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Growth, Nutrition & FTT

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1. Growth:

Some important data

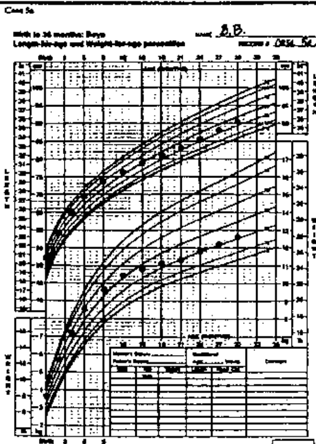
Weight gain

- BW regained: 10-14 days
- First 6 mo.: 1 oz. /day
- BW doubled: 5 mo.
- BW tripled: 1 yr.

Age 1-5: 5 lbs. /yr

Growth curves:

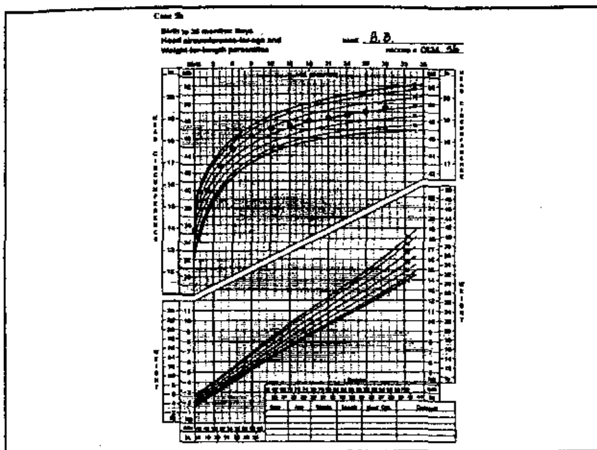
Height and weight



Growth curves:

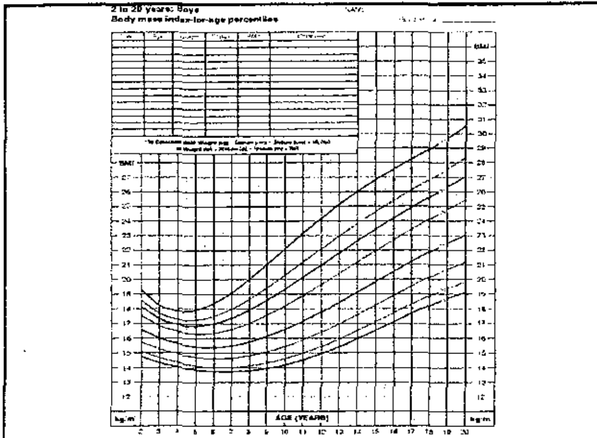
Head circumference and

Weight : height



Body Mass Index

(Body weight in Kg)/(height in meters)^2



The Head

- Head=brain size
- Age 1: size head= 2/3 adult size
  Age 2 4/5 adult size

Fontanelle closure: 6-15 mo.
First teeth: 5-10 mo.
Delay: Hypothyr., hypopituit.

Vital Signs:

- Resting respirations/min

<2 mo.:	40-60, irreg.
2-6 mo.:	40+, irreg.
>6 mo.:	30-40
>age 3:	12-20

- Pulse rate/ min.:

<2 mo.:	120
age 1:	100
3-5:	80

Vision:

Newborn:
red reflex
r/o cataracts
r/o strabismus

(cover test: > 4?)

Acuity:
birth: 20/200
(arm's length)

age 5: 20/20
(vision screen: >4)

2. Nutrition

- Infant
- Toddler
- Failure-to-Thrive

Why do we ask parents to feed only

Breast milk or formula

for the first 4-6 months?

Maturation process
for first 4 months:

- Salivary amylase
- Pancreatic amylase
- Mucosal barrier to large proteins (villi)
- Kidney ability to regulate protein & electrolyte excretion
  (no water, check formula preparation)

Breast milk

- **Advantages:**
  - -cheap
  - -no preparation mistakes
  - -improves bonding
  - -lower protein load
  - -lower solute load
  - -more digestible (whey)
  - -immunogenic
  - Non-allergenic (?)
- **Contra-indications:**
  - -galactosemia, PKU, ureacycle defects
  - -TB, Hepatitis, ?HIV
  - -alkylating agents, radioactive meds.
  - -?anti-thyr. meds,. ?narcotics, high dose contraceptives

After 4 + months:
rationale for food introduction

- Least to most allergenic
  (fruit/veg., except berries, citrus, tomato)
- New food every 4-5 days
  (watch for rashes, wheezing, eczema,...)
- Texture
- Nutrient need
  (iron, fiber)
  (add 400 IUvitamin D in breast fed)

Caloric needs

- First 6 mo.: 120 Kcal./kg/d
- 6 mo.: 100
- 1 year: 80+

What are the caloric content of breast milk, formulas and cow's milk? (cal/oz)

Why switch formula?

What is

"formula intolerance"?

