



Nutritional requirements in children 0-5 years old and growth faltering

Eugene Dinkevich, MD
Downstate Healthy Lifestyles Program
Department of Pediatrics
SUNY-Downstate Medical Center
Brooklyn, NY

Energy and cost of growth

Infancy growth is very rapid

Age	Weight gain per day (grams)	Weight gain per month (kg)	Length Gain per day (mm)	Length gain per month (mm)
0-3 months	26-31	0.78-0.93	1	30 mm
3-6 months	17-18	0.51-0.55	0.68	20 mm
6-9 months	12-13	0.37-0.4	0.47	14 mm
9-12 months	9	.28		
>12 months	7-9	0.21-.28		

At 1 year of age, an average infant has **TRIPLED** his/her birth weight!
S/he will not triple weight again until about 9-10 years of age

Energy Requirements of Infants

Parameter (kcal/kg/day)	AGE 1 month	AGE 3 months	AGE 6 months
BMR	48	52	54
Physical Activity	2.4	5.2	10.8
Thermic Effect of Food	5	4.5	4.5
Growth Energy Cost	38.5	21	10.5
Losses	5	4.5	4.5

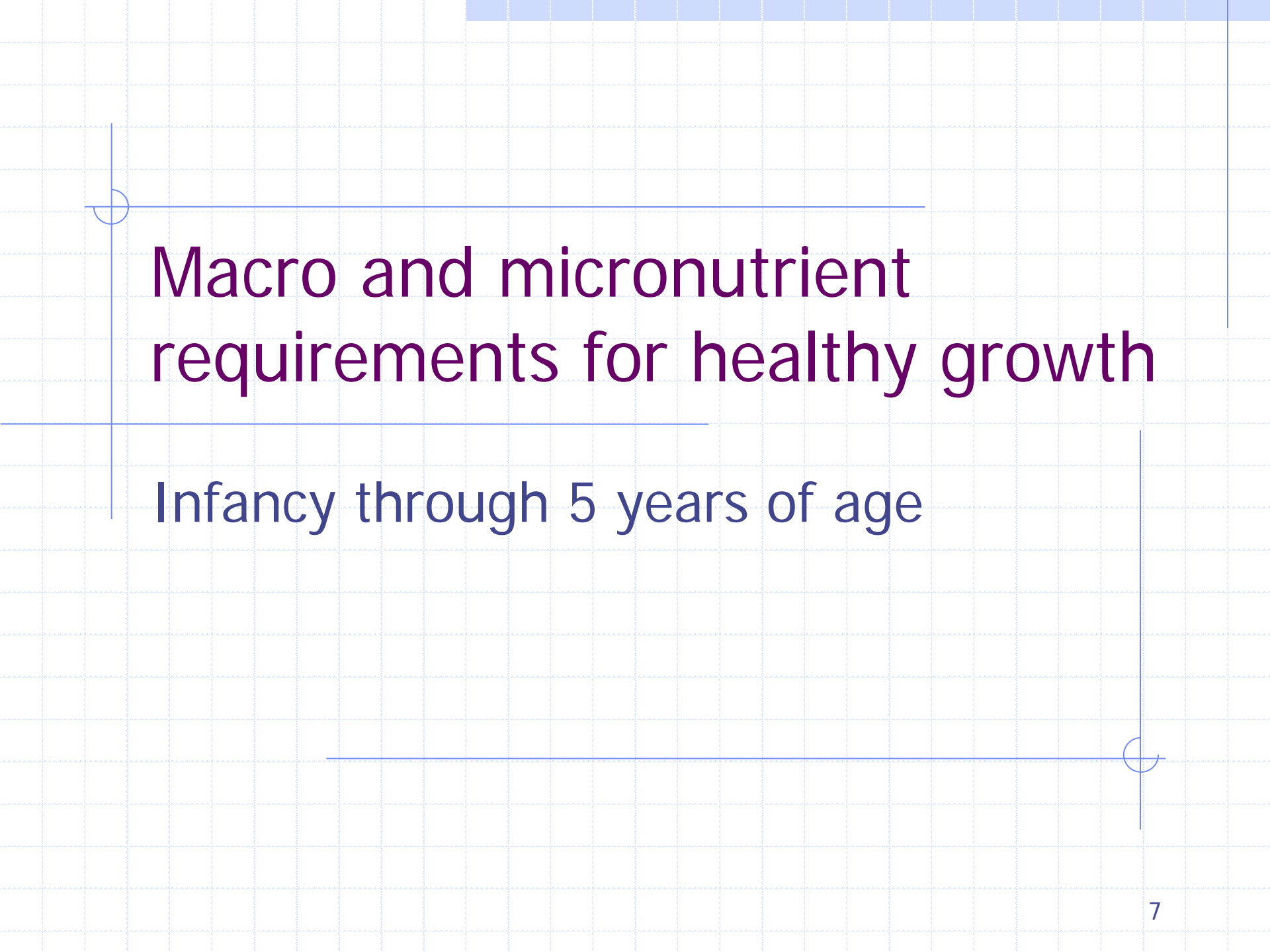
At 1 months energy needed for growth is 35% of TEE but decreases to 3% by 12 months of age

Definitions of nutrient intake recommendations

- ◆ Recommended Dietary Allowances (RDA)
 - Minimum amounts of nutrient to be consumed to meet nutrient requirements of 97-98% of healthy individuals
- ◆ Estimated Average Requirements (EAR)
 - Intake level for a nutrient at which the needs of 50 percent of the population will be met
 - Increased by about 20% to determine the RDA
- ◆ Dietary Reference Intakes (DRI)
 - Set of nutrient based reference values used to assess adequacy of diets of individuals and groups

Macronutrient distribution ranges (as percent of total energy intake)

- ◆ Fat:
 - 0-1 y old: 50%
 - 1-3 y old: 30-40%
 - 4-18 y old: 25-35%
- ◆ Carbohydrates (CHO): 45-65% for all ages
 - Added sugars <25%
- ◆ Protein: 12-15% for all ages
 - Rapid growth in infancy requires higher proportion of protein
 - Recovery from malnutrition also requires more protein
- ◆ Total energy requirements are increased in infection and trauma

