

InBody Education

Level Basic Training: Body Composition principles



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What is Body Composition

Health practitioners universally agree that too much fat is a serious health risk. Problems such as hypertension, elevated blood lipids (fats and cholesterol), diabetes mellitus, cardiovascular disease, respiratory dysfunction, gall bladder disease, and a myriad of other health problems are all related to obesity.

Being thin does **not** automatically reduce one's health risk. Being thin refers to weighing *less than the recommended values in age-height-weight tables*. Leanness, however, refers to the **muscle, bone, and fat composition of one's body weight**. Being lean intrinsically indicates greater muscle mass development than thin. Understanding the differences between thinness, leanness, overweight, and obesity is important for health practitioners to:

- Develop complete physical fitness profiles for clients
- Monitor body fat loss and muscle growth due to exercise/diet
- Provide baseline data for nutrition counseling and treatment of obesity
- Describe changes due to growth, development, maturation, and aging
- Maximise the performance of athletes and individuals, alike



What is Body Composition

Your body is made up of water, fat, protein, carbohydrate and various vitamins and minerals. If you have too much fat — especially if a lot of it is at your waist — you're at higher risk for such health problems as *high blood pressure, high blood cholesterol and diabetes*

Body composition and growth are **key components** of health in both individuals and populations.

The ongoing epidemic of obesity in children and adults has highlighted the importance of body fat for short term and long term health.

However, **other components of body composition also influence health outcomes**, and its measurement is increasingly considered valuable in clinical practice.

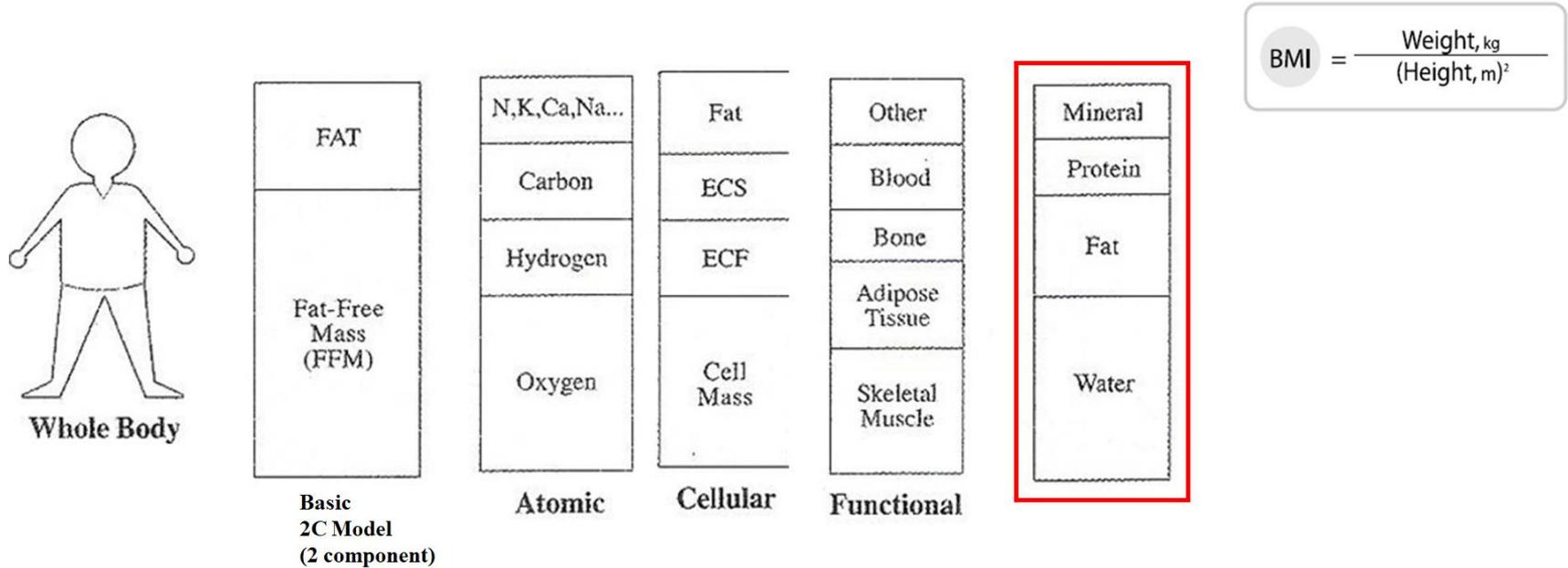


An organism's composition reflects the net lifetime accumulation of nutrients and other substrates acquired from the environment and retained by the body. Components ranging from elements to tissues and organs are the building blocks that give mass, shape, and function to all living things.



