FAILURE TO THRIVE: WHAT THE EXPERT NEEDS TO KNOW

Praveen S. Goday MBBS CNSC
Associate Professor
Pediatric Gastroenterology
Medical College of Wisconsin
Milwaukee, WI

Value-based care of the patient with FTT

DISCLOSURES
None

Objectives
• Discuss state-of-the-art assessment of the child with failure to thrive (FTT)
• Discuss nutrition considerations in the child with FTT
• Discuss further evaluation and management of the child with FTT

ASSESSMENT

Definitions
1. Weight < 75% of median weight for chronological age (Gomez criterion)
2. Weight < 80% of median weight for length (Waterlow criterion)
3. Body mass index for chronological age < 5th centile
4. Weight for chronological age < 5th centile
5. Length for chronological age < 5th centile
6. Weight deceleration crossing more than two major centile lines from birth until weight within the given age group
7. Conditional weight gain = lowest 5%, adjusted for regression towards the mean from birth until weight within the given age group
Prevalence
- Danish birth cohort
- Significant undernutrition =3% under the age of 1
- All seven criteria
  - Poor concurrence
  - None of the FTT children met all the criteria
- Single criterion
  - Most met only one criterion
  - identified less than half of these children or included too large a proportion of the total cohort

Olsen et al. Arch Dis Child 2007

Practical definition of failure to thrive
- Weight-for-length (or BMI) < 2nd percentile (WHO growth chart) or 3rd percentile (CDC growth chart)
- Poor or no weight gain
  - Over a period of time that varies according to the age of the child
- Significant downtrend in weight percentiles
  - 30% of full-term infants cross one percentile and 23% cross two percentiles between birth and 2 years
- These should be done along with:
  - Assessment of parental size / growth
  - Correction for prematurity (where applicable)

Prescriptive versus descriptive
- Descriptive growth charts
- Prescriptive growth charts

THE WHO GROWTH STANDARDS

Growth standard?
- The WHO charts are growth standards
  - describe how healthy children should grow under optimal conditions (prescriptive)
- What are optimal conditions?
  - High socioeconomic status
  - Singleton mothers
  - Breastfeeding
  - No smoking
- 0-2 years: use WHO growth standards
- 2 years+: use CDC growth charts

Compliance with Feeding criteria

<table>
<thead>
<tr>
<th>Feeding criteria</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusively / predominantly breastfeeding</td>
<td>74.7%</td>
</tr>
<tr>
<td>Complementary foods by 6 months</td>
<td>99.5%</td>
</tr>
<tr>
<td>Partially breastfeeding until at least age 12 months</td>
<td>68.3%</td>
</tr>
</tbody>
</table>
Breastfeeding

<table>
<thead>
<tr>
<th></th>
<th>Ever breastfed</th>
<th>Breastfeeding at 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO charts</td>
<td>100%</td>
<td>75%</td>
</tr>
<tr>
<td>CDC data set</td>
<td>50%</td>
<td>33%</td>
</tr>
<tr>
<td>Present US data*</td>
<td>75%</td>
<td>58%</td>
</tr>
</tbody>
</table>


The WHO growth charts

- Growth curves for children aged <24 months
  - Longitudinal measurements from birth through age 23 months
  - Enrolled at birth and visited 21 times at home until age 24 months

- Growth curves for children aged 24-59 months
  - Cross-sectional

The WHO growth charts

- Growth curves for children aged <24 months
  - Longitudinal measurements from birth through age 23 months
  - Enrolled at birth and visited 21 times at home until age 24 months

- Growth curves for children aged 24-59 months
  - Cross-sectional

WHO versus CDC

- In the first few months of life
  - WHO curves show a faster rate of weight gain
  - Use of the WHO charts
    - Increase in the misperception of poor growth in formula-fed infants

- After 3 months
  - WHO curves show a slower rate of weight gain
  - Use of the WHO charts
    - Might identify formula-fed infants as gaining weight too quickly

Outlying children

- Children under 24 months
  - Observations falling ≥ 3 SD and ≤ 3 SD of the sample median were excluded

- Children > 24 months
  - Observations falling ≥ 2 SD and ≤ 2 SD of the sample median were excluded
  - Sample was exceedingly skewed to the right

Growth performance of affluent Indian children is similar to that in developed countries

Nita Bhandari,1,2 Roju Bohl,1 Sanita Taneja,1 Mercedes de Onis,2 & Mahavraj K. Bhan2

<table>
<thead>
<tr>
<th>Mean z scores</th>
<th>Weight-for-age</th>
<th>Length-for-age</th>
<th>Weight-for-length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affluent children</td>
<td>-0.45</td>
<td>-0.28</td>
<td>-0.32</td>
</tr>
<tr>
<td>Less-affluent children</td>
<td>-2.2</td>
<td>-1.95</td>
<td>-1.47</td>
</tr>
</tbody>
</table>

