FAILURE TO THRIVE

The new term for failure to thrive is faltering growth or growth deceleration

IBRAHIM AL AYED

PROFESSOR OF PEDIATRICS

PEDIATRICIAN & GENERAL CONSULTANT

Check the last 7 slides it has important questions and their answers presented by the doctor!

Notes are taken by: Minyal Bawazir

Failure to thrive

AN OVERVIEW

Q1: What factors influence / control growth?

Hormones (growth hormone, Thyroid hormone, androgens, estrogen (sex hormones), insulin, glucagon), Genetic programming, psychology, Metabolism, and Nutrition.

Q2: How to know that a child is not growing normally?

Q3: What causes failure to thrive? How to classify it?

Q4: What specific points in history you need to know?

Failure to thrive

AN OVERVIEW

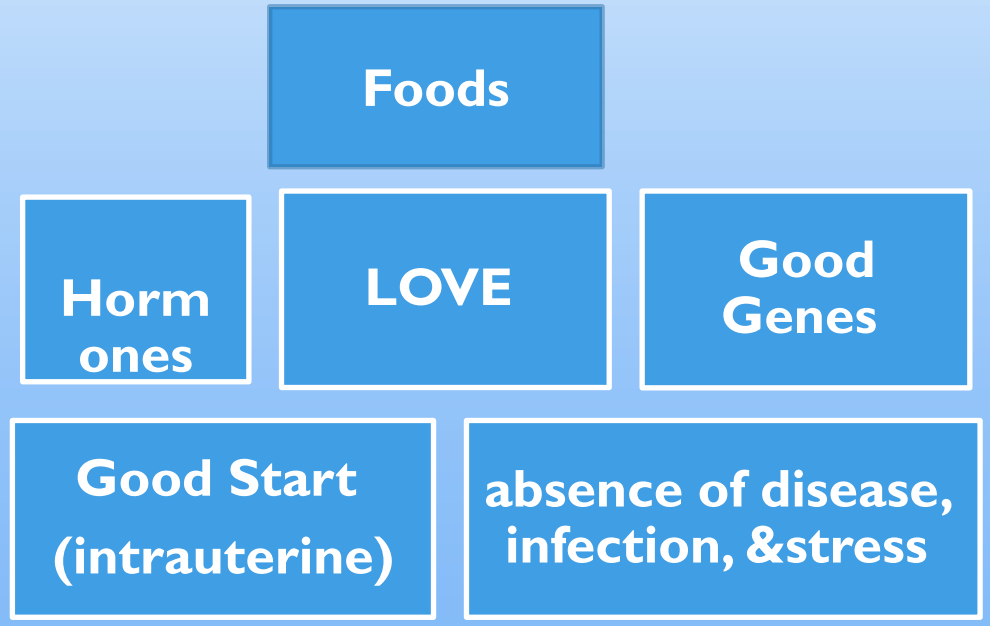
Q5: How to approach examination of a child who has growth failure?

Q6: What investigations you need to do on a child with failure to thrive?

Q7: How to treat children with failure to thrive?

Q8: Take home message.

What does a child need to grow ?



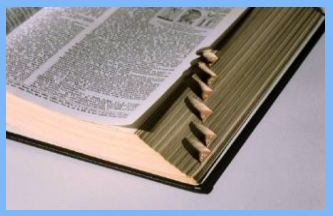
Love : emotional support favorable encouraging environment.
If a child grows in abandoned neglected discouraged environment this does affect their growth , there is known entity for that called emotional deprivation dwarfism, because there is a strong association between the psychology, neurons, mediators, hormones and enzymes which influence growth.
Good start : Small babies those who are born small may continue to be small.

DEFINITION

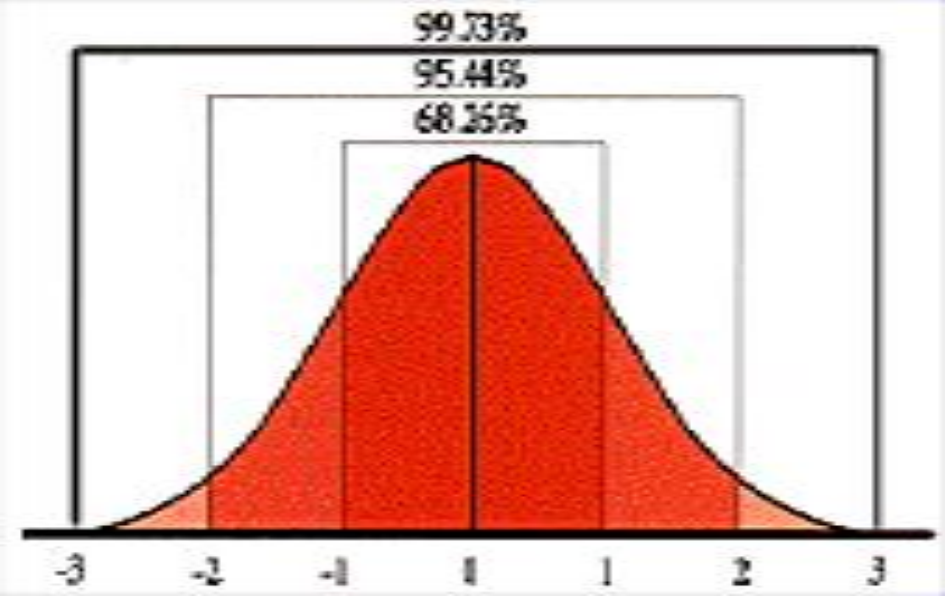
FTT (failure to thrive)

