



What are you made of?

How maths can get inside your body

The Bod Pod measures how much air your body displaces to find your volume (similar to the way the water rises when you hop into the bath) and uses an electronic scale to measure your weight. It uses these values to calculate the percentage of your body which is made up of fat. The equation:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

calculates the overall density of your body, D_{body} .

Your body is made up of some fat and other tissues like muscles and bones. The density of the fat in our bodies is very different from the density of the other fat-free tissues because muscles and bones are heavier than fat. The densities of these components of your body, D_{body} , D_{fat} and $D_{\text{fat-free tissue}}$, have the following relationship:

$$\frac{1}{D_{\text{body}}} = \frac{F}{D_{\text{fat}}} + \frac{(1-F)}{D_{\text{fat-free tissue}}}$$

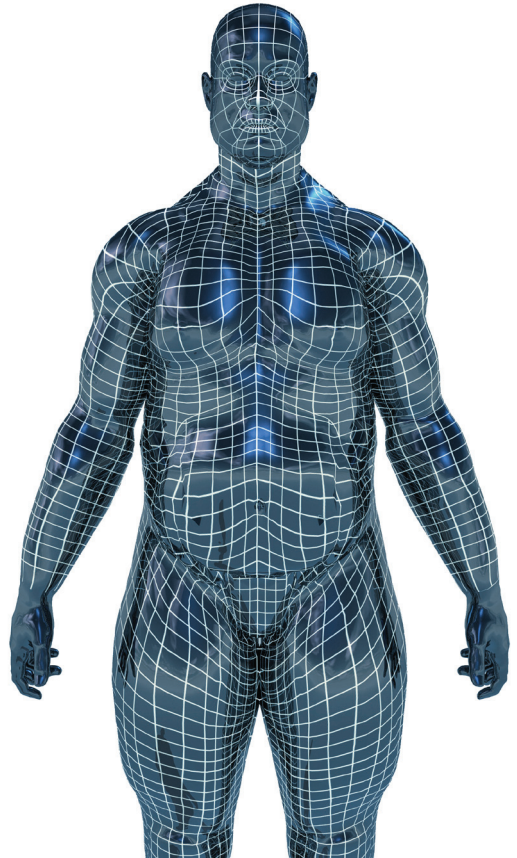
where F is the proportion of your body mass that is made up of fat.

This equation can be rearranged to give:

$$F = \frac{A}{D_{\text{body}}} - B$$

where the values A and B depend only on the densities of fat and fat-free tissue.

The Bod Pod uses this equation to calculate your percentage body fat which is simply $F \times 100$. It uses estimates of A and B from past experimental research. For the general population $A = 4.95$ and $B = 4.5$ are used, but these values can vary according to your age, gender or race.



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