Structured Notes According to

PEDIATRICS

Revision friendly **Fully Colored Book/Structured Notes**

For Best results, watch the video lectures along with reading notes

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PEDIATRICS

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Image-based Questions Of Growth

1 ASSESSMENT OF GROWTH AND GROWTH CHARTS

Growth

00:00:15

- Growth: Increase in physical size

Nomenclature	Age
Embryo	1st 8 weeks of intrauterine life
Fetus	9th week till delivery (birth of the baby)
Neonate	1st 28 days of life
Infant	1st year of life
Toddler	1-3 years
Preschool	3-6 years
Adolescent	10-19 years

Growth is assessed using Important Anthropometric parameters

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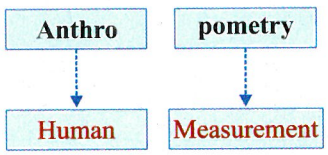
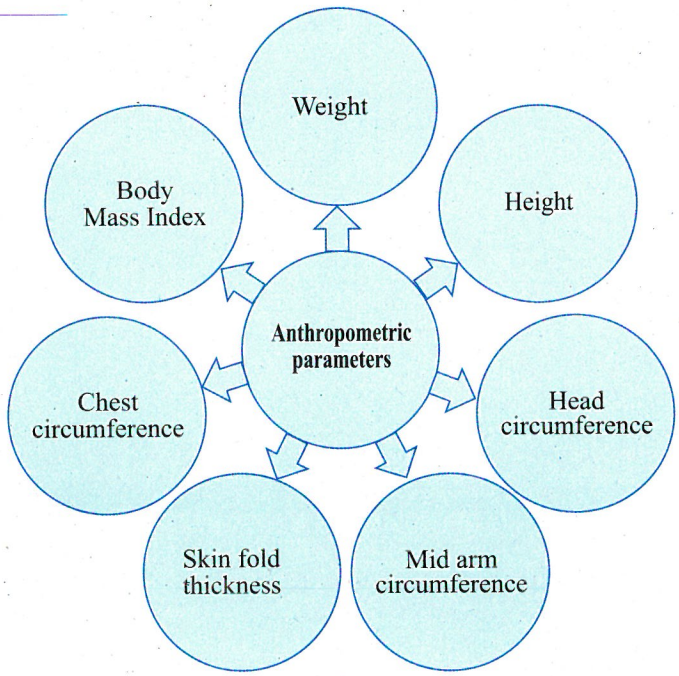




PYQ: INICET 2022

Mid Arm Circumference (MAC) / Mid Upper Arm Circumference (MUAC)

- Circumference of the midpoint of the arm, measured using a non – stretchable millimeter tape.
- The midpoint between the acromion process and the olecranon process is marked while the elbow is flexed and the circumference of the marked point is measured after the arm is hanging loosely by the side.
- MAC indicates growth and nutritional status
- Remains constant from 6 months to 5 years.
- MAC is age independent anthropometric parameter.
- Device used by health workers to measure MAC: Shakir's Tape.
- **Between 1-5 years:** Increase by 0.25 cm / year
- **Charts used for MAC at different ages:** Tanner's chart and WHO growth charts

Skin fold thickness

- When skin is pinched a certain amount of subcutaneous tissue also is present which indicates the nutritional status of the child.
- Areas where skin fold thickness is measured
  - Supra scapular
  - Subscapular
  - Biceps
  - Triceps (most accurate)
- Device used to measure it: Harpenden Callipers or Skin fold thickness callipers.

Chest Circumference (CC)

- At birth: Head Circumference (HC)> Chest Circumference (CC)
- By 9 months – 1 year: HC = CC
- In a normal child, beyond 1 year of age, CC > HC

Body Mass Index (BMI)

- Body Mass Index (BMI) = Weight (Kg) / Height (m)2
- **BMI**
  - <5th percentile: Underweight
  - >85th percentile: Overweight
  - >95th percentile: Obesity

Growth Charts

00:11:07

- Graphical representation of the anthropometric parameters

International Growth Charts	Indian Growth Charts (Local Growth Charts)

