



HOSPITALS • RESEARCH • FOUNDATION

Failure to Thrive

Guideline developed by Sowmya Patil, MD, in collaboration with the ANGELS team. Last revised by Sowmya Patil, MD February 2019.

Special Thanks to Ms. Paula Bailey (Nutritionist) for helping with the guide to formulas.

Key Points

- Appropriate growth charts important tools for diagnosis
- Occurs because of inadequate nutritional intake or absorption, excess metabolic demand, defective utilization, or a combination of these mechanisms
- Nutritional rehabilitation forms the core to managing failure to thrive
- Treatment involves a multi-disciplinary approach

Definition, Assessment, Physical Exam, Anthropometric Indicators, and Diagnosis

Definition

- Failure to thrive (FTT) is a term used to describe a patient who does not meet the normal standards of growth for corrected gestation, age, and sex or whose weight crosses 2 percentiles lower than expected on a standardized growth curve (NCHS growth curves).
 - NCHS growth curves are the National Centers of Health Statistics growth curves which include the CDC and WHO growth curves.
 - For all children ages 0-23 months, use 2006 WHO international growth charts instead of CDC 2000 growth charts.
 - There are increasing trends towards using Z scores as a statistical method for classifying faltering growth, i.e. FTT. Z scores are obtained after plotting the growth parameters on standardized growth curves. A decrease of more than 1 in Z scores is an indication for

FTT.

- A series of measurements are necessary to recognize accurately FTT, which emphasizes the importance of rate or velocity of growth.
- In children with FTT, weight is lost first, followed by height and head circumference.
 - A standardized growth curve is available for age and sex
 - Genetic potential and degree of prematurity should be accounted for while plotting the growth chart.
 - When available, condition-specific growth charts need to be used e.g., William syndrome, Turner syndrome, Downs syndrome.
- FTT has been traditionally classified as organic and non-organic depending on the etiology. (This classification is outmoded)
 - Organic cause is associated with pathology in 1 or more of the organ systems.
 - Non-organic cause is the influence of external factors like environment, psychosocial factors, and economic factors that contribute to FTT.
 - Non-organic causes are more common than organic causes.
 - Organic and non-organic causes can co-exist.
- FTT mostly occurs because of inadequate nutritional intake or absorption, excess metabolic demand, defective utilization, or a combination of these mechanisms.
- Children most susceptible to be FTT are
 - Low birth weight and very low birth weight infants
 - Premature babies
 - Children born small for gestational age
 - Children with neurodevelopmental disabilities

Assessment

- Assess prenatal and birth history, including
 - Exposure to drugs, toxins, medications, and maternal illnesses during pregnancy
 - Records of labor, delivery complications, postnatal nursery course, and newborn screen, if available
- Review the child's feeding schedule with respect to type of formula, frequency of feeds, time taken for the infant/child to feed, calorie intake, formula mixing techniques, and solid food intake.
- Social history
 - A social worker should interview the family to obtain information on the family dynamics, environmental stressors, economic status, history of any mental dysfunction in the family, and parental level of education.
 - Include assessment for food insecurity since families who cannot afford extra formula often stretch what they receive from supplemental program like WIC
 - Knowledge of social history factors could indicate a possible non-organic etiology of FTT and influence the outcome of treatment and need for additional resources to improve the health of the child.
- Developmental and behavioral assessment includes
 - Using various standardized developmental scales
 - Observing the child feed and look for swallowing technique, spitting/choking and other feeding behaviors that could indicate an anatomical or pathological problem
 - Assessing parental interaction with the child during a feed which could indicate any psychosocial problems
 - Obtaining the history of age-appropriate developmental milestones with respect to fine and gross motor skills
- Assess the history of family medical problems, parental growth patterns, and parental growth beliefs.

Physical Exam

- A complete, accurate physical exam is essential.
- Accurate measurements of weight, height (recumbent length in infants <2 years of age, standing or recumbent length between 2years- 3 years and standing height >3 years of age), and head circumference should be documented.
- General appearance of the child, dysmorphic features, and assessment of nutritional status should be recorded.
- Detailed examination of all organ systems should be conducted to identify markers of serious illnesses, nutritional deficiencies, signs of neglect or abuse, and genetic disorders.
- An important decision to be made is when to hospitalize the child; history and physical exam should guide assessment.

