Lecture 2

The Blood

Blood is a constantly circulating fluid providing the body with nutrition, oxygen, and waste removal. Blood is mostly liquid, with numerous cells and proteins suspended in it, making blood "thicker" than pure water. The average person has about 5 liters of blood.

-Blood Components

(liquid portion of the blood)

1-Plasma makes up about half of the content of blood. Plasma contains proteins that help blood to clot, transport substances through the blood, and perform other functions. Blood plasma also contains glucose and other dissolved nutrients.

(solid portion of the blood)

2-Erythrocytes – (red blood cells) – carry oxygen (and some carbon dioxide)

3-Leucocytes – (white blood cells) – protect the body against infection called also phagocytes and lymphocytes.

4-Platelets – cell fragments assist in clotting.

Complete Blood Count Normal Range*

WBCs	3,500-11,000 cells/mcL
Hematocrit	34.9%-44.5% in women 38.8%-50% in men
Platelets	150,000-450,000/mcL
RBCs	4.3-5.7 million cells/mcL in men 3.9-5.1 million cells/mcL in women
Hemoglobin	13-17 g/dL in men 11.5-15.5g/dL in women

-The pH of blood

in the arteries should be between (7.35 and 7.45) for the body's metabolic processes and other systems to work well. These processes produce acids, so the body has a complex system of feedback and regulation to maintain healthy pH levels. The lungs and the kidneys are the two main organs that regulate the pH of the blood, often at the same time. There are also chemical buffering mechanisms throughout the body's cells. The lungs can help regulate blood pH rapidly through the process of exhaling carbon dioxide, sometimes producing changes within seconds. For example, when someone exercises, they produce more carbon dioxide, so they breathe faster to prevent the blood from becoming too acidic. The kidneys regulate the pH of the blood by excreting acids in urine. They also produce and regulate bicarbonate, which increases blood pH. These changes take longer than those that occur due to breathing, potentially taking hours or days. Certain situations and medical conditions can mean that the body is unable to keep blood pH within the healthy range. The pH of the blood can change in both directions. Acidosis occurs when the blood is too acidic, with a pH below 7.35. Alkalosis occurs when the blood is not acidic enough, with a pH above 7.45.

There are four main ways in which blood pH can change:

1-Metabolic acidosis: This occurs due to reduced bicarbonate or increased acid levels.

2-Respiratory acidosis: This occurs when the body removes less carbon dioxide than usual.

3-Metabolic alkalosis: This occurs due to increased bicarbonate or reduced acid levels.

4-Respiratory alkalosis: This occurs when the body removes more carbon dioxide than usual.

-symptoms of acidosis include:

headache, confusion, tiredness, lethargy and sleepiness, coughing and shortness of breath, an uneven or increased heart rate ,stomach upset or feeling sick, muscle seizures or weakness, unconsciousness and coma

-Symptoms of alkalosis include:

confusion and lightheadedness, shaky hands, numbness or tingling in the feet, hands, or face, muscle twitches or spasms, vomiting or nausea, coma

-Body Fluids

are liquids originating from inside the bodies of living humans. They include fluids that are excreted or secreted from the body.

*Total amount of fluids in the human body is approximately 70% of body weight .

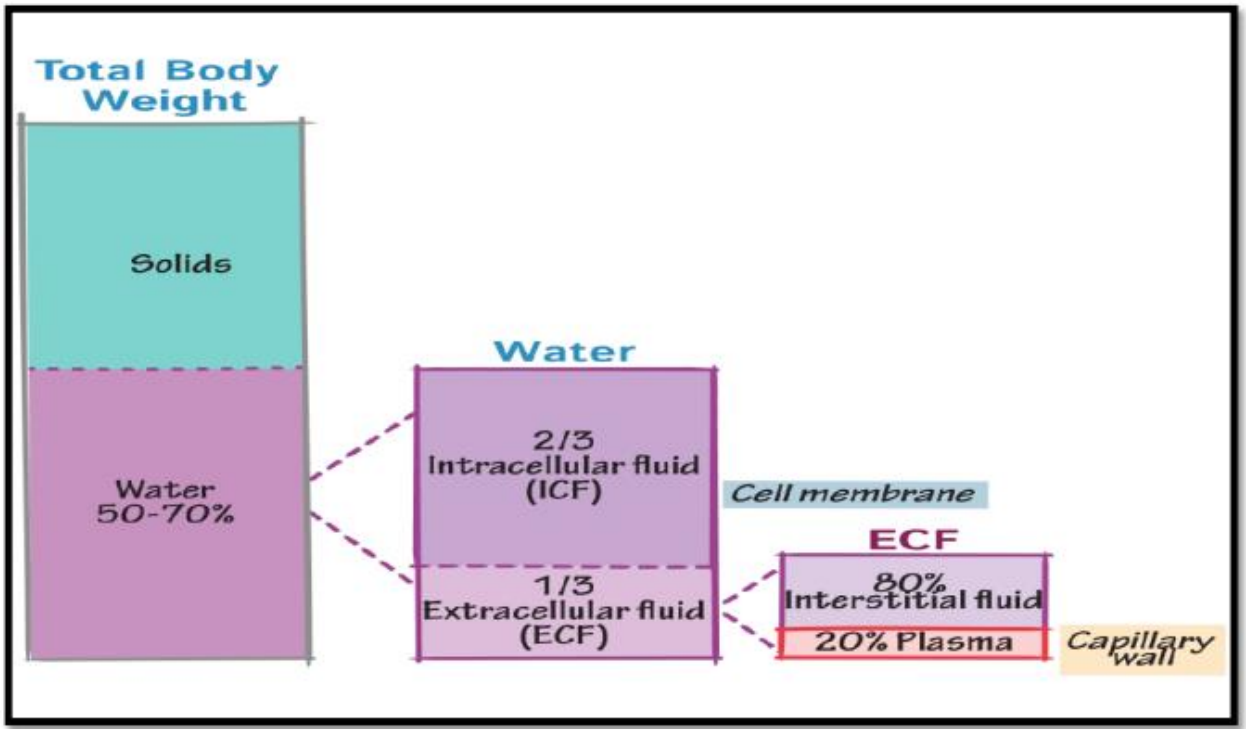
-Body fluid has been divided into two compartments:

– Intracellular fluid (ICF)

Inside the cells, 55% of total body water.

– Extracellular fluid (ECF)

Outside the cells, 45% of total body water.



Composition of body fluids

- Organic substances

Glucose ,Amino acids ,Fatty acids ,Hormones ,Enzymes

-Inorganic substances

Sodium, Potassium, Calcium, Magnesium, Chloride, Phosphate, Sulphate.

Water Balance

Water balance exists when water intake equals water output

Water Intake: - The volume of water gained each day varies from from a person to another

*About 60% of daily water is gained from drinking, another 30% comes from moist foods, and 10% from the water of metabolism .

Regulation of Water Intake:

- The thirst mechanism is the primary regulator of water intake.

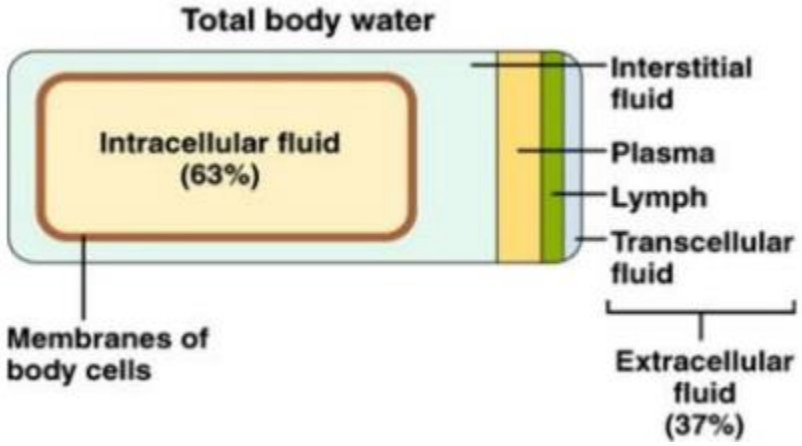
- The thirst mechanism derives from the osmotic pressure of extracellular fluids and a thirst center in the hypothalamus.

- Once water is taken in, the resulting distention of the stomach will inhibit the thirst mechanism.

Water Output: Water is lost in urine, feces, perspiration, evaporation from skin (insensible perspiration), and from the lungs during breathing.

The route of water loss depends on

* temperature, * relative humidity, and * physical exercise



Electrolytes of the body fluids

Electrolytes are salts and minerals that can conduct electrical impulses in the body.

- Common human electrolytes are sodium, chloride, potassium, calcium, and bicarbonate.

- Electrolytes in body fluids are charged , It can be:

*Cation - positively charged electrolyte, e.g .Na^{+}, k^{+},Ca^{+2}

* Anion - negatively charged electrolyte, e.g, Cl^{-1}, HCO^{-3} ,po_4^{-3}

The chief extracellular cation is Na^{+}

The chief intracellular cations are k^{+}

- Cl is the predominant anion outside cells whereas phosphates constitute the bulk of intracellular anions.

- Electrolytes Functions:

- Control the fluid balance of the body.
- important

- in muscle contraction

- in energy generation

- and almost every major biochemical reaction in the body.

-Electrolyte Balance

An electrolyte balance exists when the quantities of electrolytes gained equals the amount lost.

* Electrolytes, charged ions capable of conducting electricity, are present in all body fluids and fluid compartments. Just as maintaining the fluid balance is vital to a normal body function, so is maintaining electrolyte balance.

*Although the concentration of specific electrolytes differ between fluid compartments, a balance of cations (positively charged ions) and anions (negatively charged ions) always exists.