




Methods for Estimating Body Fat

Technique	Precision	Time	Sources of Error	Advantages	Disadvantages
Dual Energy X-ray Analysis	+/- <1%	~5 min.	Most precise	Fast; most accurate; clothing okay	Not portable
Underwater Weighing	+/-1%	1 hour plus (may include enema for best results)	Underestimates % fat in African-Americans; high muscle mass (overestimates % fat in bodybuilders); gases in lung and gut; equation used (age-, race-, gender- and activity-specific)	Relatively accurate; very consistent (great for measuring changes in % bodyfat); former gold standard	Uncomfortable; wet; bulky apparatus; skimpy outfit required; time-consuming; expensive; hard to find (for example, colleges); bone density assumption causes error
Bod Pod 	+/-1%	5-8 min.	Same as underwater weighing; temperature; hydration	Relatively accurate; very consistent (great for changes in % bodyfat); comfortable; very fast; easy to use; usable by frail, elderly	Bulky (but portable) skimpy outfit required; expensive; may be hard to find; bone density assumption causes error
Skinfold (Fatfold) Caliper 	+/-3.7%–5%	10-15 min. (includes repeats and calculations)	Measuring technique fat compressibility; age; equation used (age-, race-, gender- and activity-specific)	Cheap; convenient; fast; portable; useful for detecting changes in % bodyfat	Requires precise and consistent technique; not accurate for very thin or very fat people; only measures fat under the skin; some caliper brands are unreliable; not an accurate estimate of actual % bodyfat; based on underwater weighing (same flaws)
Circumference Measures	+/-3.7%–5%	~5 min.	High error due to holding breath, tape measure placement, etc.	Fast; free with tape measure	Not very accurate
Waist-Hip Ratio	—	~5 min.	High error due to holding breath, tape measure placement, etc.	Fast; free; predictor of heart disease and diabetes risk	Doesn't give information on body fat
BIA 	+/-3.5%–4%	~1 min.	Dehydration, bladder status, temperature; fat asymmetry (hand-held devices test upper body only); arm position; nearby appliances; exercise equation used (age-, race-, gender- and activity-specific)	Cheap; easy to use; portable; extremely fast; accurate for estimating total body water in populations if height, weight and other variables added	Poor accuracy detecting changes in % bodyfat (readings fluctuate too much); many other variables needed for accuracy (for example, weight/height); based on underwater weighing (same flaws)
Near-Infrared Reactance	>5%	~1 min.	Measures at only 1 site; very unreliable	Fastest	Measuring at one site of little value (worse than skinfold methods); flawed overall
Body Mass Index (BMI)	>5%	~5 min.	Posture (height), hydration and bowel status (weight)	Fast; free; predictor of life expectancy	Doesn't give reliable estimate of % bodyfat for athletes