SAWA UNIVERSITY

Body fluids

جامعة ساوة

كلية العلـــوم

قسم علوم الأدلة الجنائية

المرحلة الثانية

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رقم المحاضرة 1

Body fluids

Body fluids comprise of biological and chemical components that can be analyzed to provide information at varying levels of identification. There are various types of analysis that can be applied to blood, saliva, semen and vaginal secretions. However, from a forensic perspective the main analyses are presumptive testing, which indicate the presence of particular body fluids and DNA profiling, which confirms the identity of the individual who deposited the body fluid.

Body fluids or biofluids: refers to any fluid found in the body or produced by a living organism, such as blood, lymph, milk and saliva which are produced in the body and then either circulated within the body or secreted outside.

It can divide into: - Excreted: faces, vomit, urine.

- Secreted: blood/plasma, semen, vaginal fluid.

Body Fluid Content Total body fluids ≈ 60% (50-70%) of total body weight (TBW).

- Body fluids = water + dissolved solutes

- Solutes Electrolytes (Na+, K+, Cl-, HCO3-, Mg+2, Ca+2)
- Non-electrolytes (glucose, urea, creatinine).

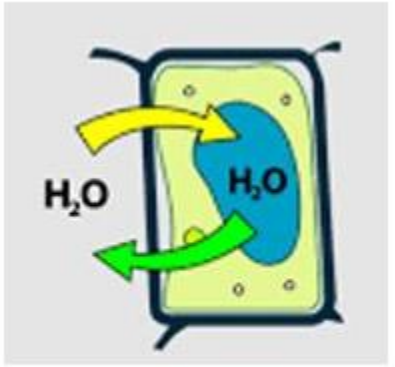
- Total body water ≈ 60% of TBW.
- - Kg of water = L of Water

Electrolytes are important for

- Maintaining fluid balance.
- Contributing to acid–base regulation.
- Facilitating enzyme reactions.
- Transmitting neuromuscular reactions.

Water Balance

- Cells are largely made of water and are surrounded by water.
- Water is constantly being exchanged between the cells and surrounding environment.
- Keeping a constant volume of water is essential for homeostasis.



Water Balance

Changes in the body fluid volume

The changing in the body volume depends on:

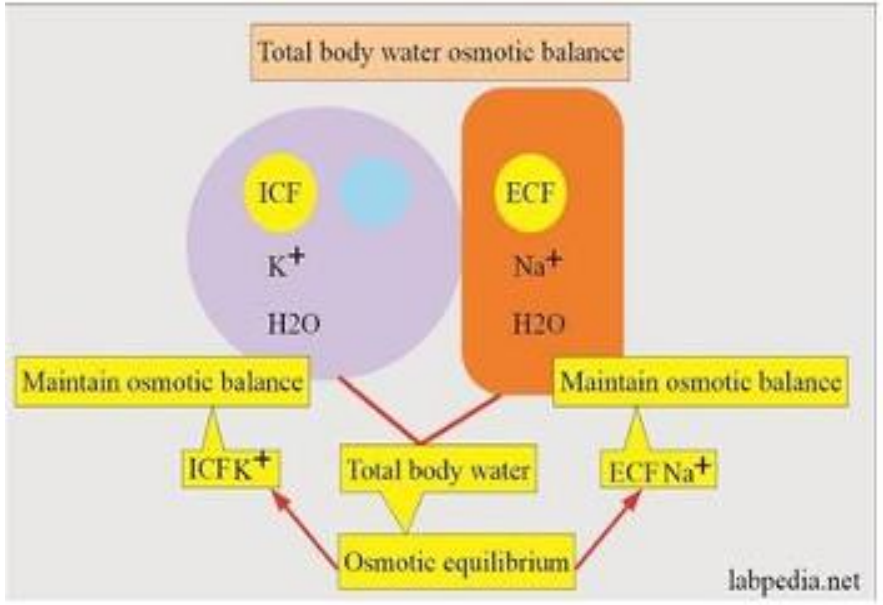
1. **Age:** as age advances the body water % decreases due to increase in fat (adipose tissue).