- FTT is a symptom rather than a disease or diagnosis.
- Weight below 3rd/ 5th centile for age.
- Weight (or weight for height) is more than 2 SD below the mean for age and sex.
- A child whose weight curve has crossed downward more than 2 major percentiles over aperiod of 6 months.

Weight below 3rd or 5th centile per say does not necessarily mean child is failing to thrive, it just indicate that he/she is small. The best definition is that a child who is not growing as expected for his age , race(genetic background), and environment.
FTT is caused by a lot of diseases but mainly it is related to nutrition, endocrine and neurological diseases.



DEFINITION



DEFINING FAILURE TO THRIVE CAN BE DIFFICULT

3rd percentile vs 5th percentile

2 standard deviations, 5th percentile

2.2 standard deviations, 3rd percentile

There are universal and local growth charts it's better to use our local growth chart. These charts are reviewed every ten years because of environmental and nutrition of population change every few years.

FTT - definition

FTT could be defined as an:

- Infant's growth deviated from an established pattern of age-appropriate growth.
- Regardless of the anthropometric indicator and cut off value selected, accurate interpretation of the growth data is dependent on serial measurements and not one point in time.

To know whether the child is growing adequately for his age or is failing to thrive we need a serial measurements.

Single measurement tells you where he is on the chart, it may tell you that he is below the expected or standard centiles or above or in between. But does not tell you what was happening to the child in the past. So, we need to have more than one reading serial measurements over expected time (age) to diagnose this phenomena or you can say this child is growing adequately or not.

The time between measurements depends on the age, the younger the age the faster the growth rate and the shorter the period. A child who is in the first few months of life we can weigh him every month or two, child who is above 3 years or 5 years we can see him every 6 months, older children we see them once a year.

NORMAL GROWTH

- Diagnosis of abnormal growth requires knowledge of normal growth patterns
- “Patterns of progression in weight and height that is consistent with the established standards for age”.

So, What's Normal?

- Infants should regain their birth weight by 2 weeks (15-30 g per day)

The growth parameters (weight and height and head circumference) is an important part of pediatric health surveillance that must be done in every pediatric clinic and should be documented and plotted in growth chart.

AGE	MEAN DAILY WEIGHT GAIN
0-3 M	**25-30 g**
3-6 M`	**17-18g**
9-12 M	**10 g**
1-3 Y	**7-10 g**
4-6 Y	**6 g**

The highest growth rate happens in utero After birth is still high and declines with age. Until puberty where there is growth spurt. And then you continue growing slowly for long time sometimes until closing of ossifying centers.

What is normal growth?

AGE	Median daily weight gain (grams)	Recommended daily allowance (kcal/kg/d)*
0-3 months	26-31	108
3-6 months	17-18	108
6-9 months	12-13	98
9-12 months	9	98
1-3 years	7-9	102
4-6 years	Approximately 6	90

The column in the right the daily calories needed for growth for normal children. Sick children may need more. It decreases by age till around 60 depends on daily activity.

*National Research Council, Food and Nutrition Board; Recommended Daily Allowance. Washington, DC. National Academy of Sciences, 1989.

AVERAGE GAINS IN WEIGHT AND LENGTH IN THE FIRST FIVE YEARS OF LIFE

Age	↑Weight	↑Length
0 – 1 week	↑10% loss	
1- 2 weeks	Birth weight regain	
2 weeks – 5 months	150 – 200 grams/week	
5 months	Birth weight doubled	1.3 x birth length
5 months – 1 year	Wt. gain velocity declines	
1 year	Birth weight trebled	1.5 x birth length
1 – 2 years	2 -3 kg/year	11 – 12 cm./year
2 – 5 years	2kg/year	Birth length doubled at about age 4.

These are approximation to help you if you don't have growth chart.

GROWTH GUIDELINES

WEIGHT-

- Birth weight is regained by the 14th day.
- During the first 3 months, the average gain is about 1 kg/month (about ½ to 1 oz/ day).
- Birth weight doubles at about 4 months, triples at 12 months, quadruples at 24 months.
- By six month, the average gain per month is 0.5kg.
- During the second year, the average gain per month is 0.25 kg.
- After age 2, the average annual increment is 2.3 kg

  (5 lb) until the adolescent growth spurt.

