

Failure to thrive: Case study



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***I have no financial
relationships with a
commercial entity to
disclose.***

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Case Presentation

- ***9 month old male presents for a check- up.***
- ***Parents state he is doing very well.***
- ***He sits alone, pulls to stand and has started to cruise. He is babbling, makes eye contact and shares attention.***

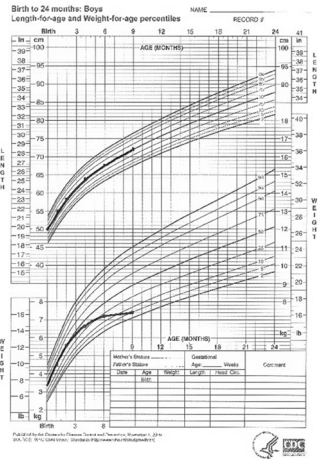
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Case Presentation

- ***PMH: Full term, born by spontaneous vaginal delivery. Pregnancy uncomplicated. No NICU stay. He has no chronic illnesses. No hospitalizations.***
- ***FH: Family history negative.***
- ***SH: He lives at home with his parents and three siblings.***

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VITAL SIGNS:



- Temperature 37° C,
- heart rate 125,
- respiratory rate 35,
- blood pressure 80/40,
- head circumference 45.1 cm,
- length 72 cm (50th percentile),
- weight 7.4 kg (5th percentile).

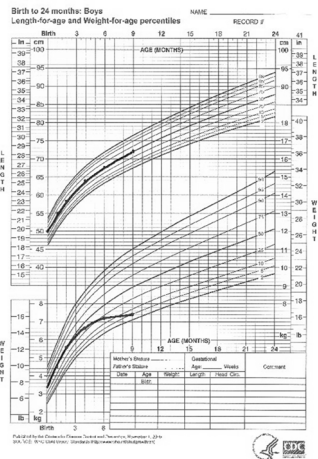
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Case: Physical Exam

- VITAL SIGNS: Temperature 37, heart rate 125, respiratory rate 35, blood pressure 80/40, weight 7.4 kg (5th percentile), length 72 cm (50th percentile), head circumference 45.1 cm.
- GENERAL: The patient is alert, awake, vigorous. He is a thin male with minimal subcutaneous fat.
- HEENT: Normal
- CHEST: Normal
- CARDIOVASCULAR: Normal
- ABDOMEN: Normal
- GU: Tanner 1 circumcised male.
- EXTREMITIES: Normal
- NEUROLOGIC: Normal
- SKIN: No jaundice, rashes or bruising

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Diet and GI History



- Taking 180-210 ml of formula every 5 hours. Eating jar baby foods three times a day.
- Mixing formula by adding 1 scoop of formula to 30 ml of water as written on the label.
- No spitting up with feeds. Stools twice a day: brown, soft stool.

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Failure to Thrive

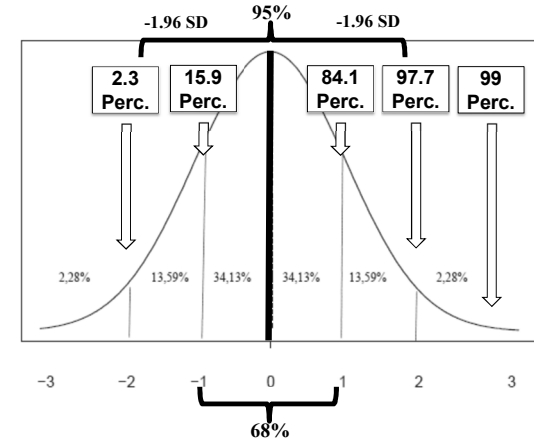
What is the technical definition?

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Failure To Thrive

- Is a symptom rather than a disease or diagnosis.
- A sign the describes a problem.
- Best defined as inadequate physical growth.

