Anthropometric Assessment of body size

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Anthropometric assessment

- "nutritional anthropometry" was defined by Jelliffe (1966) as:

  measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition.

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Advantages of anthropometric assessment

- Simple, safe, noninvasive techniques.
- Inexpensive equipment.
- Relatively unskilled personnel can perform the measurement.
- Methods can be precise and accurate.
- Retrospective information.
- Mild to moderate under nutrition as well as severe states can defined.
- Changes in nutritional states over time can be evaluated.
- Screening tests can be devised.

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- The most widely used anthropometric measurements of body size are those of stature (height or length) and body weight.
- Head circumference is important because it is closely related to brain size.
- Recumbent length is measured in infants and children < 2 y.
- Height is measured in older children and adults.
- Measurement of lower-leg length in infants and children can be used to assess growth over short time periods.
- In adults, knee-height and arm span measurements are used to estimate height in those persons with severe spinal curvature and in those who are unable to stand.

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Head circumference

- A narrow, flexible, non stretch tape made of fiberglass or steel about 0.6 cm wide should be used.
- The subject stands with the left side facing the measurer, with arms relaxed and legs apart.

Fiberglass tape

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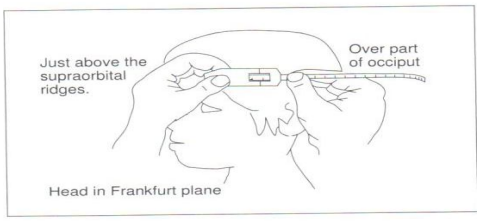

Figure 10.1: Measurement of head circumference.

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- Care must be taken to ensure that the tape is at the same level on each side of the head and pulled tightly to compress the hair.
- Measurements are made to the nearest millimeter.

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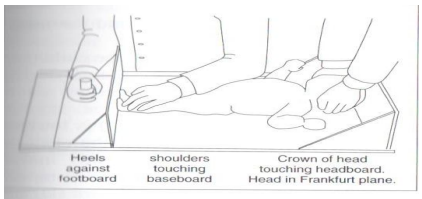
Recumbent length

- For infants and children ≤ 85 cm.
- If the subject is restless, only the left leg should be positioned for the measurement.



igure 10.3: Measurement of recumbent length. Re- duced from Robbins GE, Trowbridge FL, in:

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Height

- Children > 85 cm and adults should be measured in the standing position.
- A right-angle headboard and a measuring rod or non stretchable tape fixed to vertical surface can be used.
- Platform scales with movable measuring rods are not suitable for research measurement because they can be inaccurate.
- Clothing should be minimal when measuring height so that posture can be clearly seen.
- Shoes and socks should not be worn
- For younger subjects, it may be necessary to hold the heels to ensure they do not leave the ground.

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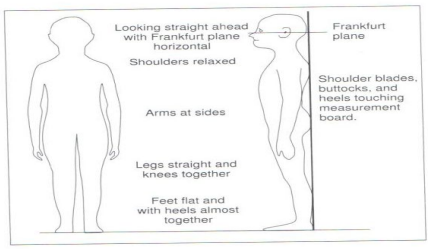

Figure 10.4: Positioning of subject for height measurement. Horizontal line is the Frankfurt plane, which should be in a horizontal position when height is measured. Reproduced from Robbins GE, Trowbridge FL,

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Knee height in children

- Two similar devices can be used to measure knee height in children > 3 y who are able to sit quietly and cooperate.

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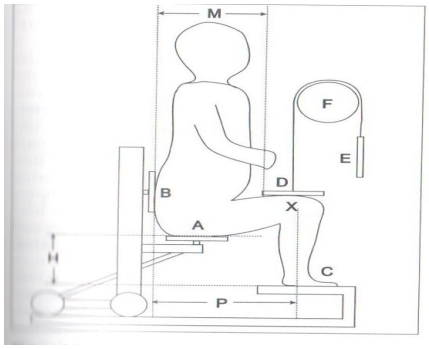
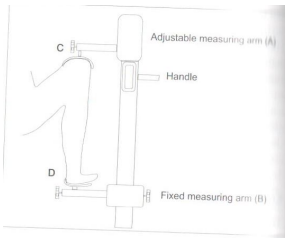


Lower leg length in infants

- The lower leg length of infants can measure short term changes in lower leg length.



Knee height in adults

- Knee height is highly correlated with stature and may be used to estimate height in persons with severe spinal curvature or who are unable to stand.
- It is measured on the left leg.

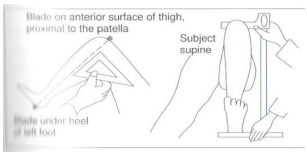


Figure 10.7: Measurement of knee height in adults.

