

## The growth and puberty

There are four phases of normal human growth

### Fetal

This is the fastest period of growth, accounting for about 30% of eventual height. Size at birth is determined by the size of the mother and by placental nutrient supply, which in turn modulates fetal growth factors (IGF-2, human placental lactogen and insulin).

### The infantile phase

Growth during infancy to around 18 months of age is also largely dependent on adequate nutrition. Good health and normal thyroid function are also necessary. This phase is characterized by a rapid but decelerating growth rate, and accounts for about 15% of eventual height.

The average term newborn weighs approximately 3.4 kg (7.5 lb); boys are slightly heavier than girls.

Average weight does vary by ethnicity and socioeconomic status.

The average length and head circumference are about 50 cm (20 in) and 35 cm (14 in), respectively

By the end of this phase, children have changed from their fetal length, largely determined by the uterine environment, to their genetically determined height. An inadequate rate of weight gains during this period is called 'failure to thrive

### Childhood phase

This is a slow, steady but prolonged period of growth that contributes 40% of final height. Pituitary growth hormone (GH) secretion acting to produce insulin-like growth factor 1 (IGF-1) at the epiphyses is the main determinant of a child's rate of growth, provided there is adequate nutrition and good health. Thyroid hormone, vitamin D and steroids also affect cartilage cell division and bone formation

### Pubertal growth spurt

Sex hormones, mainly testosterone and estradiol, cause the back to lengthen and boost GH secretion. This adds 15% to final height.

### Measurement

**Weight** – readily and accurately determined with electronic scales but must be performed on

a naked infant or a child dressed only in underclothing

## Height

In children over 2 years the standing height is measured

In children under 2 years, length is measured lying horizontally

**Head circumference** – the occipitofrontal

circumference is a measure of head and hence brain growth.

These measurements should be plotted as a simple dot

on an appropriate growth centile chart.

A single growth parameter should not be assessed in isolation from the other growth parameters: e.g. a child's low weight may be in proportion to the height if short, but abnormal if tall

## Measurement of children

- Measurement must be accurate for meaningful monitoring of growth
- Growth parameters should be plotted on charts
- Significant abnormalities of height are:
  - measurements outside the 0.4th or 99.6th centiles if the mid-parental height is not short or tall
  - if markedly discrepant from weight
  - serial measurements which cross growth centile lines after the first year of life.

## Puberty

In females the features of puberty are:

- Breast development – the first sign, usually starting between 8.5 and 12.5 years
- **Pubic hair growth** and a rapid height spurt – occur almost immediately after breast development
- **Menarche** – occurs on average 2.5 years after the start of puberty and signals that growth is coming to an end, with only around 5 cm height gain remaining

In males:

- **Testicular enlargement** to >4 ml volume measured using an orchidometer (Fig. 11.7) – the first sign of puberty
- **Pubic hair growth** – follows testicular enlargement, usually between 10 and 14 years of age

Height spurt – when the testicular volume is 12–15 ml, after a delay of around 18 months.

The height spurt in males occurs later and is of greater magnitude than in females, accounting for the greater final average height of males than

females.

In both sexes, there will be development of acne, axillary hair, body odor and mood changes