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Failure to Thrive Commonly Used Criteria

- **Percentiles**
 - Weight or weight for height less than 3rd or 5th percentile
- **Standard deviation or Z scores**
 - Z scores of -2.0 or less for wt for age, ht for age, or wt for ht
- **Percent of Median**
 - Weight expressed as a percentage of median weight for age (< 80% of ideal body weight) OR
 - Weight expressed as a percentage of median weight for length

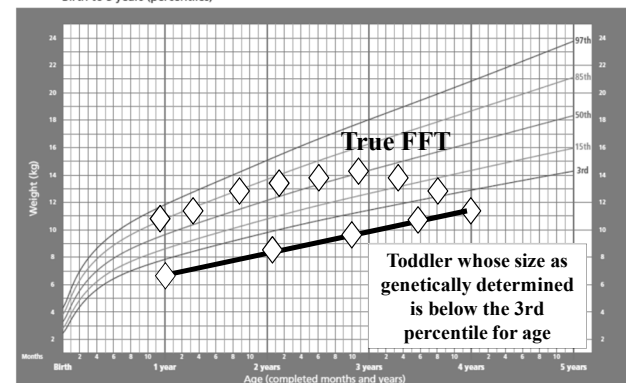
3% normal kids fall below the 3rd centile

Shashidhar H, Tolia V. Failure to Thrive. In: Wyllie R, Hyams JF, eds. Pediatric Gastrointestinal and Liver Disease 3rd ed. Philadelphia, PA: Saunders; 2006

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Weight-for-age BOYS

Birth to 5 years (percentiles)



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Failure to Thrive

BEST Used Criteria

- **Crossing of percentiles:**
 - **Downward crossing of more than two major percentile lines**

Shashidhar H, Tolia V. Failure to Thrive. In: Wyllie R, Hyams JF, eds. Pediatric Gastrointestinal and Liver Disease 3rd ed. Philadelphia, PA: Saunders; 2006

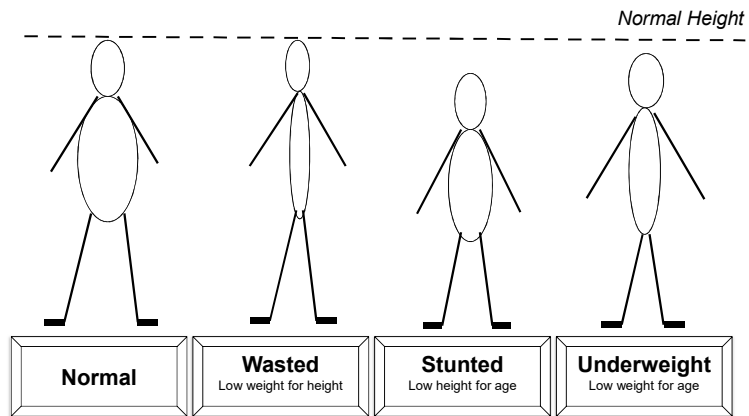
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Three Major Patterns Of Altered Growth

| head circumference | weight | height | probable |
|--------------------|--------|--------|---|
| ↓ | ↓ | ↓ | intrauterine insult or a genetic (chromosomal) defect |
| N | N | ↓ | endocrinopathies and bone or cartilage growth abnormalities |
| N | ↓ | N | nutrient intake, and intestinal malabsorption or maldigestion |

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Types of malnutrition



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Case Presentation

- **What is the cause of the patient's failure to thrive?**

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Etiology

- ***Decreased caloric intake***
- ***Increased caloric requirements***
- ***Excessive caloric losses***

Careaga MG, Kerner JA. A Gastroenterologist's Approach to Failure to Thrive. *Pediatric Annals. Pediatr Ann.* 2000;29:558-567.

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Careaga MG, Kerner JA. A Gastroenterologist's Approach to Failure to Thrive. *Pediatric Annals. Pediatr Ann.* 2000;29:558-567.

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Etiology: Decreased Calorie Intake

- ***Neurologic disorders with impaired swallowing***
- ***Injury to mouth and esophagus***
- ***Congenital anomalies***
- ***Chromosomal abnormalities***
- ***Metabolic diseases***
- ***Diseases leading to anorexia***
- ***Accidental or inadvertent***
- ***Psychosocial***
- ***Iatrogenic***

Careaga MG, Kerner JA. A Gastroenterologist's Approach to Failure to Thrive. *Pediatric Annals. Pediatr Ann.* 2000;29:558-567.

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Etiology: Increased Requirements

- ***Sepsis***
- ***Trauma***
- ***Burns***
- ***Chronic respiratory disease***
- ***Hyperthyroidism***
- ***Congenital heart disease***
- ***Diencephalic syndrome***
- ***Hyperactivity***
- ***Chronic infection***

Careaga MG, Kerner JA. A Gastroenterologist's Approach to Failure to Thrive. *Pediatric Annals. Pediatr Ann.* 2000;29:558-567.