2. **sex:** Women normally have more body fat (adipose tissue) than men, they contain slightly less water than men. In human the total body water varies from 45% to 75% of body weight, young adult male, body contains 60% to 65% of water while in a normal young adult female, the water is 50% to 55%.

3. **Obesity:** % of body fat is more. less water content.

Properties of body fluids

1. Most body fluids are neutral in charge. Thus, cations, or positively charged ions, and anions, or negatively charged ions, are balanced in fluids. As sodium (Na+) ions and chloride (Cl–) ions are concentrated in the ECF of the body, whereas potassium (K+) ions are concentrated inside cells.



Total body water osmotic balance

2. Fluid also moves between compartments along an osmotic gradient. Water will move by osmosis from the side where its concentration is high (and the concentration of solute is low) to the side of the membrane where its concentration is low (and the concentration of solute is high).

3. The body fluid or the physiologic fluid is essential for various physiological processes and the maintenance of body homeostasis.

4. The body fluid is also composed of other molecules, such as electrolytes (sodium, potassium, etc), metabolites (urea, glucose) and proteins (albumin, hormones, amino acids, antibodies). Depending on the location of the body fluid, the composition and amounts vary. Body fluid = solvent (water) + solute (Na+, hormones).

5. Water is the primary fluid in the human body. When water balance exists, it means total water intake equals total water output, maintained by homeostatic mechanisms.

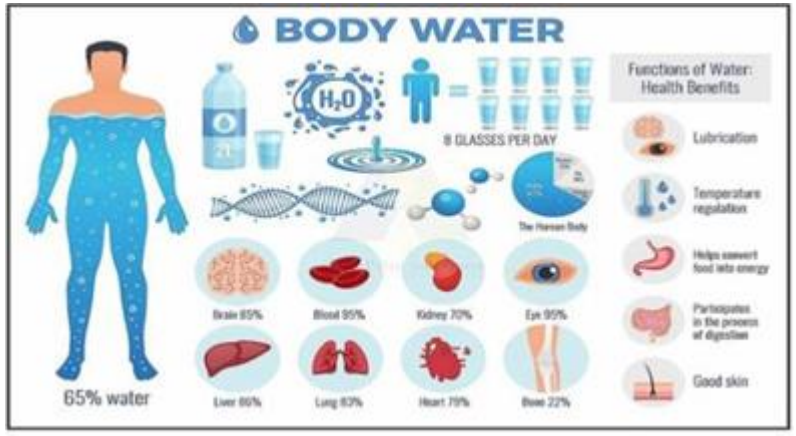
Forensic Application of body fluids

Body fluid and body tissue identification are important in forensic science as they can provide key evidence in a criminal investigation and may assist the court in reaching conclusions. Establishing a link between identifying the fluid or tissue and the DNA profile adds further weight to this evidence.

Essential body fluids (water)

The functions of water in the body include:

1. Temperature regulation.
2. Moistening of tissues.
3. Transportation of essential nutrients.
4. Elimination of waste from the body, and lubricating different joints and tissues.