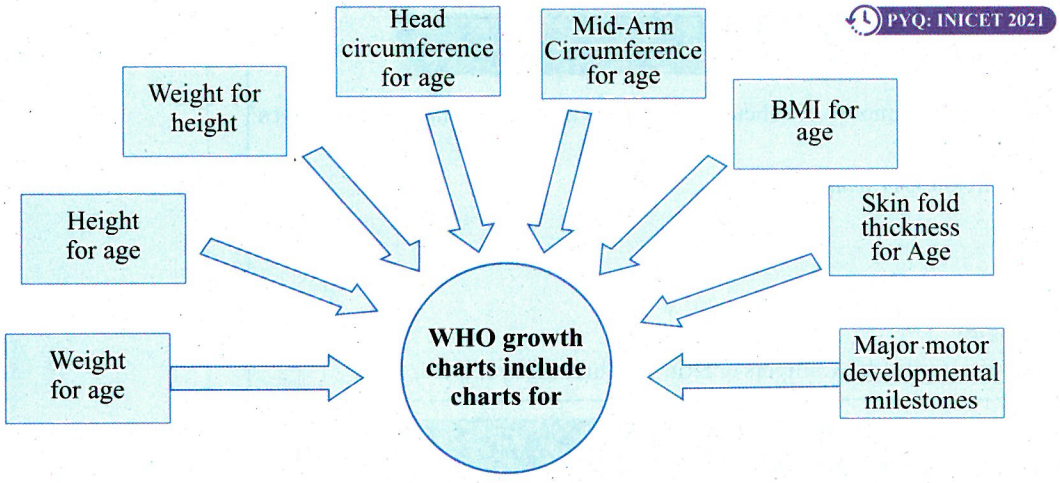
• NCHS (National Center for Health Statistics) Growth Charts (1977)
• CDC (Center for Disease Control & Prevention) Growth Charts (2000)
• WHO Growth Charts (2006)
	• Preferred beyond 5 years of age
	  ○ IAP (Indian Academy of Pediatrics) charts
	  ○ K.N. Agarwal Charts
	  ○ Khadilkar Charts

WHO Growth Charts

00:13:24

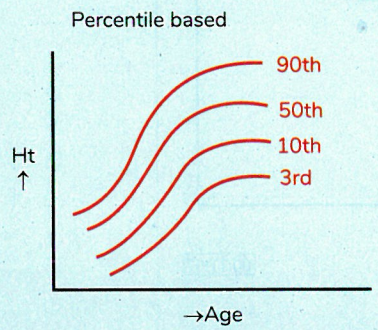
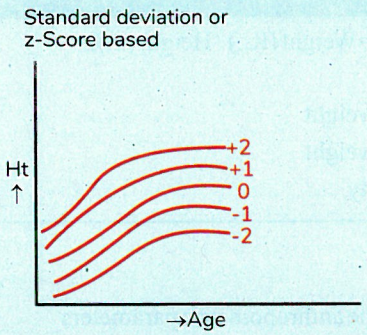
- Preferred growth charts for under-5 children all over the world
- Based on MGRS (Multicentre Growth Reference Study)
- Children from 6 different countries across the world were enrolled
- Countries included in MGRS
  - **B - B**razil
  - **O - O**man
  - **N - N**orway
  - **G - G**hana
  - **U - US**
  - **I - I**ndia [New Delhi]
- Enrolled only those babies who are exclusively breastfed children in the first 3 months of life
- Excluded factors like maternal smoking & alcohol

PYQ: INICET 2021



- Separate charts for boys & girls

Types of growth charts

Percentile based	Standard deviation or Z-score based
	

How to assess the growth of a child?

- Decide anthropometric parameters to use.
- Choose the appropriate device.
- Plot on the growth chart and compare with the normal expected value for that age
- Interpret and Counsel

2 NORMAL ANTHROPOMETRIC PARAMETERS

Weight

00:00:13

- Device used to measure weight of a child.
  - In infants (<10 kg) = Pan or basket type weighing scale
  - Older children = Platform type weighing scale

Precautions While Checking Weight of Baby

- Baby should be in minimal clothes. For small baby remove everything including diaper if possible
- Tare function should be available in weighing machine.
- Zero check should be done before weighing.
- Entire baby should be in pan and let the weight stabilize.

Important Information

- Birth weight of an average Indian baby: 2.9 Kg.

Actual Weight Gain in Different Age Group

Age	Weight Gain Per Day
0-3 months	30g/day
3-6 months	20g/day
6-9 months	15g/day
9-12 months	12g/day
1-3 years	8g/day

Expected Weight at Different Age Groups

Age	W (birth weight)
5 months	2W
1 year	3W
2 years	4W
3 years	5W
5 years	6W
7 years	7W
10 years	10W

- Birth weight doubles itself at 5 month of age,

Formula for Calculating Expected Weight of Child

- < 1 year = $\frac{x+9}{2}$, where x: age in months
- 1 - 6 year = $2x + 8$, where x: age in years
- 7 - 12 years = $\frac{7x-5}{2}$, where x: age in years

Height (Length)

00:06:18

	Length	Height
Age group	<2 years of age	>2 years of age
Device used to measure	Infantometer	Stadiometer

Important Information

- Recumbent supine length of a child is 0.7-1 cms more than the standing height

Precautions While Checking Height of Baby Using Stadiometer

- Remove footwear, cap, hairband, ponytail.
- Child should stand erect with occiput, back of shoulders, buttocks and back of heel touching the vertical rod behind.
- Child should look straight in horizontally forward plane (Frankfurt plane).
- In infants ideally 2 people are required, one will fix the vertical board at the head of the child while the other will extend the legs of child.