Anthropometric Indicators

- Growth chart is the most important tool for assessing; the best indicator for appropriate catch up is symmetry in weight-for-length or weight-for-age.
- Criteria for abnormality used widely while describing FTT is weight-for-age or weight-for-length <3%, or if the child's growth crosses ≥ 2 percentiles on the growth curve.
- Z scores can be used to classify FTT. Severity classification based on Z scores according to WHO:
 - Mild (weight/length z score or BMI <-1)
 - Moderate (weight/length z score or BMI $-3 < z \text{ score} < -2$)
 - Severe (weight/length z score or BMI z score < -3)
- Children with FTT can be divided into 3 categories:
 - Weight, height, and head circumference are all symmetrically decreased.
Children with congenital defects, hereditary disorders, and infants who have suffered prenatal insults like asphyxia fall into this category.
These children may remain small for their entire lives.
 - Weight reduced or proportionate to height and normal head circumference; includes children who exhibit endocrine problems or those who are constitutionally delayed.
 - Weight reduced out of proportion to height and normal head circumference.
Most children who are failing to thrive because of malnutrition fall into this category.
This is the most common category.

Diagnosis

- Non-organic causes of FTT can be solely diagnosed with the help of history and physical exam; no laboratory tests are needed
- If there is a suspicion for organic causes, history and physical exam should guide in appropriate laboratory investigations.
 - Some of the routinely conducted labs are complete blood count with differential and peripheral smear, basic metabolic panel to include calcium, magnesium, phosphorous levels, and urine analysis.
 - Albumin and pre-albumin levels are looked at only in cases of severe malnutrition and or child with edema and malnutrition.
 - Deficiency in zinc and vitamin D levels can be measured and treated easily.
 - Additional suggested tests are

Table 1. Additional Suggested Tests

History/Physical Exam	Laboratory Tests
Steatorrhea	Fecal fat, fat soluble vitamins
Endemic areas	Stool culture, stool for ova and parasite, white blood cells, and occult blood
Respiratory symptoms, diarrhea, weight loss	Chest X-ray, sweat chloride test
Endocrine abnormality	Bone age (X-ray of left wrist), FT4, TSH
Behavioral changes, constipation	Lead level
Skin changes: acrodermatitis, eczema, hyperkeratosis, stomatitis	Zinc level, Allergen IgE immunoassay, specific vitamin levels
Cardiac symptoms: dyspnea, excessive sweating while feeding, cyanosis, increased time to feed	Chest X-ray, echocardiogram, EKG
Signs of abuse: bruising, burn marks, fractures	Skeletal survey, fundus exam, coagulation panel, bone scan
Recurrent infections	Immunoglobulin levels, complete blood count with differential, complement levels
Dysmorphic features	Genetic test: FISH, karyotype
Evidence of organomegaly with malabsorption, lethargy, acidosis, seizures	New born screen, urine amino acids
Seizures, loss of weight, hypotonia, hypertonia, exaggerated reflexes	CT scan/MRI of brain, EEG

Management

Physician Roles

A physician has to play several vital roles in managing a patient with FTT.

- Evaluate and treat the patient appropriately.
- Monitor the patient's nutritional status, growth, and development.
- Act as a case manager and make accurate and timely referrals; make sure the family is given access to all the resources.
- Teach the family to recognize and act effectively toward the patient's ongoing requirements.
- Manage mostly as outpatient with appropriate referrals and follow-up.
- Hospitalize the child if
 - Signs of neglect or abuse are present
 - Social dynamics and family environment are a cause for concern and are contributing to the child's FTT
 - Signs suggestive of severe malnutrition are observed like dehydration, hypothermia, emaciation, low pulse rate, low blood pressure, etc.
 - A caregiver is suspected to have psychosocial problems
 - A caregiver fails to continue the patient's treatment and follow up

Goals

- Nutritional rehabilitation
- Appropriate amount of calories depending on the age of the patient:

Table 2. Appropriate Calories per Age

Age (months)	Calories required (Kcal/kg/day)	Average weight gain (gm/day)
0-3	100-120	25-30
3-6	100-120	15-20
6-12	90-100	10-15
> 12	80-90	5-10

