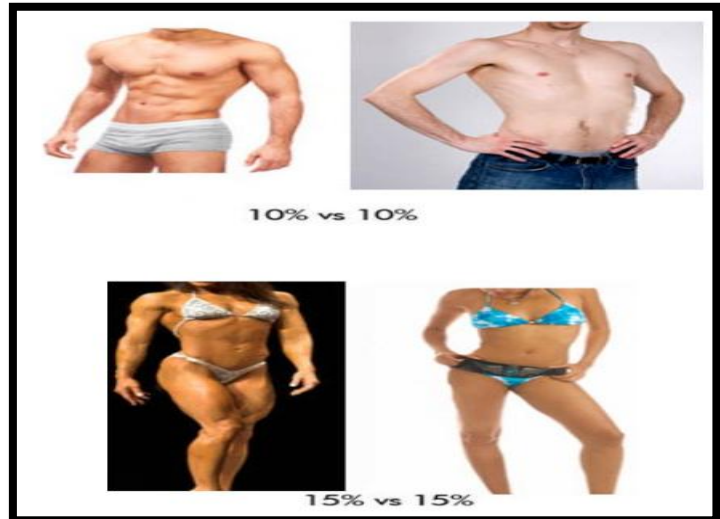


Measurement body fats :

There are several ways can be used to estimate fat percentage :

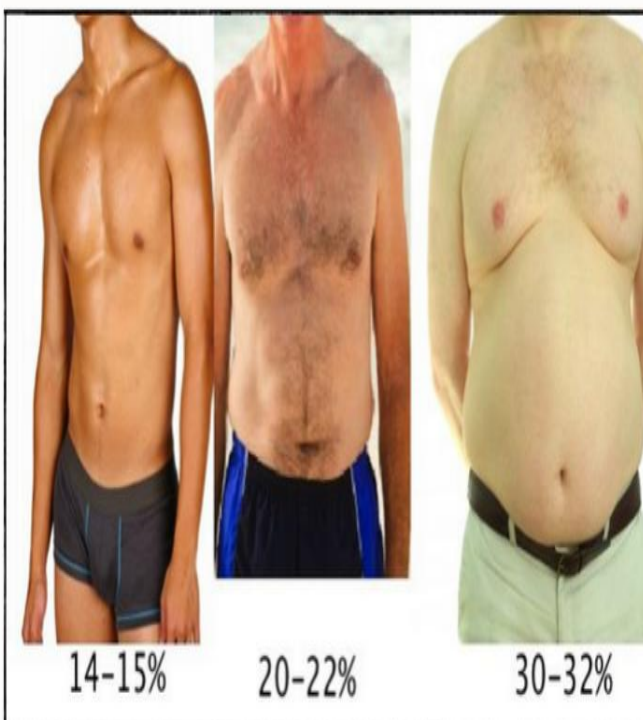
1- Visual Perception

Estimate your body fat percentage simply by looking at yourself in the mirror, and comparing your body to a list of pictures that indicate the percentage of body fat.



Note: not everybody look alike if they have the same percentage of body fat, and this depends much on muscle mass

Accepted chart for women and men when it comes to body fat percentage:



	Women	Men
Essential fat	10-12%	2-4%
Athletes	14-20%	6-13%
Fitness	21-24%	14-17%
Acceptable	25-31%	18-25%
Obese	32% plus	26% plus