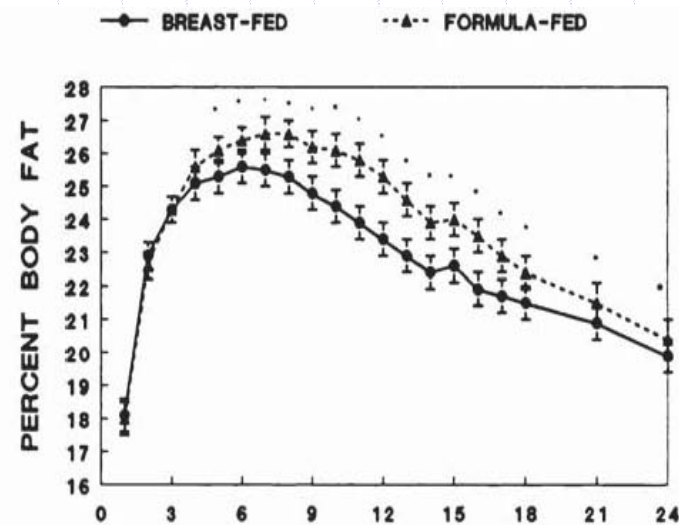
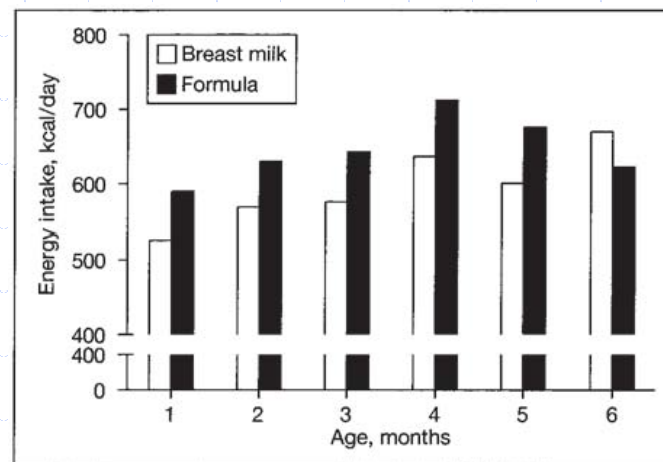


Macro and micronutrient requirements for healthy growth

Infancy through 5 years of age

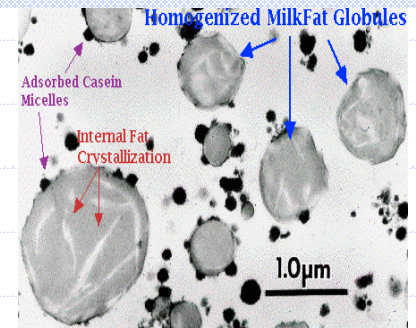
Energy in infancy

- ◆ Equal energy density in breast milk and formula ~670 kcal/l
- ◆ Breast fed infant consume less energy
 - Not all CHO and proteins in breast milk are digestible
 - Breast fed infant take less volume (800 vs 1000 ml per day at 3 mo)
 - Breast fed infants can better regulate intake
- ◆ Energy requirement of infants may have overestimated by as much as 10-30%
- ◆ Formula fed infants have significantly more body fat between 3-18 mo



Lipids (fat)

FAT



RDA (g/day)	0-6 mo	7-12 mo	1-3 y	4-8 y
Total fat	31	30	ND	ND
Linoleic (n-6)	4.4	4.6	7	10
Linolenic (n-3)	0.5	0.5	0.9	1.2

- ◆ Breast-fed and formula-fed receive 50% of energy as fat
- ◆ Similar amounts total fat in breast milk and formula (3.5%)
- ◆ L-PUFA—essential for humans, required for brain and eye development (present in breast milk, added to formula)
- ◆ Fat in breast found in milk globule (non-polar core)
- ◆ Destruction of milk globule while making formula adds to the digestion time of formula

Carbohydrates (CHO)

- ◆ Defn: Sugars (monosaccharides, disaccharides, oligosaccharides, polysaccharides) and starches
- ◆ Added sugars: sugars added during food preparation to affect taste of properties (<25% of total CHO)
- ◆ RDA for CHO: 130 g/day
- ◆ Institute of Medicine (IOM) suggests no more than 25% of daily calories as sugars while many other agencies recommend only 10%

Upper limit of CHO intake

Age	TEE (kcal/kg/d)	CHO equivalent (g/kg/d)
Newborn	73	19
1-3 y	85	22
4-6 y	68	18

Lactose in breast, bovine milk and formula

- ◆ Predominant carbohydrate in milk
 - 6.8 g/dL in human milk
 - 4.9 g/dL in bovine milk
- ◆ Structure: glucose + galactose
- ◆ Functions in humans
 - Major energy for brain--level of lactose correlates with brain size across species
 - Galactose is used to make galactolipids, especially cerebrosides needed for CNS development

Glycemic index

GLYCEMIC INDEX CHART									
Low Glycemic (55 or Below)					High Glycemic (70 or Higher)				
SNACKS		STARCH		VEGETABLES		FRUITS		DAIRY	
	G.I.		G.I.		G.I.		G.I.		G.I.
Pizza	33	Bagel, Plain	33	Broccoli	10	Cherries	22	Yogurt, Plain	14
Chocolate Bar	49	White Rice	38	Pepper	10	Apple	38	Yogurt, Low Fat	14
Pound Cake	54	White Spaghetti	38	Lettuce	10	Orange	43	Whole Milk	30
Popcorn	55	Sweet Potato	44	Mushrooms	10	Grapes	46	Soy Milk	31
Energy Bar	58	White Bread	49	Onions	10	Kiwi	52	Skim Milk	32
Soda	72	Brown Rice	55	Green Peas	48	Banana	56	Chocolate Milk	35
Doughnut	76	Pancakes	67	Carrots	49	Pineapple	66	Yogurt, Fruit	36
Jelly Beans	80	Wheat Bread	80	Beets	64	Watermelon	72	Custard	43
Pretzels	83	Baked Potato	85	Onions	75	Dates	103	Ice Cream	60

