Background of the lecture

- The importance of anthropometrics and somatoscopy assessment in childhood.
- Physical development characteristics --
  * Growth or stature
  * The body weigh (mass)
  * The head and chest circumferences
- Percentile values
- The standard deviations method
- The interference of genetic and environmental factors ensuring the physical development in children.
- Physical development in children of the different age
- Semiotics of physical developmental abnormalities

Physical development of different age groups children. Semiotics of the developmental abnormalites.

The importance of anthropometrics and somatoscopy in childhood.

It is well known that the pediatricians weight and measure a patient`s body very often in their practice. The day by day observation of the child growth is exceedingly important in deal of prevention and in time evoluation different diseases by recognition of deviations from the typical anthropometric rates in childhood.
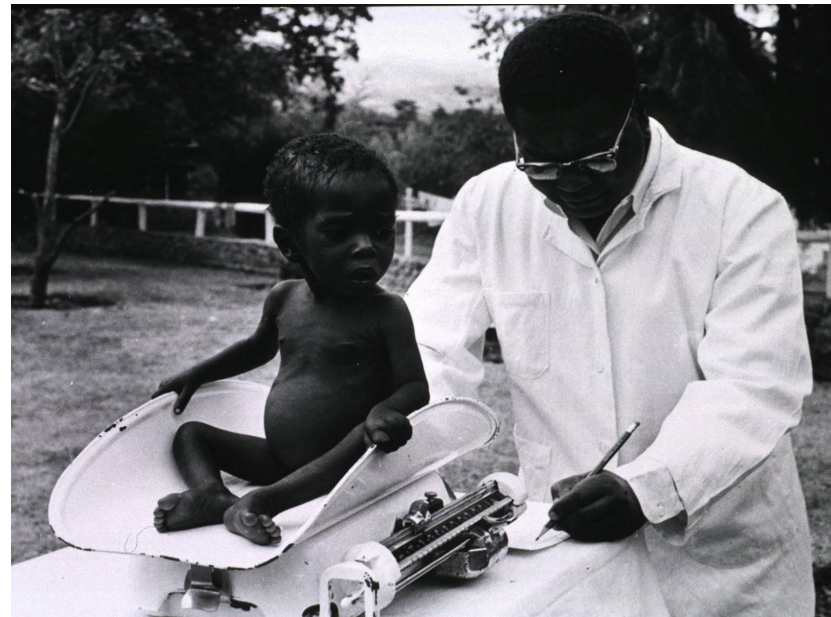
Growth assessment is an essential component of pediatric health surveillance. Many biophysiologic and psychosocial problems can adversely affect growth, and aberrant growth may be the first sign of an underlying problem. The most powerful tool in growth assessment is the growth chart used in combination with accurate measurements of height, weight, and head circumference.

Following to practical purposes it is considered that the **growth process** means the increase of the body in size. The notion of **development** in children reflects the gradual functional maturation. Often in common professional practics the term of the **physical development** is used. It unites both of the notions listed above.

The main Goal of Pediatrics is bolted in Declarations of the Children Rights (Helsinki, 1977): "to help a child to reach his (her) potential maximum in respect of growing and development to a moment of adultness".

Starvation in Sudan. By Kevin Carter (1960-1994)

The below characteristics enter
In "the physical development"
notion.

*Physical developmental characteristics* - **Growth or stature**

- **In anthropomethric and methrological sense the Grouth is an instant point estimation in centimetres of the body height in children older 2 years becouse their measurements conduct the standing up position or body length in small children becouse they are managed lying.**

Physical development characteristics – **the body weigh (mass)**

The human body mass is quantity of anatomical material and is measuring in kg or g.

Physical development characteristics – the head and chest circumferences

This parameters are measured due to the big importance of brain shaping assessment. Also the typicalness of the body proportions must be evaluated. The results have to be given in cm.
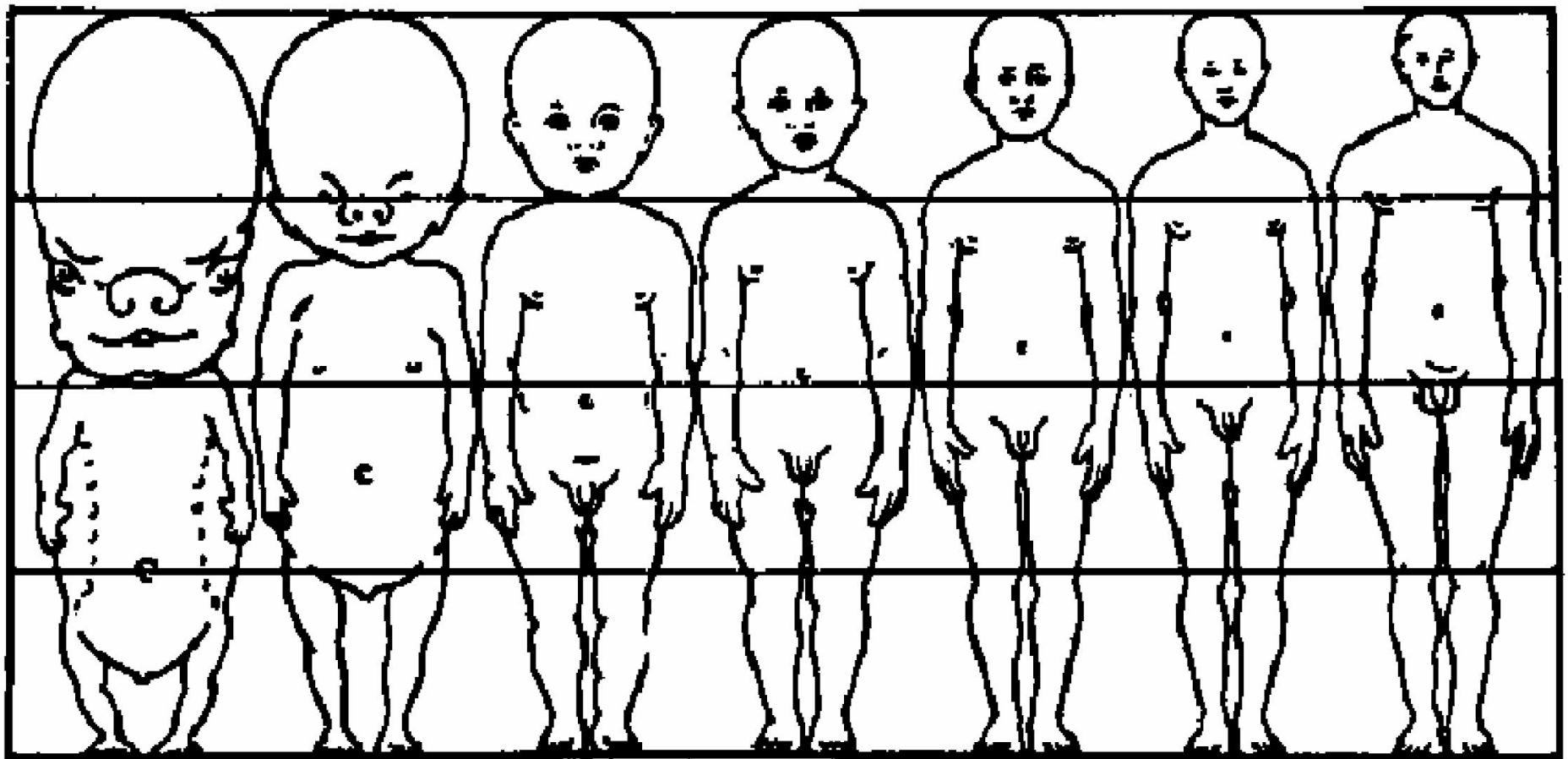
fetal