Babies lose 10% of their birthweight when they are born and they should regain their birthweight by the end of the second week.

GROWTH GUIDELINES

HEIGHT –

- Average birth length is 50cm (20 in).
- By the end of the first year, birth length increases by 50%.
- Birth length doubles by 4 years.
- Birth length triples by 13 years.
- Average annual growth is 5 cm (2 in) or better per year.

GROWTH GUIDELINES

- A nice rule of thumb for head circumference is the 3 & 9 rule. A newborn has a head circumference of 35 cm, a 3 month has a circumference of 40 cm, a 9 month has a circumference of 45 cm, a 3 year old has a circumference of 50 cm, and a 9 year old has a circumference of 55 cm.

When we talk about failure to thrive we mean mainly infants and we mean mainly weight; however we cannot separate height and weight, sometimes children they cease to gain weight and later they cease gaining height. In case of acute malnutrition (starvation) what growth parameter will get affected first?
Weight.
If malnutrition becomes chronic what is going to be affected next?
Height and then head circumference.
That's why when we calculate the weight : height ratio in acute stage we find it below the 3rd or 5th centile, while when calculated in chronic stage it is not going to be decreased that much why? Because both weight and height are affected.

FTT classification?

- FTT is best considered a physical sign of undernutrition and not a clinical syndrome caused by "organic" or "nonorganic" factors
- The underlying cause of FTT is INSUFFICIENT USABLE NUTRITION TO MEET THE DEMANDS FOR GROWTH.
- FTT = INADEQUATE NUTRITION.
- GROWTH = ENERGY INPUT – E. OUTPUT

The energy we gain is spent in activity and metabolism and the net goes to build up our cells and tissue.

NOT FTT

- Infants and young children may cross major percentile lines on growth curves during a normal course of growth. Therefore, documentation of weights or lengths falling off of growth channels is not, by itself, proof of FTT.
- Approximately 25% of normal children will have a shift in their wt curve,then follow a normal curve– this is not FTT.
- Premature/ IUGR wt may be less than 5th centile but grow parallell to centiles and may catch up late.

Some babies are born small to there genetic background due to IUGR or any other mother condition but if they are fed well they can grow and catch up.

Some babies are born big to there genetic background due to mother diabetes but then they grow according to genetic potentials.

Failure to thrive : category causes

Most pathological explanations for failure to thrive can be broken up into of the following groups:

- Inadequate caloric intake
- Inadequate absorption
- Increased metabolism
- Defective utilization

Failure to thrive: category causes

- Inadequate caloric intake
  - Incorrect preparation of formula (too diluted, too concentrated). Formula milk contains 67 calories per 100 ml.
  - Unsuitable feeding habits (food fads, excessive juice)
  - Behavior problems affecting eating
  - Poverty and food shortages
  - Neglect **Depressed mother, first time to be mother, post partum depression, short temper**
  - Disturbed parent-child relationship
  - Mechanical feeding difficulties (oromotor dysfunction, congenital anomalies, central nervous system damage, severe reflux) Very common

Failure to thrive: category causes

- Inadequate absorption
  - Celiac disease
  - Cystic fibrosis
  - Cow's milk protein allergy
  - Vitamin or mineral deficiencies (acrodermatitis enteropathica, scurvy)
  - Biliary atresia or liver disease
  - Necrotizing enterocolitis or short-gut syndrome

Food intake is adequate and it gets digested and goes to small intestines but it does not get absorbed

Failure to thrive: category causes

- Increased metabolism
  - Hyperthyroidism
  - Chronic Infection (human immunodeficiency virus or other immunodeficiency, malignancy, renal disease).
  - Hypoxemia (congenital heart defects, chronic lung disease)

They need more energy because they utilize more

Failure to thrive: category causes

- Defective utilization
  - Genetic abnormalities (trisomies 21, 18, and 13)
  - Congenital infections
  - Metabolic disorders (storage diseases, amino acid disorders).

The energy is there, it goes to the cells but the cell does not use it, it is programmed not to use energy.
FTT is a sign of many genetic diseases no matter how much the intake is they will never make use of it, they will never grow, they are programmed to be small. An example is Russell-Silver syndrome they are born small and they will be small.

EVALUATION

- Accurately plotting growth charts at every visit.
- Use correct growth charts!
- Evaluate the trends
- History and Physical more important than labs

You need to use the right chart and you need to know how to plot. There are different charts for boys and girls and for different ages so you have to use the right chart and plot height and weight in every visit.

FTT - History

- Generally, children who fail to thrive have nutritional inadequacies.
- The history and physical examination initially should focus on these problems, with special attention to feeding disorders and vomiting.
- Review of specific dietary practices, formula preparations, and feeding techniques, including caregiver/child interaction, is imperative.