Glycemic Index values obtained from www.lowglycemicdiet.com, www.nutritiondata.com and www.diabetesnet.com

- ◆ **Glycemic index**, or GI, measures how a carbohydrate-containing food raises blood glucose
- ◆ Depends on ripening, storage and processing
- ◆ Lower glycemic index food may attenuate hunger
- ◆ High glycemic index associated with increased in risk of Type 2 diabetes
- ◆ Eating foods with lower glycemic index may decrease the likelihood of obesity in children

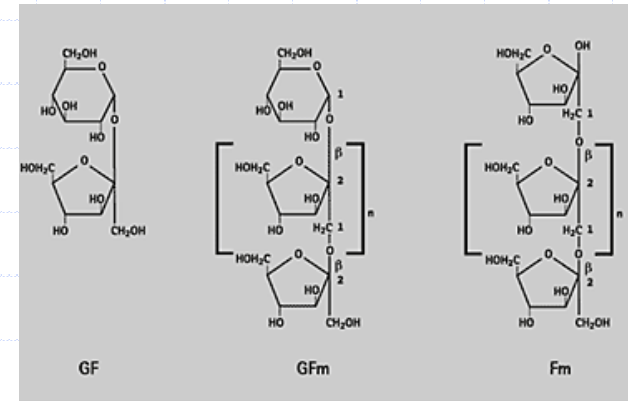
Fiber

Daily recommended intake of fiber

Age (y)	Fiber (g/d)
0-1	ND
≥1-3	19
4-8	25

- ◆ Defn: cellulose and other plant saccharides that are poorly digestible
- ◆ Types:
 - Soluble—dissolves in water (beans, fruits, oats, psyllium)
 - Insoluble—not dissolvable (whole-grain products, vegetables)
- ◆ Benefits of soluble fiber
 - Treatment of recurrent abdominal pain/constipation in children
 - Decrease in obesity by increasing satiety
 - Better glucose control (avoidance of rapid rise and fall insulin)
 - Decrease in colorectal cancer
 - Possible reduction in LDL and increase in HDL

Prebiotic oligosaccharides of breast milk



- ◆ Three to 10 monosaccharide units found in human milk that promote the growth of probiotic gut flora
- ◆ Present at 20g/L in colostrum to 5-14 g/L in mature milk
- ◆ Over 200 different oligosaccharides identified in human milk
- ◆ Oligosaccharides become substrate (prebiotics) for probiotic bacteria
- ◆ Probiotic bacteria (lactobacillus and bifidobacterium) “train” the immune system to tolerate allergens (pollen, etc), better recognize “self”, and to better respond to infections
- ◆ Some formulas in US are supplemented with prebiotics



Proteins

RDA for proteins

- ◆ RDA for proteins decrease as infant grows
- ◆ Amino acid-score: how well protein supplies essential amino acid
- ◆ Depend on protein quality
 - Distribution of essential amino acids
 - Bioavailability of amino acids in the protein
 - Digestibility of the protein
 - Animal sources are better than vegetable

Protein quality: digestibility and amino acid availability			
Protein source	True Digestibility (%)	Amino Acid Score (limiting aa)	
		6 mo to 1 yr	School-aged
Whole egg	97	0.74 (trp)	1.36 (his)
Cow milk	95	0.52 (thr)	0.90 (thr)
Beef (cooked)	94	0.54 (trp)	1.39 (trp)
Soy protein isolate	95	0.75 (cys+met)	1.14 (cys+met)
Corn, whole	85	0.41 (lys)	0.55 (lys)
Wheat flour, whole	86	0.40 (lys)	0.54 (lys)
Wheat flour, refined	96	0.37 (lys)	0.50 (lys)
Peanut butter	95	0.40 (lys)	0.55 (lys)
Beans, navy, cooked	78	0.60 (cys+met)	0.91 (cys+met)
Rice and beans	78	0.70 (trp)	1.02 (lys)
Rice, white, cooked	88	0.59 (lys)	0.80 (lys)

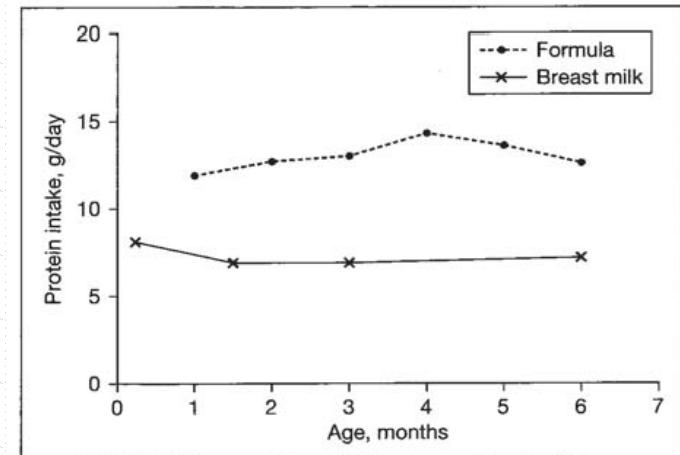
Protein in infancy—breast is best!!!