8 нед.   20 нед.   новорожденный   2   6   12   25 лет

The human body proportion changes in ontogenesis

The Physical development as a dynamic process must be defined as a progression of the human body sizes increasing being controlled geneticaly, by food supplamentation and by special familial   behavioural condition. This process should be illustrated with proper numeral sequence or graph containing the individual anthropometric measurements. Also in it every measurement opposite the child age in weeks, monthes or years must be present without fall.
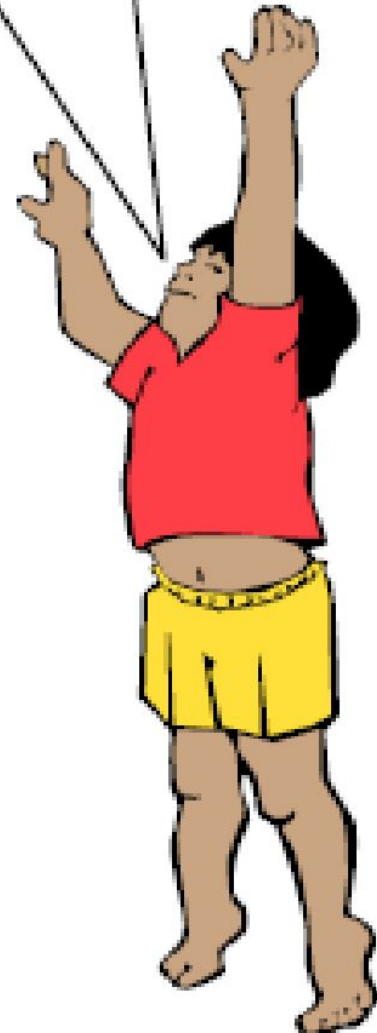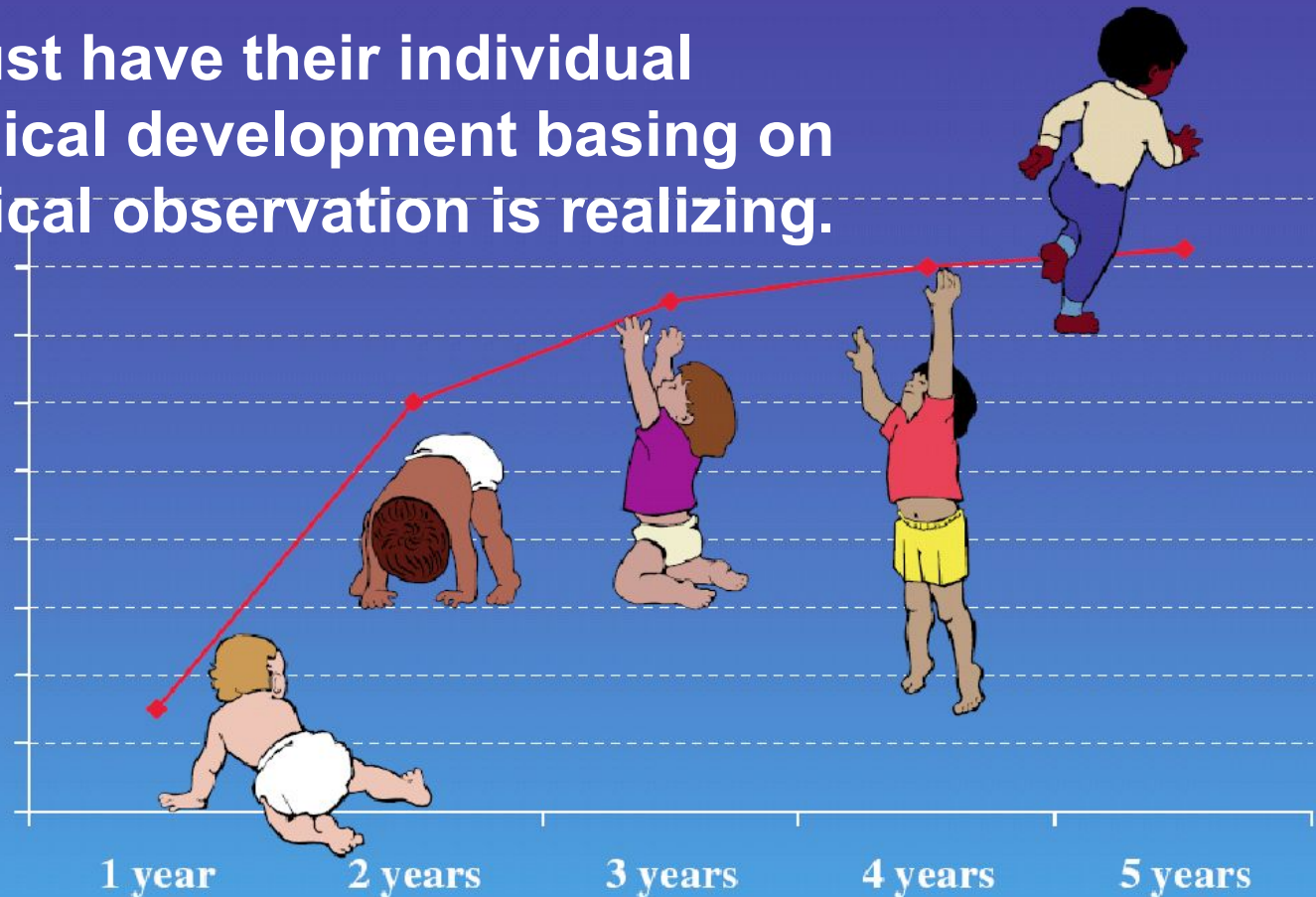
What have we know about anthropometric investigations in children?

№ 1

To know the current body length/height, head circumference and body weight they have to be measured with balances and cm-tape. Non of one even claver formulas should not substitute the process of anthropometry.

№ 2

It is necessary to measure the weight as often as it is possible. Suddenly the results could be important tomorrow!

As a minimum the anthropometrics should be evaluated:

- in newborns in the delivery department at list twice – after birth and at day of discharge;
- in infants every month;
- in toddlers every 4 – 6 mo;
- in other children every year

№ 3

The anthropometric results must be analysed.

There are a lot of empirical formulas and rules of growth and development in children. Most of them are based on relationships between the age and body measurements. For instance, well known dependence "weigh-for age" in children from 1 to 10 yr old:

$$M = 10 + 2n \ (кg),$$

where   10 – average body mass of the 1 yr old,
n   – years in the range of 1 – 10.

№ 4

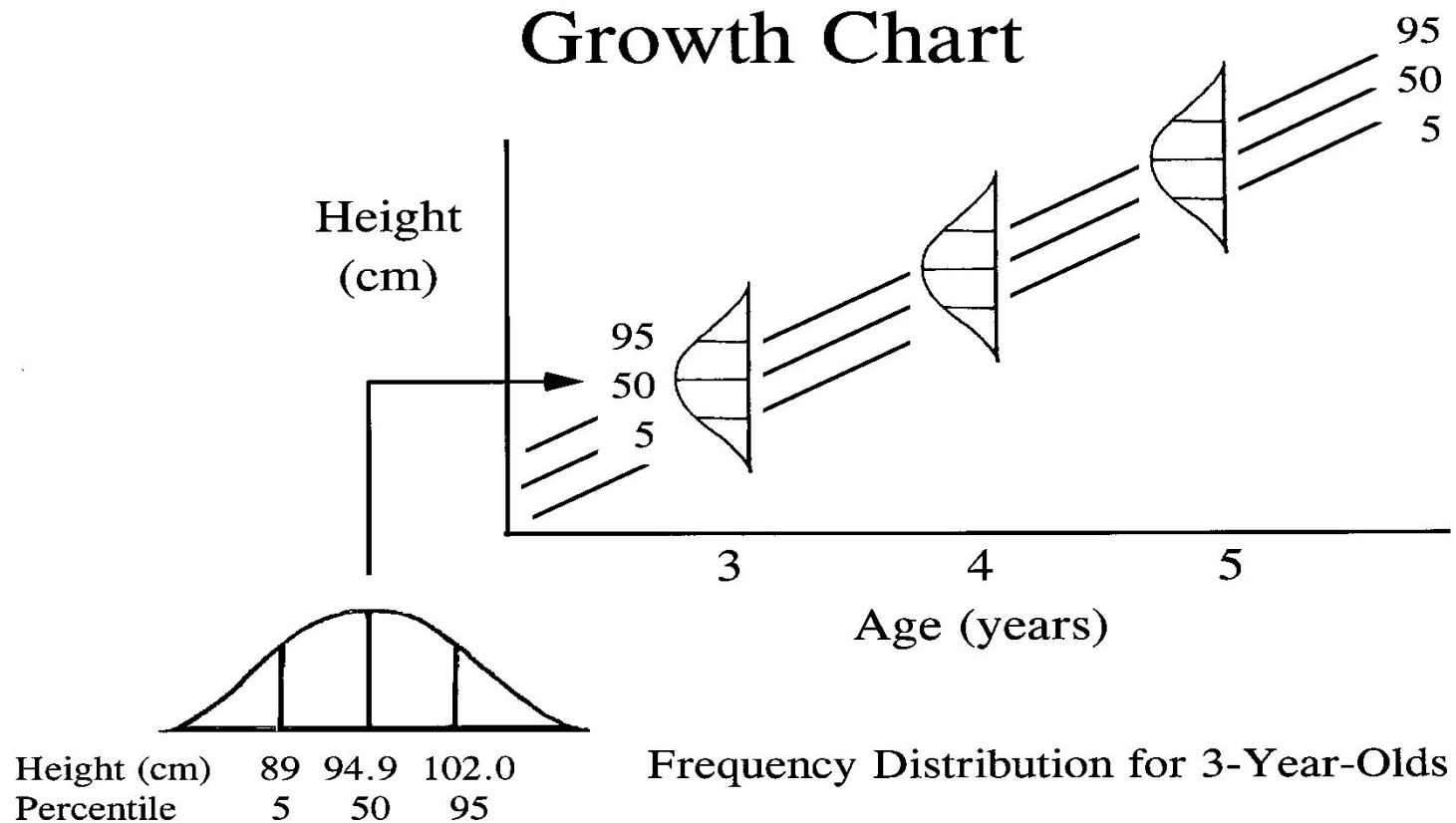**Never forget about statistics!**

It is considered that the most efficient method is the method founded on the medical variational statistics which confirms that the biological values must be valued with their variability (variations). No any one single numeral can not reflect the "normal rate". Usually the normal rate disposes in borders between the lowest and the highest possible expectations.

№ 5

In estimation of the results of anthropometry the most correct conclusions can be made on basis of the percentile tables or graphs method and/or standard deviations analysis. Both methods are founded on the variational mathematical statistics.

This background information (the graphs, tables) is recommended always to have available in the practitioner` office.

What is a percentile?

