Body Mass Index – calculation and usage

In some parts of the world food supplies are insufficient or are unevenly distributed and many people as a result are **underweight**.

In other parts of the world a likelier cause of being underweight is anorexia nervosa. This is a psychological condition that involves voluntary starvation and loss of body mass.

Obesity is an increasing problem in some countries. Obesity increases the risk of conditions such as coronary heart disease and type II diabetes. It reduces life expectancy significantly and is increasing the overall costs of health care in countries where rates of obesity are rising.

Body Mass Index (BMI) is used as a screening tool to identify possible weight problems, however, BMI is not a diagnostic tool. To determine if excess weight is a health risk further assessments are needed such as:
- skinfold thickness measurements
- evaluations of diet
- physical activity
- and family history

The table below can be used to assess an adult's status

BMI	Status
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and Above	Obese

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BMI is calculated the same way for both adults and children. The calculation is based on the following formula:

BMI = mass in kilograms
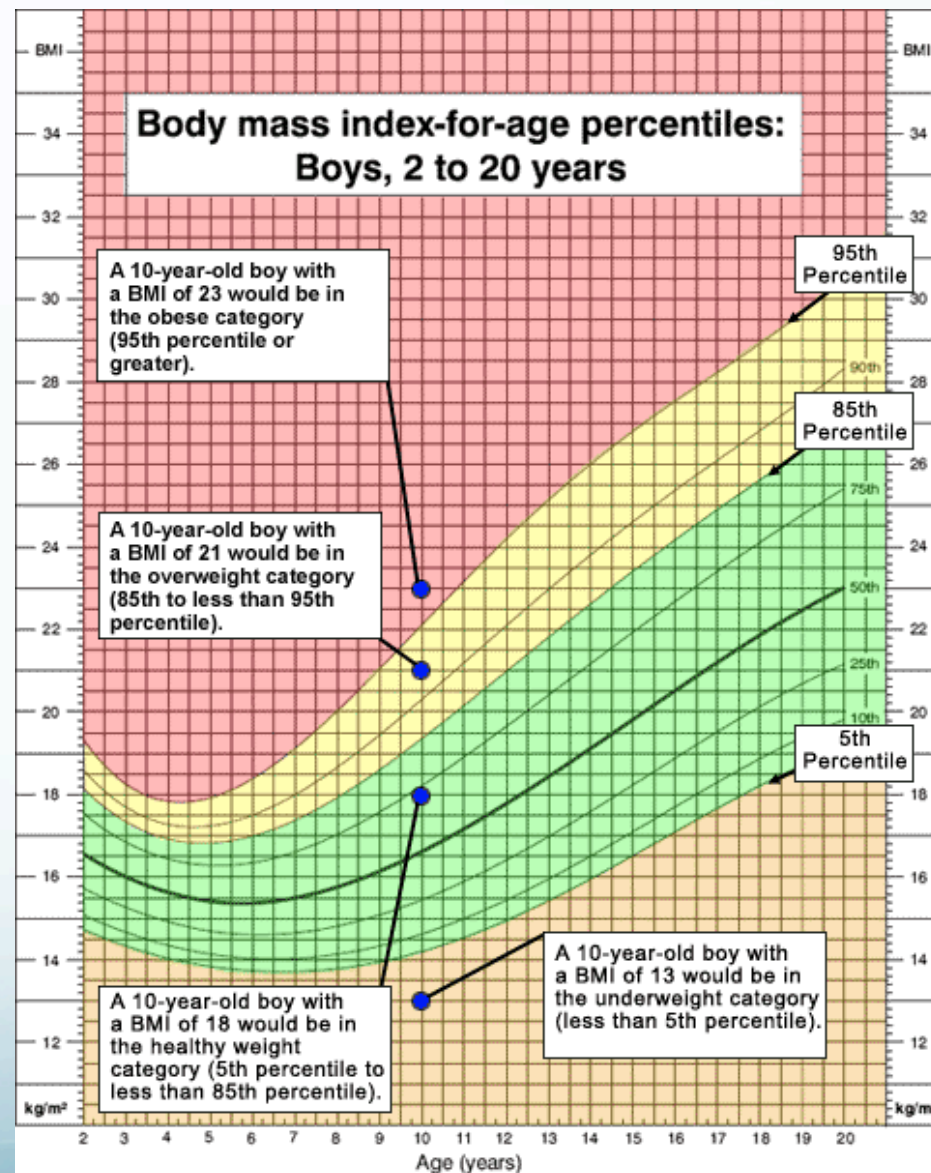$$\frac{\text{mass in kilograms}}{(\text{height in meters})^2}$$