Quantity of protein in milk	
Milk type	Mg/dL
Colostrum	20-30
Early Breast milk	9-11
6 months Breast milk	8-10
Formula	12-14

Differences in amino acids (**cow milk**)
More sulfa-containing amino acids
 Taurine—absent (added to formula)

Milk type	Whey (%)	Casein (%)
Cow	20	80
Early Breast	80	20
6 months	50	50
Formula	40	60

Formula fed babies get more protein than breast fed



Protein intake in children

- ◆ As children grow they require less protein than in infancy
- ◆ 7-12 mo: 1.6 g/kg/day; 1-3 y: 1.2g/kg/day
- ◆ If energy intake is inadequate proteins are catabolized and requirement increases
- ◆ Protein requirements are increased by 20-30% after diarrhea (for 2-3 times duration of illness)
- ◆ Children undergoing catch-up growth require additional 0.2g/kg/day as well as increase in energy and micronutrients

Selected micronutrients

Calcium

Phosphorus

Magnesium

Iron

Zinc

Calcium

- ◆ Stored mainly in the skeleton
- ◆ In serum 50% bound to albumin, rest is ionized
 - In hypoalbuminemia total calcium decreases, ionized undisturbed
- ◆ Regulated by PTH, Calcitonin and Vitamin D
- ◆ Amount of Calcium in breast milk and formula
 - Breast milk 200-340 mg/L, 67% absorbed, formula has more calcium but it is less well absorbed
- ◆ Calcium is well absorbed from vegetables that are not high in oxalate (avoid: spinach, rhubarb, swiss chard)

Calcium content of selected foods			
Food	Serving size (g)	Calcium (mg)	# serving to equal low fat milk
Whole milk	244	276	1.1
1% milk	244	305	--
Yogurt (non-fat)	170	299	1.02
Cheese (cheddar)	28	202	1.5
Tofu	126	253	1.2
Beans, baked	253	126	2.4
Tomatoes, stewed	255	87	3.5

Phosphorus and magnesium

◆ Phosphorus

■ RDA

- ◆ 0-6 mo: 100mg/day
- ◆ 7-12 mo: 275mg/day
- ◆ 1-3 y: 460 mg/day
- ◆ 4-8 y: 500 mg/day

■ Sources:

- ◆ Milk
- ◆ Meat
- ◆ Beans
- ◆ Grains
- ◆ Lentils

◆ Magnesium

■ RDA

- ◆ 0-6 mo: 30 mg/day
- ◆ 7-12 mo: 75mg/day
- ◆ 1-3y: 80mg/day
- ◆ 4-8 y: 130mg/day

■ Sources:

- ◆ Whole grains
- ◆ Beans
- ◆ Legumes
- ◆ Milk, egg, meat

- Deficiency: seizures in children, psych illness in adults

Iron



- ◆ Iron sufficiency (IS): enough iron for normal physiologic function
- ◆ Iron deficiency (ID):
 - Insufficient iron to maintain normal physiologic functions
 - Due to inadequate absorption to accommodate increase in growth
 - Negative iron balance results in low Ferritin (SF) levels
- ◆ Iron deficiency anemia: $Hgb < 11.0 \text{ g/dL}$ at 12-35 mo
- ◆ Preferential tissue iron sparing in iron deficiency
 - Liver \rightarrow skeletal muscle \rightarrow intestine \rightarrow heart \rightarrow brain \rightarrow erythrocytes
 - Therefore, adverse neurodevelopmental effects of ID are seen before onset of anemia

Iron requirements

- ◆ Full term infants 0-7 months (breastfed) 0.27 mg/d
- ◆ Full term infants 7-12 mo 11 mg/d
- ◆ Formula fed infants (satisfied by formula alone) 12 mg/d
- ◆ Children 1-3 yrs old 7 mg/d

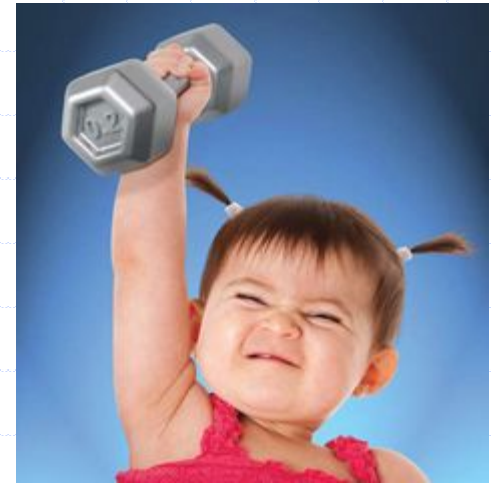
- ◆ Premature infants
 - 80% or iron stores accrued during the third trimester
 - Requirements by how premie, phlebotomy, pRBC 2-4 mg/d

Prevention of iron deficiency

- ◆ Breastfed infants
 - Exclusive: 1 mg/kg/day of oral iron from 4 mo old until adequate iron in complementary foods
 - Mixed fed: depends on how much breast milk, if over 50% also give 1mg/kg/day at 4 mo
- ◆ Formula fed infants—iron in formula is adequate
- ◆ Premature infants—2mg/kg/day by 1 mo
 - Exception—multiple transfusions
- ◆ Infants 6-12 months
 - Give iron rich foods: heme iron (meat), fortified cereal in US
- ◆ Universal screening for IDA with Hgb at 12 mo

Clinical diagnosis and treatment of iron deficiency

- ◆ No one test is sensitive or specific
- ◆ Step 1—measure Hb, if <11 mg/dL
- ◆ Step 2—assess iron deficiency risk (pregnancy issues, prematurity, poor diet, excessive milk intake, poor growth)
- ◆ Step 3—measure MCV, Serum iron, Total iron binding capacity (TIBC), ferritin and CRP
- ◆ Step 3.5—consider likelihood of thalassemia (Armenia)
- ◆ Step 4—treat with liquid iron
- ◆ Step 5—monitor treatment effect



Clinical diagnosis of iron deficiency

Parameter	ID w/o anemia	IDA
Hb	Normal	Low
MCV	Normal	Low
Serum iron	Low	Low
TIBC	High	Very high
Ferritin (<10)	Low	Very low

- ◆ If Hb < 11 g/dL can give adequate iron replacement and look for 1 g/dL increase in hemoglobin in 1 mo. Treat for 3 months
- ◆ Consider likelihood of thalassemia in pt of Mediterranean extraction, perform Hemoglobin electrophoresis
- ◆ Measure CRP to diagnose inflammation
- ◆ Newer tests such as reticulocyte hemoglobin concentration and transferrin receptor 1 (TfR1) concentration are more precise but not readily available in clinical practice