Growth Chart

Frequency Distribution for 3-Year-Olds

| Height (cm) | 89 | 94.9 | 102.0 |
| Percentile | 5 | 50 | 95 |

Relationship between percentile lines on the growth curve and frequency distributions of height at different ages.
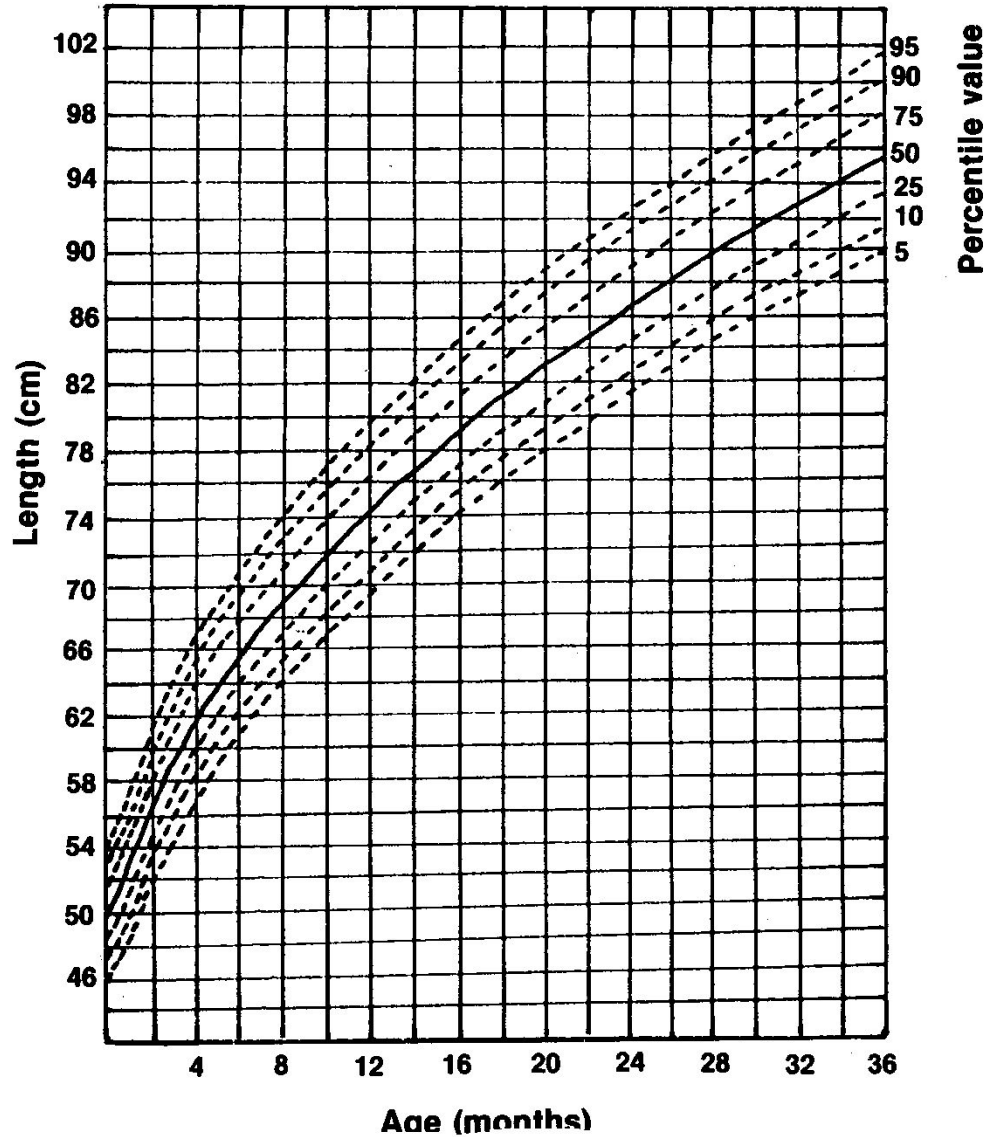
Growth Curve
(Length)
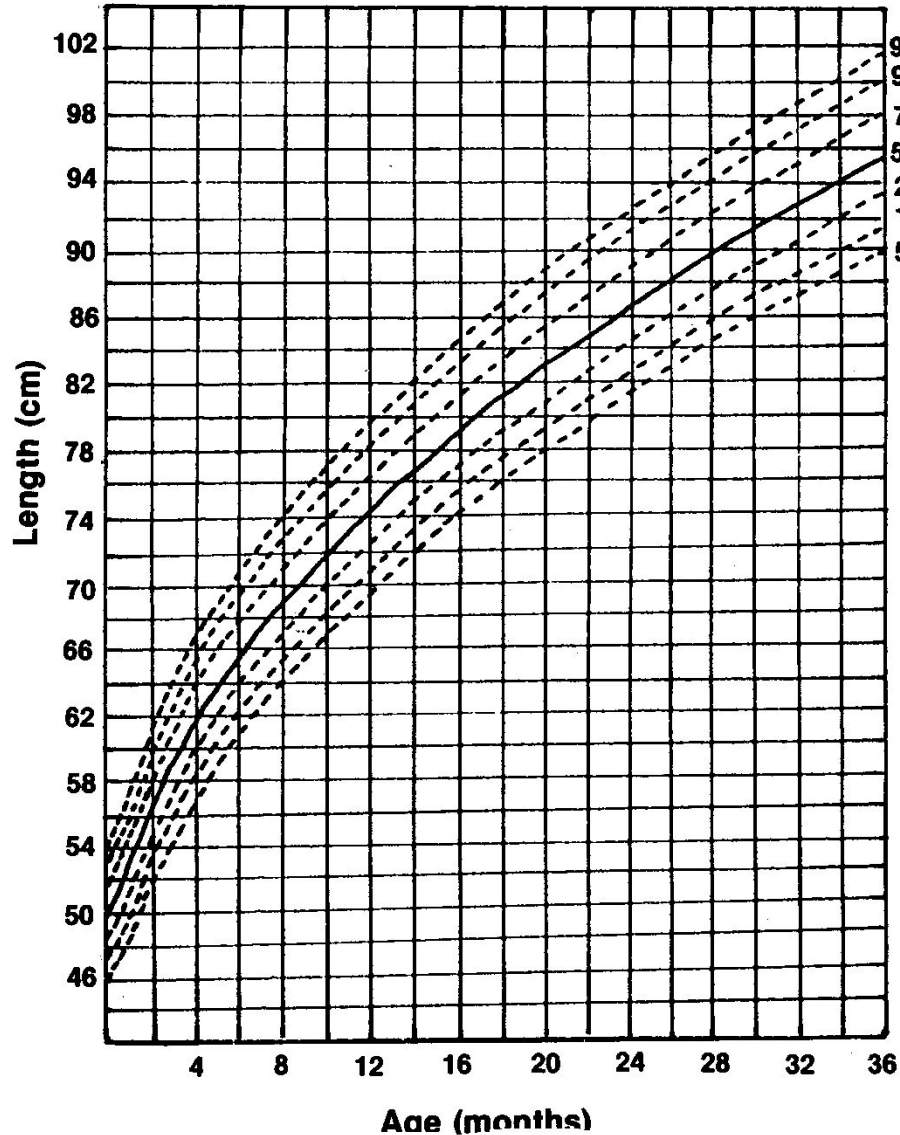
If to build a graph having the child age postponed on horizontal axis and the anthropometric value (for instance, growing) on vertical axis it is possible to point the 5-th, 10-th, 25-th, 50-th, 75-th, 90-th, 95-th percentile values for every age interval. If connect by line all the points of one percentile in different ages the percentile curves or graphs can be obtained. It is very important that this percentile graphs reflect the statistical variants of the child development. Usually the graphs are elaborated for boys and girls apart because their anthropometric values differ.

Growth Curve
(Length)

How to use percentile tablas?