Length/ Height of Child

Age	Length
At birth	50 cm
By 3 months	60 cm
By 9 months	70 cm
By 1 year	75 cm
At 2 years	90 cm
At 4 - 4 ½ years	100 cm

PYQ: NEET PG 2023

Important Information

- Length of the child increases by 50% in 1st year
- Maximum growth of a child takes place during 1st year of life followed by Puberty
- Height of a child doubles itself or increases by 100%: 4 – 4 ½ years

- Calculation of Expected height of child = (6x + 77) cm, x is age in years

Rate at Which Height Increases

Age Group	Approx Gain in Length or Height
0 – 3 months	3.5 cm/month
3 – 6 months	2 cm/month
6 – 9 months	1.5 cm/month
9 - 12 months	1.2 cm/month
1 – 3 years	0.8 - 1 cm/month

Upper Segment: Lower Segment Ratio

00:14:05

- **Upper segment:** Part of the body above symphysis pubis
- **Lower segment:** part of the body below symphysis pubis

Age	US : LS ratio
Birth	1.7 - 1.9:1
3 years	1.3:1
7-10 years	1:1

Arm Span

- Measured on arms outstretched at 90 degrees to the body from tip of middle finger of one hand to tip of middle finger of other hand.
- Arm span almost equal to height of child, the difference is less than 3 cm

Age	Arm span
<10 years	1-2 cm less than the height of child
>10 years	More than the height of the child

Head Circumference/ Occipitofrontal Circumference (OFC)

00:16:25

- Measured from the occipital prominence to the supraorbital prominence
- Measured using non stretchable measuring tape with 'mm' marking

Precautions to be Taken While Measuring Head Circumference

- Remove any headgear.
- Don't use tailors tape.
- Use overlapping technique.
- Measure 3 times and maximum reading is taken as OFC.
- At birth, head circumference: 33 – 35 cm

Time Period	Rate of increase in Head Circumference
0 - 3 months	2 cm/ month
3 - 6 months	1 cm/ month
6 - 12 months	0.5 cm/ month
1 - 3 years	0.2 cm/ month

Q. If head circumference at birth is 35 cm. When will it become 43 cm, if everything remains normal?

At birth	35 cm
1 m	37 cm
2 m	39 cm
3 m	41 cm
4 m	42 cm
5 m	43 cm

- If the increase in head circumference is by >2 cm/month is due to some underlying pathology. E.g. Hydrocephalus, CNS tumor

Brain Development

00:21:43

Age	Size of Brain (% of adult size)
At 1 month	36%
At 1 year of age	72%
At 2 years of age	85%

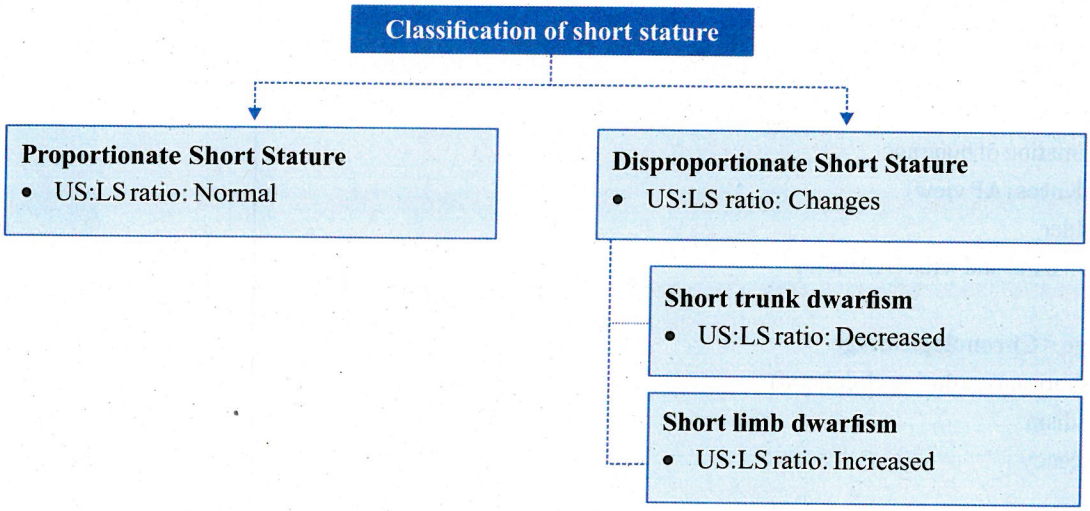
- Maximum brain growth is in 1st & 2nd years of life.