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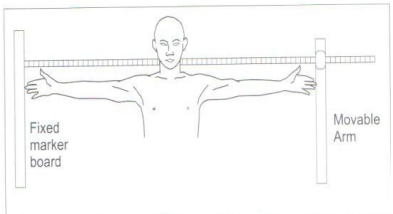
Height (Caucasian men, cm) =
(2.08 × knee height) + 59.01
Height (Caucasian women, cm) =
1.91 × knee height) − (0.17 × age) + 75.00
Height (African-American men, cm) =
1.37 × knee height) + 95.79
Height (African-American women, cm) =
1.96 × knee height) + 58.72

Arm span

- Arm span, like knee height, is also highly correlated with stature.



Weight measurement

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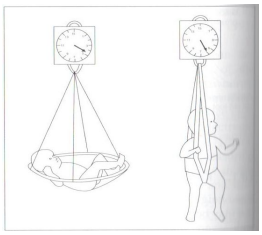
Weight in infants and children

- Care must be taken to ensure that the infant is placed on the pan scale so the weight is distributed equally on each side of the center of the pan.
- Weight is recorded to the nearest 10 g.



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Weight in older children and adults

- The measurement should be done after the bladder has been emptied and before a meal.
- The balance should be placed on a hard, flat surface (not carpet) and checked and adjusted for zero-balance before each measurement.
- The presence of visible edema should also be recorded.
- Body weight should be recorded to the nearest 0.1 kg.

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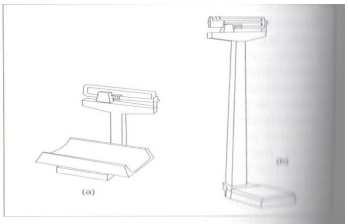

Figure 10.10: Measurement of weight: (a) [illegible] scale for infants, (b) beam balance for a child [illegible]

Elbow breadth

- It is a good measure of skeletal dimensions and frame size.
- Less affected by adiposity and highly associated with lean body mass and muscle size.

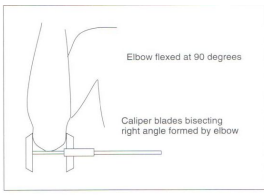

Figure 10.11: Measurement of elbow breadth.

Growth indices

- Z-scores.
- Percentiles.
- Percentage of the median

- www.cdc.gov/growthcharts

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- Head circumference-for-age
- Weight-for-age
- Weight-for-height
- Height-for-age

Weight changes

- Body weight is the sum of the protein, fat, water, and bone mass in the body.
- Changes in body weight do not provide any information on the relative changes among these components.

Weight change indicator	Calculation method
% usual wt.	$\frac{\text{actual wt.}}{\text{usual wt.}} \times 100\%$
% wt. loss	$\frac{\text{usual wt.} - \text{actual wt.}}{\text{usual wt.}} \times 100\%$
Rate of change	$\frac{BW_p - BW_i}{Day_p - Day_i}$ (kg/d)

Table 10.3: Calculation of weight change indicators. BW_p and BW_i indicate present and initial body weights on the respective days.

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Duration	Significant weight loss (%)	Severe weight loss (%)
1 wk	1–2	> 2
1 mo	5	> 5
3 mo	7.5	> 7.5
6 mo	10	> 10

Table 10.4: Evaluation of percentage of weight changes. From Blackburn et al., Journal of Parenteral and Enteral Nutrition 1: 11–22, 1977 © American Society for Parenteral and Enteral Nutrition.

Total weight gain in pregnant women

- A weight gain of 0.4 kg/wk during both the second and third trimesters is recommended for women with a normal pregnant BMI.
- 0.5 kg for those who are underweight.
- 0.3 kg for overweight women.

BMI category (kg/m^2)	IOM (1990) recommended total gain (kg)[a]
Low (BMI < 19.8)	12.5–18
Normal (BMI 19.8–26.0)	11.5–16
High (BMI 26.0–29.0)[b]	7–11.5

Table 10.5: Recommended total weight gain in pregnant women by prepregnancy BMI. [a]Adolescents and African-American women should strive for gains at the lower end of the range. [b]The recommended target weight gain for obese women (BMI > 29.0) is ⩾ 6.0.

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Body mass index in adults

Classification	BMI (kg/m^2)	Risk of comorbidities
Underweight	< 18.50	Low (but risk of other clinical problems is increased)
Normal range	18.50–24.99	Average
Overweight	⩾ 25.00	
Preobese	25.00–29.99	Increased
Obese class I	30.00–34.99	Moderate
Obese class II	35.00–39.99	Severe
Obese class III	⩾ 40.00	Very severe

Table 10.8: WHO classification of overweight in adults according to body mass index (BMI). From WHO (2000), with permission.

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BMI in children and adolescents

Overweight category	Percentile limits
Normal	< 85th percentile
At risk of overweight	⩾ 85th and < 95th percentile
Overweight	⩾ 95th percentile

Table 10.15: BMI cutoffs for overweight in children and adolescents for use in the United States. Data from Himes and Dietz, American Journal of Clinical Nutrition 59: 307–316, 1994 © Am J Clin Nutr. American Society for Clinical Nutrition.

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