Growth Curve
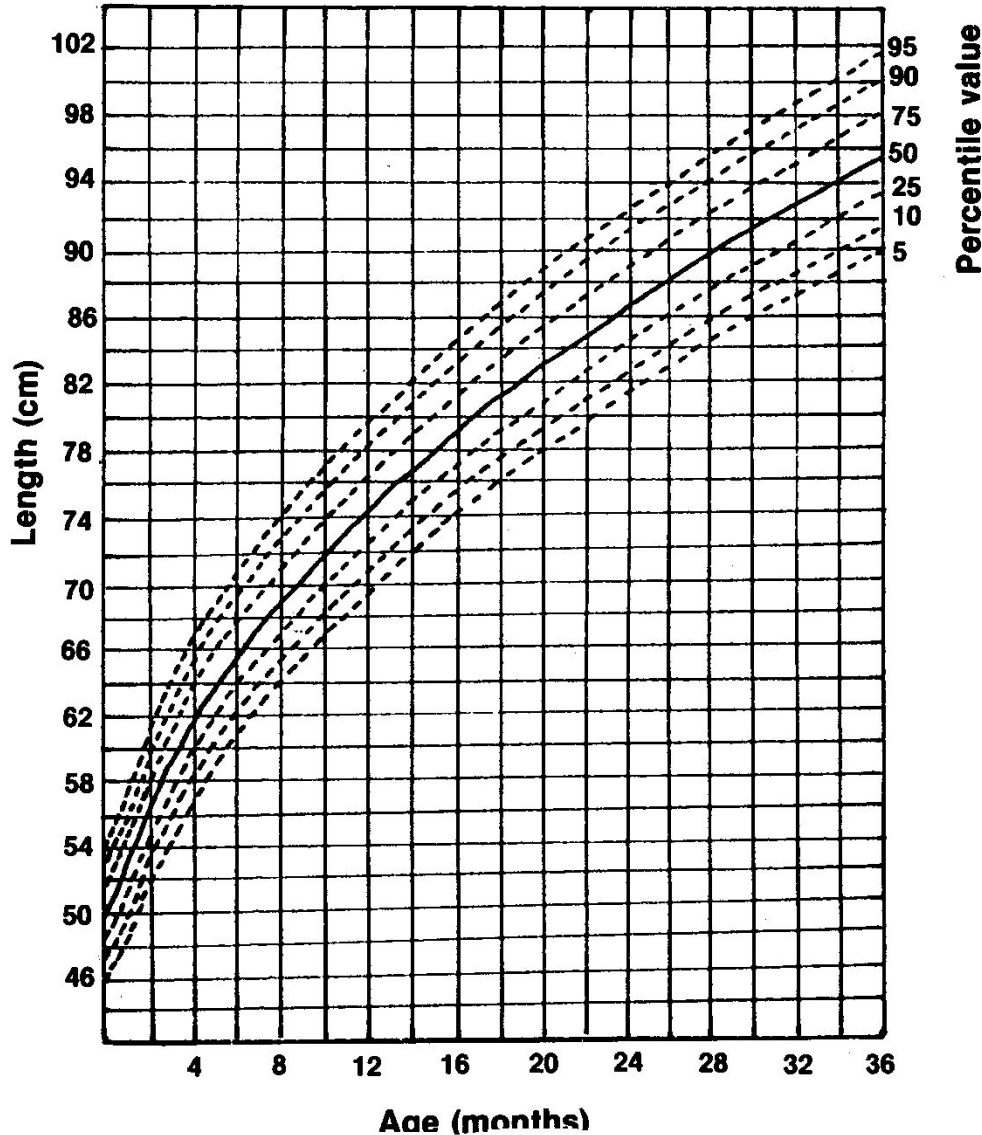## (Length)
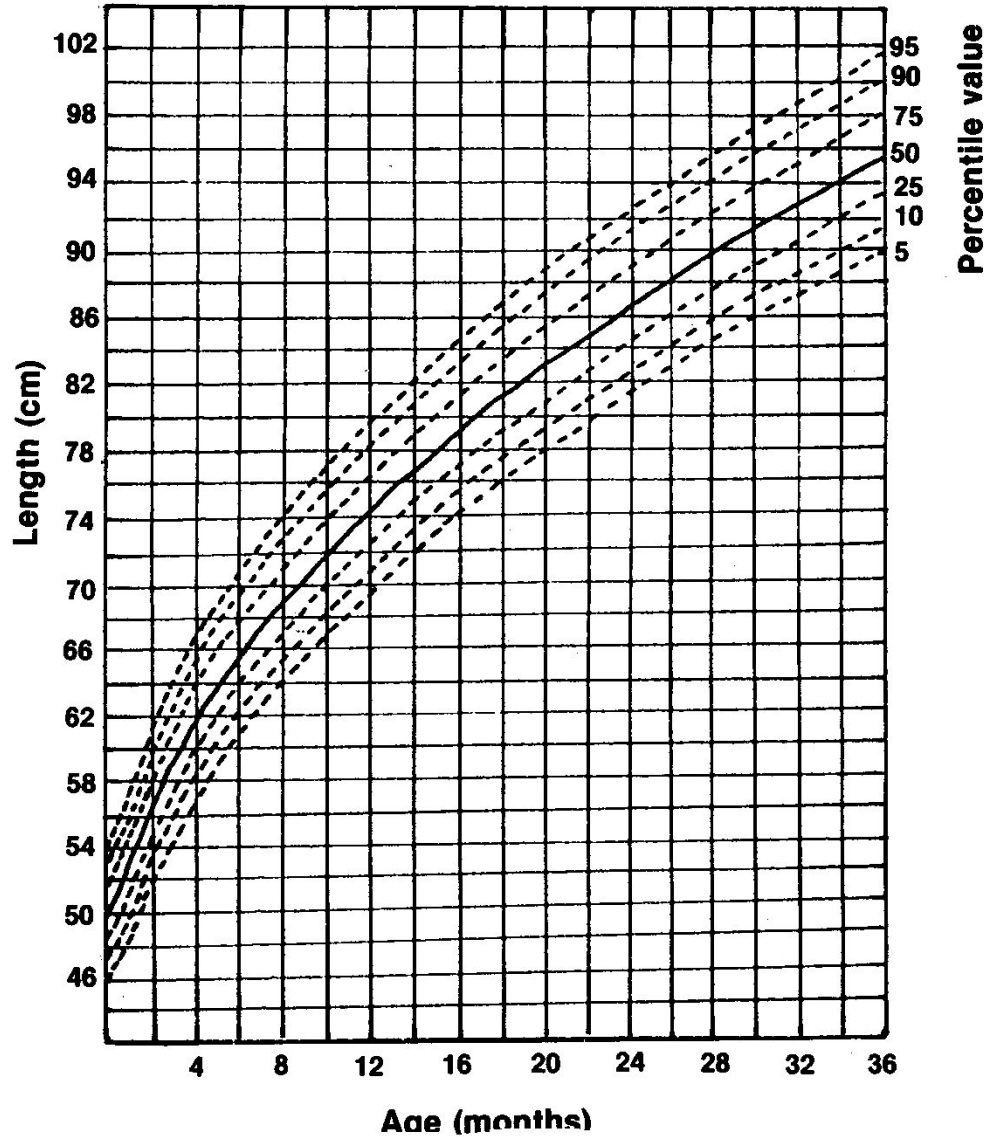
To respect gender differences, age and chosen anthropometric

boys

Growth Curve (Length) boys

To respect the gender differences, age and chosen anthropometry

To set the growth (body length) value as a point directly on the graph

Growth Curve
(Length)
boys

Length (cm): 102, 98, 94, 90, 86, 82, 78, 74, 70, 66, 62, 58, 54, 50, 46

Percentile value: 95, 90, 75, 50, 25, 10, 5

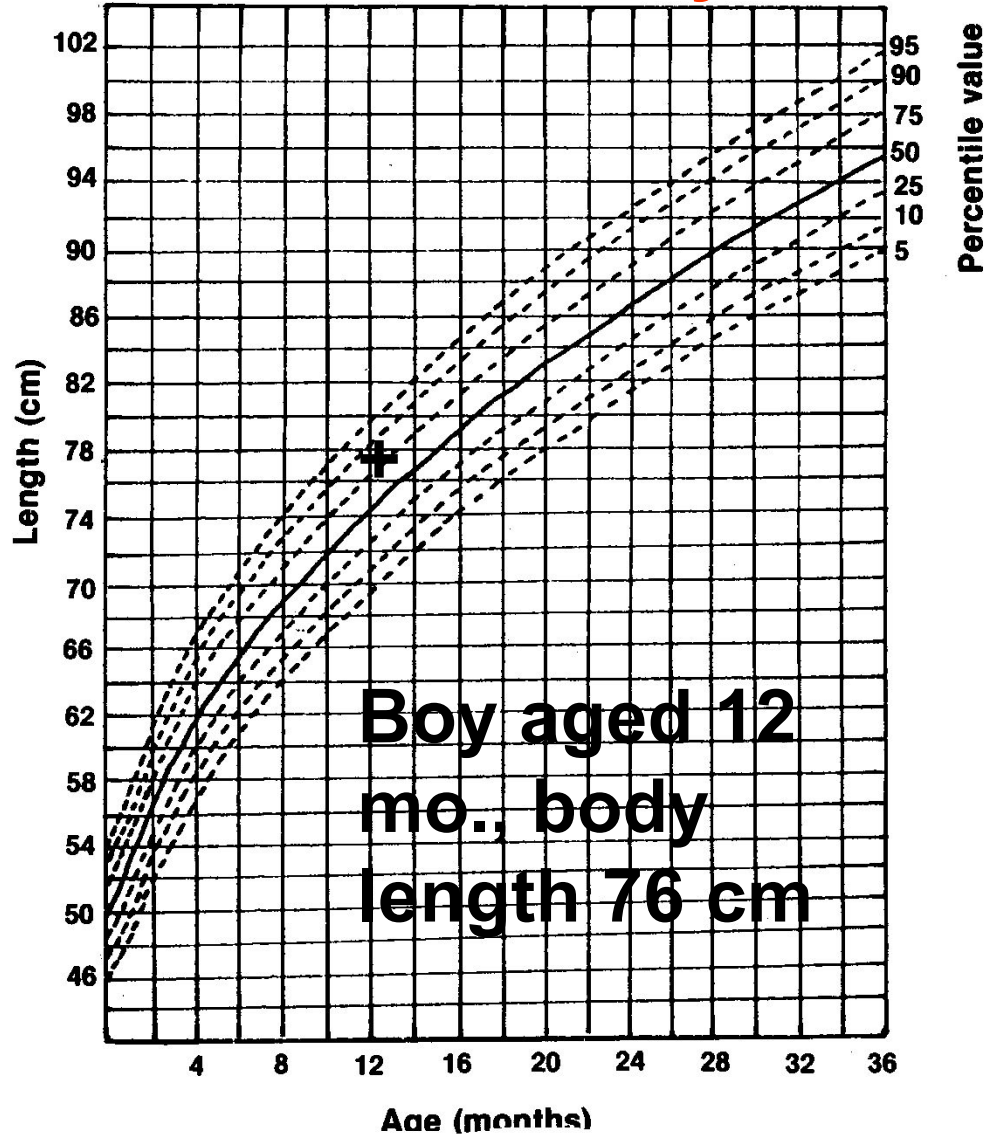Age (months): 4, 8, 12, 16, 20, 24, 28, 32, 36

Boy aged 12 mo., body length 76 cm

To respect the gender differences, age and chosen anthropometric

To set the growth (body length) value directly on the graph

To speculate about obtained results and elaborate recommendations.

Make them known to the mother.