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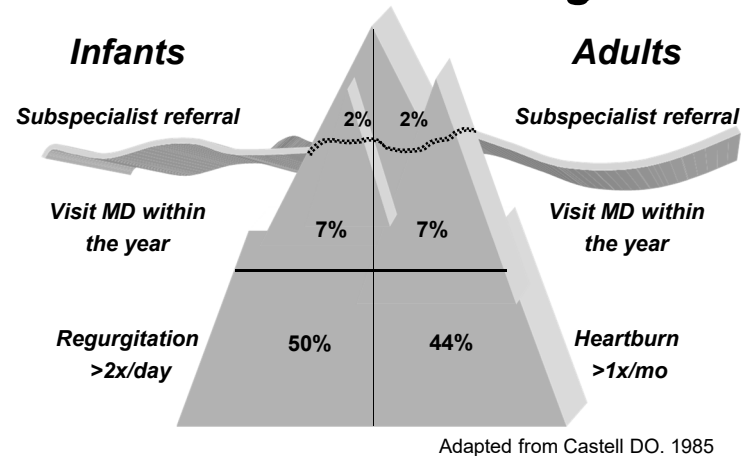
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The GERD Iceberg



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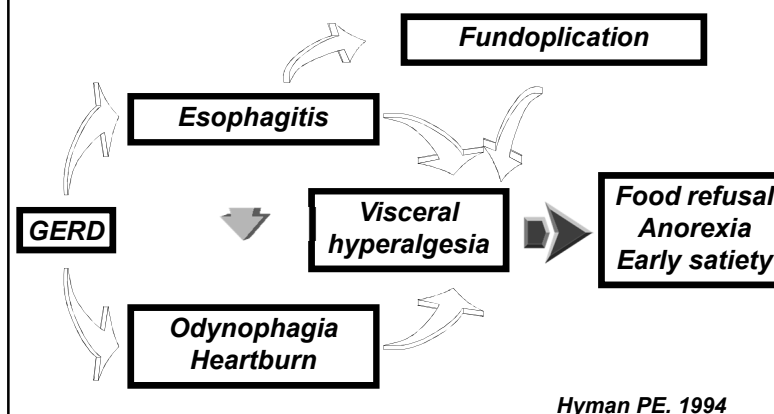
Etiology: Excessive Caloric Losses

- **Persistent vomiting**
 - **Pyloric stenosis**
 - **Gastroesophageal reflux disease**
- **Malabsorptive states**

Careaga MG, Kerner JA. A Gastroenterologist's Approach to Failure to Thrive. *Pediatric Annals. Pediatr Ann.* 2000;29:558-567.

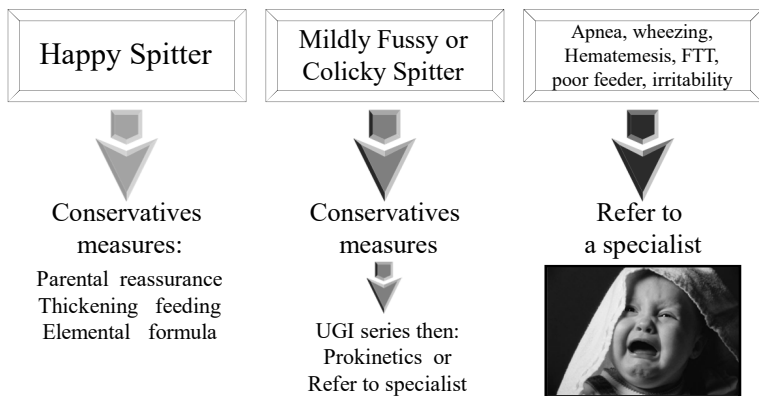
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GERD: Why baby won't eat?