- Lengths
  - Striking similarity in sites
  - 70% of the total variance in length was due to inter-individual differences
  - Only 3% was due to inter-site differences

Bulletin of the World Health Organization 2002, 10 (3)
GROWTH CHARTS FOR CEREBRAL PALSY

Gross Motor Functional Classification System (GMFCS)

I  Walks without limitations
II  Walks with limitations
III Walks using a hand-held mobility device
IV  Self-mobility with limitations, may use powered mobility
V   Transported in a manual wheelchair

Chronic Medical Conditions according to weight quintile

Mean number of chronic major medical conditions according to weight quintile. * Significant difference from the middle 3 quintiles (P < 0.05).

Crude Mortality Rates according to weight quintile

Crude mortality rates according to weight quintile. * Significant difference from the middle 3 quintiles (P < 0.05).
Brooks charts are available through www.lifeexpectancy.org

Utility
- Can be used to decide if a child with cerebral palsy needs a gastrostomy tube
- For children with gastrostomy tubes, can be used to suggest an ‘optimal’ weight

New charts for premature infants

Olsen premie charts
- Sex-specific growth charts based on actual measurements of 250,000 infants
- Racially diverse group
- Can be used to classify children as small for gestational age

Adapted from Olsen et al. Pediatrics 2010;125;393

Small for gestational age
- If a child is <10th percentile for gestational age then child is SGA

<table>
<thead>
<tr>
<th>GA</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>477</td>
<td>509</td>
</tr>
<tr>
<td>24</td>
<td>524</td>
<td>561</td>
</tr>
<tr>
<td>25</td>
<td>584</td>
<td>626</td>
</tr>
<tr>
<td>26</td>
<td>645</td>
<td>704</td>
</tr>
<tr>
<td>27</td>
<td>719</td>
<td>789</td>
</tr>
<tr>
<td>28</td>
<td>807</td>
<td>884</td>
</tr>
<tr>
<td>29</td>
<td>915</td>
<td>988</td>
</tr>
<tr>
<td>30</td>
<td>1052</td>
<td>1114</td>
</tr>
<tr>
<td>31</td>
<td>1196</td>
<td>1267</td>
</tr>
<tr>
<td>32</td>
<td>1352</td>
<td>1433</td>
</tr>
<tr>
<td>33</td>
<td>1545</td>
<td>1625</td>
</tr>
<tr>
<td>34</td>
<td>1730</td>
<td>1810</td>
</tr>
<tr>
<td>35</td>
<td>1869</td>
<td>1980</td>
</tr>
<tr>
<td>36</td>
<td>2028</td>
<td>2170</td>
</tr>
<tr>
<td>37</td>
<td>2260</td>
<td>2401</td>
</tr>
<tr>
<td>38</td>
<td>2526</td>
<td>2652</td>
</tr>
<tr>
<td>39</td>
<td>2724</td>
<td>2833</td>
</tr>
<tr>
<td>40</td>
<td>2855</td>
<td>2950</td>
</tr>
<tr>
<td>41</td>
<td>2933</td>
<td>3039</td>
</tr>
</tbody>
</table>

Adapted from Olsen et al. Pediatrics 2010;125;393

Z scores
What is a z-score?

\[ Z \text{ score} = \frac{\text{Observed data point} - \text{Mean data point}}{\text{Standard deviation}} \]

The use of z scores

- Z-scores allow more precision in describing anthropometric status

Utility of z scores

- If we all use z scores
- Eliminate use of ideal body weight
- Potentially eliminate weight gain in grams per day
- More accurately describe our patients when they do not fall within the growth chart percentiles
- Use the data for statistical analyses

FURTHER EVALUATION

Labs

- Most children with FTT do not need labs
- Labs
  - Significant FTT
  - FTT not due to inadequate calorie intake
  - Common labs
    - CBC, ESR
    - Metabolic panel, electrolytes
    - Anti-TG IgA, serum IgA level
    - Fecal elastase
    - Urinalysis

- The importance of a thorough history and examination over extensive testing was demonstrated 3 decades ago
- Laboratory tests do not help in the evaluation of FTT
- 185 children admitted for evaluation of FTT
- Only 36 of 2,607 laboratory tests performed (1.4%) were helpful in making a diagnosis
- All 36 positive results were suspected on clinical grounds

Berwick et al. Arch Dis Child 1982
Sills RH. Am J Dis Child 1978
SHOULD CHILDREN WITH FTT UNDERGO AN EGD?