Classification of percentile values

- 50 – percentile – middle line
- 25 – 75 percentiles – area of average estimations
- 10 – 25 acceptable estimations below the average
- 75 – 90 acceptable estimations above the average
- 5 – 10 acceptable but low values (area of attention)
- 90- 95 acceptable but high values (area of attention)

Growth Curve
(Length)
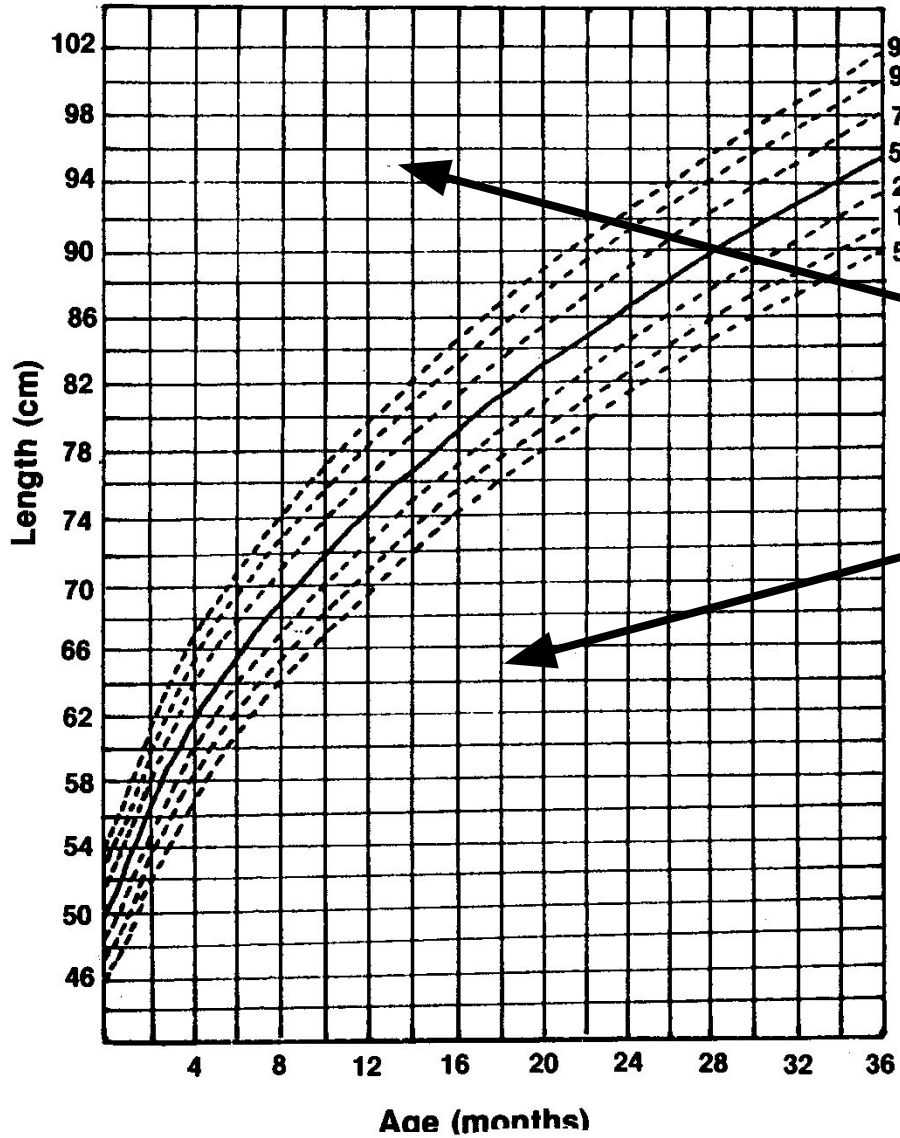
Symptomatic area

Growth Curve (Length)
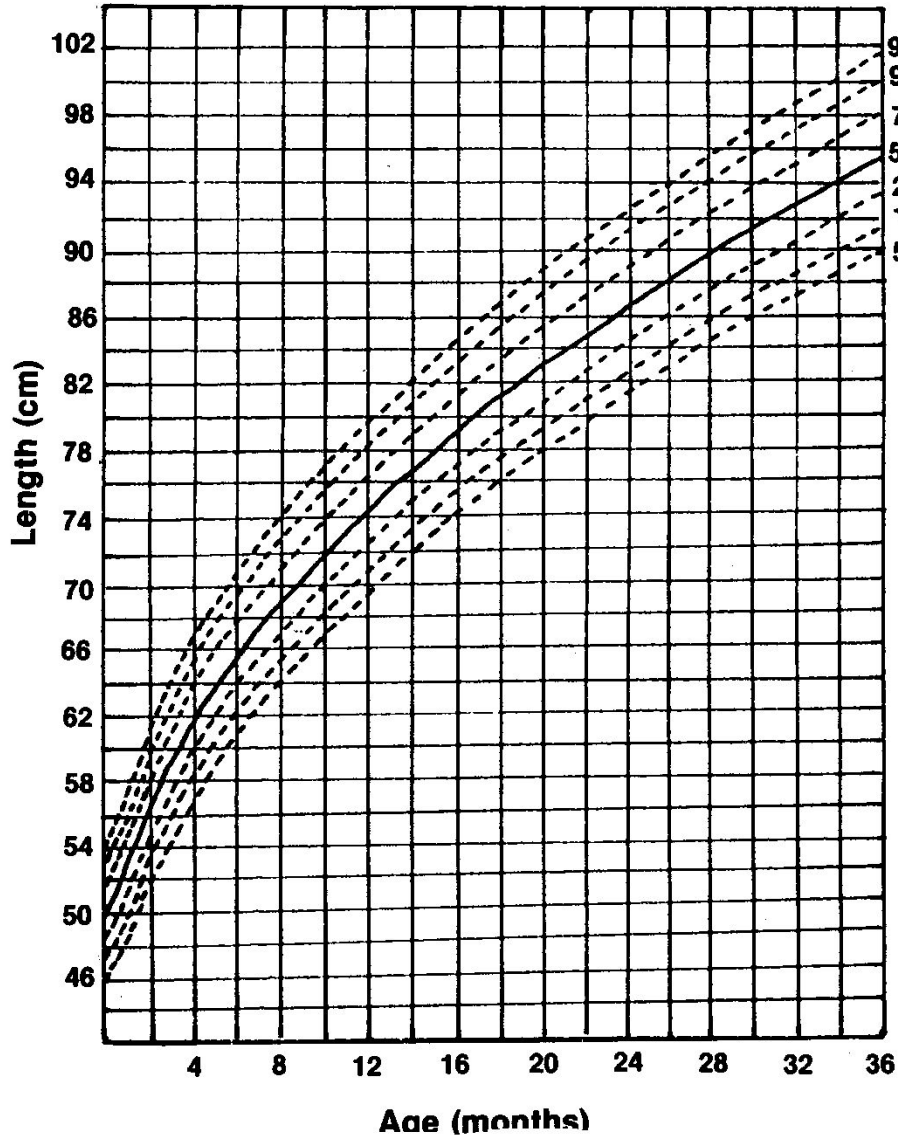
How to build an individual graph of grow?

WHO Child Growth Standards

World Health Organization

Hey, I want to know how tall I am by WHO standards!

Growth Curve (Length)
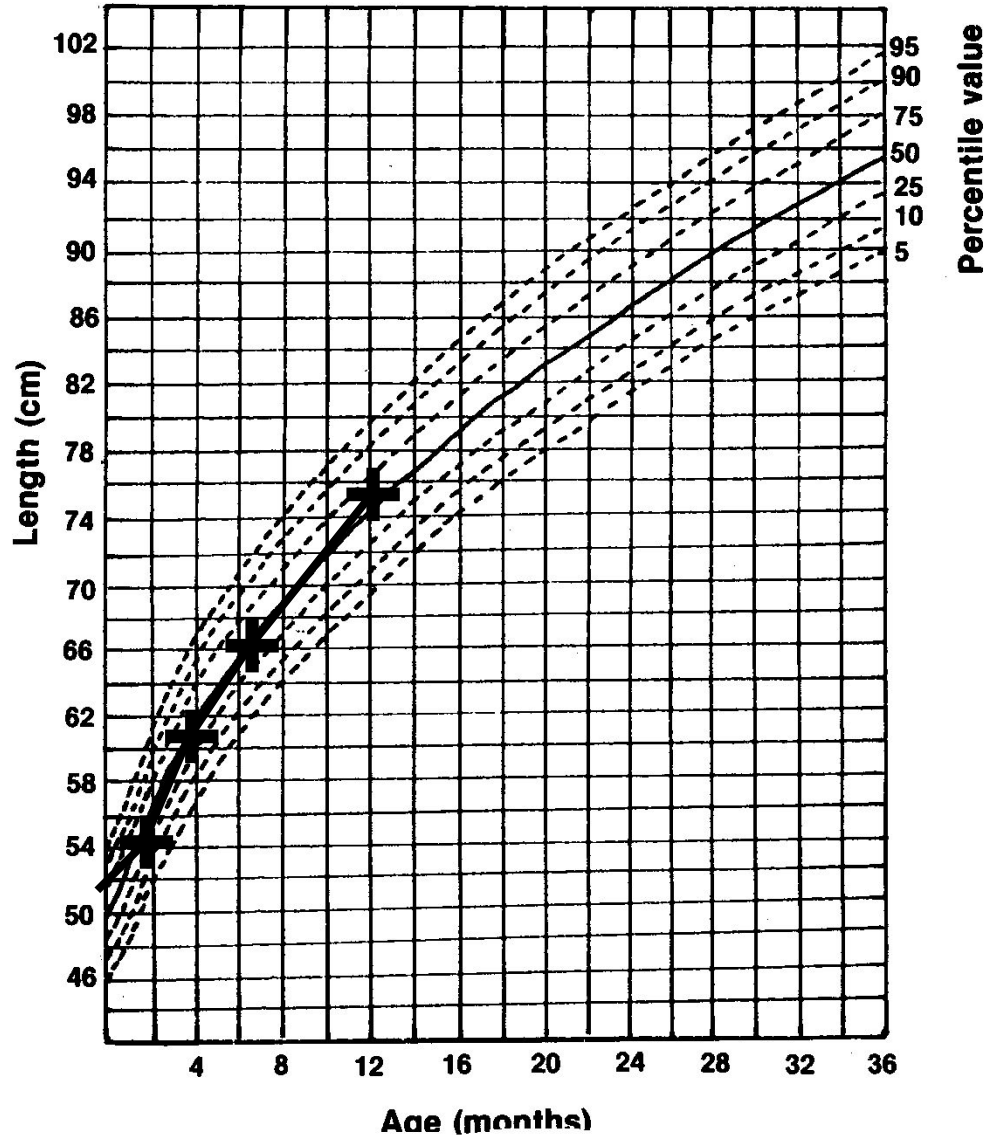
The individual graph of grow can be belt setting the anthropometric data directly on the percentile table.

