
بسم الله

Growth & puberty

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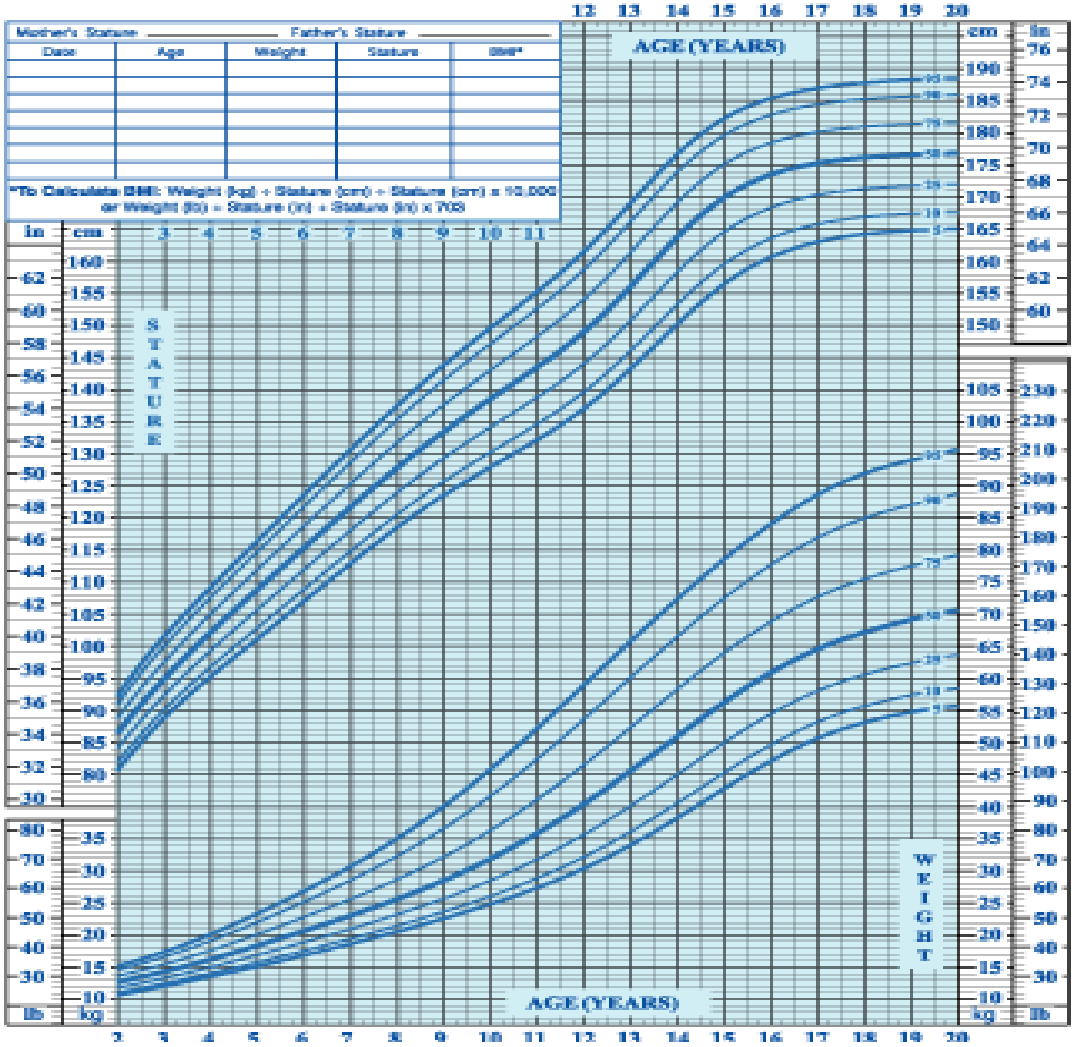
Growth Chart



Short stature

- **Height below the 3rd percentile for age.**
- **Anyone less than 10th percentile for his/her culture, area, and sex can be stated to be short.**
- **Dwarfism – severe form of SS. Height below 3SD, from the mean.**
- **Abnormal growth rates Adjusted for CA**

Fewer than 7 cm/ year under Age 4

Fewer than 6 cm/ year under Age 6

Fewer than 4.5 cm/ year from 6 years until puberty.