What is the body made of?

Despite the widespread use of BMI (Body Mass Index) as a health assessment tool, newer technologies are able to separate body weight into specific components that can be examined separately. The body composition can be studied into five different models, as seen in the below image: Basic 2C Model, Atomic, Cellular, Functional and Chemical 4C Model. InBody uses the last one.



What is the body made of?

The 4C model divides the body into 4 compartments: water, protein, mineral and fat.

WATER

PROTEIN

MINERAL

FAT



Human body is made up with 50~70% of body water

It plays the major role in a majority of functions within the body. Cells in our body hold water in order to maintain the health of the cell's components, while water dissolves solids and transport nutrients in and out of the body.



What is the body made of?

The 4C model divides the body into 4 compartments: water, protein, mineral and fat.

WATER



PROTEIN



MINERAL



FAT



Protein are necessary for growth and physical / functional maintenance. They are the major structural component of all cells in the body, especially muscle. Responsible for hormone regulation, immune response, cellular repair.



What is the body made of?

The 4C model divides the body into 4 compartments: water, protein, mineral and fat.

WATER



PROTEIN



MINERAL



FAT



Minerals support the biochemical reactions of metabolism, are mostly included in teeth and bones.

They can be split into osseous (present in the bones) and non osseous (present into the cells and in the blood).



What is the body made of?

The 4C model divides the body into 4 compartments: water, protein, mineral and fat.

WATER



PROTEIN



MINERAL



FAT



Fat is also very important for the organism, it allows the body to store energy, protects internal organs, acts as an insulator and regulates body temperature.



What is the body made of?

The 4C model divides the body into 4 compartments: water, protein, mineral and fat.

WATER

PROTEIN

MINERAL

FAT



FAT FREE MASS



FAT MASS



Why do we need body composition?

The traditional methods of assessing health, such as weight and body mass index (BMI) can be misleading.

The two persons in the picture have the same weight, height, therefore the same BMI, but they are very different.

Why? Cause the body composition is different.



Height 180cm
Weight 105Kg
BMI 32.4

Height 180cm
Weight 105Kg
BMI 32.4

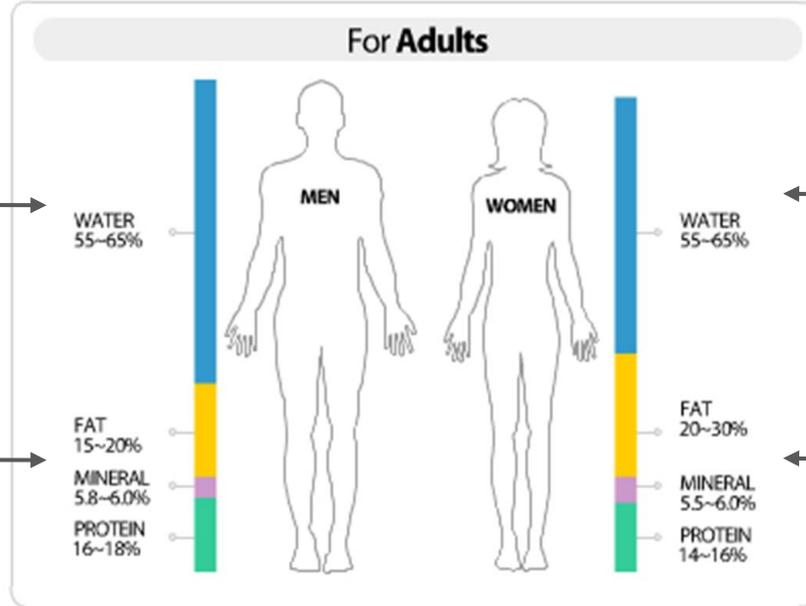


Why do we need body composition?