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Management Of GERD



Adapted from Vandenplas Y. et al. Eur J Pediatr. 1993; 152:784-711

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PPI

- **Should not be used before 1 year of age.**
- **Are used excessively for infantile colic: no evidence that they work.**
- **In fact, GERD over-diagnosed in infants and over-treated.**
- **Should be only prescribed by pediatric gastroenterologists.**

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Approved PPI dosing in children

| | Age (years) | | | Formulations for children |
|-------------------------|-------------|---|--|---|
| | <1 | 1-11 | 12-17 | |
| Nexium® esomeprazole | No | 10-20 kg – 10 mg sachet >20 kg – 10 or 20 mg (healing) | 20 & 40 mg MUPS tablet (capsule or sachet in US) | The <i>Nexium</i> ® sachet with thickening: <ul style="list-style-type: none"> • Has a pleasant, slightly citrus taste • No artificial colours or flavourings. • Can be administered through a gastric-nasogastric ≥ French 6 tube, as the pellet size is only 0.5 mm. |
| omeprazole | No | <20 kg – 10 mg >20 kg – 20 mg | 10 & 20 mg | Prilosec® sachet (in the US only) |
| lansoprazole | No | Only in US, Canada, Switzerland and Australia | Only in US, Canada, Switzerland and Australia | The oral disintegrating tablet is used but not especially developed for children <ul style="list-style-type: none"> • Has an artificial strawberry taste. • Need a ≥ French 8 tube (pellet size unknown) |
| pantoprazole | No | No | No | No |
| rabeprazole | No | No | No | No |

No PPI is approved before 1 year of age

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Etiology: Excessive Caloric Losses

- **Persistent vomiting**
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Most likely etiologies of FTT if chronic diarrhea is present:

- ***Celiac disease***
 - ***Cow milk allergy***
 - ***Cystic fibrosis***
 - ***Giardia***
 - ***Inflammatory Bowel Disease***
 - ***others***
- may exist without diarrhea

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Definition

Celiac disease is an immune-mediated enteropathy caused by a permanent sensitivity to gluten in genetically susceptible individuals.

It occurs in symptomatic subjects with gastrointestinal and non-gastrointestinal symptoms, and in some asymptomatic individuals, including subjects affected by:

- Type 1 diabetes
- Down syndrome
- Turner syndrome
- Williams syndrome
- Selective IgA deficiency
- First degree relatives of individuals with celiac disease

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History of celiac disease

- *in the 1940s the Dutch pediatrician Willem Dicke had noticed that during bread shortages in the Netherlands caused by World War II, children with celiac disease improved.*
- *He also saw that when Allied planes dropped bread into the Netherlands, they quickly deteriorated.*

Famine Hollandaise 1944-45

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Gastrointestinal Manifestations ("Classic")

Most common age of presentation: 6-24 months

- *Chronic or recurrent diarrhea*
- *Abdominal distension*
- *Anorexia*
- *Failure to thrive or weight loss*
- *Abdominal pain*
- *Vomiting*
- *Constipation*
- *Irritability*

Rarely: Celiac crisis

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Non Gastrointestinal Manifestations

Most common age of presentation: older child to adult

- *Dermatitis Herpetiformis*
- *Dental enamel hypoplasia of permanent teeth*
- *Osteopenia/Osteoporosis*
- *Short Stature*
- *Delayed Puberty*
- *Iron-deficient anemia resistant to oral Fe*
- *Hepatitis*
- *Arthritis*
- *Epilepsy with occipital calcifications*

Listed in descending order of strength of evidence

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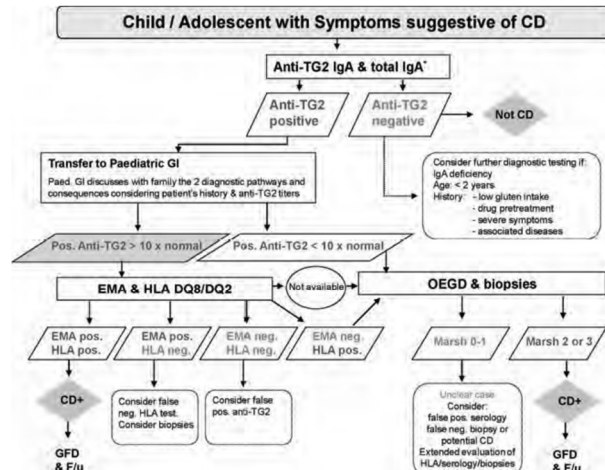
NASPHAN