- Stature between – 2 and -3SD	**8% organic**
	92% normal
- Stature between – 3 and -4SD	**50% organic**
	50% other
Severe SS:	**Ht >3SD below mean**

Proportionate

U/L ratio

- About 1.7 at birth
- 1.3 at 3 yr
- 1 after 7

➢ U/L ratio less than one

arm span

- <3 Cm during the first 7 yrs
- Near 0 from 8-12 yrs
- By age 14 to:
  - + 1 Cm for girls
  - + 4 Cm for boys

➢ Arm span 2 inches greater than Ht

Short stature

Normal variants
Familial short stature
Constitutional delay

Pathologic

Proportionate

Prenatal
IUGR
  Placental disease
  Infections
  Teratogens
Dysmorphic syndrome
Chromosomal disorder

Postnatal
Endocrine disorders
  Psychosocial dwarfism
Malnutrition
Gastrointestinal disease
Cardiopulmonary disease
Chronic anemia
  Renal disorders

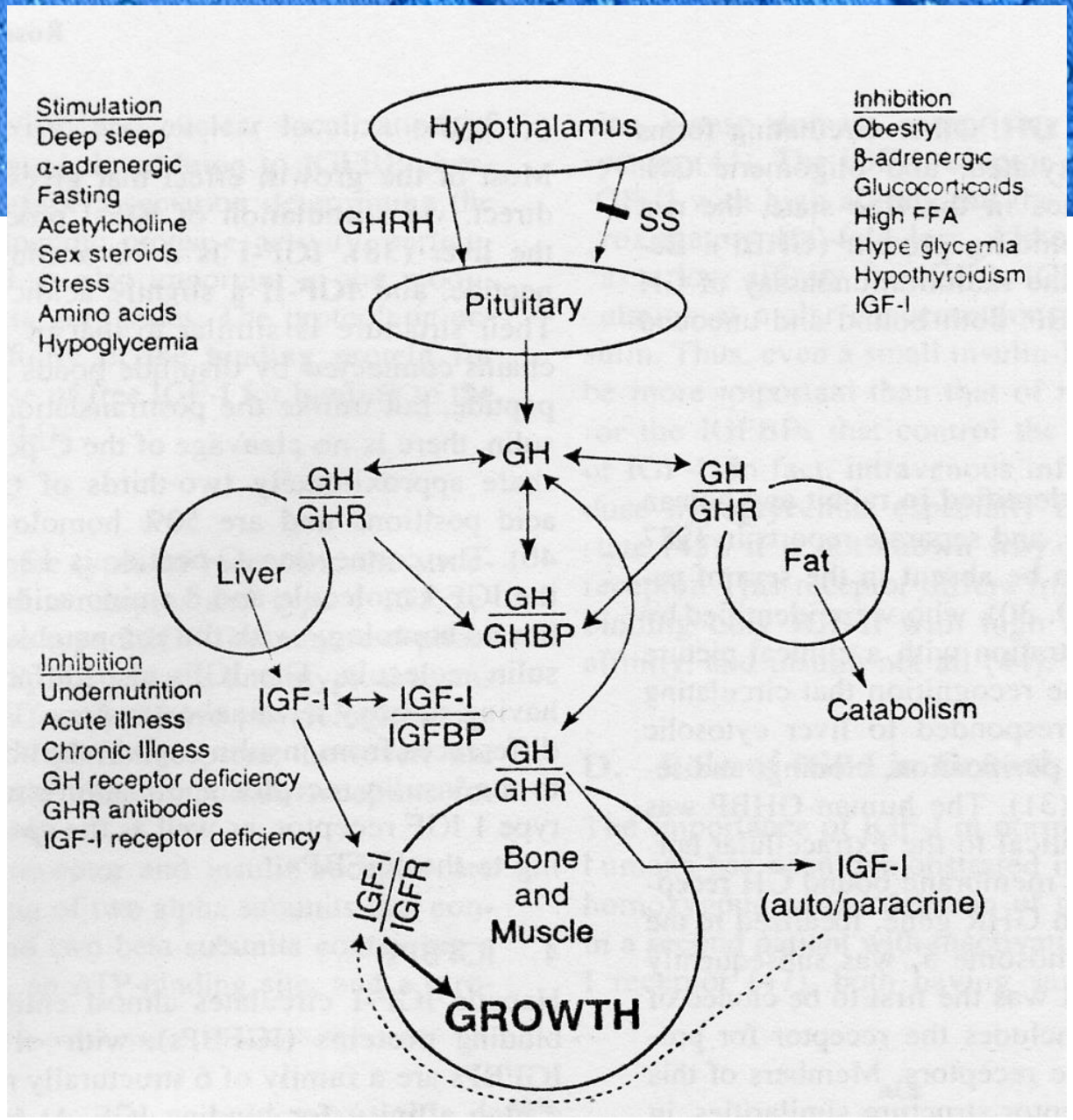
Disproportionate
Skeletal dysplasia
Rickets