Composition of Body Fluids

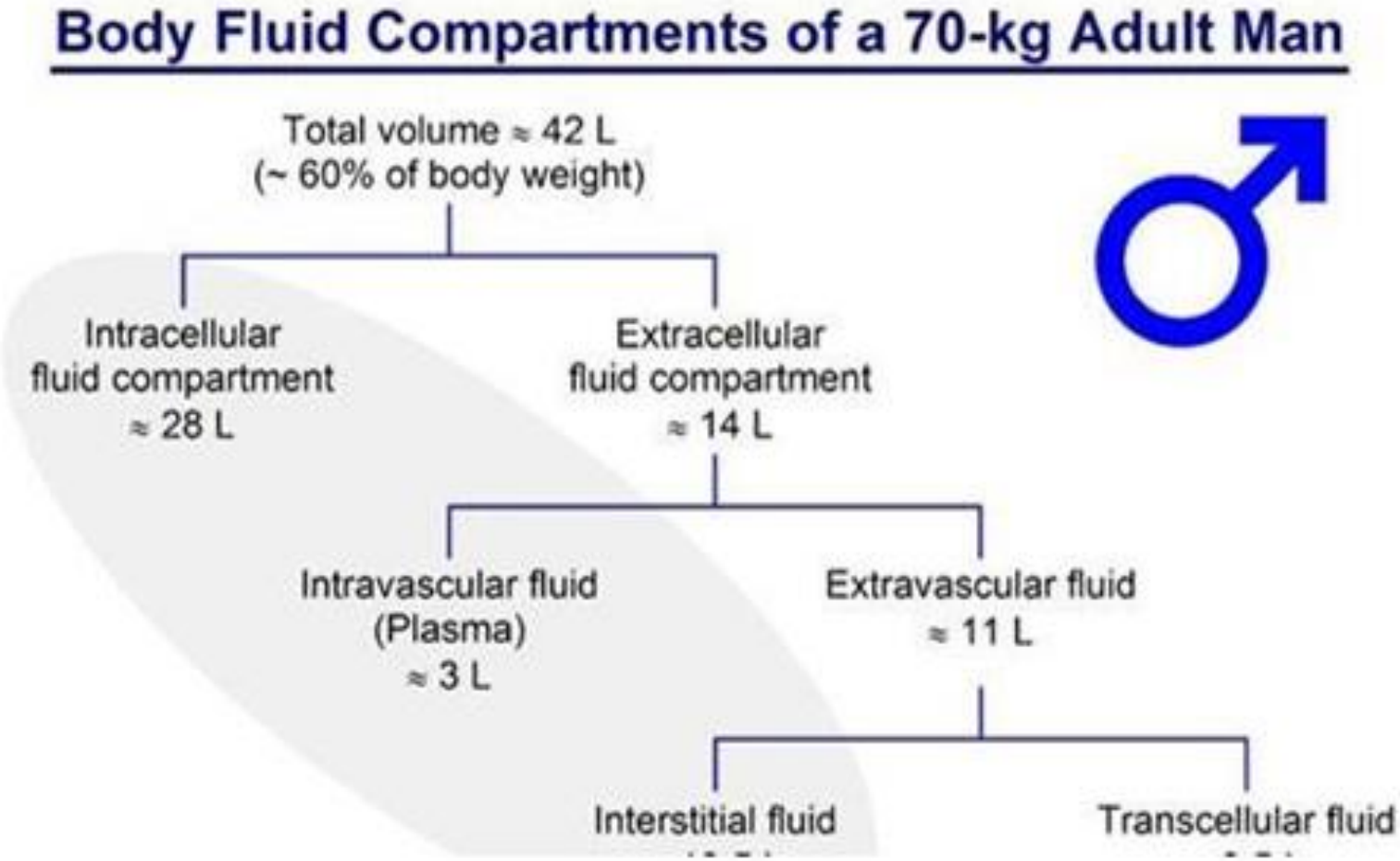
The total body fluids are distributed between two compartments, extracellular fluid (ECF) and intracellular fluid (ICF) compartments.

1.ECF: is a fluid present outside cells, it makes up about ⅓ of total body water.
ECF includes:

A: Intravascular fluid (¼ of ECF): primary component of plasma.

B: Interstitial fluid (¾ of ECF): lies outside blood vessels.

2. ICF: is a fluid present inside cells, it makes up about ⅔ of total body water and it is a Principal component of the cytoplasm of cells.



Composition of Body Fluids

Differences between ECF and ICF

Intracellular fluid	Extracellular fluid
Intracellular fluid is a fluid inside the cell membrane, containing dissolved ions and other components	Extracellular fluid is the fluid found outside of the cell, aiding the functioning of a particular tissue
Found inside the cell	Found oustide the cell
Comprises the cytosol	Comprises plasma, tissue fluid, and transcellular fluid
The concentration of sodium ions is low and the concentration of potassium ions is high	The concentration of sodium ions is high and the concentration of potassium ions is low