The process of body length increasing in a boy since 1 mo until 12 mo is shown

Estimations of the growth by means of the standard deviations method

- ***The rates of growth in children aged 0 - 3 yr are universal regardless of their races and nationalities, social-economic status and type of feeding. So they are widely recommended as an international standard all over the world.***

  WHO, 2008

Weight-for-age curves in boys aged 0 -2 yr

Маса до віку, хлопчики

від народження до 2 років (z-scores)

World Health Organization

weight, kg

Маса (кг)

Born

1 yr

2 yr

Місяці
Народження

1 рік

2 роки

Вік (повні місяці і роки)

SD +3

SD +2

Median

SD -2

SD -3

WHO Child Growth Standards

at.14
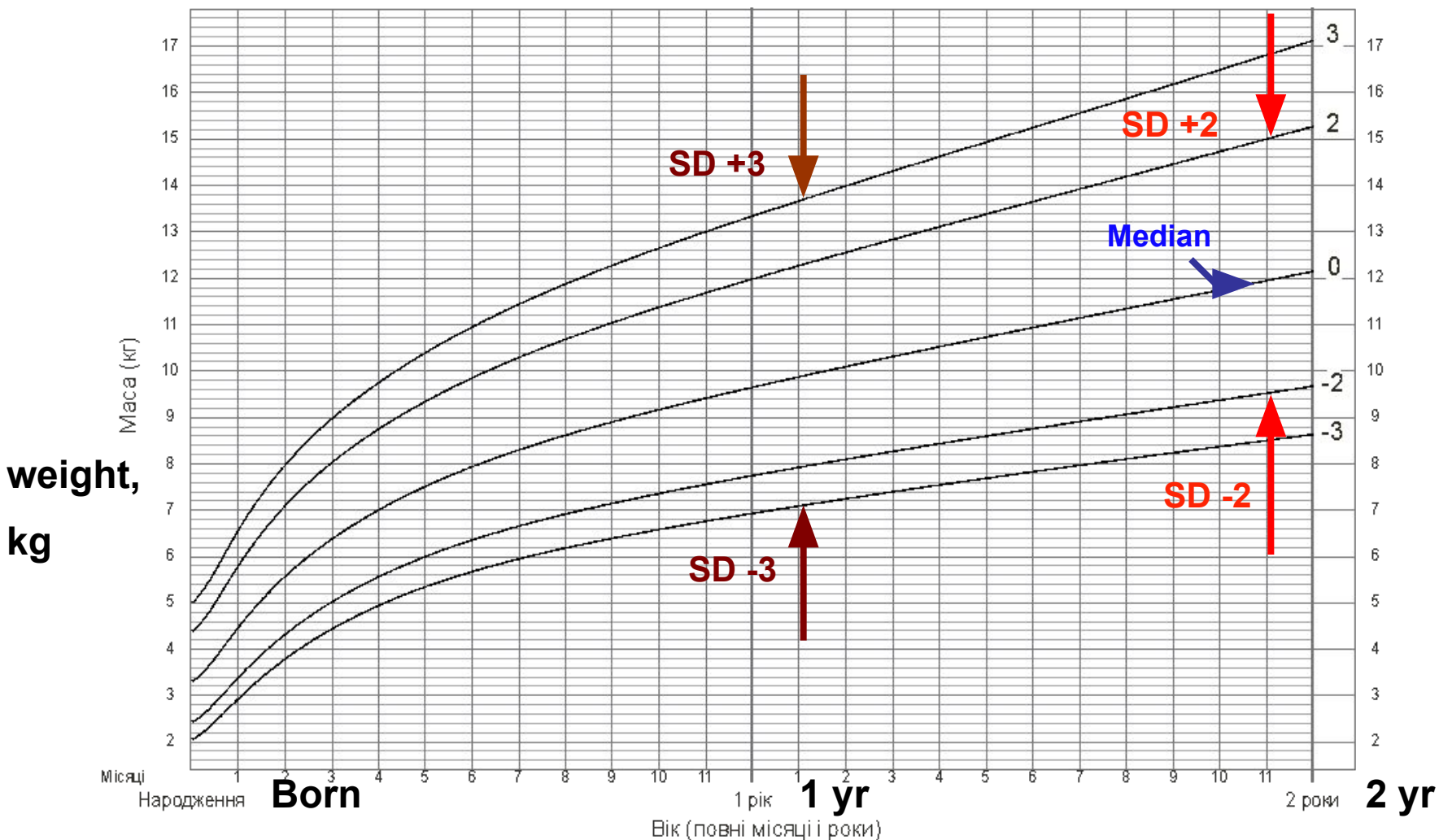
What do the SD lines mean?

- **The line 0 on every graph is being the median or math average.**

- **Other lines define statistical standard deviations (SD) showing the distance between individual anthropometrics and average estimations.**

- **Standard deviations (SD) can be positive (values or z-scores 1, 2, 3) or negative (values or z-scores −1, −2,−3).**

The interference of genetic and environmental factors ensuring the physical development in children.

Empathy

The interference of genetic and environmental factors ensuring the physical development in children.

- **<u>Behavioral reactions and physical development.</u>**

   Below listed influences slow the growth in children:

  - **quantities and qualitative underfeeding;**
  - **deficiency of parental care;**
  - **passive and active smoking.**

Physical development in children of the different age and its semiotics

Growth during the gestation

Gastation is the synonym of pregnancy (gesto lat. – to carry, to be pregnant, in utero development).

- **The math relation between body length of embrio or early fetus and term of gestation is:**

$$L=d^2,$$

   where: L is body length of embrio or early fetus in cm until 5 mo of gestation, d – term of gestation in mo.

Body length of the fetus with gestational term > 5 mo.

$$L = 10 \cdot LS - 14 \,,$$

where:

L is length of the fetus;

LS is the length of shoulder in sm according to US visualization

Weight-to-length coefficient in newborns

- **For well newborns there is the close correlation between** Weight (Wt,g) and length (L,cm). The measure of this constancy can be expressed by Weight-to-length coefficient which most often is 60-80 (units).

- **The** Weight-to-length coefficient less then **< 60 is typical of premature newborns and also children with weight deficiency**

- **The** Weight-to-length coefficient **> 80 reveals newborns with overweight or stunted (short stature) children.**

Developmental abnormalities in fetuses

One of the most important signs is the intrauterinal growth delay.

The causes of the intrauterinal growth delay are:

1. Chromosomal diseases.
2. Inborn infections.
3. Placenta insufficiency conditions.
4. Social problems (poverty, starvation, drugs and alcohol abusing, smoking).

Proportional growth delay is related with chromosomal diseases due to common body cells insufficiency in fetus (fetal hypoplasia).
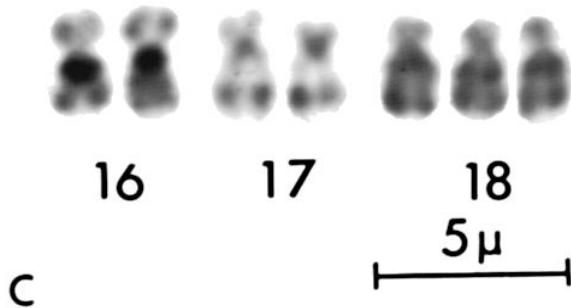
The boy was born on 43 week of gestation with body Wt 2100g, length 44 cm. Threesome 18 syndrome .

Disproportional growth delay is related with diseases due to common or partial skeleton abnormalities

The girl was born in term with Wt= 3400g and L= 43см. The short extremities with surplus of soft tissues attract an attention. The head looks large but is normal sized (h.c. 35cm). Both of the parents are short statures.

Ds: Achondroplasia

Disproportional growth delay or "spindly child" is related with maternal causes especially with placenta insufficiency. As a rule the condition happens in the 3-rd trimester of gestation. The affected children can be revealed immediately after delivery because of the subcutaneous fat lack.

The boy was born on 42 w of gestation with Wt=3050g, L=56 см (weight-to-length coefficient < 60). The pregnancy was complicated with vaginal bleeding. The post-labor placenta inspection has revealed the multiple calcifications and the signs of placental aging praecox.

The infants big for date of gestation

The boy was born at 39 week of gestation via caesarian section with Wt 6800g., Lт 68 cm, HC 40 cm.

