

HUMAN ANATOMY AND PHYSIOLOGY-1(BP101T)

UNIT: 3 BODY FLUIDS AND BLOOD

CLASS: 1

TOPIC – BODY FLUIDS, COMPOSITION AND FUNCTIONS OF BLOOD

The total body water in adults of average build is about 60% of body weight.

- This proportion is higher in young people and in adult's below average weight.
- It is lower in the elderly and in obesity in all age groups.
- About 22% of body weight is extracellular water and about 38% is intracellular water.

Types: 1. Extracellular fluid

- The extracellular fluid (ECF) consists of blood, plasma, lymph, cerebrospinal fluid and fluid in the interstitial spaces of the body.
- Interstitial or intercellular fluid (tissue fluid) bathes all the cells of the body except the outer layers of skin.
- It is the medium through which substances pass from blood to the body cells, and from the cells to blood.
- Every body cell in contact with the ECF is directly dependent upon the composition of that fluid for its wellbeing.
- Even slight changes can cause permanent damage, and any change is therefore resisted by the body, through one or more of its many control mechanisms; this is homeostasis. For example, a fall in plasma calcium levels causes tetany (abnormal spasmodic muscle contractions) and convulsions (fits), because of increased

excitability of muscle and nervous tissue. Rising blood calcium depresses muscle and nerve function, and can even cause the heart to stop beating. Calcium levels in the ECF are only one of the many parameters under constant, careful adjustment by the homeostatic mechanisms of the body. Fig: Distribution of body water in a 70 kg person.

2. Intracellular fluid:

- The composition of intracellular fluid (ICF) is largely controlled by the cell itself, because there are selective uptake and discharge mechanisms present in the cell membrane.
- The composition of ICF can therefore be very different from ECF. Thus, sodium levels are nearly ten times higher in the ECF than in the ICF.
- This concentration difference occurs because although sodium diffuses into the cell down its concentration gradient there is a pump in the membrane which selectively pumps it back out again.
- This concentration gradient is essential for the function of excitable cells (mainly nerve and muscle).
- Conversely, many substances are found inside the cell in significantly higher amounts than outside, e.g. ATP, protein and potassium

TOPIC – COMPOSITION AND FUNCTIONS OF BLOOD

DEFINITION: Blood is a fluid connective tissue. It provides one of the means of communication between the cells of different parts of the body and the external environment.

FEATURES OF THE BLOOD:

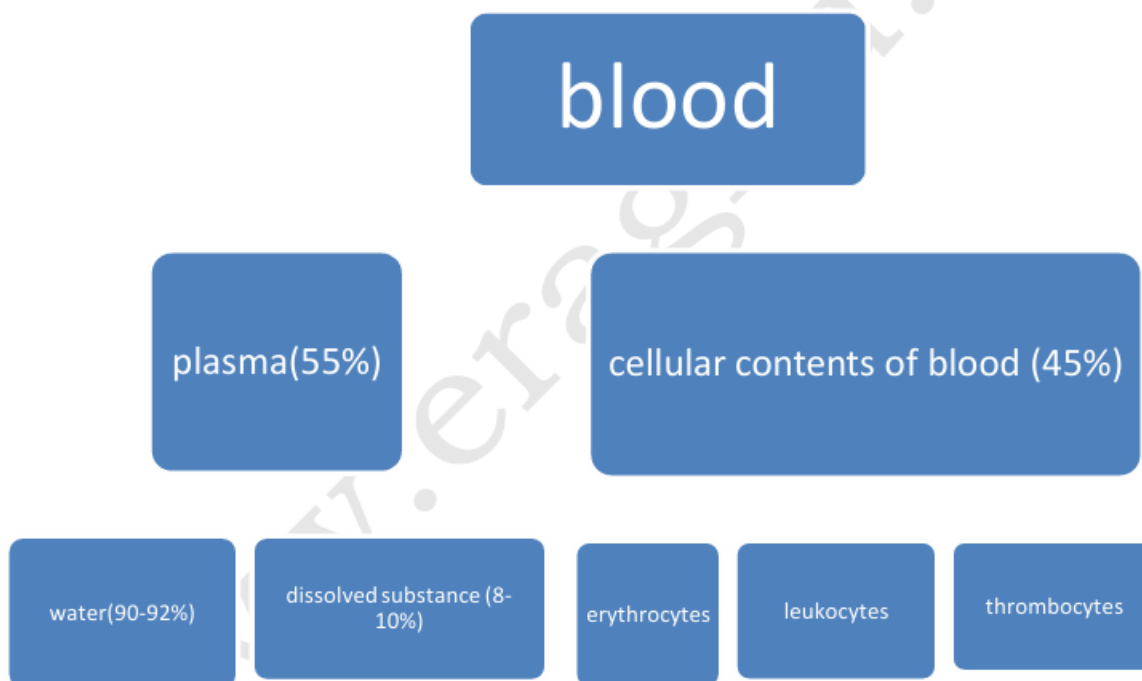
1. Amount of the blood: blood makes up about 7% of body weight of the body weight. Ex. about 5.6 ltrs in a 70kg man. This proportion is less in women considerably in greater in children.
2. Flow of the blood: blood in the blood vessels is always in motion because of the pumping action of heart. The continual flow maintains a fairly constant environment for the body cells.
3. Constituents: the blood volume and the concentration of its many constituents are kept within narrow limits by homeostatic mechanism.