2- Bioelectrical Impedance

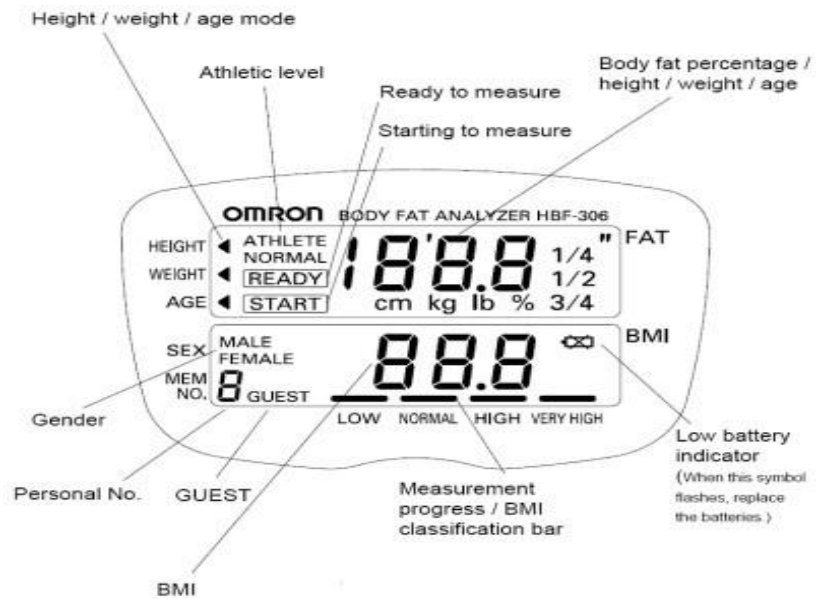
This method depends on measuring the resistance of body tissues to the flow of a tiny a painless (harmless) electrical signal that's sent through your body. Because it takes different amounts of time for the signal to pass through fat, muscle, bone and water, the time it takes it to move from one side of your body to the other can be used to estimate body fat.

The electrical signal easily passes through water, muscle faster the signal reaches the other side of your body and slows down when it goes through fat.

- ❖ Electrical current faces less impedance when it flows through body parts that contain much water such as blood and muscle than it does through fat.
- ❖ This method measures the speed and strength of the electrical signal that is sent through the body. Then depending on this measurement along with other information like weight, height, and gender it predicts the percentage of fat in the body.
- ❖ TBW can be estimated from impedance because electrolytes in TBW are excellent conductors of electrical current When volume of TBW is large, the current flows more easily through body with less resistance
- ❖ The resistance to current flow is greater in individuals with large amounts of body fat, since adipose tissue , with its relatively low water content is a poor conductor of electrical current

$$\text{FFM(Kg)} = 0.00066360(\text{ht}^2) - 0.02117(\text{R}) + 0.62854 (\text{BM}) - 0.12380 (\text{age}) + 9.33285$$

- Professional use: Spot electrodes are placed on your hands and feet. These electrodes are connected to a bioelectrical impedance device.
- Cautions
 - 1- You need to be properly **hydrated**, because they are based on normal ranges of water inside the body. So if dehydrated, the percentage of fat will be **overestimated**. Dehydration is a recognized factor affecting BIA measurements as it causes **an increase in the body's electrical resistance**,
 - 2- Body fat measurements are lower when measurements are taken shortly after **consumption of a meal** (an overestimation of body fat)
 - 3- Its **better** that you use it under the same conditions every time (1- adequate hydration 2- at the same time of the day) to get the best results.
 - 4- Moderate **exercise** before BIA measurements lead to an overestimation of fat-free mass and an underestimation of body fat percentage due to reduced impedance, For example, moderate intensity exercise for 90–120 minutes before BIA measurements causes nearly a 12 kg overestimation of fat-free mass.



3-Near-infrared Interactance (NIR)

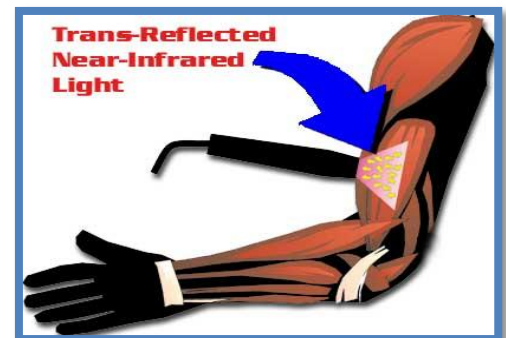
In this method a fiber optic probe sends out a beam of near infrared light to an area of your body (usually the biceps). Some of this light gets **absorbed**, some of it gets **transmitted**, and some of it gets **reflected**. A detector within the probe measures the **intensity of the light** that penetrated the tissues then reflected off the bone. This probe is connected to a digital analyzer, which uses the readings of the detector along with age and activity level to calculate the body fat percentage using a prediction equation. This method depends on the fact that the ratios between tissues under the skin affect the intensity of the reflected near-infrared light.