"Formula intolerance"

is not an entity:

one must distinguish between

Milk-protein allergy & Lactose intolerance

- **Protein allergy:**

Systemic problem
IgE-mediated: ***wheezing, hives***
-T suppressor cell defect: ***eczema***
*-**GI blood*** loss
-Eosinophilic gastritis?
-?"Colics", reflux

- **Lactose intolerance:**

Lower GI problem:
-lactose undigested in colon=fermentation (gas), osmotic load (diarrhea)
-acquired, transient (post-viral)
-acquired, genetic (age 2-5)
-not congenital (sugar in breastmilk=lactose)

Total digestive dysfunction:

- Villi atrophy:
  - -post-op. (NPO)
  - -post-viral mismanaged (prolonged clear fluids)
  - -chronic diarrhea (infectious, malabsorption)
- Enzymatic suppression:
  - -chronic malnutrition

Standard formulas

- **Similac +/- iron**
- **Enfamil +/-iron**
  - **Cow milk protein-based**
  - **20 cal/oz**
  - **Contain lactose**
  - **Casein:whey 60:40**

Other types of formulas

Hypo-allergenic	Lactose-free	"Pre-digested"
•Nutramigen	•Lactofree	•Alimentum
•???(Prosobee)	•(Isomil)	•Progestimil
•???(Isomil)	•(Prosobee)	•Neocate
•Alimentum	•(Alimentum)	
•(Progestimil)	•(Progestimil)	

Dietary assessment principles

- Children are "picky eaters"
- Parents underestimate amount of calories through "junk food"
- Excessive milk/juice intake "spoils" the appetite
- Bottle use at night/after age 15 mo./as a pacifier is detrimental to teeth
- What the patient ate yesterday may not be typical

Dietary screening

- **Before age 1:**
  - Formula/breast milk intake
  - Frequency fruit/vegetables/meats (generic, daily)
  - Breastfed: Vitamin D supplement
  - Juice intake
- **After age 1:**
  - Milk intake (24 oz/d required)
  - ? Daily meat/fruit/vegetable intake
  - ? How much juice/pop ? daily snack foods (which?)
- **Iron deficiency anemia (CBC): yearly (1 to 4)**

Dietary advice principles

- No food as pacifier (feeding 20 min. q 2-4 hrs)-avoid "nibbling" all day
- No night feeds after age 4-6 mo.
- Extra iron sources after 4 months (iron-fortified formula, meats >6 mo.)
- Avoid struggles at mealtimes, encourage self-feeding, no force-feeding
- Avoid junk food, no bottle >15 mo.

What about meat?

Why is it easy for an adult to have a balanced, meat-free diet...but not for a child?

Children are growing organisms whose iron, essential amino-acids and essential fatty acids needs are much greater than adults' needs

Iron bio-availability

		(with dairy)
• Vegetables	0.5-2%	decreased
• Grains, lentils	2-5 %	decreased
• White meats	10 %	unaffected
• Red meats	20 %	"
• Liver	30 %	"

Ascorbic acid (fruit juice,...)increases vegetable (non-heme) iron bio-availability X 3

Nutrition problems associated with certain diets

Diet	Problems
Lacto-ovo-vegetarian	Low in iron
• Lacto-vegetarian	Low cal., low iron
• Vegan	Low cal., low iron, low zinc, low protein, **No B12**, ?essential amino-acids
• "Junk food" (Low Nutrient density)	Low iron, low zinc, low vitamins, ?essential amino-acids, ? Proteins, high calories

Vitamins: who needs them?

- Picky eaters, parental smoking, poverty, anemic
- Breastfed (Vit. D)
- Vegetarians (B12, iron, Zinc)
- (Pregnant) teenagers
- Smoking parents

....but vitamins do not provide the 12 essential amino acids or essential fatty acids

Physical symptoms of deficiencies

- **Bone:**
  - **Ricketts** — **Vitamin D**
- **Hair:**
  - **Thin, breakable:** — **Proteins, calories**
- **Eyes:**
  - **Conjonctiva pale** — **Iron**
- **Gums:**
  - **Bleeding, purple** — **Vitamin C**
- **Lips:**
  - **Stomatitis, cheilosis** — **Riboflavin, Niacin, Iron, B6**
- **Skin:**
  - **Xerosis, hyperkeratosis** — **Vitamin A, EFA**
  - **Petechiae, bruising** — **Vitamin C, K**

3. Failure-to-Thrive

Diagnostic definition:

-"...weight persistently below the 5th % for age, **in the absence of constitutional delay...**"

or

-"falling across 2 or more major % in 6 months' time..."

FTT

- Affects 10 % of children
- In nutritional insufficiency, weight drops weeks to months before height. Head growth is last to drop.
- If weight and height drop in concert, the cause is not nutritional...it may be normal (constitutional growth delay or genetic short stature) or abnormal (endocrine causes)

Another way to look at this:

is this patient under-nourished or just short?