- Achieve catch up growth through formula/foods
 - Initially increase amount of calories needs to be offered (130-150 kcal/kg/day)
 - Use appropriate mixing techniques and additives such as glucose, polymers, and lipids in formulas.
 - Once catch up growth is achieved, calories can slowly be weaned to age-appropriate amounts.
- Plan specific schedules for
 - Quantity and frequency of formula intake
 - Parents regarding the feeding and mixing techniques
- Supplement vitamin and mineral deficiencies with age-appropriate doses or enriched formulas.
- Provide feeding behavioral and environmental modifications
- Introduce age-appropriate rich, nutritious solid foods along with formula
- Eliminate non-nutritious and junk food
- Conduct daily weight checks on inpatients
- Follow-up visits for weight checks as outpatients are necessary for infants to ascertain successful implementation of nutrition and education. For older children follow-up weight checks can be spaced out as daily weight checks are less helpful. This also helps alleviates parental anxiety and provides encouragement for further care.

Other Management

- Treatment is a multidisciplinary team approach involving the primary care physician, social worker, registered dietitian, occupational therapist, physical therapist, speech therapist, psychologist, behavioral and developmental specialist, and a pediatric subspecialist, e.g., gastroenterologist, allergist, endocrinologist, etc., depending on the organic disease identified.
- Appropriate referrals/consults should be made.
- Management of organic disease may necessitate use of and education regarding gastrostomy tubes, tracheostomy, and other special equipment.
- Available community resources should be identified, e.g., WIC and home health to help the families socio-economically.
- Psychosocial intervention should be administered for the patient and the family, if required.
- If neglect or abuse is the cause, placement in DHS custody should be considered until the case is fully investigated.
- Appropriate therapies such as occupational, physical, or/and speech should be prescribed based on the child's requirements.

Follow-up

- Regular and Timely
 - Follow-up care fosters physician-patient relationship and better ensures compliance.
 - Frequency depends on the etiology, severity of malnutrition, course of illness, patient's response to ongoing treatment, and special interventions.
 - Modify management plan accordingly.
- Nutrition Recovery Syndrome/Refeeding Syndrome

- Some severely malnourished children experience a spectrum of signs and symptoms that constitute the refeeding syndrome, including electrolyte disturbances, mainly Hypophosphatemia and hypokalemia
 - Sweating
 - Increased body temperature
 - Hepatomegaly
 - Widening of sutures
 - Diarrhea
 - Vomiting
 - Hemodynamic problems
- Monitor closely for complications, especially in the first week after initiation of feeds.

Prognosis

- Growth and development is influenced by
 - Time of recognition
 - Severity of illness
 - Influence of external factors
 - Underlying cause
- Children with FTT are at increased risk for
 - Cognitive deficits
 - Behavioral problems
 - Learning difficulties
 - Dysfunctional families
- About 25%-50% of children remain small for age.
- Continued improvement in understanding nutrition and its effects on the body, increased access to community services, family support, and timely use of various interventions will help improve outcomes of children with FTT.

Guide to Formulas

Table 3. Formula Table

Formula	Protein Source	Fat Source	Carbohydrate Source	Comments/Reasoning
Gerber® Good Start Gentle*, Gerber® Good Start Protect*, Enfamil® Premium, or Similac® Advance 20 kcal/oz	Gerber® Good Start products are 100% whey, other products are a combination of whey and non-fat milk	Palm olein, soy, coconut & high oleic sunflower oils, DHA/ARA	Lactose Good Start® products also contain corn maltodextrin	Milk based infant formula; Enfamil® Premium and Good Start Gentle® have prebiotics (galacto-oligosaccharide); Good Start Protect® contains probiotics (<i>B. lactis</i>)
Gerber® Good Start Soothe*20 kcal/oz	100% whey protein	Palm olein, soy, coconut & high oleic sunflower oils, DHA/ARA	Corn maltodextrin; 30% lactose	Good Start Soothe® contains prebiotics and probiotics (<i>L. reuteri</i>)
Enfamil® AR20 kcal/oz	Non-fat milk	Palm olein, soy, coconut & high oleic sunflower oils, DHA/ARA	Lactose, rice starch, maltodextrin	Reduce frequent spit-up, more nutritionally balanced than adding rice cereal
Enfamil® Gentlease20 kcal/oz	Whey and non-fat milk	Palm olein, soy, coconut & high oleic sunflower oils, DHA/ARA	Corn syrup solids; 1/5 the lactose of standard formula	Designed for babies with fussiness or gas