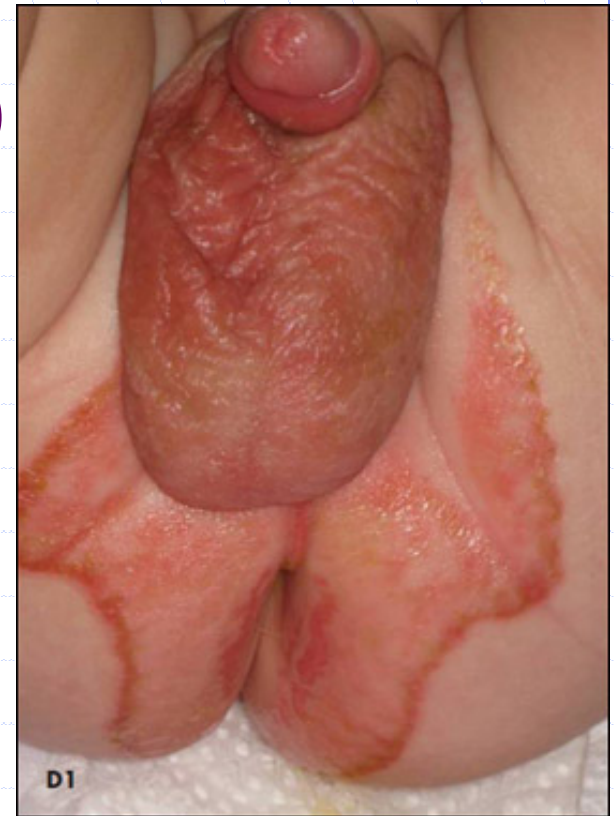
Treatment of iron deficiency in children

Condition	Dosage of elemental FE (mg/kg/day)	Frequency (times/day)
Prophylaxis	1-2	1-2
Mild to moderate ID	3	1-2
Severe anemia	4-6	3

◆ Iron must be given with citric acid to improve absorption

Zinc (acrodermatitis enteropathica)

- ◆ Function—cofactor for enzymes and needed for structural proteins
- ◆ Deficiency—common in diarrhea
 - Acro-orificial skin lesions
 - Increase risk of infections
 - Stunting—must add zinc for treatment of stunting
- ◆ Requirements
 - Infants--Colostrum (5-10mg/L), Mature milk (0.3-0.5 mg/L), In formula 4-7mg/L
 - RDA in children 3 mg/day
- ◆ Sources: sea food, meat, milk, beans, nuts
 - Phytates (soy, corn, barley) interfere with zinc absorption



Weaning and feeding toddlers

- ◆ WHO recommends weaning starting at 6 mo old, AAP after 4 months, infant needs head control
- ◆ Must assure good iron intake with supplemental iron and/or starting with meats (Fortified cereals in US)
- ◆ Add 1 food per week to assure acceptance (need average of 15-20 tries to accept new food)
- ◆ Picky eating and preference for sweet is normal
- ◆ Avoid pressuring children to eat when not hungry
- ◆ Suggest 3 meals a days with 2-3 snacks

Average Daily Intake for a Toddler

Food Group	Servings Per Day	Number of Calories Per Day	One Serving Equals
Grains	6	250	<ul style="list-style-type: none">• Bread – $\frac{1}{4}$ to $\frac{1}{2}$ slice• Cereal, rice, pasta (cooked) – 4 tbsps.• Cereal (dry) – $\frac{1}{4}$ cup• Crackers – 1 to 2
Vegetables	2 to 3	75	<ul style="list-style-type: none">• Vegetables (cooked) - 1 tbsp. for each year of age
Fruits	2 to 3	75	<ul style="list-style-type: none">• Fruit (cooked or canned) – $\frac{1}{4}$ cup• Fruit (fresh) – $\frac{1}{2}$ piece• Juice – $\frac{1}{4}$ to $\frac{1}{2}$ cup (2-4 <u>oz</u>)
Dairy	2 to 3	300-450	<ul style="list-style-type: none">• Milk – $\frac{1}{2}$ cup• Cheese – $\frac{1}{2}$ oz. (1-inch cube)• Yogurt – $\frac{1}{3}$ cup
Protein (meat, fish, poultry, tofu)	2	200	<ul style="list-style-type: none">• 1 oz. (equal to two 1-inch cubes of solid meat or 2 tbsps. of ground meat)• Egg – $\frac{1}{2}$ any size, yolk and white
Legumes (dried beans, peas, lentils)	2	200	<ul style="list-style-type: none">• Soaked and cooked – 2 tbsps. ($\frac{1}{8}$ cup)
Peanut butter (smooth only)		95	<ul style="list-style-type: none">• Spread thin on bread toast or cracker - 1 tbsp.

Portion sizes for children

Food Group	Servings per Day	Portion Size for Ages 1 to 3	Portion Size for Ages 4 to 6	Portion Size for Ages 7 to 10
Fruits	2–3 servings	<p>¼ cup cooked, frozen, or canned</p> <p>½ piece fresh</p> <p>¼ cup 100% juice</p>	<p>¼ cup cooked, frozen, or canned</p> <p>½ piece fresh</p> <p>⅓ cup 100% juice</p>	<p>½ cup cooked, frozen, or canned</p> <p>1 piece fresh</p> <p>½ cup 100% juice</p>
Vegetables	2–3 servings	¼ cup cooked	<p>¼ cup cooked</p> <p>½ cup salad</p>	<p>½ cup cooked</p> <p>1 cup salad</p>
Grains	6–11 servings	<p>½ slice bread</p> <p>¼ cup cooked cereal, rice, or pasta</p> <p>⅓ cup dry cereal</p> <p>2–3 crackers</p>	<p>½ slice bread</p> <p>⅓ cup cooked cereal, rice, or pasta</p> <p>½ cup dry cereal</p> <p>3–4 crackers</p>	<p>1 slice bread</p> <p>½ cup cooked cereal, rice, or pasta</p> <p>¾–1 cup dry cereal</p> <p>4–5 crackers</p>
Meats and other proteins	2 servings	<p>1 ounce meat, fish, chicken, or tofu</p> <p>¼ cup cooked beans</p> <p>½ egg</p>	<p>1 ounce meat, fish, chicken, or tofu</p> <p>⅓ cup cooked beans</p> <p>1 egg</p>	<p>2–3 ounces meat, fish, chicken, or tofu</p> <p>½ cup cooked beans</p> <p>1 or 2 eggs</p>
Dairy	2–3 servings	<p>½ cup milk</p> <p>½ ounce cheese</p> <p>⅓ cup yogurt</p>	<p>½ cup milk</p> <p>1 ounce cheese</p> <p>½ cup yogurt</p>	<p>1 cup milk</p> <p>1 ounce cheese</p> <p>¾–1 cup yogurt</p>



