicef.org/infobycountry/pakistan_pakistan_statistics.html

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Prevalence of Underweight in Pakistani Children

http://gamapserver.who.int/gho/interactive_charts/mdg1/atlas.html

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Nutritional Assessment

- Medical History
- Physical/Clinical assessment
- Laboratory Data
- Anthropometric Data
- Dietary Data
The Assessment of Nutritional Status is an Integral Component of Paediatric Healthcare
• Family /social history
• Acute/chronic illness
• H/o pre existing nutritional deficiencies
• H/o relevant medical or surgical treatment
• Medicines for possible drug/nutrient interaction
Physical Findings

- Physical examination and evaluation of general appearance

- Clinical signs of malnutrition only appear at severe stages of malnutrition while milder forms are difficult to detect

- These signs are also reflected in the diet history and need to be supported by biochemical evaluation
Laboratory Data

- Objective means of confirming suspicion of a nutritional problem

- Some tests are performed routinely while others are performed when diagnosis, medical history or nutritional history indicate nutritional risk

- Validity of these tests can be affected by several factors
Age appropriate growth is the hallmark of adequate nutrition- Monitoring of growth is done through measurement of:

- Weight
- Length/height
- Head circumference (for <3yr old)
- Mid upper arm and Skin fold measurements
- BMI
The growth charts allow a child’s measurements to be compared to a reference population of similar age and gender by plotting them on percentile graphs.
## BMI Percentile

BMI-for-age weight status categories and the corresponding percentiles

<table>
<thead>
<tr>
<th>Weight Status Category</th>
<th>Percentile Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>Less than the 5th percentile</td>
</tr>
<tr>
<td>Healthy weight</td>
<td>5th percentile to less than the 85th percentile</td>
</tr>
<tr>
<td>Overweight</td>
<td>85th to less than the 95th percentile</td>
</tr>
<tr>
<td>Obese</td>
<td>Equal to or greater than the 95th percentile</td>
</tr>
</tbody>
</table>

*CDC and the American Academy of Pediatrics recommends the use of BMI to screen for overweight and obesity in children 2-20 years old.*

Centers for Disease Control and Prevention 2011

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• Calculations of height for age, height age and weight for height are useful
  – Initial assessment of nutritional status
  – Monitoring progress in children who are short for their chronological age

• Calculation of height age is important
  – To determine nutritional requirement for children who are small for age
A 10 year old girl with height 115 cm, lies below 5th centile.

How to calculate height age:

Her height age is 6 years.
Standard Deviation or z-score charts give a numerical score and are useful in expressing how far away from the 50\textsuperscript{th} percentile or median a child’s measurement falls.
Importance of nutritional assessment is to identify Protein Energy Malnutrition

Growth charts can identify growth problems but do not relate the severity of under nutrition

To determine the degree of malnutrition
  - Gomez Classification
  - Water low Classification
## Diagnosis of Severe Acute Malnutrition

<table>
<thead>
<tr>
<th>Measure</th>
<th>WHO Cut-off</th>
<th>NCHS Cut-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight for height</td>
<td>&lt;-3 SD</td>
<td>&lt;70% median</td>
</tr>
<tr>
<td>MUAC</td>
<td>&lt;115 mm</td>
<td></td>
</tr>
<tr>
<td>Bilateral edema</td>
<td>Present</td>
<td></td>
</tr>
</tbody>
</table>

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• The quantity and quality of food

• Factors affecting food selection and intake

• Clinical / physical factors related to nutritional status
The assessment of milk intake for breast fed infants is difficult and only general assumptions can be made.

For older children similar methods for dietary assessment can be used as for adults.
Food Related Factors

- Chronological feeding history
  - From birth
  - Onset of nutritional problem
- Current food intake
- Feeding skills
- H/o prescribed or self imposed diets
- Food allergies/ intolerances
- Socio-economic status, cultural/religious beliefs
The Dietary Reference Intake serves as a guide to determine a child’s nutrient needs.

Several predictive equations are available to estimate the calorie requirements of healthy children.
<table>
<thead>
<tr>
<th>Age</th>
<th>Calories/Kg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants</td>
<td>110</td>
</tr>
<tr>
<td>1 – 3 years</td>
<td>100</td>
</tr>
<tr>
<td>4 – 6 years</td>
<td>90</td>
</tr>
<tr>
<td>7 – 9 years</td>
<td>80</td>
</tr>
<tr>
<td>10 – 12 years</td>
<td>70</td>
</tr>
</tbody>
</table>
# Protein Requirements of Children

<table>
<thead>
<tr>
<th>Age</th>
<th>Protein (gm/kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants</td>
<td>2.5</td>
</tr>
<tr>
<td>1 – 3 years</td>
<td>2.0</td>
</tr>
<tr>
<td>4 – 6 years</td>
<td>1.5</td>
</tr>
<tr>
<td>7 – 12 years</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*Basics of Pediatrics 8th edition by Dr. Pervez Akber. 2011*
# Requirements of sick Children

<table>
<thead>
<tr>
<th></th>
<th>Infants</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>130-150 kcal/kg/day</td>
<td>120% EAR for age</td>
</tr>
<tr>
<td>Very high</td>
<td>150-220 kcal/kg/day</td>
<td>150% EAR for age</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>3-4.5 gm/kg/d</td>
<td>2 gm/kg/d</td>
</tr>
<tr>
<td>Very high</td>
<td>6-10 gm/kg/d</td>
<td>Children can easily eat more than this</td>
</tr>
</tbody>
</table>

