



Histology

faculty of medicine - JU2017

Sheet

Slides

Number

8

Done by:

Dr Heba Kalbouneh

Corrected by:

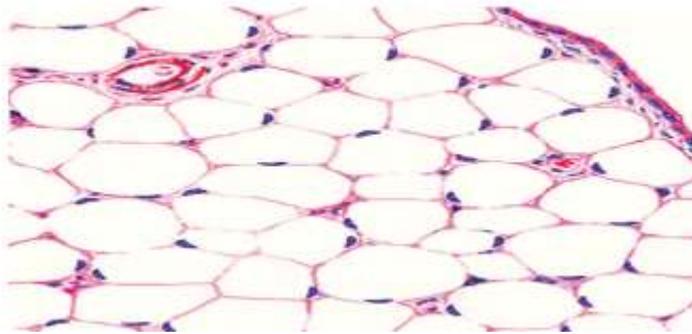
Tayma Awamleh

Doctor

Dr Heba Kalbouneh

Adipose tissue

It is a **specialized connective tissue**. It is **composed mainly** of cells (adipocytes). The **main function** of these cells is to store lipids (large quantities of triacylglycerols (triglycerides) and fat-soluble substances) in their cytoplasm. **This type of connective tissue is a loose type** because it is delicate and mainly composed of cells. Lipids are composed of **triglyceride** (three fatty acids with one glycerol). The origin of this tissue is also embryonic **mesenchyme**. The lipids are stored as **droplets inside the cytoplasm** (lipid droplets).

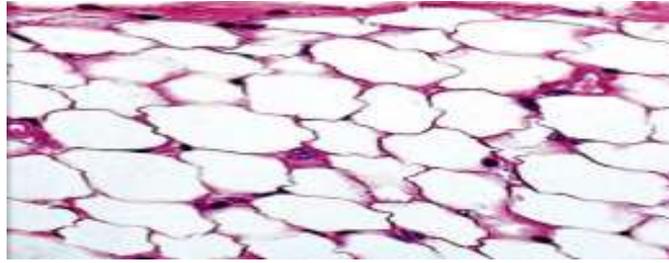


Note: Since most loose connective tissue contains scattered clusters of adipocytes, the term adipose tissue is usually reserved for large masses (grossly visible) of these cells

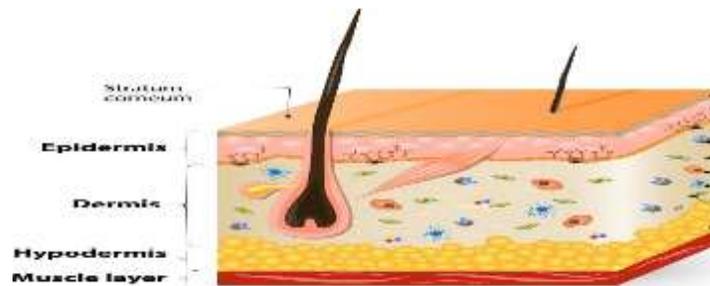
Two types of adipocytes:

1- White fat cell (fat cell: adipocyte):

- It is composed of one **large droplet** (non-membrane bound (inclusion)) in the cytoplasm which pushes the **nucleus (flat) and the cytoplasm away toward the periphery**.
- This type appears **as Signet Ring** (خاتم) because of its shape (the nucleus and the cytoplasm at the periphery represent the rim and the droplet of fat is in the center).
- This **fat droplet dissolves during preparation**, so under light microscope it appears as an empty cell (not stained). It is also **called unilocular** cell because it contains one droplet of fat.
- These cells have **little amount of organelles and cytoplasm** because they do not need to perform high metabolic or synthetic activities, it is mostly for storing fat.
- It is **the main type of adipose tissue in our body (adults)**. The main function **is to store lipids** (metabolic fuel, thermal insulator (maintaining body temperature) and protective cushion).
- It is **a metabolic fuel; it's very important to our body** (if the body doesn't have any adipose tissue, we will die **after three days** from our last meal !!!!).



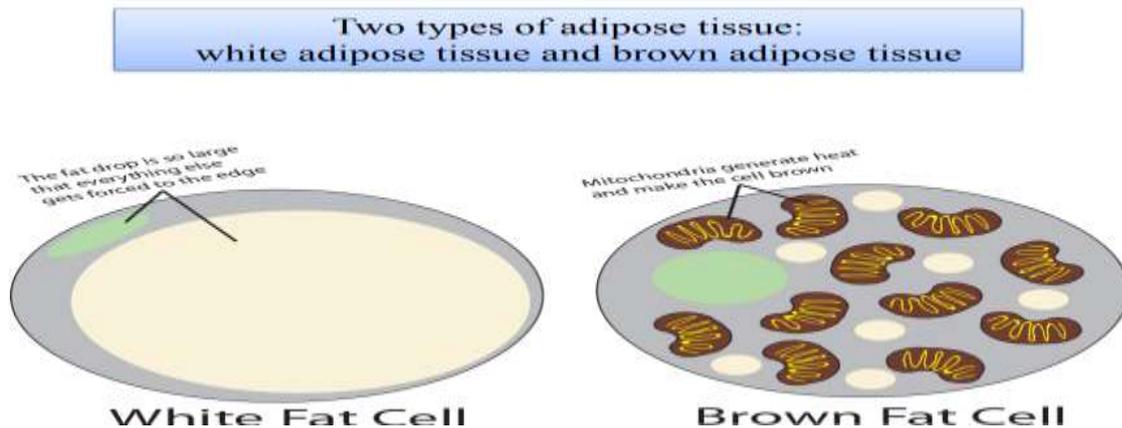
- It is a **thermal insulator**; we have the **skin** that covers our body which is composed of **epidermis** (the epithelium) under the epithelium we have a layer of connective tissue **called dermis** (loose then dense irregular connective tissue). Under the dermis there is an area **called hypodermis** (*hypo=under*), **you will find high amount of white adipose tissue**, it is called also **subcutaneous adipose tissue** (*superficial fascia*), grossly it looks **yellow** (yellow adipose tissue), this layer of adipose tissue insulates to prevent heat loss.



