SPECIAL ISSUE ARTICLE

Clinical Review of Failure to Thrive in Pediatric Patients

Catherine Larson-Nath, MD; and Vincent F. Biank, MD, MS

ABSTRACT

Failure to thrive (FTT) is a common problem that occurs when caloric intake is insufficient to maintain growth. For the majority of children it can be reversed with behavioral modifications and increased caloric provisions. In a minority of cases, FTT is the symptom of underlying organic disease. Routine evaluation with laboratory tests, imagining studies, and endoscopy results in an etiology of FTT in <1.4% of cases, and when investigations are positive the organic etiology is most often suspected based on history and/or physical examination. Therefore, these evaluations should be limited to those children with clear symptoms of organic disease and those who fail to grow with behavioral and nutritional interventions. **[*Pediatr Ann*. 2016;45(2):e46-e49.]**

Failure to thrive (FTT) is a state of under-nutrition that occurs when caloric intake is insufficient to maintain growth. However, it may represent a symptom of an underlying systemic disease or be a sign of inadequate caloric provisions for a child due to psychosocial or environmental factors. FTT is a common problem encountered by clinicians, representing 5% to 10% of patients seen in the outpatient setting.[1,2] Depending on the criteria used, a Danish birth cohort demonstrated rates of FTT ranging from 1.3% to 22.2%.[3] Despite the frequency of this diagnosis, there has been much debate on the definition of FTT.

ILLUSTRATIVE CASE

A 16-month-old boy presented with poor growth. Since birth, his z-scores for weight and length had been approximately -1.5 and -1.3, respectively, and his weight-for-length z-score had been around -0.8 over the same time period. At his current visit, he weighed 7.9 kg (z-score of -2.58), his length was 77 cm (z-score of -1.24), his weight-for-length z-score was -2.82, and his occipital-frontal circumference (OFC) was 45 cm (z-score of -1.53). His parents described the patient as a picky eater. His favorite foods were chips and fruit snacks. He drank 16 oz of whole milk per day and 30 oz of juice from a sippy cup that he carried with him throughout the day. The family was busy, and both parents worked different schedules, so they did not eat meals together. The patient did not have any vomiting, abdominal pain, diarrhea, or constipation. He had been previously healthy and his family history was unremarkable. His mother was 5 feet tall and his father was 5 feet, 7 inches tall. Aside from being thin, the patient had a normal physical examination.

You diagnosed the child with FTT due to his weight-for length z-score of <-2 and his drop in weight-for-length z-score by >2. He will meet his mid-parental height and did not have signs or symptoms of organic disease. You recommended that the family not allow the patient to "graze" on food and beverages throughout the day and instead provide him with 3 meals and 2 snacks per day that are served at a table with the family eating together. In addition, you advise the removal of juice from his diet and only allowing water between meals and snacks.

At a follow-up examination 2 months later, the family had been able to implement your recommendations and his weight had improved to 8.9 kg (z-score of -1.85), his length to 78.9 cm (z-score of -1.25), and his weight-for-length z-score to -1.74.

DEFINITION OF FAILURE TO THRIVE

Currently, there are several criterion proposed to diagnose FTT (**Table 1**). However, all the definitions of FTT require the children be plotted on an appropriate-for-age growth chart. Specifically, for children younger than age 2 years a World Health

Catherine Larson-Nath, MD, is an Assistant Professor, Department of Pediatric Gastroenterology, Hepatology, and Nutrition, University of Minnesota. Vincent F. Biank, MD, MS, is a Clinical Assistant Professor of Pediatrics, University of Chicago, Pritzker School of Medicine; and the Chief, Pediatric Gastroenterology, Hepatology and Nutrition, NorthShore University HealthSystem.

Address correspondence to Catherine Larson-Nath, MD, Department of Pediatric Gastroenterology, Hepatology, and Nutrition, University of Minnesota, 2450 Riverside Avenue, Minneapolis, MN 55454; email: lars2698@umn.edu.

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Organization (WHO) growth chart should be used, and for children age 2 years and older a US Centers for Disease Control (CDC) chart should be used.

Olsen et al.[3] have shown that the criteria in **Table 1** are not sensitive or specific in identifying all children with FTT. There are many reasons that children may look like they have FTT but are actually growing at their potential; therefore, multiple factors need to be considered when diagnosing a child with FTT. For instance, many children born large for gestational age will drop percentiles after birth to reach their appropriate growth curve. Twenty-five percent of normal children will drop more than 2 major percentile lines,[4] and 13% of children born small for gestational age will not have catch-up growth.[5] Children with small parents will have lower genetic potential for height, and children from families with a history of constitutional growth delay are more likely to be small. In addition, some normal children will naturally be below the lowest major percentile for age. Although there are many impostors of FTT, some children who have chronic poor growth may appear normal in regard to body mass index (BMI) and weight or length once their height has started to be affected by under-nutrition. Therefore, the preferred method for determining poor growth/malnutrition is through the use of anthropometric z-scores (**Table 2**).[6,7]

