

Growth and development in pediatrics

Growth : it is process of physical maturation resulting in increase of the size of body and varicose organ, it is occurs by multiplication of cells and increase in intracellular substance , it is qualitative change of body.

Development :it is process of functional and physiological maturation of the individual , it is progressive increase in skill and capacity to function , it is related to maturation and myelination of nervous system , it is includes psychological , emotional and social change , it is qualitative process .

Factors influence growth and development :

1-genetic factors : which include:

- a) Sex
- b) Nationality and race
- c) Genetic predisposing is the important factor which affect growth and development

2-prenatal : which include:

Intrauterine environment is an important factors in growth and development which include

- a) Maternal nutrition
- b) Maternal infection
- c) Maternal substance abuse
- d) Maternal illness
- e) Hormones
- f) Misalliance

3-postnatal factors :

- a) Growth potential
- b) Nutrition
- c) Childhood illness
- d) Physical environment
- e) Psychological environment
- f) Cultural influence
- g) Socio economic statues
- h) Climate and season
- i) Play and exercise
- j) Birth order of the child
- k) Intelligence
- l) Hormones influence

ASSESSMENT OF PHYSICAL GROWTH:

Growth Parameters:

1-Weight: child weighed nude on lever/electronic scale

- o Spring balance less accurate
- o 3month -12 months $(\text{Age}(\text{mo}) + 9 / 2)$
- o 3-6 years $(\text{Age}(\text{yr}) \times 2 + 8)$
- o 7-12 years $-(\text{Age}(\text{yr}) \times 7 - 5 / 2)$

2-Length: For <2 yrs

- o Child supine on rigid table/infantometer
- o Legs straightened
- o Feet at right angles
- o Foot board brought upto child's heels

3-Height:

- o Child stands upright against wall/stadiometer
- o Heels, buttocks, back in contact with vertical surface
- o Head held in Frankfurt's plane - line joining floor of external auditory meatus to floor of orbit is horizontal
- o Head piece firmly over vertex

4-Crown Rump length: Length from vertex to ischial tuberosity

5-Head Circumference: Maximum circumference from occipital protuberance to forehead

6-Chest Circumference: Measured at level of nipples midway between inspiration & expiration in recumbent position.

Body Proportions:

- o US:LS ratio 1.7:1 at birth
- o 1.3 at 3 yrs
- o 1:1 at 6-7 yrs

Mid Arm Circumference:

- o Relatively constant between 1-5 yrs \therefore age independent
 - o Normal 16.5 –17.5 cm
 - o <12.5 cm – malnourished
- Z scores = standard deviations from median reference

Weight:

- Ø Average birth weight 3 kg à lose 10% body weight à regain BW by 10 days à gain at 25-30 gm/day for 1st 3 mths à 400 gm /month till end of 1st year
- Ø Roughly, BW doubles by 5 mths
- Ø triples by 1 year
- Ø 4 times by 2 yrs
- Ø 6 times at 5 yrs
- Ø 10 times at 10 yrs
- Ø Or, gains 2 kg/yr between 3- 7 yrs
- Ø 3 kg/yr after that till pubertal spurt

Height:

- Ø 50 cm at birth
- Ø 60 cm at 3 mths
- Ø 75 cm at 1 yr
- Ø 100 cm at 4 yrs
- Ø gain 5 cm/yr till 10 yrs

Head Circumference:

- Ø Birth - 35 cm
- Ø 3 mths - 40 cm
- Ø 12 mths - 45 cm
- Ø 24 mths - 48 cm
- Ø 12 yrs - 52 cm

Chest Circumference:

- Ø 3 cm less than head circumference at birth, equal at 1 yr
- Ø After that, exceeds head circumference(2cm each

Age	Type	Total number of teeth
	Temporary teething	
6 – 12 months	Incisors(central and lateral)	2-8
12 – 15 months	First molar	8- 12
15 – 24 months	Canines(cuspids)	12 – 16
24 – 30 months	Secondary molar	16 - 20
	Permanent teething	
6 -7 years	First permanent molars	24
7 10 years	Replacement of temporary	
10 -12 years	Replacement of temporary molar by premolars	
12 – 15 years	Secondary permanent molars	28
16 years	Third permanent molars	32

Development:

4 areas of development:

- 1) Gross motor
- 2) Fine motor (adaptive)
- 3) Social
- 4) Language

GROSS MOTOR : Involves control of child over his body. Tested in :

1-Ventral Suspension: Baby held in prone position and lifted off the bed. Newborn – head flops down

4-12 wks – brings head to plane of body and then above plane of body

2-Supine :

Child placed supine and gently pulled up by the arms

Newborn – head lag ,By 16-20 wks – head in plane of body or ahead with back straight

3-Prone:

Newborn – can turn head to 1 side

1 mth – lifts chin momentarily

3 mths – lifts head and upper chest

6 mths – lifts head & chest

5-8 mths – rolls over, first back to side and front

8 mths – crawls

4-Sitting:

5 mths – sits with support

8 mths – sits steadily with back straight, without support

10 mths – pulls from supine to sitting position

5-Standing:

4 mths – Bears weight on legs

9 mths – early stepping movements, pulls to standing with help of furniture

10 mths – cruising

13 –15 mths – walks unsupported

15 mths – walks sideways/backwards

6-Climbing stairs –

2 yrs – climbs stairs – 2 feet per step

3 yrs – climbs upstairs – one foot per step

4 yrs – climbs down one foot per step

Key Gross motor milestones:

3 mths – neck holding

2 month Holds head steady while sitting

3 month pulls to sit, with no head lag

- 3 month Brings hands together in midline
- 4 month asymmetric tonic neck reflex gone
- 5 mths – sitting with support
- 8 mths – sitting without support
- 9 mths –standing with support
- 10 months – cruising
- 12 mths – standing without support
- 14 mths – walking without support
- 18 mths – running
- 24 mths – walking upstairs

FINE MOTOR OR ADAPTIVE MILESTONES:

Includes eye coordination, hand eye coordination, hand mouth coordination and manipulation with hands

Tested with red ring, pen torch, red cubes (2.5 cm), pellet, cup with handle, spoon, book with thick pages, red pencil/crayon, paper, wooden blocks, doll, mirror

1-Eye coordination:

- 4 wks – regards torch/red ring kept at 20 cm in front
- 6 wks – follows object from side to side –unsteadily
- 2-3 mths – follows with steady movements of eyes
- Binocular vision by 3-6 mths

2-Hand eye coordination:

- 4 mths – tries to grasp red ring dangling in front but may overshoot
- 5 mths – reaches out & grasps object with ulnar side
- 6 mths – radial grasp, transfers objects from hand to hand
- 10 mths – pincer grasp
- In 13 month builds tower of 2 cubes
- In 22 month Builds tower of 6 cubes

3-Hand-mouth coordination:

1 yr – tries to feed with spoon but may spill

15 mths – feeds with spoon

18 mths – feeds self from cup

4-Hand skills:

Grasps rattle 3.5 month

Reaches for objects 4 month

Palmar grasp gone 4 month

Transfers object hand to hand 5.5 month

Thumb-finger grasp 8 month

turns pages of book 12 month

scribbles 13 mths –

turn 2-3 pages at a time

24 mths – turns 1 page at a time

5-Scribbling:

- Ø 12-24 mths – scribbles
- Ø 2 yrs – copies vertical line
- Ø 2 ½ yrs –copies horizontal line
- Ø 3 yrs – circle
- Ø 4 yrs – cross, rectangle
- Ø 5 yrs – copies cross, triangle

PERSONAL & SOCIAL DEVELOPMENT:

- Ø 1 mth - regards face of mother/caretaker
- Ø 2 mth - social smile
- Ø 3 mths - recognises mother/caretaker
- Ø 2 month Smiles in response to face
- Ø 6 month Monosyllabic babble
- Ø 7 month Inhibits to "no"
- Ø 7 month Follows one-step command with gesture
- Ø 10 month Follows one-step command without gesture
- Ø 10 month Says "mama" or "dada"
- Ø 10 month Points to objects
- Ø 6 mths - enjoys mirror
- Ø 8-9 mths - separation anxiety
- Ø 9 mths - waves bye-bye
- Ø 12 month Speaks first real word

LANGUAGE DEVELOPMENT:

- ❖ 1 mth - turns head towards sound
- ❖ 3-5 mths - vowel sounds, gurgles
- ❖ 6 mths - monosyllables
- ❖ 9 mths - bisyllables
- ❖ 10 mths - understands spoken speech
- ❖ 12 mths - speaks 2 words with meaning
- ❖ 18 mths - 20 words
- ❖ 24 mths - joins 2-3 words in a short sentence
- ❖ 3 yrs - 250 words

BOWEL & BLADDER CONTROL:

- o Early months - gastrocolic reflex à defecates after each feed
- o 7 mths - no relation to feeds
- o Toilet trainable by 18mths - 2 yrs

Development in summary

NEONATAL PERIOD (1ST 4 WK)

prone: lies in flexed attitude; turns head from side to side; head sags on ventral suspension

supine: Generally flexed and a little stiff

visual: May fixate face on light in line of vision;"doll'r-eye" movement of eyes on turning of the body

reflex: Moro response active; stepping and placing reflexes; grasp reflex active

social: Visual preference for human face

AT 1 MO

prone: Legs more extended; holds chin up; turns head; head lifted momentarily to plane of body on ventral suspension

supine: Tonic neck posture predominates, supple and relaxed; head lags when pulled to sitting position

visual: Watches person; follows moving object

social: Body movements in cadence with voice of other in social contact; beginning to smile

