

Human Physiology

Lecture 1 – Wednesday 10/2/2016

“Body fluids” with Dr. Khalid Talafih

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PharmaGlory 15

Note: The book is “Essentials of Physiology”/”Fundamentals of Physiology” by Sherwood.

- **Body fluid (الجزء السائل من الجسم) = Body water + electrolytes**
Electrolyte: Any substance that produces an electrical charge (negative or positive) when dissolved in water
[مادة تنتج شحنة كهربائية حين تذاب في المياه]
- In healthy adults, **60%** of the total body weight is fluid.
[٦٠% من وزن الإنسان* البالغ في حالته الصحية الطبيعية* هو سائل]
However, it is not always 60%. The difference between the percentages of body fluid is due to age & gender.
[هذه النسبة ليست ثابتة... و سبب الاختلاف هو عمر و جنس الإنسان]
As age increases, the total **body water content decreases**... About 80% of the body of a newborn is fluid.
Gender plays a role as a healthy female adult body is 56% fluid, because females have more fatty tissue.
- There are two major types of fluids:
 1. **Intracellular fluid (ICF)** – fluid inside the cell
[السائل داخل الخلية]
 2. **Extracellular fluid (ECF)** – fluid outside the cell
[السائل خارج الخلية]
- Intracellular fluid forms 40% of body weight.
- In animals, extracellular fluid is divided into 2 parts – interstitial/tissue fluid (السائل النسيجي) & blood plasma.
Note: Tissue fluid and plasma have the same components, except proteins (there are no proteins in tissue fluid).

- Extracellular forms 20% of total body weight:-
 Interstitial/tissue fluid forms 15% of total body weight.
 Plasma forms 5% of total body weight.
- Blood = Plasma + formed components (red & white blood cells, platelets). Blood forms 8% of the total body weight.
 Example: A person with a body that weighs 100kg has 8L of blood.
- Intracellular & extracellular fluid have the same components but in different concentrations.
 Example: Both have Sodium, but in ICF Sodium is present in 10 mEq/l & 142 mEq/l in ECF.
- The total number of cations (positively charged ions) in plasma is equal to the total number of anions (negatively charged ions) in the plasma.
 [عدد الايونات ذات الشحنة الإيجابية في البلازما يساوي عدد الايونات ذات الشحنة السلبية]

Electrolytes	
	mEq/L
Cations	
Sodium (Na ⁺)	142
Potassium (K ⁺)	5
Calcium (Ca ⁺⁺)	5
Magnesium (Mg ⁺⁺)	2
Total cations	154
Anions	
Chloride (Cl ⁻)	103
Bicarbonate (HCO ₃ ⁻)	26
Phosphate (HPO ₄ ⁻)	2
Sulfate (SO ₄ ⁻)	1
Organic acids	5
Proteinates	17
Total anions	154

- Similarly, the total number of cations in ICF is equal to the total number of anions of ICF.

- The difference in concentration of ICF/ECF components is due to the permeability (نفاذية الخلية) of the cell, and the activity of the cell. For example, if a cell needs glucose, glucose will diffuse from blood to tissue flood to the cell.
- Measurement of body fluid volumes is done by injecting a substance (example: sucrose) that will stay in one compartment. The substance must be non-toxic. After a certain period of time, this substance will be metabolized & removed from the body by excretion.

$$\frac{(\text{Amount injected}) - (\text{Amount excreted})}{\text{Plasma level of the substance after mixing}}$$

For example: 150mg of sucrose is injected into a healthy man. The plasma sucrose level of sucrose after mixing is 0.01mg/mL, and he excreted 10mg of sucrose.

Volume of distribution of sucrose = $(150-10)/0.10 = 14000\text{mL}$

Notes:

1. The syllabus is on e-learning.
2. Do not do any make-up exams, make-up exams will have difficult essay questions.
3. Dr. Khalid recommends we all get the book.