

Measuring body composition using bioelectrical bioimpedance

Keywords: [Fat free mass](#) [fat mass](#) [lean body mass](#)

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Body composition refers to the relative proportions of body weight in terms of lean body mass and body fat. Lean body mass represents the weight of muscle, bone, internal organs, and connective tissue. Because muscular tissue takes up less space in our body than fat tissue, our body composition, as well as our weight, determines leanness. Two people of equal height and body weight may look completely different from each other because they have a different body composition. Body fat represents the remaining fat tissue. Body fat serves three important functions: (1) Act as an insulator to conserve heat; (2) Provides metabolic fuel for the production of energy; (3) Acts as padding to cushion your internal organs. It's essential to maintain some body fat, but an excess level may pose a serious health risk in adults.

How is body composition measured?

Body composition (particularly body fat percentage) can be measured in several ways. The most frequently used techniques are:

- **Bioelectrical Impedance Analysis (BIA):** The analysis that you just received is BIA uses a scale to send an undetectably low voltage electric current up one leg and down the other. Since fat is a poor conductor of electricity, fat will impede the current more so than lean muscle tissue. By measuring the resistance to the current, the machine estimates the percent body fat. BIA represents a 2-compartment model for estimating body composition, because it can divide the body into two compartments: fat and all other fat-free mass that does include bone. If the pre-test protocol is followed the test has $\pm 3\%$ accuracy. This form of measurement is the most widely used due to yielding timely results within seconds.
- **Skinfold Testing:** When performed by a trained professional skinfold testing is more accurate than bioelectrical impedance. Skinfold testing uses a tool called a caliper to pinch multiples places on the body in order to measure the thickness of the fold. Skinfold testing can include at the minimum three fold sites and at the maximum nine sites including areas such as the chest, subscapular region, arms, thighs, and abdominal areas. These measurements are used to estimate total body fat with a margin of error of approximately four percentage points depending on the experience and accuracy of the tester and by the adherence of the pre-test protocol followed by the participant.
- **Dual- Dual-Energy X-Ray Absorptiometry (DXA):** DXA, once used for determining bone density, evolved into a technique for also estimating body composition. DXA represents a 3-compartment model for estimating body composition, because it can divide the body into three compartments: fat, bone mineral, and all other fat-free mass that does not include bone. Thus, unlike 2-compartment models, DEXA is not subject to errors caused by variations in bone density among different ethnicities.
- **Whole-Body Air Displacement Plethysmography (Bod Pod):** The technique measures the volume of air displaced by the person and the measurement involves air being gently blown around the subject during two 1-minute periods. Body volume is combined with body weight (mass) in order to determine body density. The technique then estimates the percentage of body fat and lean body mass through known equations (for the density of fat and fat free mass).
- **Other techniques are: Isotope dilution (hydrometry), Magnetic resonance imaging (MRI), computed tomography (CT), and multicompartement models.**

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