



What is Adolescence?

Adolescence is defined by the World Health Organisation (WHO) as the period of life between 10 to 19 years of age. While puberty refers to the physical and sexual maturation of boys and girls, the term adolescence refers to the behavioural characteristics of this period, which is influenced both by culture as well as physical changes.



Puberty

The period of transition between juvenile state and adulthood during which secondary sex characteristics appear and fertility is acquired.

The catalyst for puberty is unknown

Puberty occurs when there is maturation of the hypothalamo-hypophysial-gonadal axis



Puberty

- ◆ The components of maturation are
 - **pulsation of GnRH**
 - FSH and LH secretion from pituitary
 - gonads stimulate production of testosterone or estrogen



Puberty - Terminology

- ◆ Adrenarche - onset of adrenal androgen production and signals the onset of puberty; precedes puberty by 2-3 years; age 7-8
- ◆ Thelarche - Onset of breast bud development - an estrogen induced effect. Average - 10.8 yrs in the US
- ◆ Pubarche - onset of pubic hair growth under influence of estrogen or testosterone. Age-11.0 in females; 11.6 in males
- ◆ Menarche - onset of menstrual flow. Average age is 12.8 years in the US



Puberty

◆ Somatic Changes

- Secondary sex characteristics and genital growth
 - Female-all due to estrogen production - fat deposition, breast development, genital growth
 - Male-all due to testosterone - muscular growth, deepening of the voice, enlargement and increased pigmentation of scrotum, enlargement of vas deferens



Puberty

◆ Somatic Changes

- Adolescent growth spurt - sex steroid mediated in presence of growth hormone. Stimulates long bone growth and fusion of epiphyseal plates



Puberty

- ◆ Development of Hypothalamic-Pituitary-Gonadal (H-P-G) Axis
 - The one component that is missing before puberty is the pulsatile fashion of GnRH
 - Fetal life -
 - LH and FSH is secreted by fetal pituitary
 - Testes secrete testosterone, ovaries are inactive
 - Negative feedback mechanism develops -
Male - T; Female- Ø



Puberty

◆ Development of H-P-G Axis

– Infancy and Childhood

- Negative feedback mechanism becomes more sensitive to the presence of sex steroids, taking less steroid to suppress hypothalamic and pituitary hormones that prevents puberty
- H-P-G axis is active for approximately 6 months and then is suppressed
- Hypothalamic stimulation of pituitary declines by ~2 yrs of age.



Puberty

- ◆ Development of H-P-G Axis
 - Prepubertal period
 - Increased GnRH secretion
 - Increased Pituitary sensitivity
 - Increased gonadal responsiveness to LH & FSH



Puberty

◆ Development of H-P-G Axis

- Puberty - final maturation which begins approximately age 8-9
 - Sleep associated rise in LH
 - Activation of positive feedback in females; first few cycles usually anovulatory
 - Progressive development of secondary sex characteristics
 - Ovulatory cycles in female; spermatogenesis in male



Puberty

- ◆ Nutritional theory regarding puberty
 - Weight gain and percent of body fat is prerequisite to puberty
 - 48 kg/105 lbs and 17% fat
 - Females that are slightly obese (up to 30% of ideal weight) begin puberty earlier
 - Females with >30% fat may have delayed puberty



Puberty

◆ Tanner Staging - Girls

– Breast Development

<u>Stage</u>	<u>Characteristics</u>
I	Prepubertal; elevation of the papilla only
II	Breast buds are noted or palpable, with enlargement of the areola (age 9-13)
III	Further enlargement of the breast and areola, with no separation of their contours (age 10-14)
IV	Projection of areola and papilla to form a secondary mound above the level of the breast (11-15)
V	Adult contour breast with projection of papilla only (12-17)



Puberty

◆ Tanner Staging - Girls

– Pubic Hair Development

<u>Stage</u>	<u>Characteristics</u>
I	Prepubertal; no pubic hair
II	Sparse growth of long, straight or slightly curly, minimally pigmented hair, mainly on labia (age 9-13)
III	Considerably darker, coarser hair spreading over the mons pubis (age 10-14)
IV	Thick, adult-type hair, which does not yet spread to the medial surface of thighs (age 11-15)
V	Hair is adult in type and distributed in the classic inverse triangle (age 12-17)