AT 2 MO

prone: Raises head slightly farther; head sustained in plane of body on ventral suspension

supine: Tonic neck posture predominates; head lags when pulled to sitting position

visual: Follows moving object 180 degrees

social: Smiles on social contact; listens to voice and coos

T 3 MO

prone: Lifts head and chest with arms extended; head above plane of body on ventral suspension

supine: Tonic neck posture predominates; reaches toward and misses objects; waves at toy
sitting: Head lag partially compensated when pulled to sitting position ;early head control with bobbling motion; back rounded

reflex: Typical Moro response has not persisted; makes defensive movements or selective withdrawal reactions

social: Sustained social contact; listens to music ;says "aah,ngah"

RT 4 MO

prone: Lifts head and chest, with head in approximately vertical axis; legs extended

supine: Symmetric posture predominates, hands in midline;reaches and grasps objects and brings them to mouth

sitting: No head lag when pulled to sitting position; head steady, tipped forward; enjoys sitting with full truncal support

standing: When held erect ,pushes with feet

adaptive: Sees pellet, but makes no move to reach for it

social: Laughs out loud; may show displeasure if social contact is broken; excited at sight of food

AT 7 MO

Prone- Rolls over; pivots; crawls or creep-crawls (Knobloch)

Supine: Lifts head; rolls over; squirms

Sitting: Sits briefly, with support of pelvis; leans forward on hands; back rounded

Standing: May support most of weight; bounces actively.

Adaptive: Reaches out for and grasps large object; transfers objects from hand to hand; grasp uses radial palm; rakes at pellet

Language: Forms polysyllabic vowel sounds

Social: Prefers mother; babbles; enjoys mirror; responds to changes in emotional content of social contact

AT 10 MO

Sitting: Sits up alone and indefinitely without support ,with back straight

Standing: Pulls to standing position;"cruises"or walks holding on to furniture

Motor: Creeps or crawls

Adaptive: Grasps objects with thumb and forefinger;pokes at things with forefinger ;picks up pellet with assisted pincer movement; untovers hidden toy;attempts to retrieve dropped object; releases object grasped by other person

Language: Repetitive consonant sounds ("mama,""dada") I

Social: Responds to sound of name; plays peek-a-boo or pat-a-cake; waves bye-bye

AT1 YR

Motor: Walks with one hand held (48 wk);rises independently, takes several steps (Knobloch)

Adaptive: Picks up pellet with unassisted pincer movement of forefinger and thumb ;releases object to other person on request or gesture

Language: Says a few words besides"mama,""dada"

Social: Plays simple ball game, makes postural adjustment to dressing

AT 15 month

Motor: Walks alone; crawls upstairs

Adaptive: Makes tower of 3 cubes ;makes a line with crayon ;inserts raisin in bottle

Language: Jargon; follows simple commands; may name a familiar object (e g , ball)

Social: Indicates some desires or needs by pointing; hugs parents

AT 18 month

Motors :Runs stiffly;sits on small chair ;walks upstairs with one hand held; explores drawers and wastebaskets

Adaptive : Makes tower of 4 cubes; imitates scribbling;imitates vertical stroke; dumps raisin from bottle

Language : 10 words (average); names pictures; identifies one or more parts of body

Social : Feeds self;seeks help when in trouble;may complain when wet or soiled; kisses parent with pucker.

24 months :

Motors :Runs well, walks up and down stairs ,one step at a time ;opens doors ; climbs on furniture; jumps.

Adaptive : Makes tower of 7 cubes (6 at 21 mo);scribbles in circular pattern; imitates horizontal stroke; folds paper once imitatively.

Language : Puts 3 words together (subject,verb,object)

Social : Handles spoon well; often tells about immediate experiences; helps to undress; listens to stories when shown pictures

30 months :

Motors :Goes up stairs alternating feet

Adaptive : Makes tower of 9 cubes;makes vertical and horizontal strokes, but generally will not join them to make cross; imitates circular stroke, forming closed figure .

Language :Refers to self by pronoun"1"; knows full name.

Social : Helps put things away; pretends in play.

36 months :

Motors :Rides tricycle ;stands momentarily on one foot.

Adaptive :L Makes tower of 10 cubes ;imitates construction of bridge 'of 3 cubes; copies circle; imitates cross.

Language : Knows age and sex ;counts 3 objects correctly;repeats 3 numbers or a sentence of 6 syllables.

Social : Plays simple games (in"parallel"with other children); helps in dressing (unbuttons clothing and puts on shoes);washes hands.

48 months :

Motors :Hops on one foot; throws ball overhand; uses scissors to cut out pictures ; climbs well.

Adaptive : Copies bridge from model; imitates construction of "gate" of 5 cubes; copies cross and square; draws man with 2 to 4 parts besides head; identifies longer of 2 lines.

Language : Counts 4 pennies accurately; tells story.

Social : Plays with several children, with beginning of social interaction and role-playing; goes to toilet alone.

60 months :

Motors :Skips.

Adaptive: Draws triangle from copy; names heavier of 2 weights.

Language- Names 4 colors; repeats sentence of 10 syllables ;counts 10 pennies correctly

Social: Dresses and undresses ;asks questions about meaning of words ;engages in domestic role- playing