In severely malnourished children initially energy and protein should be based on weight rather than age.
### Types of Malnutrition

<table>
<thead>
<tr>
<th>Type of malnutrition</th>
<th>Anthropometric index</th>
<th>Normal</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic (stunting)</td>
<td>Ht for age %std</td>
<td>95</td>
<td>90-94</td>
<td>85-89</td>
<td>&lt;85</td>
</tr>
<tr>
<td>Acute (wasting)</td>
<td>Weight for age % std</td>
<td>90</td>
<td>75-89</td>
<td>60-74</td>
<td>&lt;60</td>
</tr>
<tr>
<td></td>
<td>Wt for ht % std</td>
<td>90</td>
<td>80-89</td>
<td>70-79</td>
<td>&lt;70</td>
</tr>
</tbody>
</table>

*Hand book of Pediatric Nutrition 3rd edition by Samour & King, 2005*

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Causes of Malnutrition

Non organic
• Poverty
• Neglect
• Lack of knowledge
• Misperceptions about diet
• Error in formula preparation

Organic
• Persistent vomiting
• Malabsorption
• Systemic disease related anorexia
Management of Malnutrition In-Patients

**F-75**
- Starter Formula
- Contains 75 kcal and 0.9 g protein per 100 ml

**F-100**
- Catch up Formula
- Provides 100 kcal and 2.9g protein per 100 ml

**High Density Diets**
- Home based therapy
- Use of nutrient dense foods
## Recipes for Re-feeding Formulas

<table>
<thead>
<tr>
<th>Food item</th>
<th>F-75 (starter: cereal-based)</th>
<th>F-75(starter)</th>
<th>F-100(catch-up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dried skimmed milk(g)</td>
<td>25</td>
<td>25</td>
<td>80</td>
</tr>
<tr>
<td>Sugar(g)</td>
<td>70</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Cereal (g)</td>
<td>35</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vegetable oil(g)</td>
<td>27</td>
<td>27</td>
<td>60</td>
</tr>
<tr>
<td>Electrolyte/mineral solution(ml)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Water : make up to(ml)</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Energy (k.cal)/100ml</td>
<td>75</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>Protein(g)/100ml</td>
<td>1.1</td>
<td>0.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Osmolality (mOsm/l)</td>
<td>334</td>
<td>413</td>
<td>419</td>
</tr>
</tbody>
</table>

Pocket book of hospital care for children: guidelines for the management of common illnesses with limited resources (WHO 2005)
Daily weight

- Record the weight gain for 3 days (g/kg/day)

If the weight gain is

- Poor (<5 g/kg/day) - full reassessment
- Moderate (5-10 g/kg/day) - check for intake target met or if infection has been overlooked
- Good >10 g/kg/day
Discharge Criteria

• Includes:
  – Return of appetite
  – Most/all of edema gone
  – Weight for length 90% (equivalent to -1 SD)

• Regular follow-ups
  – After 1, 2 and 4 weeks & then monthly for 6 months
  – If there is failure to gain weight over a 2-week period, may need hospitalization
### High Density Diet

<table>
<thead>
<tr>
<th>Food item</th>
<th>gm</th>
<th>Calories</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>40</td>
<td>143</td>
<td>3.0</td>
</tr>
<tr>
<td>Dal</td>
<td>30</td>
<td>105</td>
<td>6.75</td>
</tr>
<tr>
<td>Milk powder</td>
<td>20</td>
<td>100</td>
<td>7.50</td>
</tr>
<tr>
<td>Sugar</td>
<td>90</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>90</td>
<td>810</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>900</td>
<td></td>
<td>17.25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1518</strong></td>
<td></td>
</tr>
</tbody>
</table>

Provides 45 cal/oz or 1.5 cal/ml (approximately)

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Management of Malnutrition in Outpatients

- **Regular meals** - at least 5 times a day, that contain Approx. 100 kcal and 2-3 g protein /100 gm of food
- **Frequent high energy snacks** (Milk shakes, potato cutlets, desserts, chicken cheese SW etc)
- **Fortification**
- **Supplements** (High caloric & high protein commercially available supplements)
Case Study

15 months old M. Bux belongs to low socio economic group, presented to the outpatient department with complaint of on and off diarrhea. Exclusively breast fed for two months and then switched to diluted cow’s milk. Proper weaning was never introduced. Mother started biscuits and tea when the child was 8 months old. Occasionally the child eats chips (papar)
• **Anthropometric data**
  Height: 77 cms (at 25\textsuperscript{th} centile)
  Weight: 8.5 Kgs (<5\textsuperscript{th} centile)
  IBW: 11 kgs

• **Biochemical data**
  Hemoglobin 6.7 (all other biomarkers within normal limits)

• **Physical examination findings**
  Pale appearance
Nutrition Diagnosis

• Inadequate energy intake related to food and nutrition knowledge deficit as evidenced diet history

• Altered laboratory values evidenced by Hb of 6.7mg/dl
Estimation of Energy Requirement

• Weight = 8.5 kg
• EAR for 15 months = 100 kcal/kg
• 8.5 x 100 = 850 kcals
Intervention

Nutrition Prescription: 850 Kcal diet

- Counseled regarding proper safe, hygienic complimentary foods e.g. cooked potatoes, khitchree, suji with milk, bananas, mashed fruits & vegetables etc appropriate for age

- Emphasize intake of iron rich foods (egg, beef, chicken, liver puree, dals etc)

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Monitoring/Evaluation

- Monitor weight
- Food intake
- Lab values.
- Adherence to recommendations

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