Congenital gigantisms or Beckwith-Wiedemann syndrome

The child was born by mother suffering with gestational diabetes mellitus at 36 week with Wt 4100g, L 49 cm (Wt-to-L coefficient > 80).
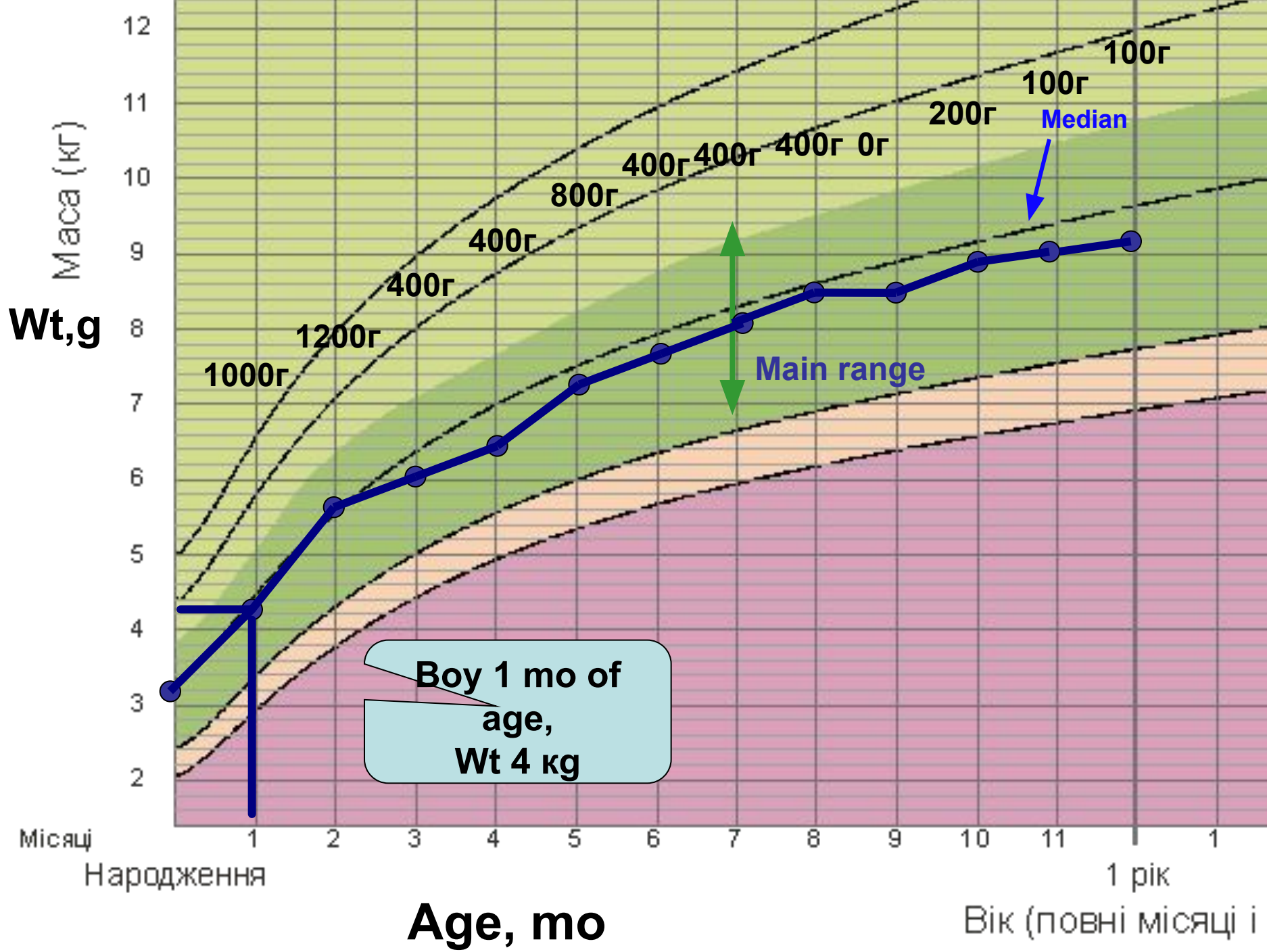
Physical development in children of the different age

The growth of the early age children (ad 3 yr).

Weight loss in first few days: 5-10% of BWt (birth weight). Return to BWt: 7 – 10 days of age.

It is physiologic phenomenon

The early childhood must be defined as a very quick but progressively fading growth.

Semiotics of physical developmental abnormalities

Weight achievement delay, deficiency of thrive, hypotrophy, underfeeding, underwaight, alimentary marasmus
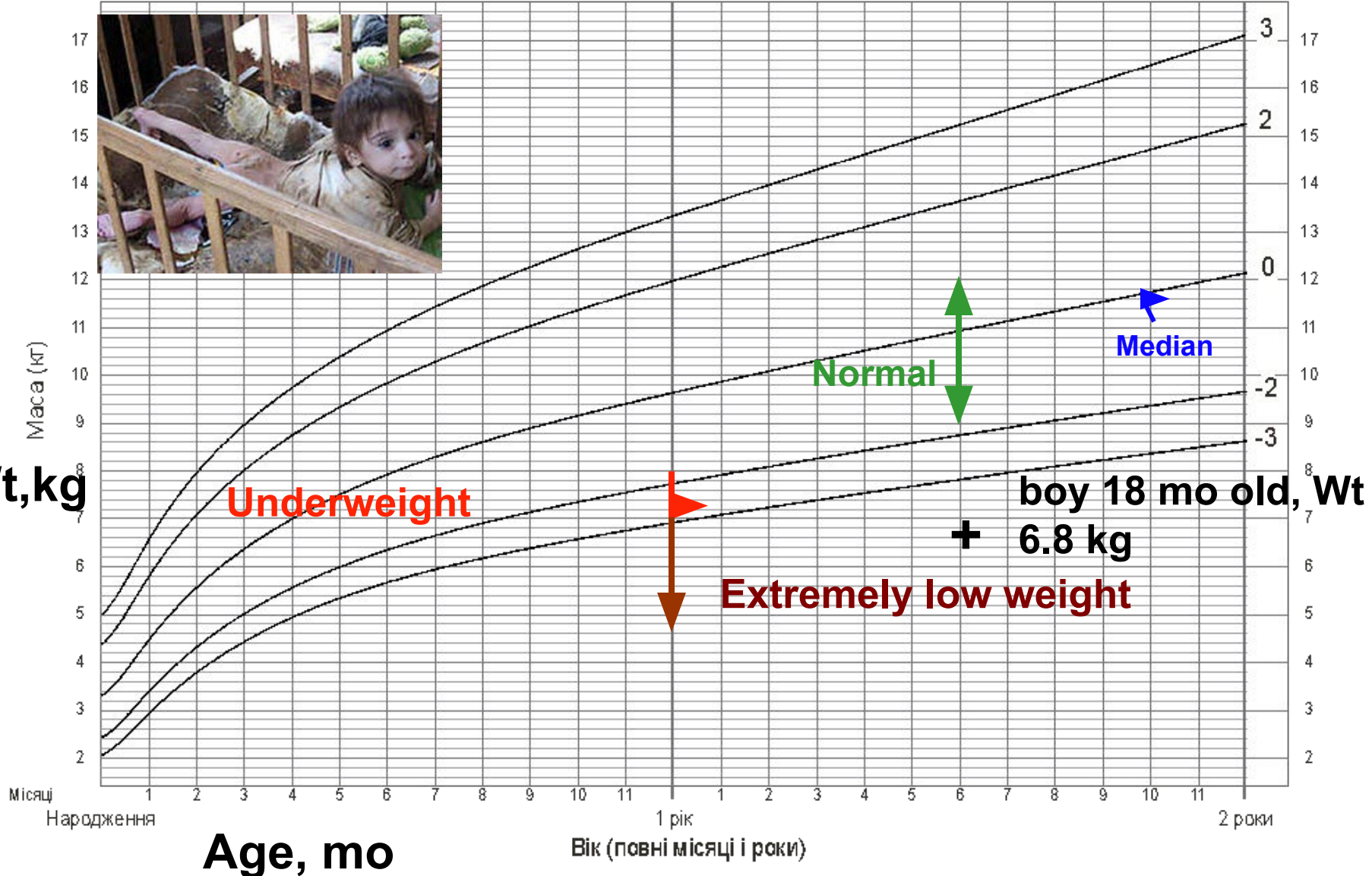
Growth delay in height (short stature, dwarfism proportional or disproportional)