FUNCTION OF BLOOD:

1. Transport of oxygen: the blood carries the oxygen from the lungs to the tissue and CO₂ from the tissues to the lungs for excretion.
2. Transportation of nutrition: the blood carries nutrients from the alimentary tract to the tissues, and cell wastes to the excretory organs mainly the kidney.
3. Transport of hormones: hormones secreted by endocrine gland to their target glands and tissues through blood.
4. Heat transfer: the heat produced in active tissues that will be transferred to other less active tissues.
5. Protective substance: protective substances such as antibodies which are acts against the antigen which are produced by any infection caused to the body.

6. Clotting factors: clotting factors that coagulates blood, minimizing the bleeding from the ruptured blood vessels.

Composition of the blood



Blood is composed of plasma 55% and cellular contents 45%.

1. Plasma: blood is composed of a straw colored transparent fluid i.e called plasma. The constituents of plasma are water i.e 90-92% and dissolved substance.

A) Water: it is in major quantity about 90-92%.

B) Dissolved substances: includes-

- I. Plasma proteins
- II. Inorganic salts
- III. Nutrients
- IV. Waste products
- V. Hormones

VI. Gases

I) PLASMA PROTEINS:

- It is making up to 7% of plasma.
- They retain with in the blood because they are too big to escape through the capillary pores in to tissues.
- They are largely responsible for creating the osmotic pressure of blood.
- The osmotic pressure exerted is 25 mm of Hg or 3.3K Pa. • This keeps the fluid within the circulation.
- If the plasma protein levels fall because of decrease in production or due to loss of blood vessels that decreases the osmotic pressure.
- Due to this the fluid moves in tissue and body cavities i.e. called odema.
- Different types of plasma proteins:
 - a) Albumin: these are formed in liver. More abundant in number. Functions are to maintain normal osmotic pressure and it acts as carrier molecule for lipids and steroid hormones.
 - b) Globulin: they are formed mostly in liver. Some are in lymphoid tissue. Functions are it mainly acts as antibodies (immunoglobulins) which are complex proteins produced by lymphocytes that play an important part in immunity. They also bind to, and neutralize, foreign materials (antigens) such as microorganisms. Other proteins:- Thyroglobulin: they are used to transport the hormones and minerals salts. This thyroglobulin carries the hormones thyroxine and transferrin carries the mineral iron. α 2-Macroglobulin: inhibit the proteolytic enzymes such as this α 2 macroglobulin inhibits trypsin activity. Fibrinogens: this is synthesized in the liver and is essential for blood coagulation.

II) INORGANIC (MINERAL) SALTS: The inorganic salts such as Na^+ , Ca^{++} , Mg^{++} , k^+ etc. They involved in some activities such as:

- Muscle contraction
- Transmission of nerve impulse
- Formation of secretions
- Maintenance of acid –base balance.
- Ph of blood maintained between 7.35-7.45

III) NUTRIENTS: In an alimentary tract food material broken down in to a small molecules.

Large food molecules → small food molecules

Carbohydrates → monosaccharide

Proteins → amino acid

Fats → fatty acid + glycerol

That small food molecules were absorbed by blood and get energy.

IV) WASTE PRODUCT: Urea, creatinine and uric acid are the waste material of protein metabolism. They are formed in liver conveyed in blood and excreted through kidney.

V) HORMONES: These are the substance synthesized by endocrine glands. Hormones pass directly from the endocrine cells in to the blood. This transports them to their target tissue and organs elsewhere in the body, where they influence cellular activity.

VI) GASES: O₂, CO₂ , and N₂ are transported round the body dissolved in plasma. O₂ and CO₂ are also transported in combination with hemoglobin in R.B.C. Most O₂ is carried in combination with hemoglobin and most carbon di oxide as bi carbonate ions dissolved in plasma. Atmospheric N₂ enters in the body in the same way as other gases and is present in plasma but it has no physiological function.