Z-scores are standard deviations scores and allow for more precision in describing poor growth, especially at the extremes of the growth curve. The 50th percentile is equivalent to a z-score of 0 and the 3rd percentile is equivalent to a z-score of -1.89. When using a percentile chart, the most accurate any child may be described is <3rd percentile. Percentiles do not differentiate between a child with a z-score of -2.5 and one with a z-score of -3.5 when the later child is at more nutritional risk. Z-scores also allow for better tracking of growth changes (for example, if a z-score improvement from -3.5 to -3 would not be observed using percentile standards). As with percentiles, absolute z-scores cannot be used for a child on the growth curve who is faltering and for whom deceleration of z-scores needs to be considered. Z-score calculators for both WHO and CDC growth charts can be found online.[8]

TABLE 1.

Etiologies of Failure to Thrive

Inadequate intake
- Lack of food availability
- Neglect
- Difficulties with breast-feeding
- Improper formula preparation
- Cleft lip and or palate
- Developmental delay
- Eating disorder

Inadequate absorption
- Celiac disease
- Pancreatic insufficiency
- Inflammatory bowel disease
- Eosinophilic esophagitis or gastroenteritis/food allergy
- Cow's milk enterocolitis
- Congenital diarrhea

Increased caloric expenditure
- Congenital heart disease
- Renal disease (eg, renal tubular acidosis)
- Chronic pulmonary disease (eg, cystic fibrosis)
- Laryngomalacia
- Malignancy
- Immunodeficiency
- Thyroid disease

TABLE 2.

Traditional Definitions of Failure to Thrive

- Weight <75% of median weight-for-age
- Weight <80% of median weight-for-length
- BMI for age <5th percentile
- Weight for age <5th percentile
- Length for age <5th percentile
- Weight deceleration across >2 major percentiles since birth
- Conditional weight gain in the lowest 5% using WHO growth velocity standards

Abbreviations: BMI, body mass index; WHO, World Health Organization.

CAUSES OF FAILURE TO THRIVE

Traditional thinking dichotomizes the etiology of FTT into organic and nonorganic categories. Organic etiologies are reversible with treatment of the underlying disease, whereas nonorganic etiologies of FTT improve with behavioral interventions. Up to 86% of children hospitalized with FTT have nonorganic etiologies of their FTT, and this percentage is likely higher in the outpatient setting.[9] More recently, the dichotomization of FTT into pure organic and nonorganic etiologies has been questioned. Even with organic FTT, behavioral aspects often present. More specifically, organic pathology does not rule out the possibility that environmental factors are also contributing to a child's poor growth. Therefore, in many cases, a combination of organic and nonorganic factors contribute to a child's poor growth.[6,10-12] Etiologies of FTT may, therefore, be categorized into inadequate caloric intake, inadequate caloric absorption, or increased caloric expenditure (**Table 3**).

APPROACH TO THE PATIENT WITH POOR GROWTH

The key to diagnosing FTT and elucidating an etiology is a detailed history and physical examination. A detailed feeding history is required to determine if there are risk factors for organic disease causing a child to have FTT. Important considerations regarding feeding history include preparation of formula, duration and frequency of feeding and meals, feeding environment, and signs of distress with feeding such as coughing or gagging. Intake, including types and variety of foods the child is

TABLE 3.

Failure to Thrive Defined by Malnutrition Z-Scores

Anthropometric Measurements	Mild Malnutrition	Moderate Malnutrition	Severe Malnutrition
Weight-for-height/BMI z-score	-1 to -1.9	-2 to -2.9	≤ -3
Length/height z-score	-	-	≤ -3
Mid-upper arm circumference z-score	-1 to -1.9	-2 to -2.9	≤ -3
Weight gain velocity[a] (<2 years)	<75% expected	<50% expected	<25% expected
Weight loss (≥2 years)	5% body weight	7.5% body weight	10% body weight
Deceleration of weight-for-length z-score	-1 z-score	-2 z-scores	-3 z-scores

Abbreviation: BMI, body mass index.
[a]Based on World Health Organization data.[20]
Adapted from a consensus statement from the American Society for Parenteral and Enteral Nutrition.[7]

consuming and volume of liquids, paying particular attention to juice, soda, milk, and water, must also be ascertained. This is often best done through a 24-hour food recall or 3-day food diary.

Past medical history is important to obtain, including any chronic illnesses, history of frequent infections, and developmental delay. Important family history factors include a history of constitutional growth delay in parents. In cases of constitutional growth delay, after about age 6 months, a child will most often be proportionally small with low weights, lengths, and OFCs, whereas children with FTT will tend to have their weight drop off first, then their height, and lastly OFC. Mid-parental height is also important to calculate to assess if a child would reach their genetic potential by continuing on their current growth curve. Mid-parental height is calculated by the following equation, and a child should fall within 8.5 cm of their mid-parental height once they reach their adult height:

(Maternal Height [in cm] + Paternal Height [in cm] [+5 cm if male; -5 cm if female] / 2)

Social history should focus on who feeds the child and the environment in which the child eats, and should also tease out any difficulties accessing food.