Pros

- It's a safe method and the device is portable and lightweight.
- Doesn't require much training to be used.

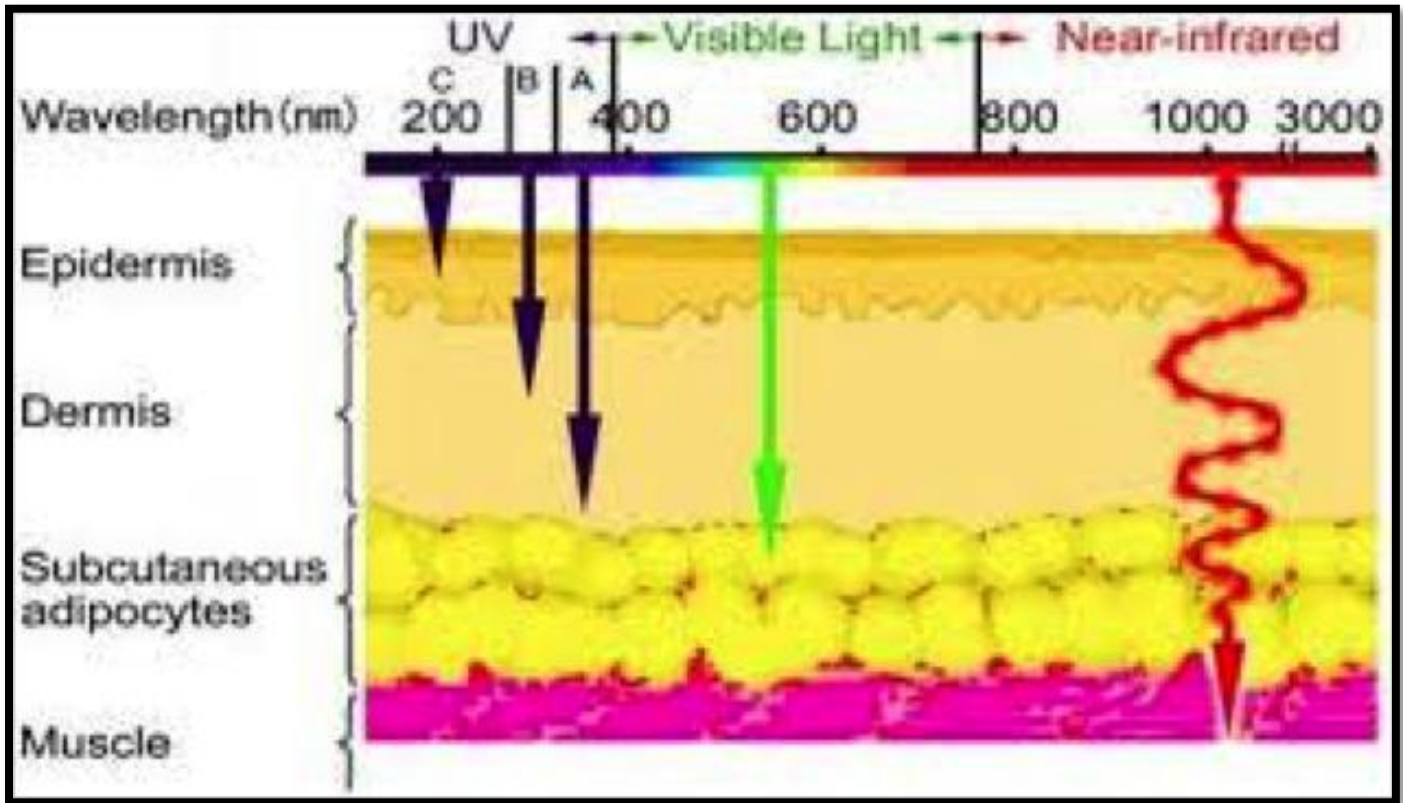
Cons

- May not give accurate readings if there were thick fat layers.
- It assumes that fat in the biceps has fixed proportions to total body fat, which may not be true.





Equipment required: Near Infrared Interactance is measured using a computerized spectrophotometer, which has a single, rapid scanning monochromator and fiber optic probe.