Recommendations 2016

- The diagnosis of CD is confirmed on demonstration of the characteristic changes in the histology of the small intestinal mucosa.
- It is recommended that 1 or 2 biopsies be obtained from the bulb and 4 from the distal duodenum because of the patchy distribution of the lesions.
- These changes can be seen in autoimmune enteropathy, food allergies (in children, particularly allergies to cow's milk and soy protein), Crohn disease, and a number of viral, bacterial, and parasitic infections.
- Therefore, in addition to the biopsy findings, the clinical history, results of the serological tests, and response to a strict GFD are all essential considerations to confirm a diagnosis of CD

NASPHAN, JPGN 2016;63: 156-165

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Symptomatic patient. CD=coeliac disease; EMA=endomysial antibodies; F/u=follow-up; GFD=gluten-free diet; GI=gastroenterologist; HLA=human leukocyte antigen; IgA=immunoglobulin A; IgG=immunoglobulin G; OEGD=oesophagogastroduodenoscopy; TG2=transglutaminase type 2.

ESPGHAN: JPGN 2012;54: 136-160

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NASPHAN

Recommendations 2016

- Although a nonbiopsy diagnosis of CD is desirable (as recommended by ESPGHAN 2012), there are potential risks associated with skipping the biopsy.
- There is currently no standardization of serological tests for CD and marked variation in antibody levels between commercial assays has been documented.
- it is possible that without biopsy confirmation, some children may be falsely diagnosed with CD and treated for a lifelong dietary change.
- There is a potential for missing additional gastrointestinal disorders (such as peptic esophagitis, EoE, Helicobacter pylori gastritis), which may occur as comorbidities

NASPHAN, JPGN 2016;63: 156-165

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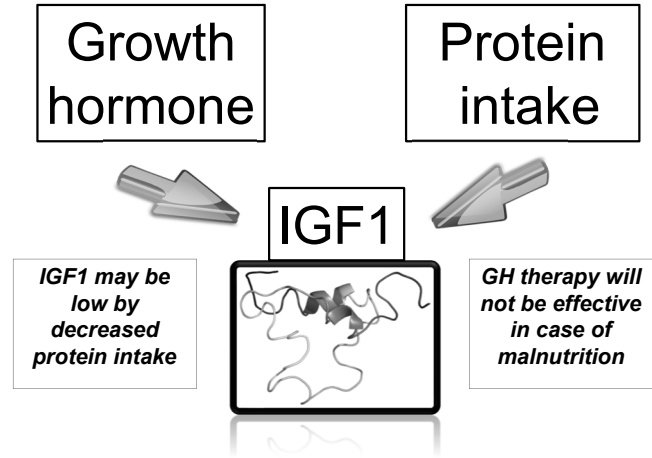
Treatment



- **Only treatment for celiac disease is a gluten-free diet (GFD)**
 - **Strict, lifelong diet**
 - **Avoid:**
 - **Wheat**
 - **Rye**
 - **Barley**

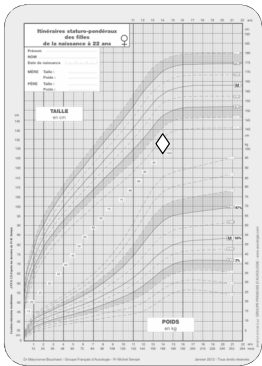
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IGF1 is stimulated by:



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Short stature



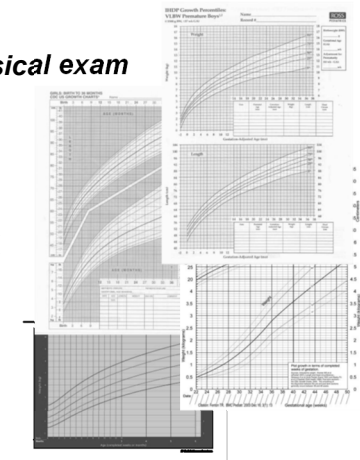
- **Most prevalent: constitutional delay and genetic short stature**
- **Prevalence of celiac disease**
 - **1:5000, but varies among country**
- **Prevalence of GH deficiency**
 - **estimated at about 1:3500 in the United States, with rates worldwide ranging from 1:1800 for children in Sri Lanka to 1:30,000 for children in Newcastle, United Kingdom.**
 - **GH deficiency is responsible for about 14% cases of short stature in a hospital setting*.**

Awan TM, Sattar A, Khattak EG., Frequency of growth hormone deficiency in short statured children: J Coll Physicians Surg Pak. 2005 May;15(5):295-8.