HISTORY

- **Pregnancy/Birth**
  LBW, IUGR, prematurity, postnatal complications, tube feeding. **Substance abuse? postpartum depression?**
- **Dietary** type of food, time spent over meal, number of meals, self feed, formula/supplements, unusual feeding behavior, who feeds?
- **Past medical history**
  Illnesses, hospitalizations, reflux, vomiting, stools, difficulty swallowing
- **Social**
  Who lives in the home, family stressors, poverty, drugs?
- **Family**
  Parental height, siblings, Medical condition (or FTT) in siblings, mental illness, stature?

This list is very nice go over them one by one but it covers most of the important points.

DIETARY HISTORY

Important

- Assess methods of feeding
- breastfeeding patterns (including maternal diet use of medications that can affect milk production and let-down such as alcohol or diuretics)
- formula preparation
- volume consumed
- feeding techniques.
- Caloric counts- food diary
- A detailed his**to**ry of formula preparation :may reveal a dilute formula that contains insufficient calories and excess water.

Dietary Associations With Poor Growth in Young Children

- Breastfeeding difficulties
- Improper formula mixing
- Poor transition **to** food (6 **to** 12 months of age)
- Excessive juice consumption
- Avoidance of high-calorie foods

Examination: Key Points

Go over them and read it carefully it is really helpful, you would not miss a diagnosis if you use this list.

- Infant eye contact (if avoids may be abuse)
- Poor suck or motor skills
- Watch caretaker feed the infant!!!
- Plot height, weight and head circumference
- Dysmorphic features
- Systems examination
- Skin: scars, jaundice, eczema, bruises or rash
- Signs of neglect or abuse.
- Inappropriate behavior.

Physical Examination

- Observe parent-child interactions
  - Especially during a feeding session
    - How is food or formula prepared?
    - Oral motor or swallowing difficulty?
    - Is adequate time allowed for feeding?
    - Do they cuddle the infant during feeds?
    - Is TV or anything else causing a distraction?

INVESTIGATIONS

- Lab tests should be guided by H&P.
- Less than 2% of the lab studies performed in evaluating children with FTT were useful.
  Sills RH AM J Dis Child 1978

Investigations

Rule 1 ⇒ if Hx & exam is negative
unlikely to find a cause

Rule II ⇒ NO FISHING

Rule III ⇒ Guided by finding Hx and exam.

Initial work up

- **CBC-d + ESR**
- **Electrolyte profile**
- **Urine analysis**
- **Stool analysis**
- **Bone profile.**

Specific investigations.

FTT

FTT is strongly associated with neurodevelopmental deficits. The rest is repetition but you can read it.

- It is unclear how many children have adverse neurodevelopmental outcomes from FTT.
- Extensive laboratory screening is of little utility in the evaluation of FTT.
- Certain children who appear to have FTT may be biologically programmed to be smaller and thinner than most children. Insulin resistance may be a mechanism, and aggressive nutritional intervention may put these children at risk of developing metabolic syndrome

Why isn't this baby growing?

These are common considerations according to the age

Age on onset	Diagnostic considerations
Before birth (IUGR, prematurity)	Especially in "symmetric" IUGR, consider prenatal infections, congenital syndromes, teratogenic exposures (anticonvulsants, alcohol, etc.).
Neonatal	Incorrect formula preparation; failed breastfeeding; neglect; poor feeding interactions; metabolic chromosomal, or anatomic abnormally (less common).
3-6 months	Underfeeding (possibly associated with poverty); improper formula preparation; milk protein intolerance' oral-motor dysfunction; celiac disease; HIV infection; cystic fibrosis; congenital heart disease.
7 -12 months	Autonomy struggles; overly fastidious parent; oral-motor dysfunctions; delayed introduction of solids; intolerance of new foods.
After 12 months	Coercive feeding; highly distractible child; distracting environment; acquired illness; new psychosocial stressor (divorce, job loss, new sibling, death in the family, etc.)