Formula	Protein Source	Fat Source	Carbohydrate Source	Comments/Reasoning
Good® Start Soy*, Enfamil® ProSobee & Similac® Isomil20 kcal/oz	Soy protein isolate	Palm olein, soy, coconut & high oleic sunflower oils, DHA/ARA	Corn syrup solids, Good Start® also contains corn maltodextrin	Lactose/galactose free ProSobee is also sucrose free
Enfamil® Nutramigen* Enflora 20 kcal/oz	Casein hydrolysate & amino acids	Palm olein, soy, coconut & high oleic sunflower oils, DHA/ARA; no MCT ^b oil	Corn syrup solids & modified corn starch	Lactose/sucrose free for infants sensitive to intact milk protein; now with probiotics
Alimentum®** 20 kcal/oz	Casein hydrolysate & L-amino acids	33% MCT, safflower & soy oils, DHA/ARA	Sucrose & modified tapioca starch	Lactose free; readily digestible sources of protein/fat for malabsorption
Enfamil® Pregestimil* 20 kcal/oz	Casein hydrolysate & amino acids	55% MCT oil, soy, corn & high oleic safflower or sunflower oils, DHA/ARA	Corn syrup solids, modified corn starch, dextrose	Lactose/sucrose/galactose free; readily digestible sources of protein/fat for malabsorption
Neocate®* 20 kcal/oz	Free amino acids	Safflower & refined vegetable oils, 5% MCT; DHA/ARA	Corn syrup solids	Lactose/sucrose free; for infants with milk and/or soy allergy
EleCare® 20 kcal/oz	Free amino acids	33% MCT, high oleic safflower oil, soy oil;DHA/ARA	Corn syrup solids	Contains no milk, soy protein, fructose, galactose, lactose, or gluten; for infants with milk and/or soyallergy
* Denotes WIC approved- WIC formulary is subject to change. For information, please call 501-661-2508 or http://www.healthy.arkansas.gov/programsServices/WIC/Pages/Topics.aspx#3 for WIC approved formulas, special formula request, and medical documentation requirements. ^a DHA/ARA = docosahexaenoic acid (DHA) and arachidonic acid (ARA) ^b MCT = medium chain triglycerides (coconut oil)				

Premature Infants' Formulas

- Enfamil® Premature Lipil (20 & 24 kcal/oz) or Similac® Special Care Advance (20, 24, & 30 kcal/oz)
 - Increased in vitamins/minerals, specifically calcium, phosphorus & Vitamin D; also contains Medium Chain Triglycerides (MCT) oil
 - Can be used up to 3.5kg
- Similac® Neosure & Enfamil® Enfacare (22 kcal/oz)
 - Contains some MCT oil
 - Can be used up to 9 months appropriate gestational age
 - Many time used to 12 months appropriate gestational age

Table 4. Pediatric Formulas

Pediatric Formulas				
Formula	Protein Source	Fat Source	CHO source	Comments/Reasoning
PediaSure® 30 kcal/oz	Milk protein concentrate	LCT ^a ; 15%-20% MCT ^b	Sucrose & maltodextrin	Lactose free; routine pediatric formula for oral or enteral feeding
EleCare Junior® 30 kcal/oz	Free amino acids	33% MCT, high oleic safflower oil, soy oil; DHA/ARA	Corn syrup solids	Contains no milk, soy protein, fructose, galactose, lactose, or gluten; for children with milk and/or soy allergy
Nutren Junior® 30 kcal/oz	Milk protein concentrate; 50% whey protein	LCT; 20% MCT	Sucrose & maltodextrin	Lactose free; routine pediatric formula with increased amount of whey
Peptamen Jr® & Vital Jr® 30 kcal/oz	100% whey	60% MCT; LCT; 50% MCT Vital Jr®	Maltodextrin, cornstarch & sucrose	Lactose free; semi-elemental, peptide based
Vivonex® Pediatric 24 kcal/oz	Free amino acids	68% MCT; LCT	Maltodextrin & cornstarch	Lactose free; elemental formula
Neocate® Junior with prebiotics 30 kcal/oz	Free amino acids	LCT; 35% MCT	Corn syrup	Milk/soy free; lactose/sucrose free; elemental

^aLCT-Long Chain Triglycerides

^bMCT-Medium Chain Triglycerides

Concentrating Formula

(These standards are for infant products only, not for junior products.)