Having a good body composition, means having a good balance between all the different components of your body. If the amount of even one of the 4 components (water, muscle, fat, minerals) gets out of balance severely, it can lead to diseases.

Too little bone minerals can lead to osteoporosis, which can lead to bone fractures.

Too little muscle can cause sarcopenia, but also play a role in the development of diabetes, because muscles plays an important role in the absorption of glucose.



Broken fluid balance can lead to edema, may indicate renal failure/cardiovascular disease.

Too much fat can lead to cardiovascular disease, diabetes and even cancer.

Scientific evidence shows that a healthy body composition will increase your lifespan; reduce the risk of heart disease, cancer, diabetes, insulin resistance, etc.; increase energy levels, and improve self-esteem.



Fat Free Mass (FFM)

The Fat Free Mass (FFM), simply defined, is the sum of all **non-fat** components of the body. It includes the muscles, bones, ligaments, tendons, blood, and internal organs, **without the fat component**. It is around the 70~85% of the total body weight and it contains almost all the total body water.

Organs



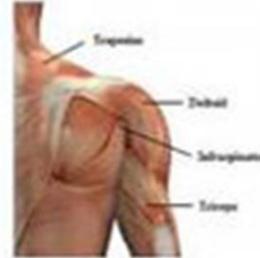
Blood



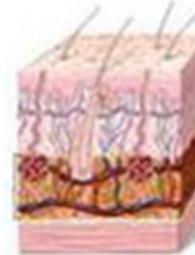
Bones



Muscle



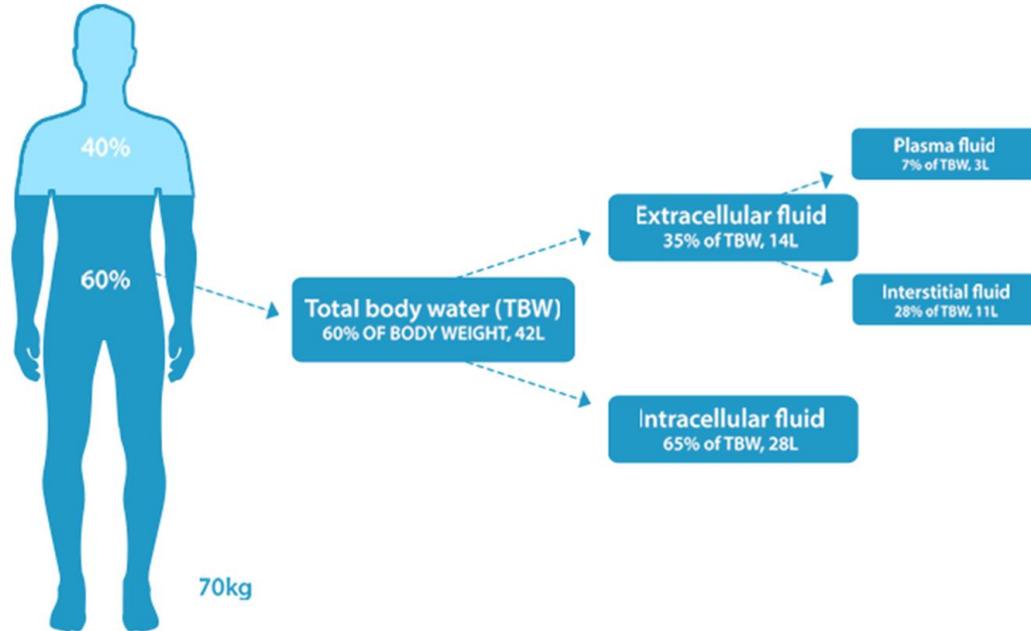
Skin



Fat Free Mass (FFM): Body Water

The main component of Fat Free Mass is WATER (FFM is 73% of water).

Body water (TBW) plays an important role for the body: it carries nutrients, removes waste during metabolism, keeps the body temperature in control and it is used during nutrient decomposition/synthesis.



$$TBW = ICW + ECW$$

The absolute value of ICW and ECW can vary based on body composition (high muscle mass \rightarrow high ICW). It is important to evaluate the **RELATIONSHIP** between ICW and ECW, which in healthy people is constant and equal to about 3:2.

$$ICW \ 3 : ECW \ 2$$



Fat Free Mass (FFM): Body Water

Because the ICW can be seen as the water inside the muscles.