Clinical approach to Growth faltering (Failure to thrive)

Approach to recognition and treatment

- ◆ Definition of Failure to Thrive:
 - Weight below 3rd or 5th percentile line
 - Crossing 2 major percentile lines on 2 separate occasions
- ◆ Cause: Proximal cause is always malnutrition
- ◆ Investigation—need to investigate 4 domains
 - Medical
 - Nutritional
 - Developmental
 - Social

Frequency of crossing 2 major percentiles up or down in healthy US children

(n=18,085, born between 1959 and 1967)

Age (mo)	Growth parameter		
	Ht for age (%)	Wt for age (%)	Wt for Ht (%)
0-6	32	30	62
6-12	15	15	27
12-18	16	7	21
18-24	14	6	21

Evaluation: Family history

- ◆ Consanguinity
- ◆ Recurrent miscarriage or stillbirth
- ◆ Developmental delay
- ◆ Atopy
- ◆ HIV or other recurrent infections
- ◆ Alcoholism and/or substance abuse
- ◆ Psychiatric illness
- ◆ Growth retarding family illness: CF, Celiac disease, IBD, lactose intolerance
- ◆ Familial short stature or growth delay in parents
- ◆ Economic/social family issues

Evaluation: birth history and perinatal illness

◆ Birthweight < 2500g—
increased risk of FTT

◆ Prematurity

■ Correct for gestational age

- ◆ Head circumference—18 mo
- ◆ Weight—24 months
- ◆ Length—40 months

■ Monitor growth—must be parallel to 5th % or better

■ Feeding

- ◆ Give 22 cal formula if <34 weeks until >6 mo old
- ◆ Evaluate for oral-motor discoordination if needed

Pregnancy and Delivery
Mother's reproductive history
Pregnancy hx: nutrition, weight gain, meds, drugs, smoking, occupation, complications
Delivery: pregnancy duration, mode, Apgar score, complications, newborn wt, ht, hc
Post delivery complications

Evaluation: perinatal factors (cont.)

◆ Small for Gestational Age (SGA)

- Definition: <10% for gestational age
- Types:
 - ◆ Asymmetric SGA (Head circumference (HC) is spared, weight and height affected)
 - Better prognosis
 - May be difficult to handle
 - Best catch up potential in is first 6 months—optimize nutrition
 - ◆ Symmetric SGA (HC, Weight, Height depressed)
 - Look for a syndrome: chromosomal abnormalities, intrauterine infections, prenatal teratogen exposure

Evaluation: postnatal medical issues

- ◆ Common medical conditions associated with FTT
 - Diarrhea
 - Celiac disease
 - Food allergies
 - Gastrointestinal reflux disease
 - Cystic fibrosis
 - Lactose intolerance
 - Giardiasis
 - Urinary tract infection
 - Renal tubular acidosis
- ◆ Uncommon medical conditions—Organic syndromes
 - Neurological disease
 - Chromosomal abnormalities
 - Inborn errors of metabolism