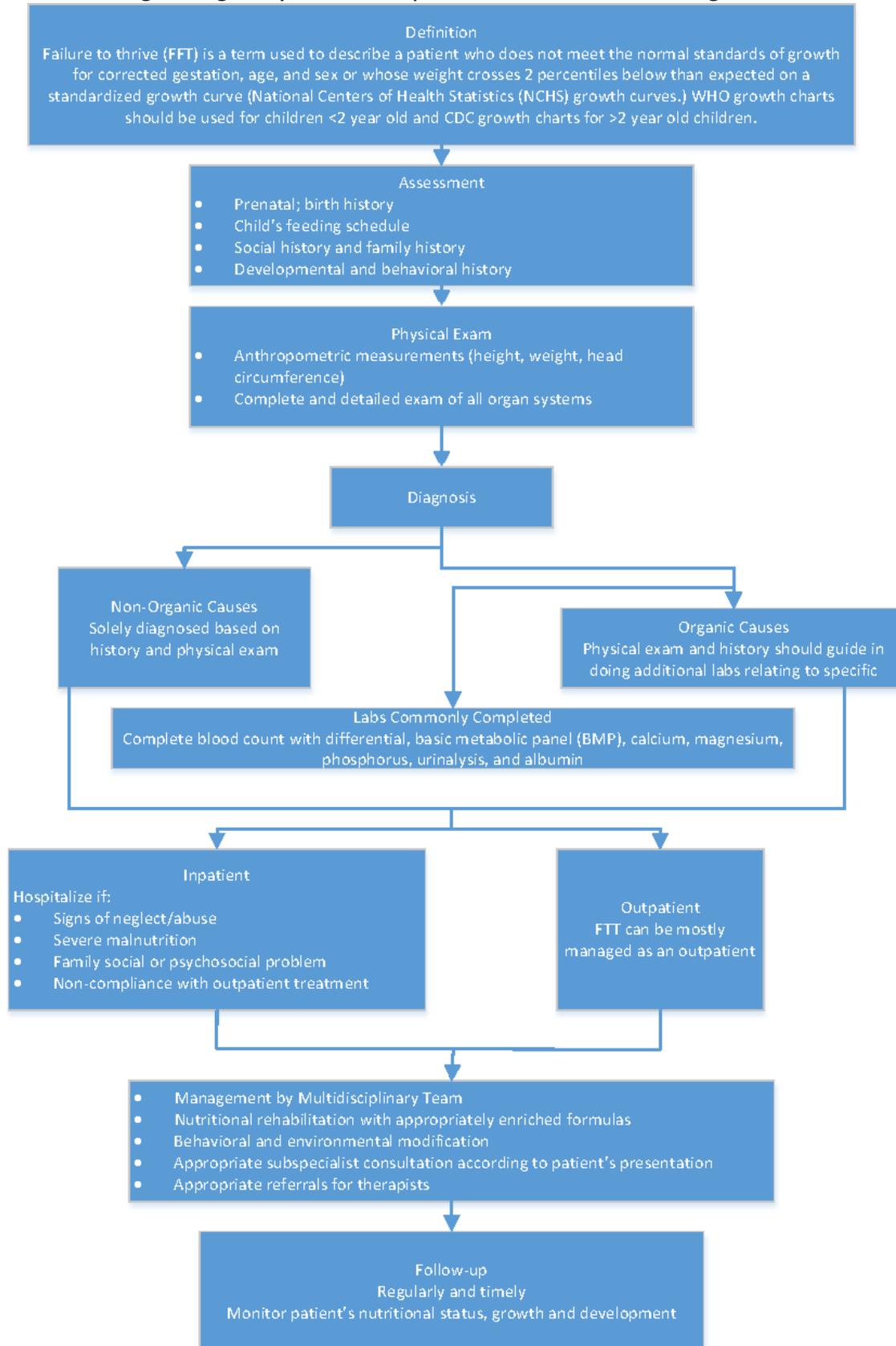
- Add powder first and then add water (i.e., 1 scoop formula + water to 2 oz line) = 2 oz, 22 cal/oz.
- Three scoops powder + 5 oz of water = 6 oz, 24 cal/oz.
- Three scoops powder + water to 5 oz = 5 oz, 27 cal/oz.