- The **distribution of this fat in subcutaneous tissue is variable between body parts**, in certain parts we have thick layer of subcutaneous fat and others, like eyelids, there is no or minimal fat tissue, and **it's variable between male and female**(in female there is more fat).
- It acts as **protective cushion**; like the gluteal region you have thick layer of adipose tissue in order to protect the underlying structures while sitting, behind the eyeball, and around the kidneys. **Spaces in our body are also filled with adipose tissue** (surrounding and between organs).
- **According to the location of white adipose tissue we can divide it into:**
 - 1- Subcutaneous (superficial fascia).
 - 2- Visceral fat: body fat that is stored within the abdominal cavity and is therefore stored around a number of important internal organs such as the liver, pancreas and intestines
- This tissue is **vascularized**. Adipocytes are surrounded by a thin **external lamina** containing type **4 collagen**. (as basal lamina of epithelium)
- (**imp**) Now during the growth period, the **number of adipocytes increases**. And after puberty the number **does not increase but the size increases only**.

Histological appearance

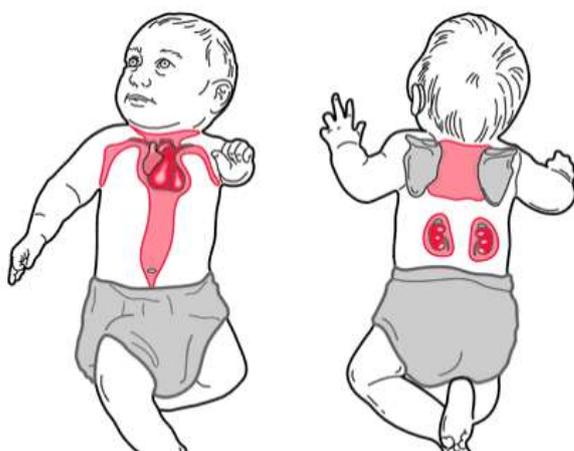
- Under the light microscope, the appearance of an adipocyte is that of a clear space with a very thin border. The lipid droplet which comprises the bulk of each adipocyte is not stained by ordinary aqueous stains, and may even be removed by solvents during specimen preparation. Adipocyte cytoplasm itself is thin, and the nucleus of any adipocyte is unlikely to be included in any given section (because these cells are very large (150um), so it's unlikely to catch the nucleus in the section)



2- Brown fat cell:

- The brown adipocyte contains many *small droplets of lipids* and a *round nucleus* with a *large amount of mitochondria*.
- This type appears *brownish in color due to the high amount of mitochondria* (special type of enzymes that gives it the brown color), that's why it's called brown adipose tissue.
- These *small droplets of lipids dissolve during preparation*, the cell appears full of bubbles, and the cell is called *multilocular* because of multiple fat droplets.
- These cells *have larger amount of organelles and cytoplasm in order to burn lipids and to produce energy in the form of heat* (high metabolic rate in order to produce heat, found mainly in fetus and newborn and as we grow other physiological mechanisms control the production of heat).

- The *mitochondria in other cells have enzymes that produce energy in the form of ATP by oxidative phosphorylation*, **BUT** the mitochondria in this type of cell have high *amount of enzymes that are specialized to uncouple the process of phosphorylation to produce heat instead of ATP*. So the function of these cells is heat production.
- It is *found mainly in fetus* (*all* fat in fetus is in the form of brown adipose tissue) and *in newborns*, it's *found mainly around the large blood vessels to produce heat in order to keep the blood warm*, and as we grow these brown fat cells are converted to white fat cells.
- The *research showed that the lean people have more amount of brown adipose tissue* (they could eat whatever they want without gaining much weight!! Brown fat is a heat-generating type of fat that burns energy instead of storing it). *One reason for your body's propensity for weight gain as it ages may have to do with decreasing levels of brown fat*
- The brown adipose tissue is present in significant amounts in human infants. Its distribution is very limited in adults (around the kidneys for example).
- It counts for *2-5% of the body weight of the newborn* (located mainly in *the back between the scapulae, neck, around the kidneys, heart, large blood vessels*). This *fat is important to avoid hypothermia* (reduction in body temperature) of newborns. *Most of it is replaced by white adipose tissue. It stays in very small amount around aorta and kidneys*.
- Brown fat is present in *hibernating animals*
- Brown fat is *more vascularized*
- The brown fat cells are *smaller than* white fat cells.



Brown adipose tissue