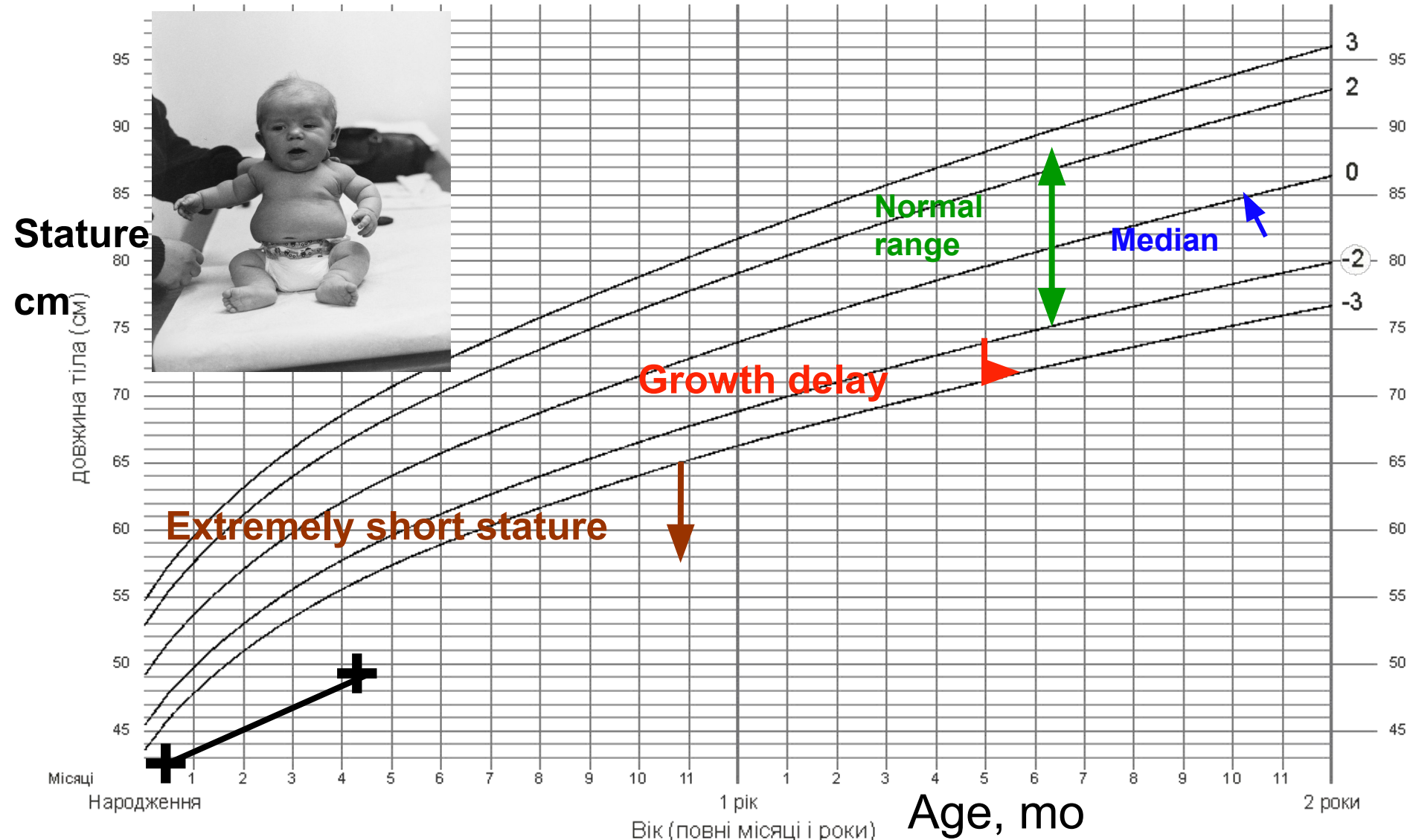**The girl was born L= 43 cm. Today she is 4 mo old. Her body length is only 48 cm.**

Stature-to-age chart in girls

Довжина тіла до віку, дівчатка

від народження до 2-х років (z-scores)

World He
Organiza

Stature cm

Normal range

Median

Growth delay

Extremely short stature

Age, mo

Physical development in children of the different age

The growth of the children aged 3 – 18 yr.

The growth of the children aged 3 – 18 yr.

- **This age period of childhood is characterizing with more stable (constant) annual growth chart. The average annual weight gain is 2 kg and height 5 cm between 2-3 yr and puberty. Also the spurts (accelerations) and plateaus may occur.**

The growth of the children aged 3 – 18 yr.

- **The puberty accelerates significantly the growth in teenagers little bit earlier in girls and later in boys when the average annual weight gain achieves 8-10 kg and body height 8-10 cm.**

- **The end of puberty is characterizing with the definitive height of stature achievement. Also the girls significantly accumulate the fat storages in this period preparing for future pregnancies.**

The main semiotics of growth disturbances in children aged 3 – 18 yr.

- **Short stature (5…3 percentiles, -2…-3 SD)**
- **Dwarfism – height below 3 percentile or < -3 SD**
- **High stature 95…97 percentiles, 2 …3 SD (often familial)**
- **Giantismus (over 97 percentile or > 3 SD)**
- **Body weight deficiency, wasting.**
- **Overweight risk, overfeeding, obesity.**
- **Microcephalus, macrocephalus**

Overfeeding, owerweight, obesity

- **Semiotics of this condition are the subcutaneous fat increasing and abnormally high anthropometrics as a weight-to-height correlation and Body-Weight index (BWi).**

Body-Weight index is essential for obesity evaluation .

$$BWi = \frac{Body\ weight\ (kg)}{Stature\ (m)^2}$$

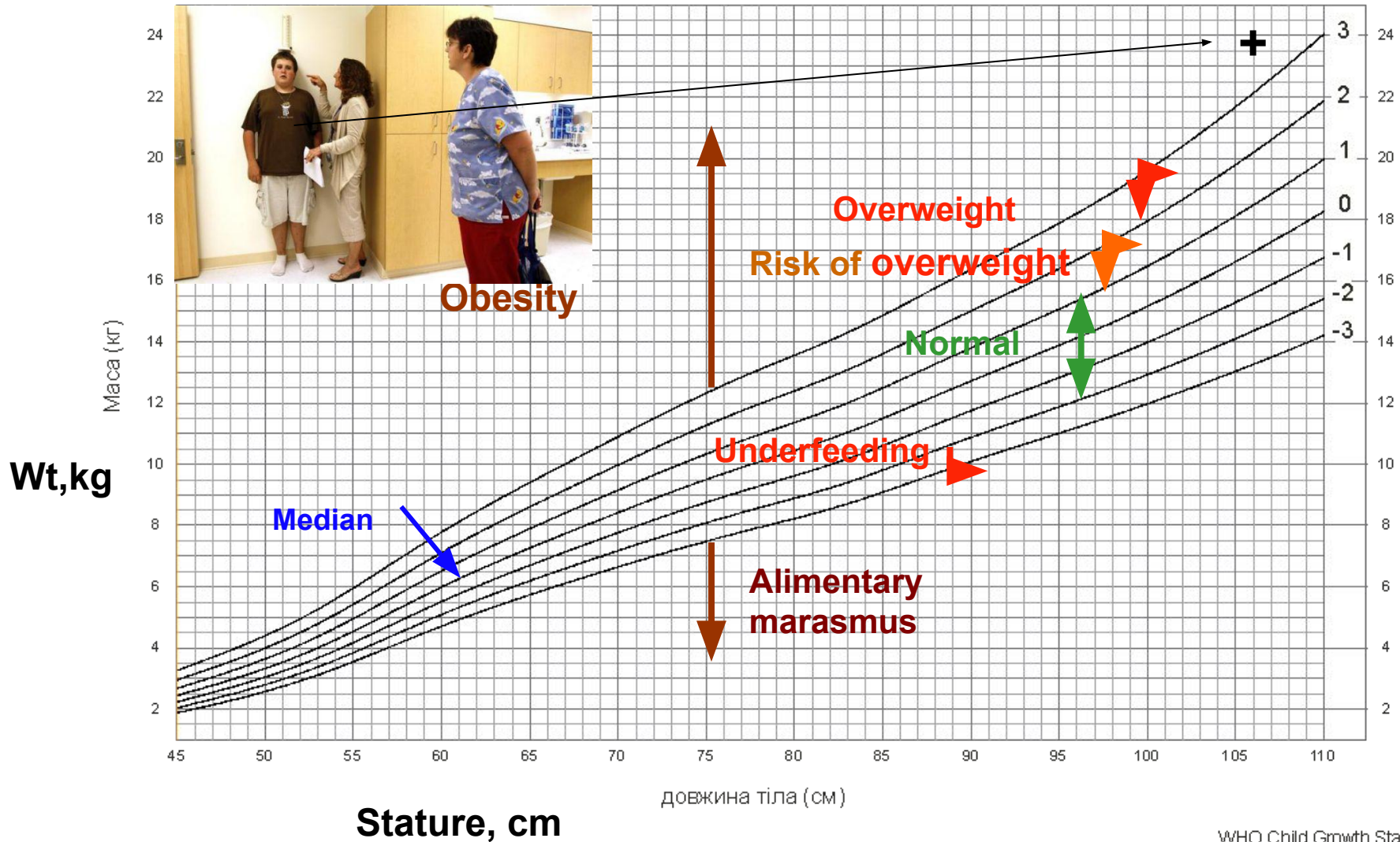Obesity in young children – BWi > 20 kg/m²

Obesity in adults – BWi > 30 kg/m²

Weight-to-height correlation

Маса до довжини тіла, хлопчики

від народження до 2 років (z-scores)

World Health Organization

Wt,kg

Маса (кг)

Stature, cm

довжина тіла (см)

Obesity

Overweight

Risk of overweight

Normal

Underfeeding

Median

Alimentary marasmus

WHO Child Growth Standards

1.How to know the child` body waight?

A. To ask a colleague

B. To use formula

C. To use percentile graph

D. To use Standard Deviation Chart (Z-scores)

E. To weight the child with balances

2. Often the children born by diabetic mothers are:

A. Severe premature

B. Severe post termed

C. Slim, spindly

D. Short

E. Obese

Instead to say you Good bay

Rules of Thumb for growth

Weight

Weight loss in first few days: 5-10% of BWt (birth weight).
Return to BWt: 7 – 10 days of age.
Double BWt: 4 – 5 mo.
Triple BWt: 1 yr
 Quadruple BWt: 2 yr.
Average weights: 3.5 kg at birth
                                 10 kg at 1 yr
                                 20 kg at 5 yr
                                 30 kg at 10 yr
4. Daily weight gain: 20-30 g for first 3 – 4 mo
                                 15-20 for rest of the first yr
5. Average annual weight gain: 2 kg between 2yr and puberty (spurts and plateaus may occur).

Height

Average length: 50 cm at birth, 75 cm at 1 yr.
At age 3 yr, the average child is 3 ft tall.
At age 4 yr, the average child is 100 cm tall (double birth length).
Average annual height increase: 5 cm between age 4 yr and puberty

Head Circumference (HC)

Average HC at birth: 35 cm
HC increases: 12 cm for first yr and 10 cm for rest of life.