Chronic disease

1. Malnutrition
2. Malabsorption and GI disease
3. Chronic liver disease
4. Cardiovascular disease
5. Hematologic disorders
6. Inborn Errors of metabolism
7. Pulmonary disease
8. Renal disease

Endocrine disorders

1. Diabetes mellitus
2. Hypothyroidism
3. Cushing's syndrome
4. Pseudohypoparathyroidism
5. Rickets
6. GH deficiency


Stimulation
Deep sleep
α-adrenergic
Fasting
Acetylcholine
Sex steroids
Stress
Amino acids
Hypoglycemia
Hypothalamus
GHRH
SS
Pituitary
Inhibition
Obesity
β-adrenergic
Glucocorticoids
High FFA
Hype glycemia
Hypothyroidism
IGF-I
GH
GH
GHR
GH
GHR
Liver
Fat
GH
GHBP
Inhibition
Undernutrition
Acute illness
Chronic Illness
GH receptor deficiency
GHR antibodies
IGF-I receptor deficiency
IGF-I
IGF-I
IGFBP
Catabolism
GH
GHR
IGF-I
IGFR
Bone
and
Muscle
IGF-I
(auto/paracrine)
GROWTH

Auxological criteria

- Severe short stature (height <−3SD)
- Height <−2SD with height velocity <−1SD over 1 year
- Height velocity <−2SD over 1 year
- Height-for-age curve has deviated downwards across two major height percentile curves.

urgent evaluation for GHD

- Severe short stature (height <−3SD)
- Height <−2SD with height velocity <−1SD over 1 year
- Height velocity <−2SD over 1 year
- Child with sellar–suprasellar mass
- Child with signs and symptoms of an intracranial lesion
- Neonate with symptoms and signs of GHD/MPHD

Laboratory tests

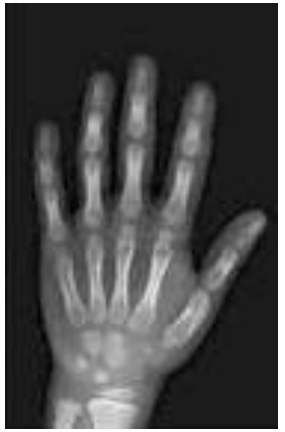
- CBC, BUN, Cr,TFT,FBC,UA,ESR,Ca,Ph, LFT,Sweat test,Na,K, AST, ALT, ALP, VBG
- GH provocative test
- Karyotyping

Bone Age

- useful in the evaluation of short stature.
- **A radiograph of the left hand and wrist**

- Growth disorders caused by an underlying illness or hormone disorder (e.g., renal disease, malnutrition, glucocorticoid excess) are associated with a delayed bone age
- hypothyroidism and GHD

- genetic disorders and familial short stature is normal
- CDGD, the bone age is delayed
- Experience
- Prediction of **Adult** Height