Thickeners

- Rice cereal: Adds 5 calories/tsp
 - Nectar consistency = 10 ml/30 ml.
 - Honey consistency = 15 ml/30 ml.
 - Concern is that rice cereal increases risk for dehydration and constipation, and continues to thicken over time.
- Thick-It® 2: Adds 5.5 calories/tsp
 - Nectar consistency = 10 ml/120 ml.
 - Honey consistency = 15 ml/120 ml.
- Simply Thick®: Dilutes calories (Usually not recommended for infants due to potential risk for necrotizing enterocolitis)
 - Nectar dilutes 2 calories/oz.
 - Honey dilutes 4 calories/oz¹⁴⁻¹⁶

Figure 1. Diagnosis and Management

To view a larger image on your device, please click or touch the image.



This guideline was developed to improve health care access in Arkansas and to aid health care providers in making decisions about appropriate patient care. The needs of the individual patient, resources available, and limitations unique to the institution or type of practice may warrant variations.

References

References

1. Abbott Nutrition Products: <http://abbottnutrition.com> Accessed Nov 26, 2013.
2. Bennett S. Failure to thrive. *Paediatr Child Health* 1996;1(3):206-10.
3. Buck CJ. Certain conditions originating in the perinatal period. In 2012 ICD-9-CM. Vols. 1-2. Professional ed. St Louis, MO: Elsevier Saunders; 2011:997.
4. Buck CJ. Symptoms, signs, and ill-defined conditions. In 2012 ICD-9-CM. Vols. 1-2. Professional ed. St Louis, MO: Elsevier Saunders; 2011:1001.
5. Casey PH. Failure to Thrive. In: *Developmental-Behavioral Pediatrics*. Fourth ed. Philadelphia, PA: Saunders/Elsevier. 2009:583-91.
6. Gahagan S. Failure to Thrive: A consequence of undernutrition. *Pediatr Rev* 2006;27(1):1-11.
7. Gahagan S, Holmes R. A stepwise approach to evaluation of undernutrition and failure to thrive. *Pediatr Clin North Am* 1998;45(1):169-87.
8. Glaser H, Heagarty M, Bullard Jr. D, Pivchik E. Physical and psychological development of children with early failure to thrive. *J Pediatr* 1968;73(5):690-8.
9. Good Start Products: <http://www.gerber.com> Accessed Nov 26, 2013.
10. Greer FR, Jatinder JS. CDC: Use WHO growth charts for children under 2. *AAP News* 2010;31:1.
11. Kirkland RT. Management of failure to thrive (undernutrition) in children younger than two years. Updated 2008; Accessed: Nov 26, 2013 Available from: http://www.uptodate.com/patients/content/topic.do?topicKey=~Gp.pSwq_mWv_OG.
12. Krugman SD, Dubowitz H. Failure to thrive. *Am Fam Physician* 2003;68:879-84, 886.
13. Mead Johnson Products: *Pediatric Product Handbook*, Mead Johnson Nutrition, REV 3/10.
14. Mehta et al- Defining Pediatric Malnutrition: a paradigm shift toward etiology-related definitions- *J Parenter Enteral Nutr* July 2013; 37 (4): 460-481.
15. Shah MD. Failure to thrive in children. *J Clin Gastroenterol* 2002;35(5):371-4.
16. Steward K, Ryan-Wenger N, Boyne L. Selection of growth parameters to define failure to thrive. *J Pediatr Nurs* 2003;18(1):52-9.
17. Use of World Health Organization and CDC Growth Charts for Children Aged 0-59 Months in the United States. *MMWR Morb Mortal Wkly Rep*. 2010;59(RR-9)
18. Wilcox WD, Nieburg P, Miller S. Failure to thrive: a continuing problem of definition. *Clin Pediatr* 1989;28(9):391-4.
19. Wright CM, Parkinson KN, Shipton D, Drewett RF. How do toddler eating problems relate to their eating behavior, food preferences, and growth? *Pediatrics* 2007;120(4):e1069-75.