Similarities Between Intracellular and Extracellular Fluid

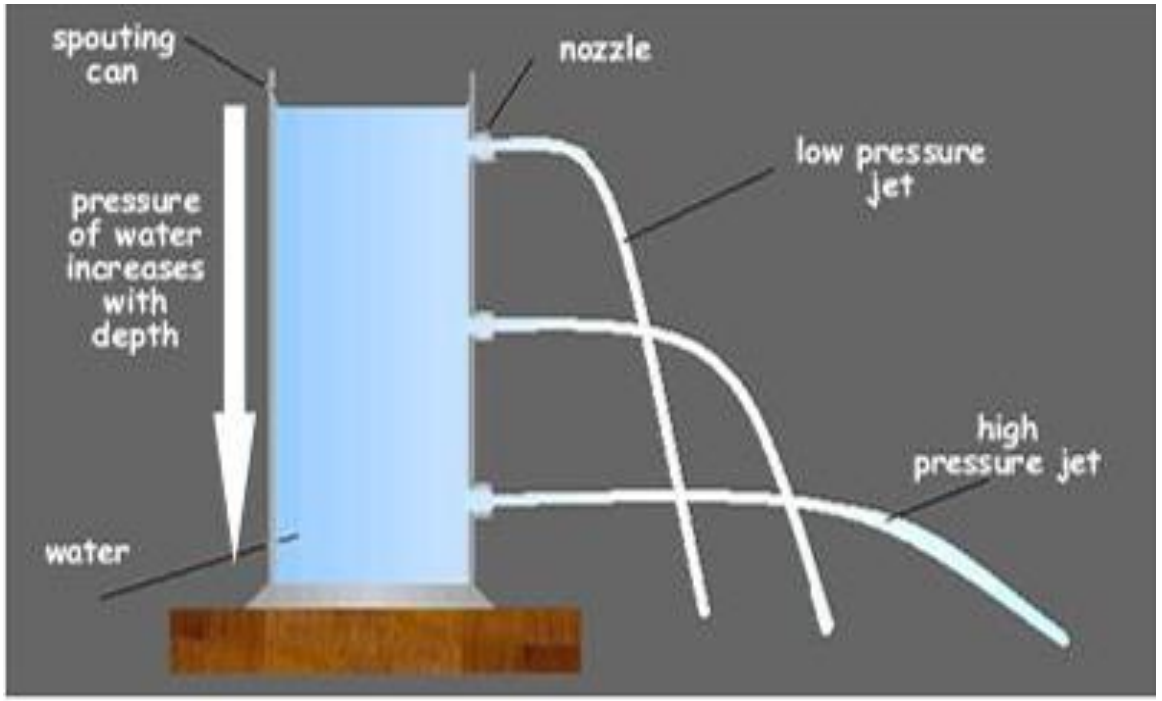
1. Both intracellular fluid and extracellular fluid make up the total body fluids.
2. The exchange of materials between intracellular fluid and extracellular fluid
occurs between the cell membrane.
3. The main function of both intracellular and extracellular fluids is to provide
nutrients to the cells in the body.

Three major factors contribute to the movement of fluid from one compartment to another:

1- Hydrostatic pressure, 2- Osmotic pressure., and 3. Oncotic pressure.

1-Hydrostatic pressure or pressure of the liquid

The normal force exerted by a liquid per unit area of the surface in contact. Liquids and gases exert equal pressure on all sides of a container.



Hydrostatic pressure

The hydrostatic pressure of blood is the pressure exerted by blood against the walls of the blood vessels by the pumping action of the heart.

2. Oncotic pressure

Oncotic pressure: is the pressure exerted by colloidal plasma proteins (e.g., albumin) to reabsorb water back into the blood system across a semipermeable membrane (i.e., vascular endothelium) into another solution (i.e., interstitial fluid) or vice versa.

3. Osmotic pressure

Osmotic pressure: is the pressure applied on the solution which stops the fluid movement through the semi-permeable membrane. It is the pressure required to prevent ‘osmosis’. Osmosis: is the process where solvent molecules, such as water, in a solution tend to move from a region of low solute concentration to a region of high solute concentration across a semi-permeable membrane.

Any questions?