Growth patterns are established by 36 months of age

- Infant growth rate is determined by perinatal factors (maternal nutrition, maternal substance abuse, congenital infections, placental sufficiency)
- As perinatal influences diminish, infants "channel" up or down to their genetic potential

Symetric decrease in height/weight: **Short stature**

- **Normal:**
  - Drift to genetic pattern
    - short parents
    - chronological bone age
    - short adult
  - Constitutional growth delay
    - average/normal parents
    - delayed bone age
    - average/normal adult

    (late bloomers)
- **Abnormal:**
  - Endocrine defect
    - hypo-thyroidism
    - hypo-pituitarism
    - delayed bone age
    - DD:

      constitutional growth delay

      (Lab. tests)

Familial short stature:

- Family history of short stature
- Birth wt.>2.5 kg.
- Ht.<3rd %
- Growth parallel curve (nl.velocity)
- Nl. (chronological) puberty pattern

Target height: mid-parental height

+/- 2 SD (1 SD=2 in.)

- **For girls (inches):**

  $$\frac{(\text{father ht.} - 5\text{in.}) + (\text{mother ht.})}{2}$$

- **For boys (inches):**

  $$\frac{(\text{father ht.} + 5\text{in.}) + (\text{mother ht.})}{2}$$

Pattern of growth established by age 3 to genetic potential

"Constitutional delay": the "late bloomers"

Constitutional growth delay (late bloomers)

- Parents of average/tall height
- At least one parent had delayed puberty
- Delayed bone age ("room to grow")
- After initial drift down (6-36 mo.), ht/wt curves parallel normal curves
- Normal TSH, GH

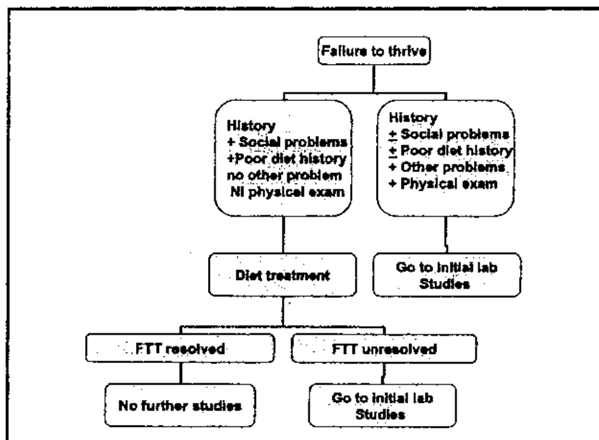
Common features of constitutional delay and endocrine pathology:

- Weight/Height is at the **50th %**
- Adding calories is **not** therapeutic

...as opposed to nutritional causes:

"True" nutritional FTT

- Weight/height<50th %
- Insufficient intake, excessive losses or chronic illness increasing caloric needs
- ?"Psychosocial deprivation"



"Organic" vs "Inorganic"

- Often mixed
- Psycho-social factors may be secondary to primary disabling organic condition
- Depression can suppress or increase appetite

"*food for thought*": is poverty with insufficient food "organic" or "psychosocial" ?

Etiology by age at onset

- **Before 6 months**
  - **formula preparation, poverty, ?breast fed**
  - **perinatal problems (oral-motor dysfunction, anatomical)**
  - **reflux**
  - **heart disease**
  - **CF**
  - **allergies, celiac**
  - **HIV, infections (UTI,...)**
- **After 6 months**
  - **autonomy struggles, coercive feeding, PS stressors**
  - **foods allergies**
  - **sleep hypoxemia (snoring)**
  - **other acquired illness (CF, celiac, IBD, renal,...)**

History clues

- **Vomiting:** reflux, pyloric stenosis, CAH
- **Diarrhea:** infections, CF, celiac, excessive juice intake
- **Snoring, recurrent OM:** upper airways sub-obstruction (adenoids)
- **Respiratory:** CF, asthma, aspiration (reflux, anatomical)
- **Serious infections:** HIV, immune deficiency

Feeding behaviors screening

- Are mealtimes struggle times?
- Does the family sit to eat together in the morning/evening? Who feeds the child?
- Does the family watch TV during meals?
- Does the child have a high chair? Where do the meals take place?
- Does the family "graze" all day, no distinct meals?
- Does the child over 15 months still use a bottle? (what is in the bottle?)

Psycho-social screening

- Household composition
- Parental education level/occupation
- Child-care arrangement
- Who shops for/ prepares food/feeds child
- Parental depression/domestic violence
- Financial resources/availability of food

Basic laboratory work-up

- CBC (r/o anemia, iron deficiency, infections)
- UA, urine culture (r/o UTI,...)
- electrolytes, BUN (r/o kidney dis.)

Standard laboratory tests will not uncover essential aminoacid or fatty acid deficiencies

Further targeted tests:

- (modified) **barium swallow** (reflux, oral-motor dysfunction, aspiration
- **CXR** (aspiration, CF, asthma, cardiac dis.)
- **Sleep study** (sleep hypoxemia)
- **Stool culture** (giardia,...)
- **RAST** tests (food allergies)
- **PPD, HIV** testing, **immunoglobulins** (severe infections)

Nutritional supplements

- **Infants:** -Increase formula concentration (after 6 mo. only) to **24 cal/oz:** 13 oz conc. Formula + 9 oz water
  -MCT oil
  -Polycose
- **After 1:** -Pediasure, Kindercal: **30 Cal/oz.** (not a replacement-max. 2-3 x 8 oz.cans/d)