High values of ICW do not indicate swollen cells but greater cellularity -> high muscle mass.

Low values of ICW do not indicate more deflated cells, but fewer cells -> reduced muscle mass (elderly, malnutrition, sedentary lifestyle).

High values of ECW can be observed in people with high BMI (athlete/overweight).

Low values of extracellular water are observed in case of low BMI (underweight).

In InBody technology we use the ECW ratio (ECW/TBW) to measure the extra fluid.

High ECW ratio values indicate accumulation of extracellular water (edema)

Low ECW ratio values indicate dehydration.

- In general, when the body mass index is high (athlete, overweight person), they are observed high values of total body water, intracellular water and extracellular water.

- In people who are underweight, sarcopenic or severely malnourished, due to mass reduction muscle and BMI, a decrease in the 3 parameters is observed.



Fat Free Mass (FFM): Protein

The proteins are fundamentals for the Body:

1. Structural function: the connective tissue of the body, that is, the tissue that supports and acts as a "bridge" between the different organs and the different structures body, it is mainly made up of collagen, a protein
2. Immune function: antibodies are proteins
3. Hormonal function: many hormones are proteins (eg insulin, GH ..)
4. Receptor function and transport of substances between the inside and outside of the cell: proteins are present on cell membranes
5. Enzymatic function: enzymes are proteins! These are at the base not of the digestion of food, but also of all reactions chemicals that take place inside the cell!
6. Contractile function: proteins, as already mentioned, make up part of the muscle that has contractile properties!
7. Energy function: proteins, in the event of a shortage of energy substrates, can be demolished to provide energy to the body.



Fat Free Mass (FFM): Protein

Proteins build up the Muscle, which can be: Skeletal, Cardiac or Smooth muscle.

Skeletal muscle mass is defined as a form of striated muscle tissue which is under the control of the somatic nervous system (can be moved/controlled voluntarily).

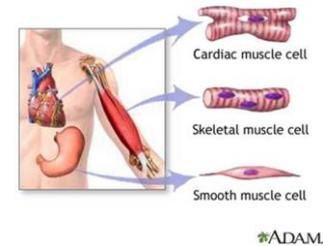
Skeletal muscle is connected directly to the bones mostly by attaching to tendons. These muscles, while primarily important for **posture** and maintaining the normal balance/structure of the human body, are also the motor-generating **forces responsible for movement**.

Skeletal muscle is the largest component of the fat free mass in humans.

These are the muscles that are most readily influenced by diet and exercise.

Exercise that causes strain on the muscles will similarly cause strain on bones; thus, bone and SMM are both increased through (hypertrophic) resistance training.

Since the arms and legs are some of the biggest components SMM, a **majority of skeletal muscle is located in the extremities**.



Fat Free Mass (FFM): Protein

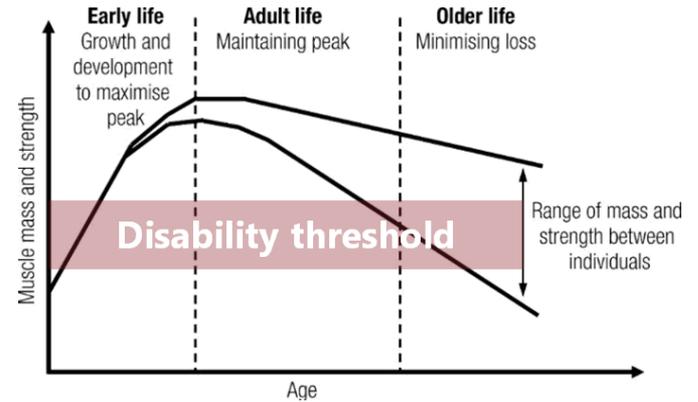
Why is monitoring muscle important?



Muscle is a very important body composition related to nutrition status and physical performance.

- ① Related to functions of movement, posture
- ② Circulation
- ③ Glucogenic storage

Muscles tend to decrease as we age.
From 20s to 80s,
people lose almost 50% of the muscle.