units for BMI are kg m^{-2}

Example:

Mass = 68 kg, Height = 165 cm (1.65 m)

BMI = 68 ÷ (1.65)^2 = 24.98 kg m^{-2}

*In this example the adult would be (borderline) overweight - see the table on the previous slide*

Charts such as the one to the right can also be used to assess BMI.

Body mass index-for-age percentiles: Boys, 2 to 20 years

A 10-year-old boy with a BMI of 23 would be in the obese category (95th percentile or greater).

A 10-year-old boy with a BMI of 21 would be in the overweight category (85th to less than 95th percentile).

A 10-year-old boy with a BMI of 18 would be in the healthy weight category (5th percentile to less than 85th percentile).

A 10-year-old boy with a BMI of 13 would be in the underweight category (less than 5th percentile).

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An alternative to calculating the BMI is a nomogram. Simply use a ruler to draw a line from the body mass (weight) to the height of a person. Where it intersects the W/H² line the person's BMI can be determined. Now use the table to assess their BMI status.

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(feet) height (m)   Body mass index   (lbs) weight (kg)

$$BMI = W(\text{kg})/H(\text{m})^2$$
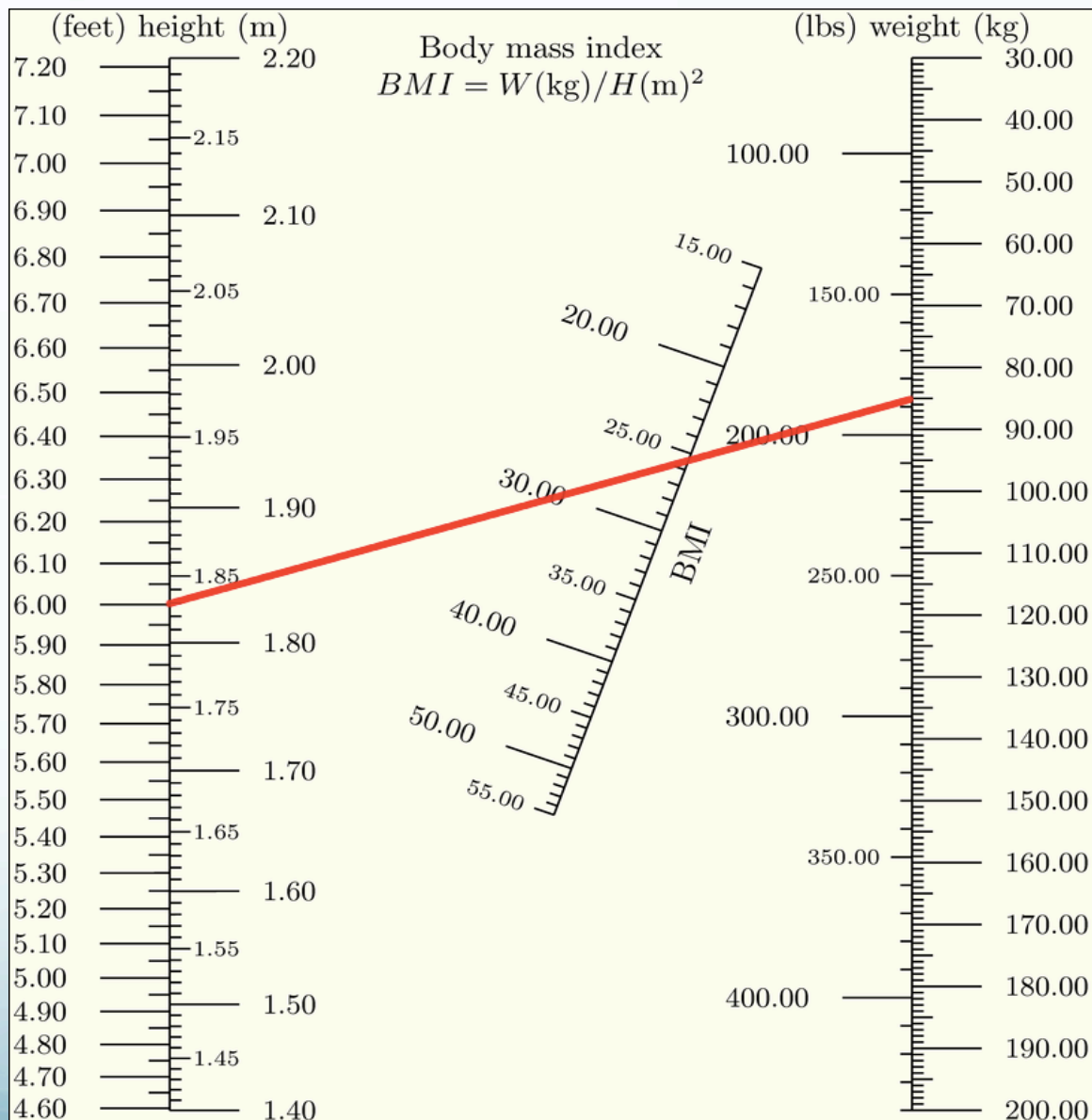
Body Mass Index – calculation and usage

