Hillary W. Petska, MD has documented that she has no relevant financial relationships to disclose or conflicts of interest to resolve.

Key Points

- Failure to thrive is a common problem in infancy and childhood.
- Failure to thrive is due to inadequate nutrition, although the underlying cause is typically multifactorial.
- Failure to thrive has significant short- and long-term health consequences for children.
- Failure to thrive may be a sign of child neglect.
What is normal?

- Infants typically lose 5-10% of birth weight, but regain by 10-14 days
- Double birth weight by 4-5 months
- Triple birth weight by 1 year

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Weight Gain (oz/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3</td>
<td>1 (26 – 31 g)</td>
</tr>
<tr>
<td>3 - 6</td>
<td>0.6 (17 – 18 g)</td>
</tr>
<tr>
<td>6 - 9</td>
<td>0.4 (12 – 13 g)</td>
</tr>
<tr>
<td>9 - 12</td>
<td>0.3 (9 – 13 g)</td>
</tr>
<tr>
<td>12 - 36</td>
<td>0.25 (7 – 9 g)</td>
</tr>
</tbody>
</table>
Nutrition 101

- Infants should be breast or formula fed until 1 yo
- Breastfed babies should be given Vit D
- Solids can be started around 6 mos
- At 1 yo, transition to whole cow’s milk (max: 24 ounces), low fat milk at 2 yo
- For kids > 1 yo, limit juice to 4-6 oz/d

Optimal Nutrition

- Not all diets are created equal.
  - Low iron formula – iron deficiency
  - Cow milk – iron deficiency
  - Goat milk – folate deficiency
  - Raw milk – infection risk
  - Almond milk – multiple deficiencies
  - Fruit juice – kwashiorkor
- Caloric needs vary by age
  - Infants: 100-120 kcal/kg/d
  - Toddlers: 90-110 kcal/kg/d
  - School Age: 60-90 kcal/kg/d
  - Adolescents: 55-60 kcal/kg/d

Epidemiology of FTT

- Mostly diagnosed in children < 2 yo
- Seen in 5-10% of children in primary care settings
- Accounts for 1-5% of all referrals to children’s hospitals
Definition

- Prolonged cessation of appropriate weight gain compared to age/gender norms
- Weight < 3rd percentile
- Decline of weight across 2 major percentiles in 6 months

- Decreased weight in proportion to length = FTT
- Inadequate nutrition: weight, then height, then head circumference affected
- Isolated cessation of head circumference growth may indicate a neurologic disorder.

- Decreased length in proportion to weight = endocrine abnormality
- Proportionate decrease in weight-for-length with normal growth velocity ≠ FTT

“Mimics”
- Intrauterine growth restriction, prematurity, genetic short stature, constitutional growth delay
- Conditional growth charts for children with altered growth patterns:
  - Trisomy 21 (Down syndrome)
  - Prader-Willi syndrome
  - Williams syndrome
  - Cornelia de Lange syndrome
  - Turner syndrome
  - Rubinstein-Taybi syndrome
  - Marfan syndrome
  - Achondroplasia

FTT is a sign, not a diagnosis

Causes
- Inadequate energy intake
- Inadequate nutrient absorption
- Increased energy requirements

May be due to a medical condition, psychosocial reasons, or both
Medical Risk Factors

- Prematurity
- Developmental delay
- Congenital anomalies
- Intrauterine exposures
- Lead poisoning
- Anemia
- Dietary beliefs/practices
- Any condition that results in inadequate intake, malabsorption, or increased metabolic rate

Psychosocial Risk Factors

- Poverty
- Social isolation
- Family violence
- Substance abuse
- Mental health
- Cognitive limitations
- Stress

Effects of FTT

- Poor linear growth
- Decreased brain growth
- Lower IQ
- Developmental delay
- Behavioral problems
- Increased risk of infection
- Poor wound healing
- Anemia
- Weak bones
- Death
Medical Evaluation

- Comprehensive history and physical exam can typically rule out medical causes
- Hospitalization may be required:
  - Diagnostic work-up
  - Severe malnutrition or dehydration
  - Protection

Medical Management

- Multidisciplinary team
- Nutrition education
- Feeding recommendations
- Referral for resources
- Developmental screening
Identification

Thinning of the hair, head appears large compared to neck, eyes or cheeks appear sunken due to decreased subcutaneous fat

Information Gathering

- Medical records request
- WIC records
- Interview of child and/or siblings at a Child Advocacy Center
- Collaboration with other investigators

Atrophy or wasting of buttocks, "extra" skin, emaciated limbs, "large" joints or scrotum, prominent ribs, spine, shoulder blades, flat abdomen
Home Visit

- Observe a feeding:
  - Preparation of formula
  - Oral-motor dysfunction
  - Feeding environment
  - Parent-child interaction
  - Home environment

Other Types of Maltreatment

- Neglect
  - Physical
  - Medical
  - Emotional
  - Educational
- Abuse
  - Physical
  - Sexual

Environmental Neglect

- Inadequate formula/food
- No clean dishes
- No electricity
- No running water
- Safety hazards
Physical Neglect

- General appearance
- Dirty clothes/body
- Matted hair
- Inappropriately dressed
- Odor
- Behavior
  - Stealing, hoarding food
- Disclosures
  - Reports missing meals

Case

- Almost 3 yo female adopted from Guatemala at 1 yo
- Followed by GI for FTT
- No weight gain x 1 year

- Eventually evaluated for physical abuse after an anonymous report to CPS
- 9 fractures (jaw, skull, arms, leg)
- Multiple cutaneous injuries
FTT can also be seen in older children

Case
- 17 yo male admitted for fever, vomiting, poor feeding, trouble breathing x 4 days
- PMH: born at 28 weeks, cerebral palsy, seizure disorder, chronic lung disease
- Social history: placed with grandparents at 8 mos due to physical abuse by father

Neglect?
- Medical records - no growth x 10 years
- Nutrition - primarily baby food
- No services in the home for patient
References

- Kirkland RT, KJ Motil. Etiology and evaluation of failure to thrive (undernutrition) in children younger than 2 years. UpToDate. 2013.
- I would also like to acknowledge Dr. Lynn K. Sheers and Dr. Angela L. Rabbitt who provided additional cases/slide content.