Accurate anthropometric measurements are a critical part of the physical examination in a patient with FTT. For children younger than age 2 years, weight should be obtained nude or in a clean, dry diaper. For children age 2 years or older, weight should be obtained in light clothing without shoes. A length board should be used up until age 2 years to obtain length, and a stadiometer should be used for children age 2 years or older. Beyond anthropometric measurements, a detailed physical examination looking for signs of organic disease and neglect is important in guiding the provider when evaluating a child with FTT.

EVALUATION

Evaluation of FTT through laboratory tests, imaging, and endoscopy rarely uncovers an etiology of FTT. Studies have shown that 0.8% to 1.4% of tests lead to an organic etiology of FTT, and in these studies all etiologies were expected based on history and physical examination.[9,13] Therefore, unless there are striking findings based on history and examination to suggest an organic etiology, behavioral interventions and increased calories should be the first-line treatment in managing FTT.

If behavioral and nutritional interventions fail, further evaluation should be considered. Laboratory evaluations that many be considered include complete blood count, electrolytes, blood urea nitrogen, albumin, celiac screening if exposed to gluten (anti-transglutaminase immunoglobulin A and immunoglobulin A level), and erythrocyte sedimentation rate. Imaging studies that may be considered include an upper gastrointestinal fluoroscopy series for persistent vomiting (beyond normal infant reflux) to assess for malrotation, head imaging, echocardiogram, and chest X-ray. Genetic screening may be necessary if the physical examination suggests a genetic etiology.

INTERVENTIONS

Interventions in a child with FTT are aimed at optimizing growth, including catch-up growth, through behavioral interventions and increased caloric provision (**Table 4**).

Behavioral interventions are mostly derived from the feeding-disorder literature. Meals should be provided at an appropriate location such as in a highchair or at a table, depending on the developmental status of the child. Meals and snacks should be structured and at appropriate frequency for the child's age. Young infants should feed no less frequently than every 3 hours and older children should have 3 meals and 2 snacks a day. Mealtimes should be limited to no more than 20 to 30 minutes and children should not be allowed to "graze" throughout the day. Only water should be provided between meals and snacks to encourage hunger at mealtimes. No juice or sweetened beverages should be provided as juice is low in calories (15 kcal/oz) and has been shown to contribute to FTT.[14]

For infants, increased caloric provision may be as simple as assuring that formula is being mixed properly. It also can be obtained by fortifying formula or breast-milk to 22, 24, or 27 kcal/oz. For older children, increased calories can be obtained by adding fats and oils to foods or by providing increased-caloric beverages. Increased-caloric beverages should only be used if behavioral interventions do not improve weight gain; they should be provided with meals and snacks, and should be offered for the shortest time possible.

If these measures are not effective, then hospitalization may be considered. The primary goal of hospitalization is to observe parent-child interactions and implementation of behavioral interventions. Studies have shown short-term benefits of hospitalization for FTT in regard to catch-up growth, but evidence of sustained long-term benefits are lacking.[15] Any child who does not show growth while hospitalized warrants further evaluation through laboratory tests, imaging, and endoscopy as indicated and may benefit from enteral tube placement.

TABLE 4.

Interventions in Failure to Thrive

Behavioral
Eliminate grazing
Meals and snacks at appropriate frequency for child's age
Limit mealtimes to 20-30 minutes
Provide meals in a developmentally appropriate location (eg, highchair)
No juice or sugar-sweetened beverages
Only water between meals and snacks
Nutritional
Assure proper preparation of formula
Fortify formula or breast-milk to 22, 24, or 27 kcal/oz
Add oils and fats to foods
Provide increased caloric beverage with meals and/or snacks[a]

[a] Increased-caloric beverages should only be used when other interventions have failed and should be used for the shortest time possible.

OUTCOMES

In the developing world, untreated malnutrition clearly results in poorer outcomes with regard to growth and development.[16] Studies regarding long-term growth outcomes of children with FTT in the developed world are limited, but point toward lower mean weights and heights.[17] Infancy and childhood are critical times for neurologic development, although the effects of FTT on this development are not clearly understood. Children with FTT have been shown to have similar to slightly lower IQs than those without FTT, but they have more trouble with math.[18,19]

CONCLUSION

FTT is a common problem seen by the primary care provider. Most cases of FTT can be reversed with behavioral interventions and increased caloric provision. Further evaluation, including laboratory testing, imaging, and endoscopy should be limited to those children with significant findings on clinical examination and those children who fail behavioral management.

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