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Diagnosis

- **Detailed history and physical exam**
- **Diet history**
- **Use of Correct Growth Chart**
 - **World Health Organization Growth Chart**
 - **Growth data developed from healthy breast-fed infants**
 - **Recommended for use in ages 0-2 years**
 - **Down's Syndrome Growth Chart**
 - **Cerebral Palsy Growth Chart**



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Evaluation

- **< 2% of lab tests performed for FTT are of diagnostic value**
- **Routine Screening Tests**
 - **CBC with differential**
 - **BUN, Creatinine**
 - **Electrolytes**
 - **Albumin**
 - **Calcium, Phosphorus**
 - **Alkaline phosphatase**
 - **Urinalysis**
 - **Urine culture**

Shashidhar H, Tolia V. Failure to Thrive. In: Wyllie R, Hyams JF, eds. Pediatric Gastrointestinal and Liver Disease 3rd ed. Philadelphia, PA: Saunders; 2006

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Evaluation

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Case Presentation

- **Analysis of his diet revealed he was getting a total of 60 kcal/kg/day from formula.**
- **CBC and Thyroid function tests were normal.**

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Evaluation: Optional Investigations Guided by findings in the history and physical exam

- | | |
|--------------------------------------|--|
| ■ Calorie count | ■ Quantitative immunoglobulins |
| ■ Celiac disease serologies | ■ HIV Ab |
| ■ Stool alpha one antitrypsin | ■ Urine organic acids |
| ■ Fecal fat | ■ Serum amino acids |
| ■ Fecal elastase | ■ Liver function tests |
| ■ Fecal chymotrypsin | ■ Chest x-ray |
| ■ Upper and lower endoscopy | ■ Echocardiogram |
| ■ Pancreatic stimulation test | ■ Head MRI |
| ■ Sweat chloride test | ■ Abdominal US |
| ■ Karyotype | ■ Bone age |
| | ■ Heavy metal screening (lead, arsenic) |
| | ■ Video feeding study |

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Case Presentation

- **Calorie count performed**
- **Recommend:**
 - **3 meals + 2 snacks**
- **720-840 ml of formula a day fortified to 0.7-0.8 kcal/ml**
- **Goal kcal/day: 120 for catch-up growth**

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Increasing Dietary Energy and Nutrient Supply



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Management

- **Goal: increase calorie intake to enable weight gain**
 - **Higher daily weight gain goal than that of typically developing child**
 - **Increase caloric intake by 50% greater than basal requirement**
 - **Example: typically developing 1 yr old child requires 100 kcal/kg/day; in FTT child would increase goal to 150 kcal/kg/day for catch up growth**
- **Nutrition consultation**
- **Multivitamin including iron and zinc**

Shashidhar H, Tolia V. Failure to Thrive. In: Wyllie R, Hyams JF, eds. Pediatric Gastrointestinal and Liver Disease 3rd ed. Philadelphia, PA: Saunders; 2006

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Infants: Options for Increase Energy Density of infant formula

- **Increased concentration of infant formula to 15% powder instead of 13% increases the energy density by 15%.**
- **Addition of Glucose polymers at 1 - 4 g / 100ml, adds 3.9 – 15.6 Kcal /100 ml milk formula**
- **Addition of Glucose polymers - Fat Mixtures either vegetable oil or medium chain triglyceride from 1 to 4 g/100ml adds 5.1 – 10.5 kcal/ 100 ml.**
- **Addition of oils or fat emulsions 1g/kg body weight per day add 9kcal /g.**

**Disadvantage: Increased renal solute load and reduced tolerance.
The supply of essential nutrients per kilocalorie is reduced.**



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For Children :
Preferential choice of Energy = dense Foods



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For Children:
option of increasing the energy density of foods

Addition of fats and oils to foods

- Use of extra butter/ margarine/ vegetable oils/ cream/ fatty cheese e.g. extra fat, cream and cheese with vegetables starchy food, milk products. Increase the concentration stepwise according to individual tolerance
- **Disadvantage:** The supply of essential nutrients per kilocalorie is reduced and may not always be sufficient particularly for catch-up growth



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For Children :
Preferential choice of Energy – dense Foods, Drinks and Snacks

- Energy- dense foods e.g. deep fried foods (French fries) , fatty foods
- Energy- dense drinks e.g. milk shakes, high fat milk chocolate drinks. For many children it is easier to drink extra calories than to take them with more solid food
- Energy- dense snacks e.g. ice cream without or with extra whipped cream, chocolate, chocolate mousse or energy dense puddings (with cream), potato chips (fried in oil), nuts and nuts with raisins



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Guidelines for Catch-up growth: Protein

What is the % of energy to be derived from protein (PE%) needed for catch-up growth?