3 SHORT STATURE AND TALL STATURE

Short Stature

00:00:22

- Height of a child < 3rd percentile or < - 2 SD or Z score of expected, according to age & sex of child.



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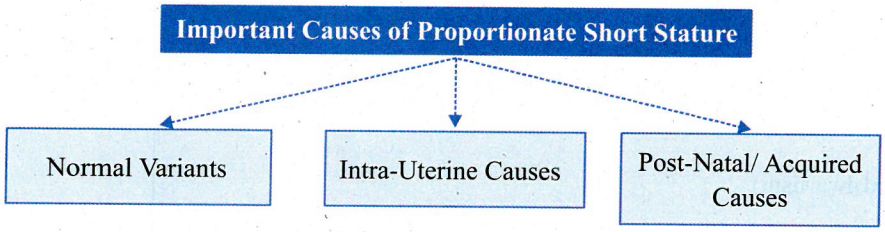

Normal Variants

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PYQ: FMGE 2023

Familial Short Stature	CDGP (Constitutional Delay in Growth & Puberty)
Child is short, but height is normal as per his expected height based on mid parental height.	Child's height is less than expected during childhood, but final adult height attained is normal
Family H/O short stature in parents	Height of the parents is normal
Child has normal puberty	Child has delayed puberty and family h/o of delayed puberty
Bone age = Chronological age	Bone Age < Chronological age

Mid Parental Height (MPH)

00:08:25

Boys	Girls
$\frac{FH + MH + 13}{2}$ cm	$\frac{FH + MH - 13}{2}$ cm

- FH: Father's Height
- MH: Mother's Height

Bone age

- Preferred X-ray for estimation of bone age
  - Neonates: X-ray of Knees (AP view)
  - Infants: X-ray shoulder
  - 1-13 years: X-ray left hand and wrist (AP view)

Condition in which Bone Age < Chronological Age

- CDGP (M/C cause of short stature during childhood)
- Congenital hypothyroidism
- Growth hormone deficiency
- Severe Malnutrition

Intra Uterine Causes

00:10:30

- IUGR (Intrauterine growth restriction)
- Intrauterine Infections (TORCH)
- Genetic syndromes
  - Turner syndrome
  - Down syndrome
  - Seckel syndrome (Bird headed dwarfism)

Post Natal/ Acquired Causes

- Severe long-standing malnutrition
- Malabsorption (Celiac disease)
- Chronic systemic disease (Chronic kidney disease)
- Endocrine disorders: Growth hormone deficiency, Cushing syndrome (Mc cause is Iatrogenic)
- Psychosocial dwarfism (Maternal deprivation)

Growth hormone Deficiency

00:14:15

- Presents with short stature, Obesity
- US: LS Ratio is normal
- Bone age < Chronological age
- Dynamic testing
  - GH Stimulation Test: Done by using anyone of
    - → Clonidine
    - → Insulin
    - → Arginine
- **Rx:** Recombinant GH therapy (S/E: Pseudotumor cerebri)

Important Causes of Disproportionate Short Stature

Medicine | PYQ: FMGE 2020

Short trunk dwarfism (US:LS ratio → Decreases)	Short limb Dwarfism (US:LS Ratio → increases)
Note: Mnemonic: **S**hort **M**an **M**ay **C**limb **H**igh • **S**pondyloepiphyseal dysplasia • **M**ucopolysaccharidosis • **M**ucolipidosis • **C**aries spine (Pott's disease) • **H**emivertebra/ Butterfly vertebra	**Note:** Mnemonic: **ROCCA** • **R**ickets • **O**steogenesis imperfecta • **C**ongenital hypothyroidism • **C**hondroectodermal dysplasia • **A**chondroplasia

Alagille syndrome	• Due to mutation in the JAK pathway • Neonatal cholestasis • Triangular facies (also seen in Russell silver syndrome) • Pulmonary stenosis • Butterfly vertebrae

Osteogenesis Imperfecta/ Brittle Bone Disease	• Type-I collagen Defect
	• Autosomal dominant inheritance
	• **Triad**
	  ○ Recurrent fractures / Bony deformity
	  ○ Blue sclera
	  ○ Deafness
	• Dentigerous imperfecta (Dental problem)
	• **Rx:** Bisphosphonates [Pamidronate]

Achondroplasia	• **A**utosomal dominant inheritance; FGFR3 gene mutation • **C**hampagne glass pelvis on x ray • **H**and abnormality (Trident Hand) • **O**besity • **N**eurological problems • **D**elayed motor milestones • **R**ecognized at birth • B**O**wing of legs • **P**roximal limb shortening • **LA**rge head • **S**hort stature • **Interpedicular** distance between vertebra decreases

Tall Stature

00:25:35

Definition

- Height of a child > + 2 SD or Z score of expected, according to age and sex of child.