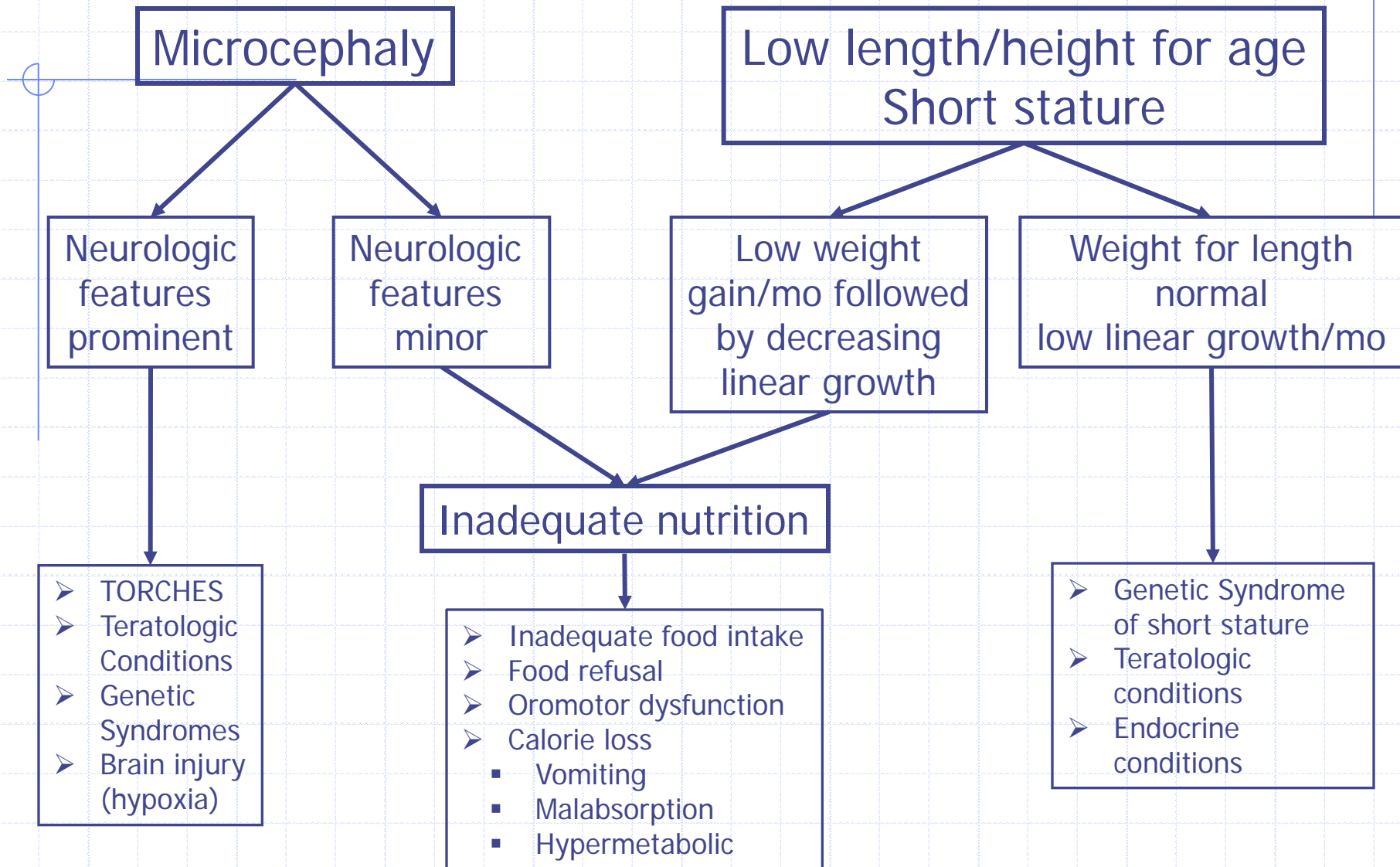
Evaluation: Physical examination

Vital signs	BP (>2 y), Temperature, Pulse, Respirations, Oxygen saturation
Antropometry	Plot growth from birth: weight and height for age, weight for age, head circumference
General appearance	Activity, affect, posture
Skin	Hygiene, rashes, trauma (bruises, burns, scars)
Head	Hair quality, fontanelle, frontal bossing, sutures, facial dysmorphism, philtrum
Eyes	ptosis, strabismus, palpebral fissures, conjunctival pallor, icterus, cataracts
Ears	external form, rotation, tympanic membrane
Mouth, nose, throat	thinness of upper lip, hydration, dentition (eruption and hygiene), glossitis, cheilosis (inflammation of corner of mouth), gum bleeding, enlarged tonsils
Neck	hairline, masses, lymphadenopathy
Cardiovascular	CHF, cyanosis, murmurs
Abdomen	Protuberance, hepatosplenomegaly, masses bowel sounds
Genitals	Malformations, hygiene, trauma
Rectum	Fissures, trauma, hemorrhoids
Extremities	Edema, dysmorphism, rachitic changes, nails and nail beds
Neurologic	Cranial nerves, reflexes, tone, primitive reflexes, voluntary movement

Laboratory work up for FTT

Routine tests	CBC with red cell indices (anemia and iron deficiency), Complete chemistry panel (renal and hepatic function), stool ova and parasites, urine analysis, Tuberculin test, lead test
Recurrent or persistent vomiting or diarrhea	BUN (measures protein in diet), creatinine, urine pH (renal tubular acidosis), Potassium for hypokalemia
Severe stunting/wasting	Albumin and prealbumin, Alkaline phosphatase (low=zinc deficiency, high=rickets), calcium, phosphorus
Malabsorption	Serum IgA, anti-tissue transglutaminase antibody (Celiac disease), serum IgE (food allergy)
Constitutional growth delay vs endocrinopathy	If weight proportionate to height: --constitutional growth delay: bone age=chronological age, but > height age --endocrinopathy or chronic malnutrition: bone age=height age, but <chronological age