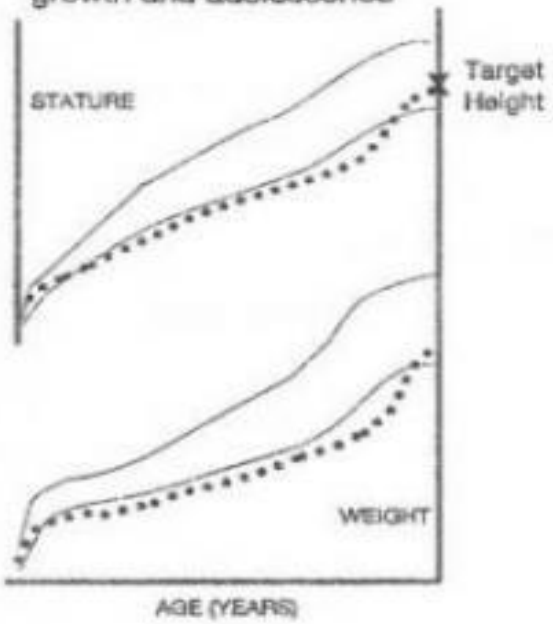


Familial Vs Constitutional*

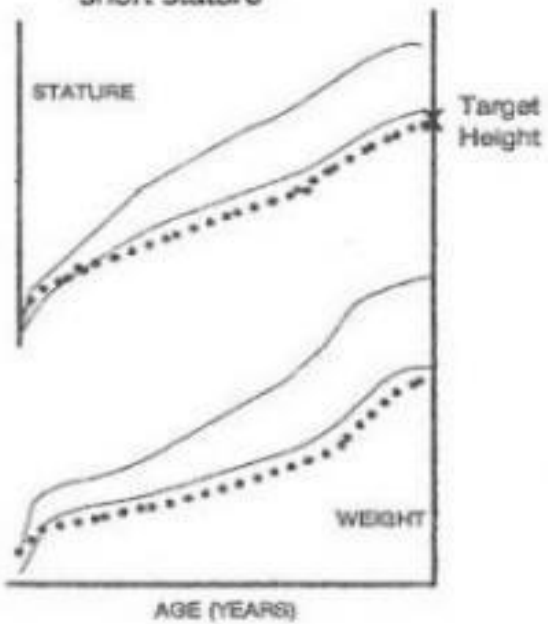
Feature	Familial Short Stature	Constitutional Short Stature
1) Sex	Both equally affected	More common in boys
2) Family History	Of short stature	Of delayed puberty
3) Height Velocity	Normal	Normal
4) Puberty	Normal	Delayed
5) Bone Age	Normal	Less than chronological age
6) Final Height	Short, but normal for target height	Normal

*IAP spatiality series Endocrinology 2nd edition

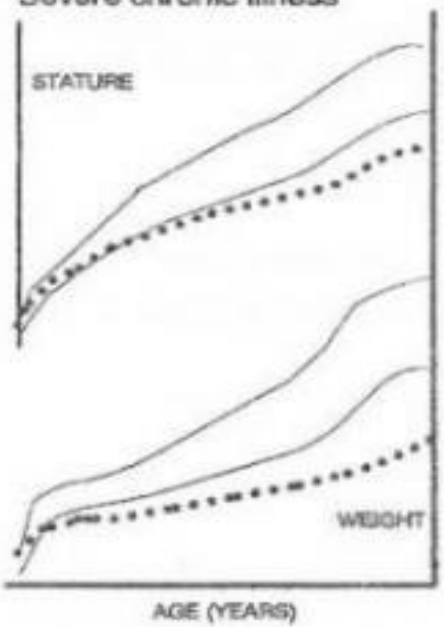
Constitutional delay of growth and adolescence