Procedure: This method uses the principles of light absorption and reflection to measure body fat. The measurement is taken on the person's dominant arm. A monochromator, sends a low-energy beam of near-infrared light into the biceps and penetrates the underlying tissue to a depth of one centimeter. The energy is either reflected, absorbed, or transmitted, depending on the scattering and absorption properties of the biceps. A detector within the monochromator measures the intensity of the re-emitted light. Shifts in the wavelength of the reflected beam and a prediction equation are used to compute the percent body fat.

4-Hydrodensitometry Also known as underwater weighing

This method **depends** on fat has less density than other body tissues, which weight under water will be less than the air.

Based on Archimedes' principle: an object (or human) immersed in fluid, loses an amount of weight equivalent to the weight of the fluid that is displaced

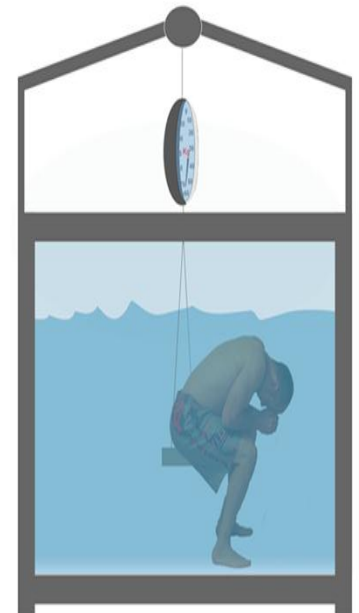
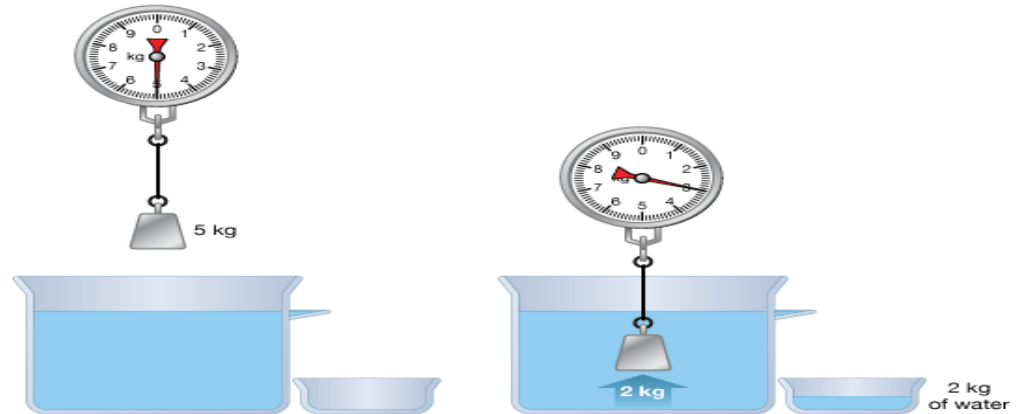


Archimedes' principle

Body density = body mass / body volume.

$$\% \text{ body fat} = (4.95 / \text{body density}) - 4.50.$$

- sit on a special scale in the water while just your head is above water, then you submerge your head completely in water and exhale as much air as you can.
- You remain motionless while your weight is recorded (it just takes a second or a few seconds).
- This procedure is repeated several times to get an accurate dependable reading.
- The operator enters the readings into an equation to calculate body density then body fat percentage.



Pros

- It was considered the accepted reference method of body fat estimation for many years.

Cons

- Some people feel uncomfortable when they are fully submerged in water, which may cause incorrect readings.
- An experienced operator is required for this procedure.
- It doesn't show the distribution of fat in the body.

5- DEXA scan (Dual X-Ray Absorptiometry)

The DEXA scan calculates your body composition by passing a very low level X-ray of two different wave lengths through you towards the detector which is under the table that you lay on. How much of that x-ray of each wave length gets through to the detector in each pixel of you is determined by the overall density of your body in that



pixel.



The result of this scan divides the body into three components: bones, lean (fat free) mass, and fat mass.

Pros

- A precise and accurate method.
- Safe to use.
- Not only it gives the percentage of the body fat, it shows how fat is distributed in the body.

Cons

- The equipment used is expensive.
- Should be used in laboratory settings.