Causes of Tall Stature in Childhood

- Constitutional tall stature
- Exogenous obesity
- Endocrine causes: Precocious puberty, GH excess etc
- Syndromes:
  - Klinefelter syndrome
  - Fragile X syndrome
  - Marfan syndrome
  - Homocystinuria
  - Sotos syndrome
  - Beckwith-Wiedemann syndrome
  - Weaver syndrome: Intellectual disability, facial dysmorphism, joint contractures.

4 ABNORMALITIES OF HEAD SIZE AND SHAPE

Abnormalities of Head Size

- Microcephaly
- Macrocephaly

Microcephaly/ Small Head

00:00:50

PYQ: FMGE 2021

Definition

- Head circumference of a child < - 3 SD or Z score of expected according to age & sex of child

Classification

- Primary
- Secondary

Etiology of Primary microcephaly

00:02:17

Genetic causes	Structural causes
• Cornelia de Lange Syndrome • Smith Lemli Opitz Syndrome • Patau Syndrome (Trisomy 13) • Edward Syndrome (Trisomy 18) • Familial • Rubinstein Taybi Syndrome (microcephaly, nose deformity, broad deviated thumb, congenital heart disease) • Cri-du-chat syndrome (5p deletion)	• Anencephaly • Lissencephaly • Polymicrogyria • Schizencephaly

Note: Mnemonic Cannot See PEFR in a Child

Etiology of Secondary microcephaly

Maternal Causes	Causes related to the baby

• Alcohol Intake (Fetal Alcohol Syndrome)
• Smoking
• Drugs: Phenytoin intake
• Phenylketonuria
• Radiation Exposure
• Infections (TORCH)
	• CNS infections during infancy (Meningoencephalitis)
	• Severe malnutrition in baby
	• Perinatal asphyxia
	• Inborn errors of metabolism
	  ○ Phenylketonuria
	  ○ Methylmalonic acidemia
	  ○ Citrullinemia
	• Acquired Microcephaly
	  ○ **R** - Rett Syndrome (X-Linked Dominant)
	  ○ **A** - Angelman Syndrome
	  ○ **S** - Seckel Syndrome (face of child resembles the bird)

Macrocephaly / Large Head

00:09:02

Definition

- Head circumference of the child > + 2 SD or Z score of expected, according to age & sex of child

Important Causes of Macrocephaly

Obstetrics & Gynaecology, Biochemistry

Increased Thickness of Cranial Bones

- Chronic hemolytic anemia (Thalassemia)
- Osteogenesis imperfecta
- Rickets

Subdural Fluid Collection

- Present as effusion or empyema
- As a complication of Meningitis

Megalencephaly (↑ Size of Brian)

- **Note:** Mnemonic: BALWAN SiNGh
  - **B - B**enign familial megalencephaly: runs in families (M/C cause in children)
  - **A - A**mino acid disorders
    - → Maple Syrup Urine Disease (MSUD)
    - → Type - I: Glutaric aciduria
  - **L - L**ysosomal storage disorder
    - → Mucopolysaccharidosis, GM1 Gangliosidosis, Tay Sach's disease
  - **W - W**eaver syndrome
  - **A - A**chondroplasia (Short Limb Dwarfism)
  - **N - N**eurocutaneous disorder (For ex. NF, TS, Sturge weber syndrome)
  - **S - S**oto's syndrome/ cerebral gigantism
  - **N - N**eurodegenerative disorders (Regression of milestones)
    - → Alexander disease (GFAP gene: Glial fibrillary protein deposition)
    - → Canavan disease (ASPA gene: Deposition of NAA in brain)
  - **G - G**alactosemia

Hydranencephaly

- Both Cerebral hemispheres are absent & replaced by fluid filled sacs
- Transillumination is +ve
- Midbrain and brainstem are intact

Hydrocephalus

- Increase in size of ventricles inside brain due to increased production or impaired drainage of CSF
- Treatment: Ventriculoperitoneal shunt