- >10-14% recommended by Deweys¹
- 9-11% suggested by Waterloo² and Jackson³
- 9% suggested by Shaw & Lawson⁴
- 11.6% according to WHO Guidelines⁵

For “accelerated” or “catch-up” growth to occur, it is necessary to provide about 9-14% energy from protein

1. DEWEYS et al. 1996
2. WATERLOO et al. 1961
3. JACKSON A. 1990
4. SHAW & LAWSON 2001
5- WHO 2003, for severe malnourished children

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Complete Balanced Liquid Formula Best solution

- High-energy infant feeds (1-2 KCal/ml) with a balanced nutrients composition are a preferable alternative to adding energy in the form of carbohydrates or fat which dilute the nutrient density particularly for infants who need a high energy and nutrients density over prolonged time periods



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QUESTION: Infants at nutritional risk fed Complete Formula

1. has a weight gain
2. had no weight gain, but better nutritional status
3. had no change whatsoever



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Management

- **Appetite stimulants?**
 - Cyproheptadine (Periactin)
 - Megestrol (Megace)
- **4-6 weeks after initiation of intervention**
 - If no weight gain, then initiate NG feeds to supplement PO intake

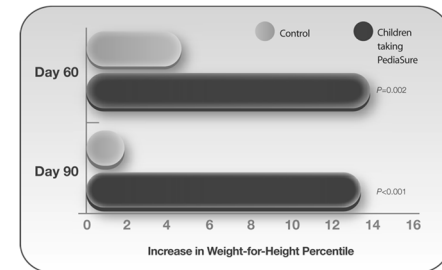


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Catch-Up Growth in Mild Malnutrition

- Picky eaters at nutritional risk fed Complete Balanced Liquid Formula gained, in 2 months, more than twice as much weight as children who were not fed this formula.



*Children in both groups received nutritional counseling.

Study design: Multicenter, randomized, parallel formula open-label study of 92 children with picky eating behaviors between the ages of 36 to 60 months who were below the 25th percentile in weight-for-height.

Alarcon P, et al. *Clin Pediatr*. 2003;42:209-217.



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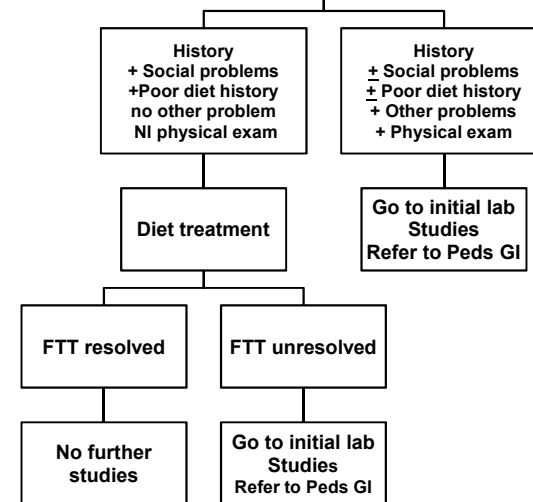
Prognosis

- **Almost all children get better with intervention**
- **Many children improve growth, even without intervention**
- **Some children are picky eaters later in childhood**
- **FTT in infancy has been shown to be associated with deficits in IQ in later childhood**

Gahagan S. Failure to Thrive: A Consequence of Undernutrition. *Pediatr in Review.* 2006;27:e1-11

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Failure to thrive



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Conclusion



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General Feeding Guidelines for Parents

- **Avoid distractions while eating**
 - *Food should be eaten in a calm environment*
- **Adopt a neutral attitude to eating behavior**
 - *Avoid excess praise, criticism, stimulation, and coercion*
- **Feed at specific intervals**
 - *Avoid snacking to encourage appetite*
 - *Feed 3 to 4 hours apart and nothing in between*
- **Limit the duration of meals**
 - *Meals should last between 20 to 30 minutes or 15 if the child is not eating*

South African Journal of Clinical Nutrition. 2008;21:45.



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Thank You