EGD in FTT
- Eosinophilic esophagitis
- Feeding disorder is a common presentation of EoE in infants and toddlers
- Celiac disease

Spergel et al. JPGN 2008

Endoscopy in feeding disorders
- Retrospective review
- ~ 1500 children
- 85 children underwent EGD
  - 47 had clinical findings including esophagitis, gastritis, duodenitis
  - 17 / 47 had eosinophilic esophagitis or celiac disease

- These data suggest that 20-250% of a select group of children with feeding disorders have endoscopy findings that are clinically relevant

Jhaveri et al. NASPGHAN 2012

Feeding disorders associated with EoE

Mukkada et al. Pediatrics 2010

BASIC MANAGEMENT OF FTT

- Consider early endoscopy in children with feeding disorder and
  - Other atopic conditions
  - Food allergy
  - Family history of EoE or esophageal dilatations

- Consider endoscopy in all children with feeding disorder that cannot be treated by basic interventions
Initial interventions in a child with failure to thrive

- Establish Meal Time Routine
  - Meals and snacks offered every 3 hourly
  - All meals and snacks should be offered in a high chair/at the table
  - Minimize distractions
  - Avoid force feeding
  - Grazing in between meal and snack times should be eliminated

Initial interventions in a child with failure to thrive

- High-calorie diet
  - Use the family’s regular meals but add fats only to foods presented to the patient
  - Do not switch child over to junk food
  - High-calorie beverages

Initial interventions in a child with failure to thrive

- Curtail Beverages and Other Low-Calorie Foods
  - Eliminate juice, sweetened beverages
  - Appropriate milk intake for age

DIFFICULT PATIENTS WITH FTT

Significant feeding disorder

- 3-year-old male with mild developmental delays
  - will eat only 3 foods – Cheerios, pepperoni pizza, oranges
  - drinks 42 oz of milk each day
  - spends the whole day drinking milk from a sippy cup and refuses to eat any other foods
  - no history of atopy
  - There are no concerns with regard to his anthropometric measurements

Behavioral interventions

- Feeding structure
- Manipulation of hunger
- Contingency management
- Shaping
- Parent training

Fischer et al. Semin Speech Lang. 2007
Feeding structure

- Meals and snacks offered every 3 hourly
- All meals and snacks should be offered in a high chair/at the table
- Minimize distractions
- Avoid force feeding
- Grazing in between meal and snack times should be eliminated

Manipulation of hunger

- Selectively withholding milk
- Use of cyproheptadine
- Introduction of other foods

Cyproheptadine

- One positive study in underweight children
  - Randomized controlled study with 10 children in each arm
  - 4 months of cyproheptadine or placebo
  - Improvement in weight and height velocities and IGF-1 levels with cyproheptadine
- Positive studies in cancer and cystic fibrosis
- Retrospective study in stimulant-induced weight loss

Fervent’ breast feeder

- 10-month old male
  - refuses to consume anything but breast milk and only directly from the breast
  - His weight z score is -2.25 and his weight-for-length z score is -2.1

Is there a medical problem?

- Involvement of a speech and language pathologist
- EGD
- Nutritional issues
  - Macronutrients
  - Micronutrients – vitamin D, iron, zinc and calcium
- Emotional issues
  - Data suggesting that mothers have various psychological issues and that these children grow poorly despite adequate intervention

SHOULD CHILDREN WITH FTT BE GIVEN A MULTIVITAMIN / MINERAL PREPARATION?
- Vitamin D
  - 9% of US children and adolescents are deficient
- Metaanalysis of zinc supplementation in children found positive increments in weight and height
  - Growth response greater in children with low initial weight-for-age z scores
- 8% of US children are iron deficient


Small-for-gestational-age child

- 10-month-old was born at 36 weeks gestation with a birth weight at the 3rd percentile
- He is presently below the 3rd percentile for weight and weight-for-length
- His z scores for weight and weight-for-length have been between -2.1 and -2.2 since 3 months of age

Small-for-gestational-age child

- The most common definition of SGA is below the 10th percentile for gestational age
- ~90% of SGA infants exhibit spontaneous catch-up growth
- Appropriate weight gain (“Goldilocks” amounts) is associated with the best neurological outcomes
  - ↑ weight gain (> 5000 gm in the first 16 weeks of life) is associated with ↓ cognition and ↑ BMI at age 7 years

Pylipow et al. J Pediatr 2009

Prognosis

- Meta-analysis involving FTT children < 2 years of age
  - 3-point reduction in IQ in children at age 3
- Another meta-analysis
  - Less-exacting inclusion criteria
  - FTT in infancy is associated with adverse intellectual outcomes sufficient to be important
  - A study of adolescents who had FTT in infancy failed to show any evidence of emotional deficit in cases compared with controls

Rudolf et al. Arch Dis Child 2005
Corbett et al. J Child Psychol Psychiatry 2004

Conclusions

- Use the appropriate growth charts in the evaluation of children with FTT
- A history and physical examination are crucial in the evaluation of FTT
  - Labs are less important
  - Endoscopy should be used judiciously
- Behavior modification should be the cornerstone of FTT management