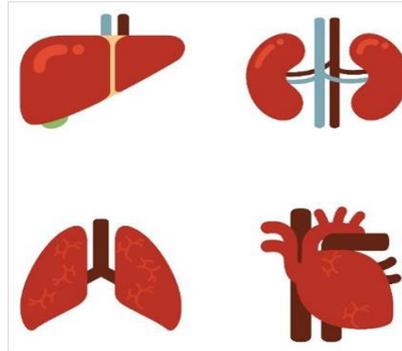


Why is monitoring muscle important?

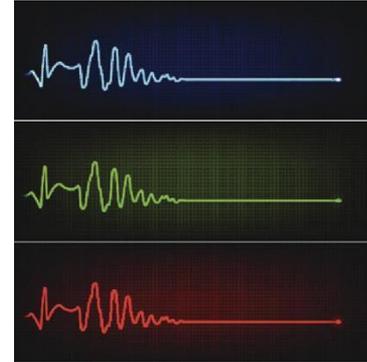
Lack of muscle = sarcopenia



Risk of falls



Risk of diseases

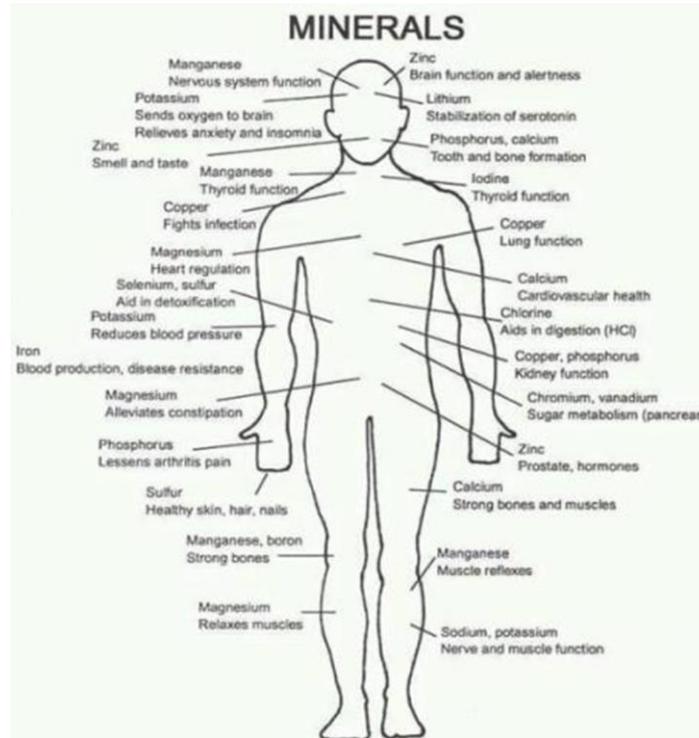


Increased mortality



Fat Free Mass (FFM): Mineral

Minerals are important for your body to stay healthy. Your body uses minerals for many different jobs, including building bones, making hormones and regulating your heartbeat. Minerals also support the biochemical reactions of metabolism. They can be split into osseous (present in the bones) and non osseous (present into the cells and in the blood).

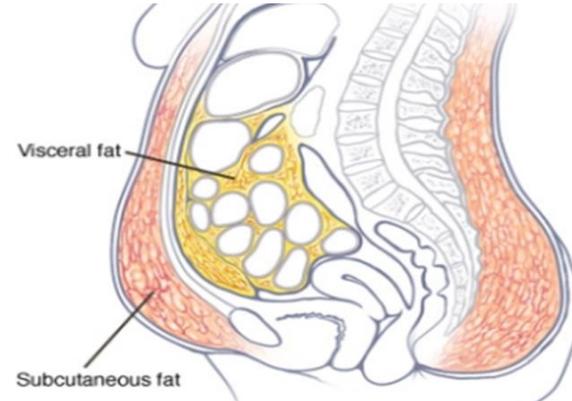


Fat Mass (FM)

The Fat Mass (FM) can be gained for many different reasons: eating lots of high fat or high sugar foods, maintaining an inactive lifestyle, not exercising for long periods of time, not getting enough sleep, and being stressed. Ageing is also a major factor in getting this type of fat. There are three different types of fat: Subcutaneous 80%, Visceral 15% and Intramuscular 5%.



