**Lec.4 Oral Physiology Dr. Muna**

**The Blood:**

Blood is classified as a specialized type of connective tissue in which blood cells or cell like structure which is called formed element are suspended in fluid matrix called plasma.

❖ The blood is formed by:

1. liquid part is called ***plasma*** makes up about *55****%*** of blood volume.

2. non-liquid part is called ***formed elements*** makes up about other *45%*.

❖ Blood comprise about 7% of the body weight,

❖ In standard 70 kg weight:

-In adult male the amount of blood is 5-6 liters.

-In adult female about 4.5-5.5 liters.

❖ The Blood is a sticky opaque fluid with a characteristic metallic depending on the amount of oxygen it is carrying, the color of blood varies from scarlet(oxygen rich)to dark red(oxygen poor).

❖ Blood is slightly alkaline, with a pH between 7.35 and 7.45.

**Functions of blood:**

**1- Distribution (transport) functions of blood include**

A. Transport oxygen and carbon dioxide from the lungs.

B. Transport nutrients from the digestive tract to all body cells which are organic (like glucose, vitamins, fatty acids, and amino acid) and inorganic nutrients (Ions like: sodium ions Na**+**, potassium ions K**+**, and calcium Ions Ca**+2**).

C. Transport metabolic waste products from cells to elimination sites to the kidneys for elimination of urea, creatinine, uric acid).

D. Transporting hormones from the endocrine organs to their target organs.

**2- Regulation: regulatory functions of blood include:**

A. Maintaining appropriate body temperature by absorbingاand distributing heat throughout the body and to the skin surface to encourage heat loss.

B. Maintaining normal pH in body tissues. The blood transport acids and bases to appropriate organs of excretion and aid to pH regulation.

C. Maintaining interstitial fluid volume in the circulatory system. The passive exchange of water and salts between the plasma and tissue fluid by infiltration in the capillaries that prevent excessive fluid loss from the blood stream into the tissue spaces to support efficient blood circulation to all parts of the body.

**3- Protection: Protective functions of blood include:**

A. Preventing blood loss. When a blood vessel is damaged, platelets and plasma proteins initiate clot formation, the blood coagulate.

B. Preventing infection. The blood contains antibodies and white blood cells, all of which help defend the body against foreign body such as bacteria and viruses.

**Components of blood:**

The blood composed of ***plasma*** and ***formed elements***.

**1. Blood Plasma:** Blood plasma is a complex substance form 55% of the blood volume. It is a sticky fluid:

**-**it is mostly ***water about 90%***.

**-**plasma contains about ***1% different inorganic*** constituents including Ions: Na+, K+, CL-, Ca+2.

**-*7-9% organic nutrients: glucose, amino acid, lipids***, and **plasma proteins.**

**2. Formed elements:**

The formed elements suspended in the blood plasma form 45% of the blood volume including: ***Red blood cells, White blood cells, and platelets.***

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**Lec.5 Oral Physiology Dr.Muna**

**The blood: Formed elements**

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1. **A. Red blood cells (Erythrocyte):**

Erythrocytes or red blood cells (RBCs) are small cells, about 8.5 μm in diameter 2 μm in thickness at the edge and 1 μm in the center. The mature cell shaped like non nucleated biconcave disc with depressed centers. This shape provides the maximum surface area for the cell and the greatest possible diffusion for the passage of the gases.

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Numbers: average number in adult male is range from 4.5-6 million cells/ mm3

average number in adult female is range from 4.3- 5.5 million cells/ mm3

• The average half-life of RBC is about 90-120 days.

• The red blood cell contains hemoglobin (Hb) is the RBC protein that has important function in gas transport O2 and CO2 transport depending on the presence of the respiratory pigment hemoglobin that makes red blood cells red, binds easily with oxygen, and most oxygen carried in blood is bound to hemoglobin.

• The normal value of Hb in adult male is about 13-18 gm/100 ml.

in adult females is about 12-16 gm/100ml.

• The main function of Hb is able to combine with oxygen to from compound is called Oxyhaemoglobin. The presence of Hb in the red blood cells increases the oxygen-carrying capacity of blood to have high concentration of oxygen that occurs in the capillaries which breaks down into oxygen and Hb to diffuse into the tissue and then to the cell where there is low concentration of oxygen.



Erythrocytes have important function of oxygen transport because they:

1.Contain haemoglobin which able to combine oxygen.

2. Have no nucleus so there is more space for haemoglobin molecules.

3.Are shaped biconcave discs that increase the surface area for oxygen exchange.



1. **B. White blood cell (Leukocytes):**

**Leukocytes** are nucleated cells. Leukocytes are far less numerous than red blood cells.

Numbers: average number in **adult** is range from **4000 -11000** cells/ mm3

Leukocytes are grouped into two major categories on the basis of structural and chemical characteristics:

1. **Granular leukocytes (Granulocytes):** contain obvious cytoplasmic granules



which include:

**- Neutrophil**: 60–70%

**- Eosinophil: 2–4%**

**- Basophil:** 0.5–1%

-The half-life is **12 hour – 3 days.** They have 2-3 lobes in the nucleus.

**2. Non-granular leukocytes (non-granulocytes):** lack obvious granules



which include:

- Lymphocytes: 20-25%

- Monocytes: 3–8%

The half-life is **100 – 300 days** under normal condition.

1. A. **T lymphocytes (T- cells)** function in the immune response by acting directly against virus-infected cells and tumor cells.

B. **B lymphocytes (B - cells)** give rise to plasma cells, which produce **antibodies** (immunoglobulins) that are released to the blood.

**Immunoglobulin G (IgG):** This is the most common antibody. It's in blood and other body fluids, and protects against bacterial and viral infections. IgG can take time to form after an infection or *immunization.*

• **Immunoglobulin M (IgM):** Found mainly in blood and lymph fluid, this is the first antibody the body makes when it fights a new infection.

C. Platelets



**Platelets** are also called ***thrombocytes*** which are not cells but they are cytoplasmic fragments of cells with no nucleus is originated in red bone marrow lasts about 7 days. In blood smears, each platelet exhibits a blue-staining outer region and an inner area containing granules that stain purple. They carry of chemicals that essential in the normal blood clotting.

The function of platelets is to stop bleeding and clot formation when the blood vessle ge damage like cut the pletelets bind together and form colt and stop bleeding

• Numbers: average number in **150.000- 400.000**/ mm3 of blood.