1. A man has a mass of 75 kg and a height of 1.45 meters.

   a. Calculate his body mass index. (1)

   b. Deduce the body mass status of this man using the table. (1)

   c. Outline the relationship between height and BMI for a fixed body mass. (1)

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Body Mass Index – calculation and usage

1. A man has a mass of 75 kg and a height of 1.45 meters.

   a. Calculate his body mass index. (1)

   BMI = mass in kg ÷ (height in m)^2
   = 75 kg ÷ (1.45 m)^2
   = 75 kg ÷ 2.10 m^2
   = 35.7 kg m^{-2}

   b. Deduce the body mass status of this man using the table. (1)

   35.7 kg m^{-2} is above 30.0 (see table below) therefore the person would be classified obese.

   c. Outline the relationship between height and BMI for a fixed body mass. (1)

   The taller a person the smaller the BMI; (negative correlation, but not a linear relationship)

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Body Mass Index – calculation and usage

2. A person has a height of 150 cm and
   a BMI of 40.
   a. Calculate the minimum amount of
      body mass they must lose to reach
      normal body mass status. Show all of
      your working. (3)

   b. Suggest two ways in which the
      person could reduce their body
      mass. (2)

Body Mass Index – calculation and usage

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   a. Calculate the minimum amount of body mass they must lose to reach normal body mass status. Show all of your working. (3)

   b. Suggest two ways in which the person could reduce their body mass. (2)

Reduce their nutritional intake / diet / reduce the intake of lipids;
Exercise / increase activity levels;

BMI = mass in kg ÷ (height in m)^2

mass in kg = BMI ÷ (height in m)^2

Actual body mass = BMI ÷ (height in m)^2
= 40 kg m^{-2} x (1.50 m)^2
= 90 kg

Normal BMI is a maximum of 24.9 kg m^{-2}

Normal body mass
= 24.9 kg m^{-2} x (1.5 m)^2
= 56 kg

To reach normal status the person needs to lose 90 kg – 56 kg = 34 kg