Medical causes of inadequate intake that may be overlooked

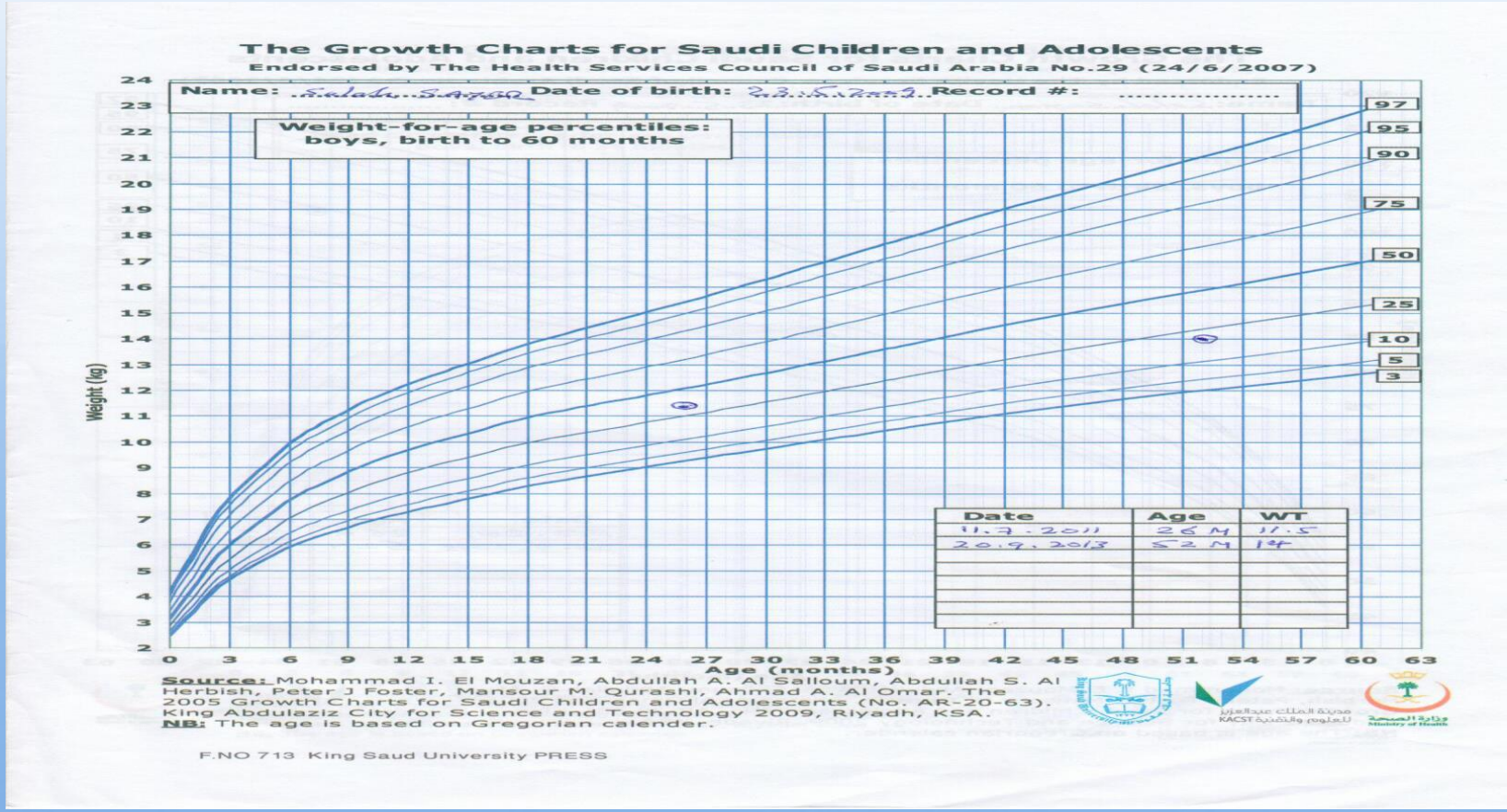
These are common causes, depending on category

Infectious: Giardiasis other parasites (e.g., nematodes) Chronic UTI, Chronic sinutis
Mechanical: Adenoid hypertrophy, Dental lesions, Vascular slings, GE reflux with esophagitis
Neurologic: Oral-motor dysfunction (gagging, tactile hypersensitivity).
Toxic/metabolic: Lead toxicity, Iron deficiency, Zinc deficiency
Gastrointestinal: Celiac disease, Malabsorption (various causes), Chronic constipation.