Puberty

◆ Tanner Staging - Boys

– Genital Development

<u>Stage</u>	<u>Characteristics</u>
I	Prepubertal; testicular length <2.5 cm
II	The testes >2.5 cm in the longest diameter, and the scrotum thinning and reddening (age 10-14)
III	Growth of the penis in width and length, and further growth of the testes noted (age 11-15)
IV	Penis further enlarged, and testes larger, with darker scrotal skin color (age 12-16)
V	Genitalia adult in size and shape (age 13-17)



Puberty

◆ Tanner Staging - Boys

– Pubic Hair Development

<u>Stage</u>	<u>Characteristics</u>
I	Prepubertal; no pubic hair
II	Sparse growth of slightly pigmented, curved pubic hair, mainly at the base of the penis
III	Thicker, curlier hair spread to the mons pubis
IV	Adult-type hair, which does not yet spread to the medial thighs
V	Adult-type hair spread to the medial thighs



What are the effects of early Vs. late physical maturation?

- ◆ There exists a great deal of difference in the behavioral characteristics of early- vs. late-maturing adolescents.

In males,

- ◆ It is generally found that early-maturing boys tend to be more popular among their peers, self-assured, poised, and athletic. Late-maturing boys are generally found to be physically less attractive, less poised, more attention-seeking, and talkative.





In females,

- ◆ For girls, however, there are no clear advantages in being an early maturer. Early-maturing girls, compared to late-maturing girls, exhibit less prestige, popularity, and leadership qualities. The level of self-esteem is found to be higher in the late-maturing girls than in those who mature early.



Precocious Puberty

Precocious puberty is sexual maturation that begins before age 8 in a girl or before age 10 in a boy.

- ◆ In true precocious puberty, the sex glands (ovaries or testes) mature and a child's outward appearance becomes more adult. Pubic hair grows, and the child's body shape changes. In pseudoprecocious puberty, only the outward appearance becomes more adult, while the sex glands remain immature.
- ◆ True precocious puberty is two to five times more common in girls than in boys.



Causes

- ◆ True precocious puberty is caused by the early release of sex hormones (gonadotropins) from the pituitary gland; these hormones affect the sex organs. Early hormone release may be caused by an abnormality in the pituitary, such as a hormone-secreting tumor, or by an abnormality in the hypothalamus, the region of the brain that controls the pituitary.



About 60 percent of boys with precocious puberty have an identifiable abnormality. In contrast, no abnormality can be found in about 80 percent of girls age 6 or older with this condition, but most girls under 4 years of age with true precocious puberty have a brain abnormality.



In pseudoprecocious puberty, high levels of male sex hormones (androgens) or female sex hormones (estrogens) are produced; the cause may be a tumor in the adrenal gland or in a testis or ovary. These hormones don't cause the sex glands to mature but do cause a child to look more like an adult.



Symptoms and Diagnosis

- ◆ In both true precocious and pseudoprecocious puberty, a boy develops facial, underarm, and pubic hair. His penis lengthens, and his appearance becomes more masculine.
- ◆ A girl may start to have menstrual periods, especially if she has true precocious puberty, or she may develop breasts, pubic hair, and underarm hair.
- ◆ In boys and girls, body odor changes, and acne may appear.



Symptoms and Diagnosis cont..

- ◆ Height increases rapidly but stops at an early age. Therefore, the final height is shorter than had been expected.
- ◆ In true precocious puberty, but usually not in pseudoprecocious puberty, the testes or ovaries enlarge to adult size.



Symptoms and Diagnosis cont..

- ◆ Diagnostic tests include measuring blood hormone levels and taking x-rays of the hand and wrist to estimate bone maturity.
- ◆ Ultrasound examination of the pelvis and adrenal glands and computed tomography (CT) or magnetic resonance imaging (MRI) of the brain are performed to see whether tumors have developed in the adrenal glands, hypothalamus, or pituitary gland.



References

- ◆ Web Site references and notes can be accessed from www.medschool.co.za
- ◆ http://www.merck.com/mrkshared/mmanual_home/sec23/258.jsp
- ◆ <http://usc nurse.usc.edu/class/585/files/unit5puberty.ppt>