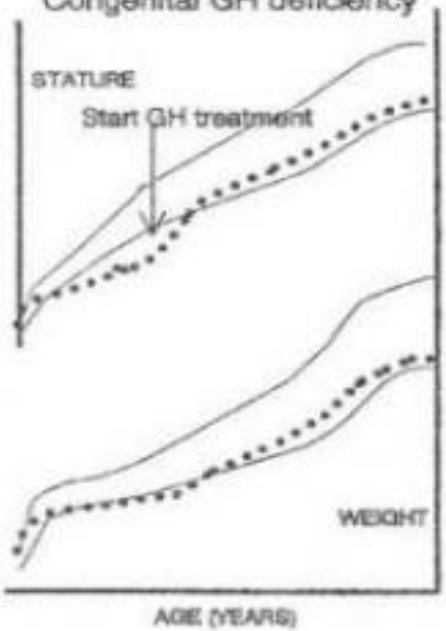
Familial or genetic short stature



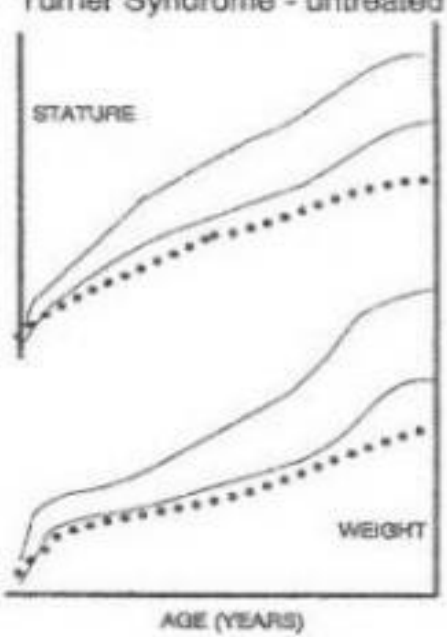
Primary nutritional deficiency
Severe chronic illness



Congenital GH deficiency



Turner Syndrome - untreated



Precocious Puberty

- Onset of secondary sexual characters before the age 8 years in girls and 9 years in boys.

Type of precocious puberty

1. Central (Gonadotropin dependent, True, C.P.P)
2. Peripheral (Pseudopuberty or Gonadotropin independent = PPI)
3. Midxed type

CPP is always isosexual

PPP may be Iso or hetrosexual.

Incomplete (Partial) precocious development

Premature thelarche

Premature pubarche (Adrenarche)

Premature menarche

Premature thelarche

- Breast development is present at birth,
- Most often appears in the first 2 yr of life
- May be unilateral or asymmetric
- Fluctuates in degree.
- May regress after 2 yr
- Often present for 3-5 yr.

Rarely is progressive

Genitalia shows no evidence of estrogenic stimulation

Menarche occurs at expected age

Lab findings in premature thelarche

- Serum level of FSH and FSH response to GnRH stimulation test is greater than normal girls.
- Plasma level of LH and estradiol are low (undetectable)
- Ultrasound examination of the ovaries reveal normal size A few small (<9 mm) cyst may be seen.

Premature pubarche (Adrenarche)

- Appearance of sexual hair before the age of 8 yr in girls as 9 in boys without other evidence of maturation.
- More in girls than in the boys.
- Adult type Axilary odor is common.
- Height and osseous maturation is slightly advanced.

Cause of PA

Early maturation of adrenal androgen production (precocious maturation of zona reticularis)

↑C-17, 20 lyase activity

↓ 3 Beta hydroxysteroid dehydrogenase activity

↑ in basal and ACTH stimulated serum concentration of Δ5 steroid (170 H pregnonolone and dihydroepiandrosterone) and lesser exlent of Δ4 steroid (androstendione)

These hormonal changes are comparable to early stage of normal puberty.

Premature menarche

- Isolated vaginal bleeding in the absence of other secondary sexual characteristics.
- It occurs 1-3 episodes of bleeding .
- Puberty occurs at the usual time and menstrual cycls are normal.

Lab findings

- Normal FSH and LH
- Estradiol may be elevated
- Some patients have ovarian follicular cyst on ultrasound.
- No need to any treatment .

DDX of PM

Common cause

- Vulvovaginitis
- Adhesion of labia
- Foreign body
- Sexual abuse

Uncommon cause

- Urethral prolaps

Delayed Puberty

Absence of sign of secondary sexual development:

- In boys after age 14
- In girls after age 13

Classification of delayed puberty

- Idiopathic or constitutional
- Gonadotropin deficiency (hypogonadotropic – hypogonadism)
- Gonadal failure (Hypergonadotropic hypogonadism)


THANK YUO