Diagnostic red flags for FFT

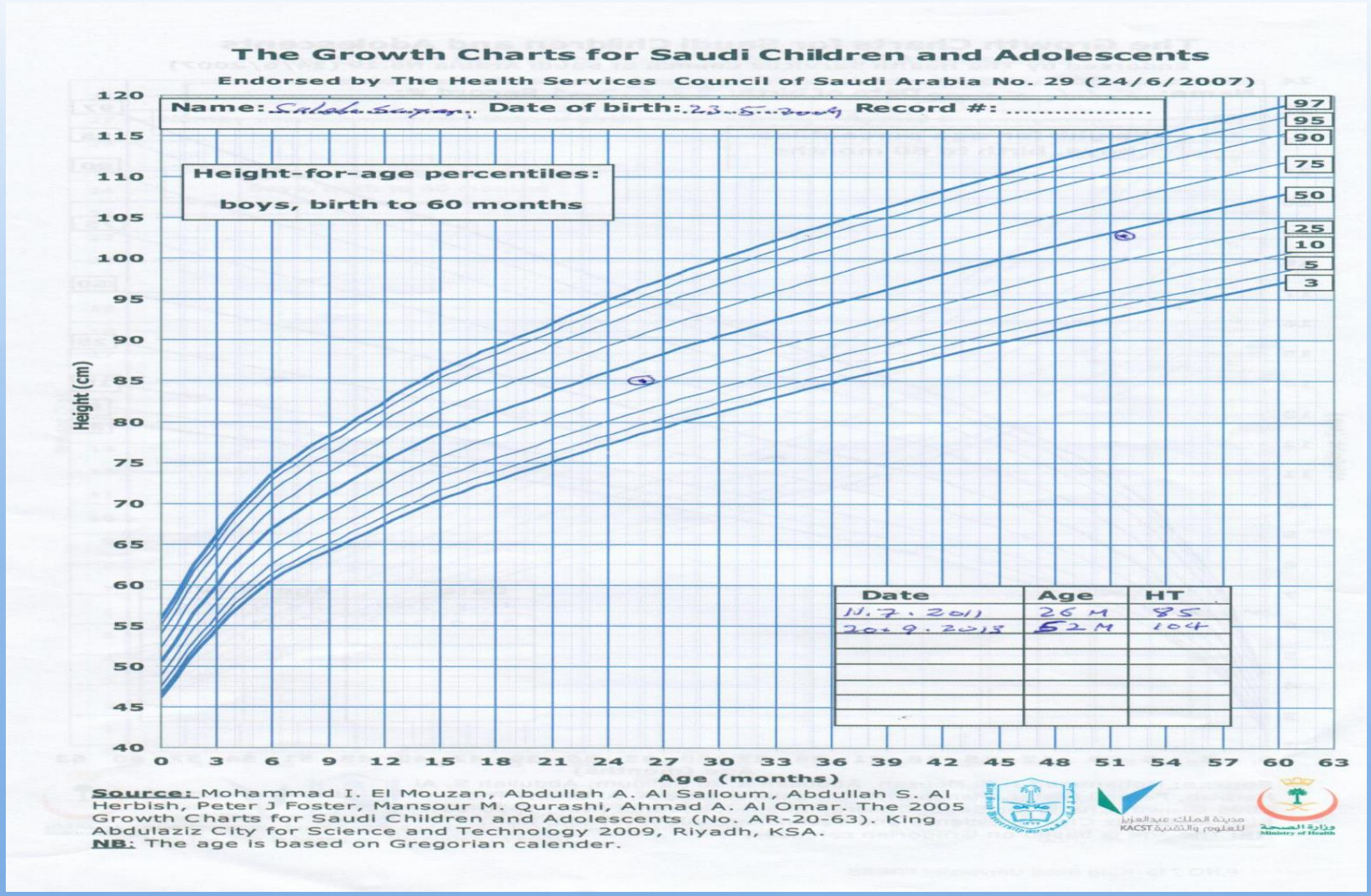
History	Diagnostic consideration	Investigation
Spitting, vomiting	Gastroesophageal reflux	Upper GI series, Ph probe, esophagoscopy
Abdominal distension, cramping, diarrhea	Malabsorption (e.g., cystic fibrosis, celiac disease, lactase deficiency)	D-xylose test, stool fat, antigliadin titer or biopsy, swear chloride.
Travel to or from developing country; homeless, overcrowded, or living in shelter	Parasitosis (especially giardia), TB inadequate access to cooking facilities and refrigeration	Stool O & P, duodenal biopsy, string test, PPD
Snoring, periodic breathing during sleep, restless sleep, noisy or mouth breathing	Adenoid hypertrophy	Lateral neck film (soft tissues and airway)
Symptoms of asthma, bronchitis	Chronic aspiration, cystic fibrosis.	Chest film, radionuclide scan for aspiration, sweat chloride*
Polyuria, polydypsia, polyphagia	Diabetes	Blood glucose
Frequent (minor) infections	HIV, other immune deficiency	Serologic tests, immunoglobulins, * PPD with control for anergy*

