

Puberty and the Tanner Stages

Developed by Professor James M Tanner

Introduction

Adolescents experience several types of maturation, including cognitive (the development of formal operational thought), psychosocial (the stages of adolescence), and biologic. The complex series of biologic transitions are known as puberty, and these changes may impact psychosocial factors.

The most visible changes during puberty are growth in stature and development of secondary sexual characteristics. Equally profound are changes in body composition; the achievement of fertility; and changes in most body systems, such as the neuroendocrine axis, bone size, and mineralization; and the cardiovascular system. As an example, normal cardiovascular changes, including greater aerobic power reserve, electrocardiographic changes, and blood pressure changes, occur during puberty.

The normal sequence of pubertal events and perils of puberty are reviewed here. This is within the normal ranges and does not take into account Precocious Puberty or Delayed Puberty.

Tanner Stages

Conceptually, pubertal maturation can be described in terms of sequence, timing, and tempo. Puberty consists of a series of predictable events, and the sequence of changes in secondary sexual characteristics has been categorized by several groups. The staging system utilized most frequently is that published by Marshall and Tanner and the sequence of changes, commonly referred to as "Tanner stages", is described below.

Boys - development of external genitalia

Stage 1:	Prepubertal
Stage 2:	Enlargement of scrotum and testes; scrotum skin reddens and changes in texture
Stage 3:	Enlargement of penis (length at first); further growth of testes
Stage 4:	Increased size of penis with growth in breadth and development of glans; testes and scrotum larger, scrotum skin darker
Stage 5:	Adult genitalia

Girls - breast development

Stage 1:	Prepubertal
Stage 2:	Breast bud stage with elevation of breast and papilla; enlargement of areola
Stage 3:	Further enlargement of breast and areola; no separation of their contour
Stage 4:	Areola and papilla form a secondary mound above level of breast
Stage 5:	Mature stage: projection of papilla only, related to recession of areola

Boys and girls - pubic hair

Stage 1:	Prepubertal (can see velus hair similar to abdominal wall)
Stage 2:	Sparse growth of long, slightly pigmented hair, straight or curled, at base of penis or along labia
Stage 3:	Darker, coarser and more curled hair and begins to extend laterally
Stage 4:	Hair adult in type, but covering smaller area than in adult; no spread to medial surface of thighs
Stage 5:	Adult in type and quantity, with horizontal distribution ("feminine")

Tanner Stages - Growth

	Boys	Girls
Stage 1:	5-6cm per year	5-6cm per year
Stage 2:	5-6cm per year	7-8cm per year
Stage 3:	7-8cm per year	8cm per year
Stage 4:	10cm per year	7cm per year
Stage 5:	No further height increase after 17 years	No further height increase after 16 years