Growth charts guide diagnosis of FTT

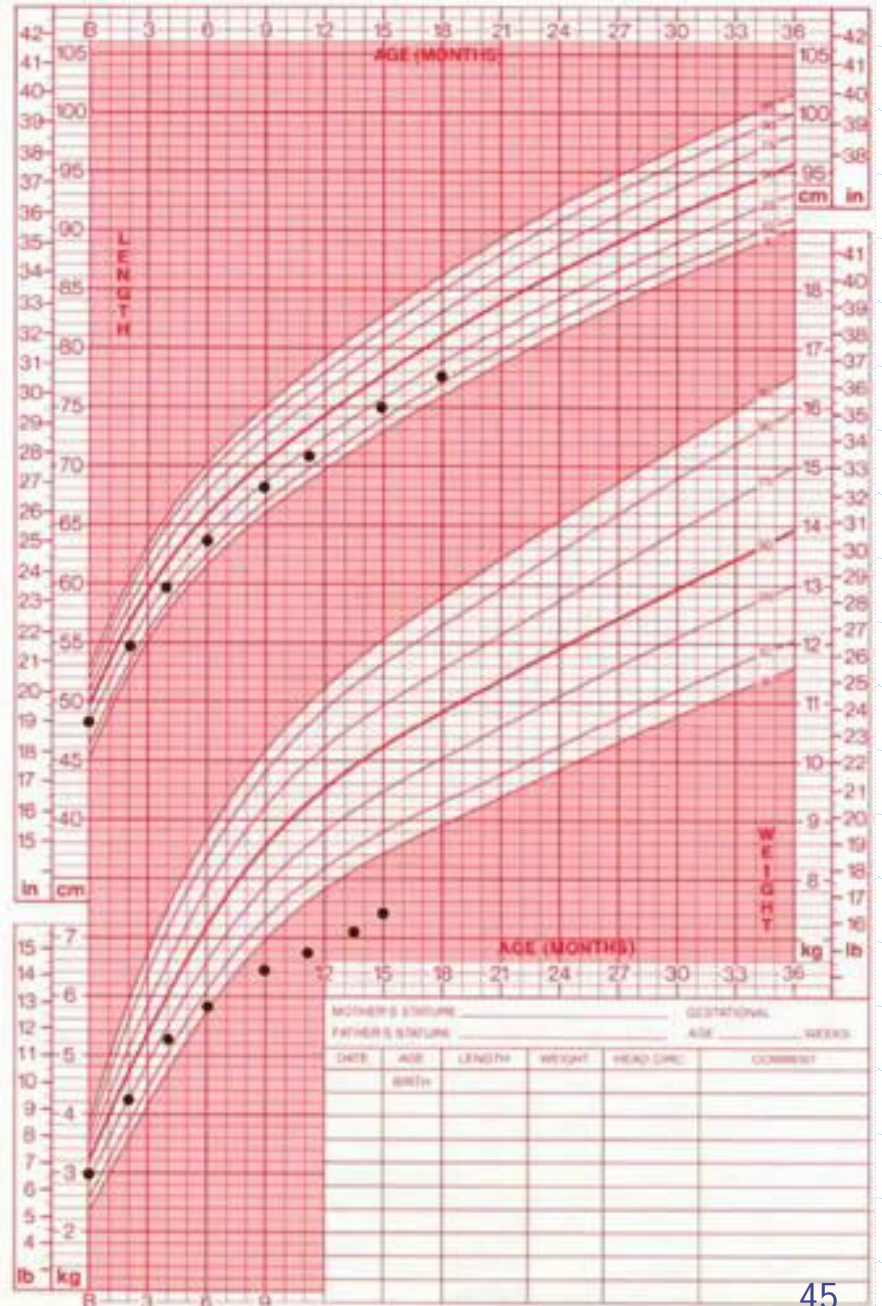


Treatment of FTT

- ◆ Nutritional repletion—sine qua non of therapy
 - Assess feeding practices
 - ◆ Evaluate aberrant practices (formula dilution, fad diet, infrequent feeding, grazing, etc)
 - ◆ Identify aversive eating/feeding behaviors and oromotor dysfunction
 - Adequate intake to achieve catch up growth
 - ◆ Assure adequate calories, protein, zinc, macro and micronutrients and vitamins
 - ◆ Consider nasogastric feeding or gastrostomy
 - Monitor growth, development and behavior frequently

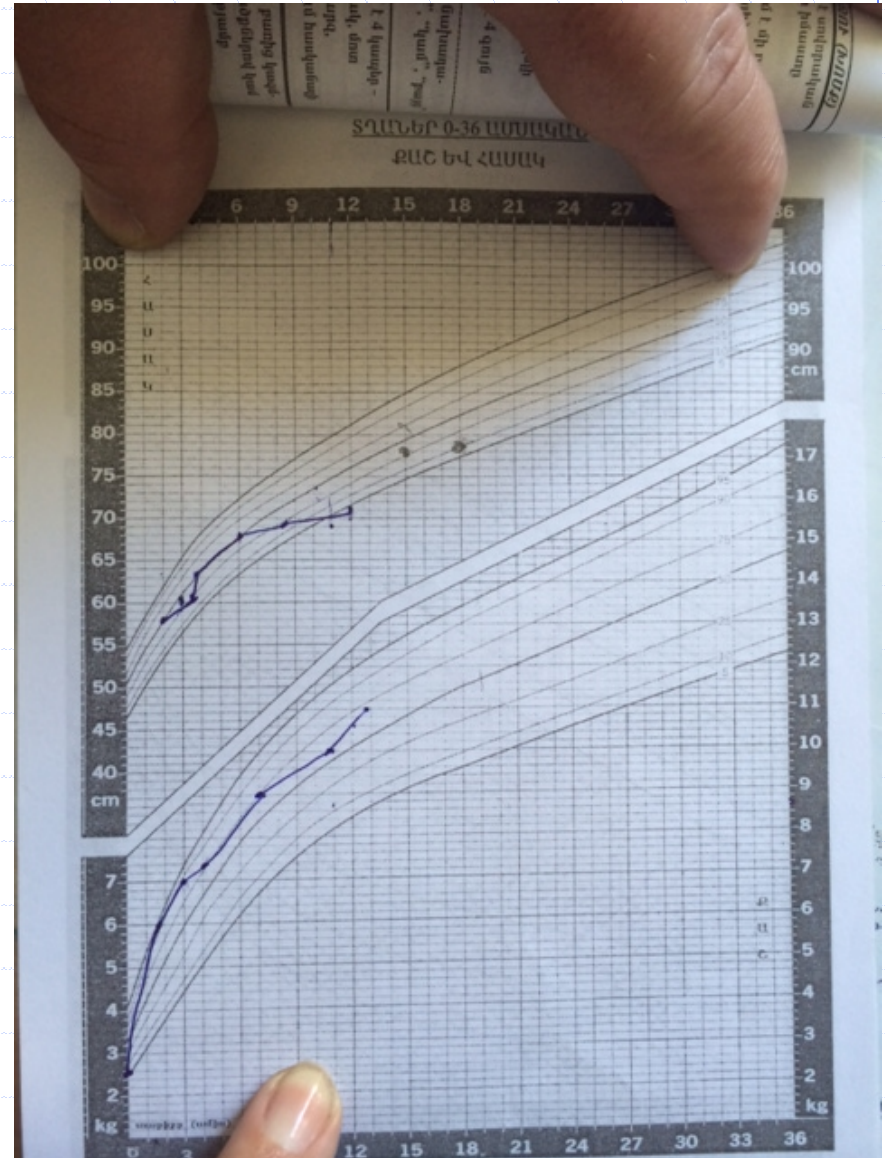
Case 2

Full term Boy, born 3000g, height 48.5. Mixed fed since 2 months of age. Bad social economic conditions. Parents are average size.



Case 3

Chart reviewed. No history available



Case 4

Girl born FT, 2800g, height 45 cm. Breast fed exclusively until three months. 1st seen in current office at 3 yrs old, healthy and developing normally. Growth as below. Both parents are at 15% for height.