* May be abnormal secondary to malnutrition

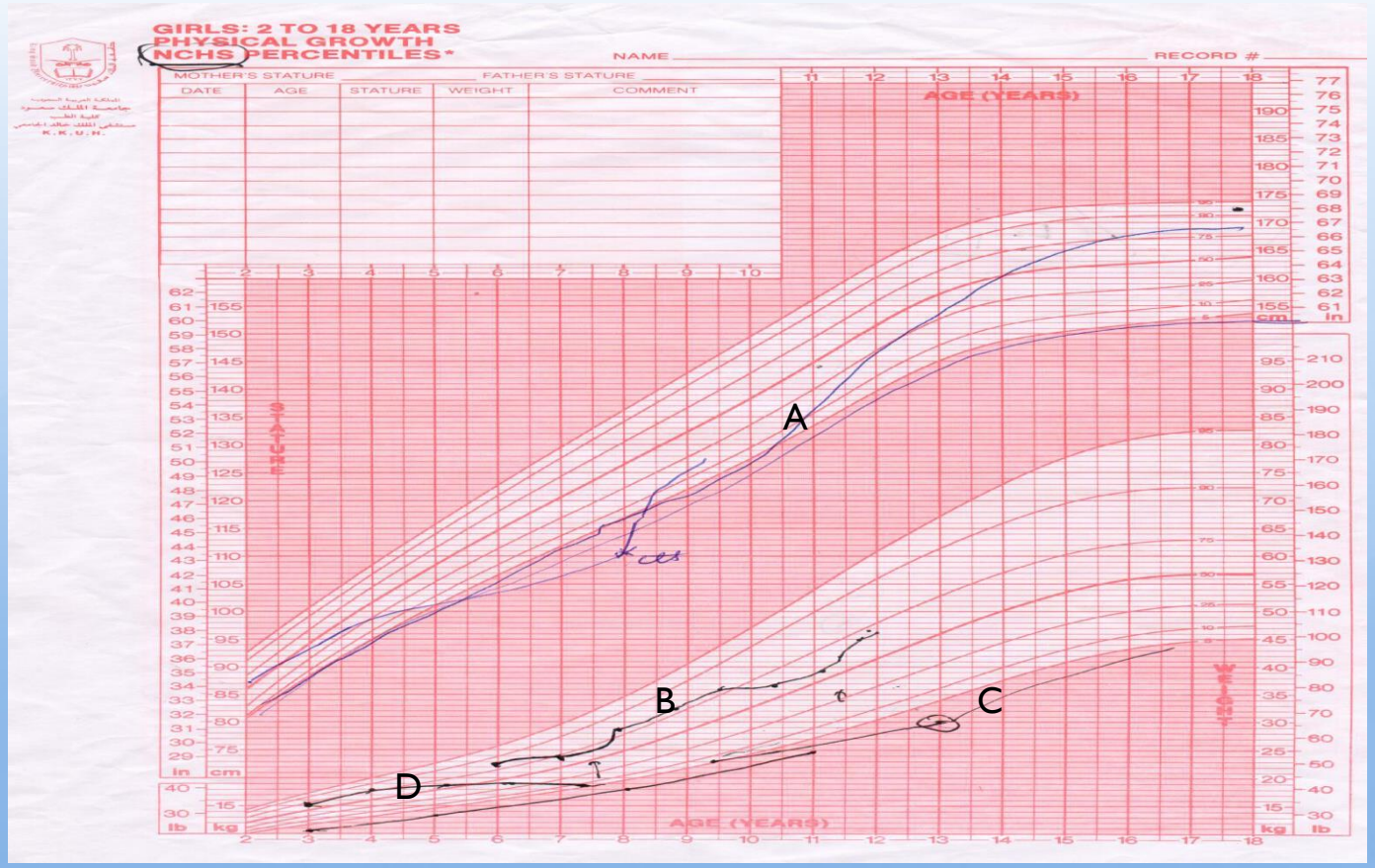


This child was above 25th centile at 26 months of age, then he drop below 25th centile at 52 months of age. This is normal he is probably going back to his genetic. This is slow after almost 2 years he became below 25th centile. we need to follow him overtime and if he crosses 10th centile for example it would be abnormal.

Here the decline is slow it took almost 2 years, and he went from above 25th centile to below it, so it is not dramatic drop..



This is the same child here is the height plotted in chart. Some children do not gain weight instead they gain height they become slimmer but they are growing.



A. It is going parallel to the centile so he is growing he started his life as small child.
B. This child had acute illness he lost weight and then he regain it and that is typical for children
C. This child has disease he lost weight and then treated and now he is catching up.
D. This is abnormal, this child is steadily going down over short period.

A,B,C are normal D is abnormal.

MANAGEMENT

The doctor skipped the rest

- Goal is “catch-up” weight gain
- Most cases can be managed with nutrition intervention and/or feeding behavior modification
- General principles:
  - High Calorie Diet
  - Close Follow-up
- Keep a prospective feeding diary-72 hour
- Assure access to food programs and other community resources

CALORIC REQUIREMENT

- To determine caloric requirements for infants :
- RDA for age (kcal/kg) x ideal weight for height (kg)/actual weight (kg)

INTAKE

- Energy intake should be 50% greater than the basal caloric requirement
  - Concentrate formula, add rice cereal to pureed foods
  - Add taste pleasing fats to diet (cheese, peanut butter, ice cream)
  - High calorie milk drinks (e.g Pediasure has 30 cal/oz vs 19 cal per oz in whole milk)
  - Multivitamin with iron and zinc
  - Limit fruit juice to 8-12 oz per day

WHEN TO HOSPITILIZE

- Do you hospitalize?
  - Rarely necessary
  - Consider if:
    - the child has failed output management
    - FTT is severe
      - Medical emergency if wt <60-70% of ideal wt
      - Hypothermia, bradycardia, hypotension
    - safety is a concern