Subcutaneous fat is the fat below the skin.
It has a major function of thermic isolation.

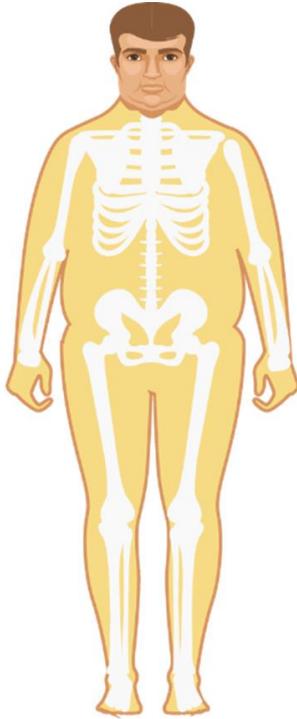


Visceral fat is the most dangerous fat to have. It lies deeper inside the abdomen and surrounds the abdominal organs.



Fat Mass (FM)

Why is monitoring body fat important?

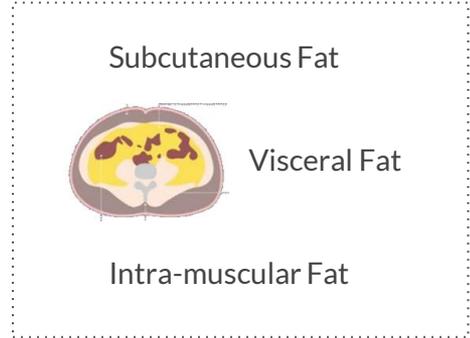


Body fat is the component where the body stores the excessive energy left from food consumption. It also has an essential role within the physiological function.

Roles

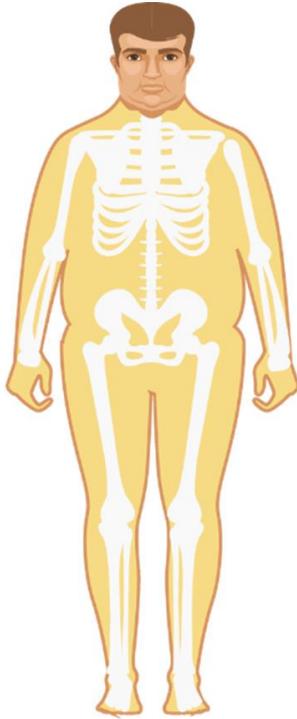


Storage Fat

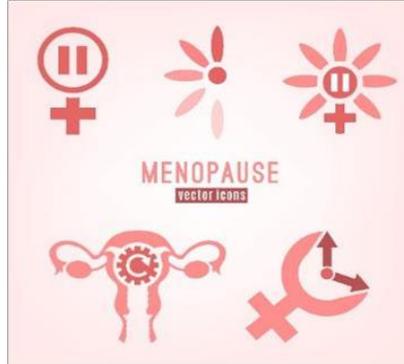


Fat Mass (FM)

Why is monitoring body fat important?



Certain amount of body fat is needed for normal physical function. However, too much accumulation of fat can lead to obesity and increased risk for diseases.



Lack of fat mass



Excessive fat mass



Lessons learnt

- Body Composition: dividing the body in different components that together represent the full body.
- Body Weight=FFM+FM
- FFM= Water+Proteins+Minerals
- Having a balanced body composition can prevent the onset of many diseases (cardiovascular diseases, kidney failure, Diabetes, etc.).
- Water is the main component of FFM. It carries nutrients, removes waste during metabolism, keeps the body temperature in control and it is used during nutrient decomposition/synthesis. $TBW=ICW+ECW$. In healthy people the relationship between this two component is constant and equals to 3:2.
- The ECW ratio (ECW/TBW) is used to measure the extra fluid.
- Proteins have many functions: structural and functional.
- Monitoring the Muscle is important to prevent risk of falls and diseases as Sarcopenia.
- Minerals support the biochemical reactions of metabolism. They can be split into osseous (present in the bones) and non osseous (present into the cells and in the blood).
- Fat is our energy store, protects internal organs, acts as an insulator and regulates body temperature. Certain amount of body fat is needed for normal physical function. However, too much accumulation of fat can lead to obesity and increased risk for diseases.