HOSPITILIZATION

- For difficult cases:
  - Multidisciplinary team approach produces better outcomes
    - Dietitians
    - Social workers
    - Occupational therapists
    - Psychologists
  - NG tube supplementation may be necessary

TAKE HOME MESSAGES

1. Evaluation involves careful H&P, observation of feeding session, and should not include routine lab or other diagnostic testing

2. Nutritional deprivation in the infant and toddler age group can have permanent effects on growth and brain development

4. Earlier intervention may make it easier to break difficult behavior patterns and reduce sequelae from malnutrition

TAKE HOME MESSAGES

- Accurate plotting is essential
- Most important evaluation is H&P
- Dietary history and social milieu are important clues.
- Key is to observe family/infant interactions.
- Selective labs may be useful.
- Catch up growth requires increased calories, and there are many ways to achieve this


THANK
YOU

1) A 2-month-old male infant is brought for a routine health supervision visit. His mother reports that he cries a lot. He feeds vigorously then regurgitates. The regurgitation is nonbilious and nonprojectile. Findings on physical examination are normal except for the fact that the infant's weight has fallen from the 60th to the 25th percentile for age.

Of the following, the MOST likely diagnosis is:

A. adrenal insufficiency
B. cystic fibrosis
C. gastro esophageal reflux
D. poor feeding technique
E. pyloric stenosis

2) A 6-month-old infant has a large ventricular septal defect complicated by congestive heart failure. His corrective surgery has been delayed because of 2 hospitalizations for bronchiolitis during which he lost weight. He is currently feeding 24 kcal/oz formula, but has not shown any weight gain, and his weight is now below the third percentile for his age. The baby has a good suck, but he takes no more than 60 to 75 mL every 4 hours.

Of the following, the BEST next step to increase this baby's energy intake is to

A. add microlipid to the current formula

B. add protein powder to the current formula

C. change to an amino acid-based formula

D. increase the caloric density of the current formula to 35kcal/oz

E. start total parenteral nutrition

3) You are examining a girl at her 1-year health supervision visit. Her weight, length, and head circumference all were at the 10th percentile at birth. There were no pregnancy, labor, delivery or nursery complications. Physical examination reveals her weight. Length, and head circumference are at the 5th percentile.

Of the following, this child's growth parameters MOST likely represent:

A. a chromosomal abnormality
B. a malabsorptive disorder
C. an endocrine disorder
D. inadequate caloric intake
E. normal growth

4) You review a recent clinical case of a 15-month-old boy followed in the well child clinic since 3 months of age. He has a chronic cough and has had 3 episodes of pneumonia in the past 12 months. He was brought in for evaluation of pale foul-smelling diarrhea. His mother described bulky and greasy stools, gassiness, and abdominal distention. Review of the growth chart demonstrated decreasing weight from the 38th percentile at birth to the 10th percentile.

Of the following, the cause of diarrhea in children with this disorder is

A. cow milk protein intolerance

B. disaccharidase deficiency

C. endocrine pancreatic insufficiency

D. exocrine pancreatic insufficiency

E. small bowel bacterial overgrowth

5) You are evaluating a 2-year-old child for failure to thrive. The dietary history suggests the boy's caloric intake is 100 kcal/kg per day, which is the recommended dietary allowance (RDA) for his age. He has not been vomiting, and he is passing one to two normal bowel movements per day. On physical examination, he appears to be an active, happy, thin toddler. His weight is 10.5 kg (5^{th} percentile), height is 85 cm (25^{th} percentile. There is mild eczema on the cheeks and antecubital fossae. The abdomen is not distended, and other finding are normal.

Of the following, the BEST explanation for this child not gaining weight is that he has:

A. a food allergy
B. caloric requirements that exceed the RDA
C. celiac disease
D. cystic fibrosis
E. reflux esophagitis

6) Both the weight and height parameters of a 6-month-old girl have dropped to substantially below the 5th percentile for age. Until 2 months of age, she had maintained growth at the 50th percentile. At that time, her mother returned to work and the grandmother assumed her care. She has received iron fortified formula since birth and currently ingests 6 oz every 4 hours.

Of the following, the best INITIAL step in management of this child is to:

A. determine how the formula is mixed
B. obtain a creatinine level
C. obtain a sweat test
D. obtain thyroid function studies
E. reassure the mother that this is a normal growth pattern

Answers:

1. **C** (her weight dropped from 60th centile to 25th centile over 2 months which is abnormal, she cries because of pain, she regurgitates because of feeding vigorously, best explained by gastro esophageal reflux)
2. **A** (we need to increase the energy without increasing the volume because he has heart failure so we add microlipid, which1 gm has 9 calories anything else would not add the same energy).
3. **E** (this is normal growth over a year he crosses a centile).
4. **D** (it is most likely cystic fibrosis)
5. **B** (normal child he needs more calories especially if they are more active, if there is food allergy he would have bloody diarrhea).
6. **A**