

Body fluid and fluid compartment

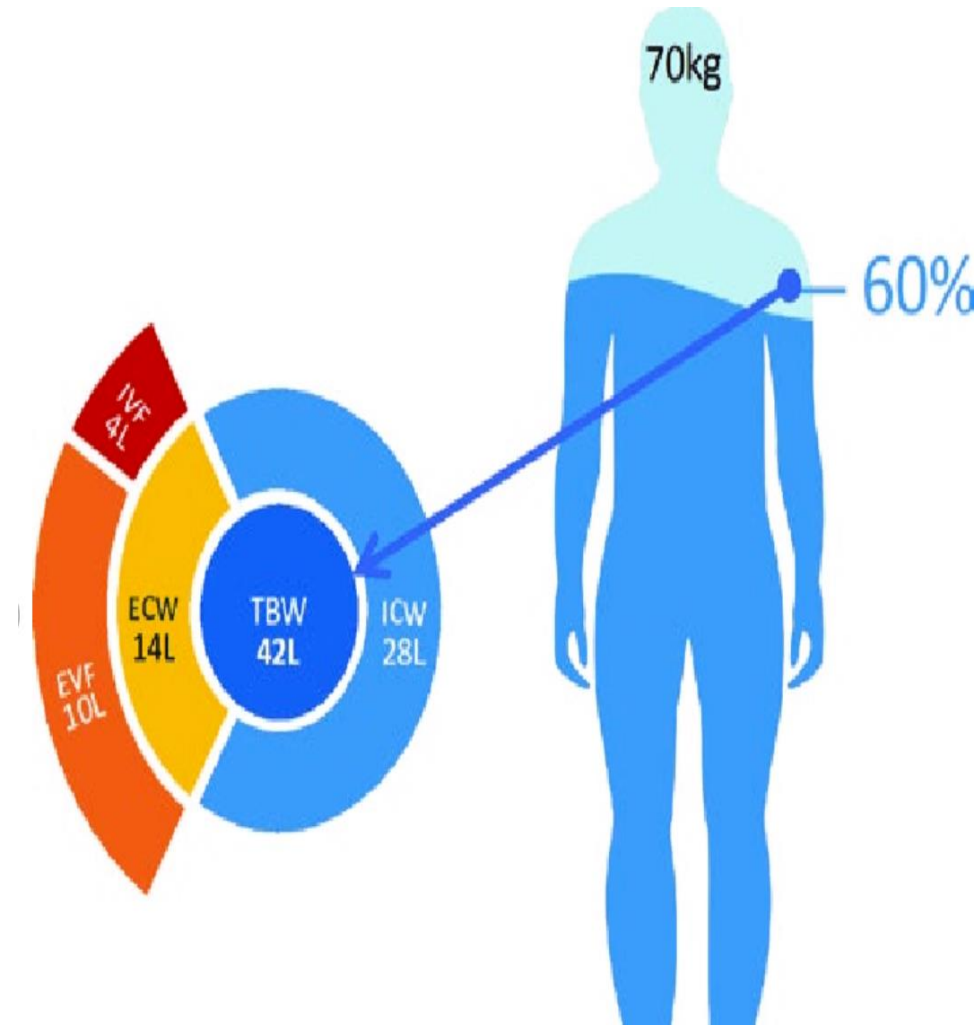
BY

Al Shaimaa Mahmoud Kotb

Assistant Professor of Physiology

Faculty of Medicine- Mutah university

2025-2026



Body Water

The Total Body Water is about 60% BW (~ 42 L).

Distributed as follow:

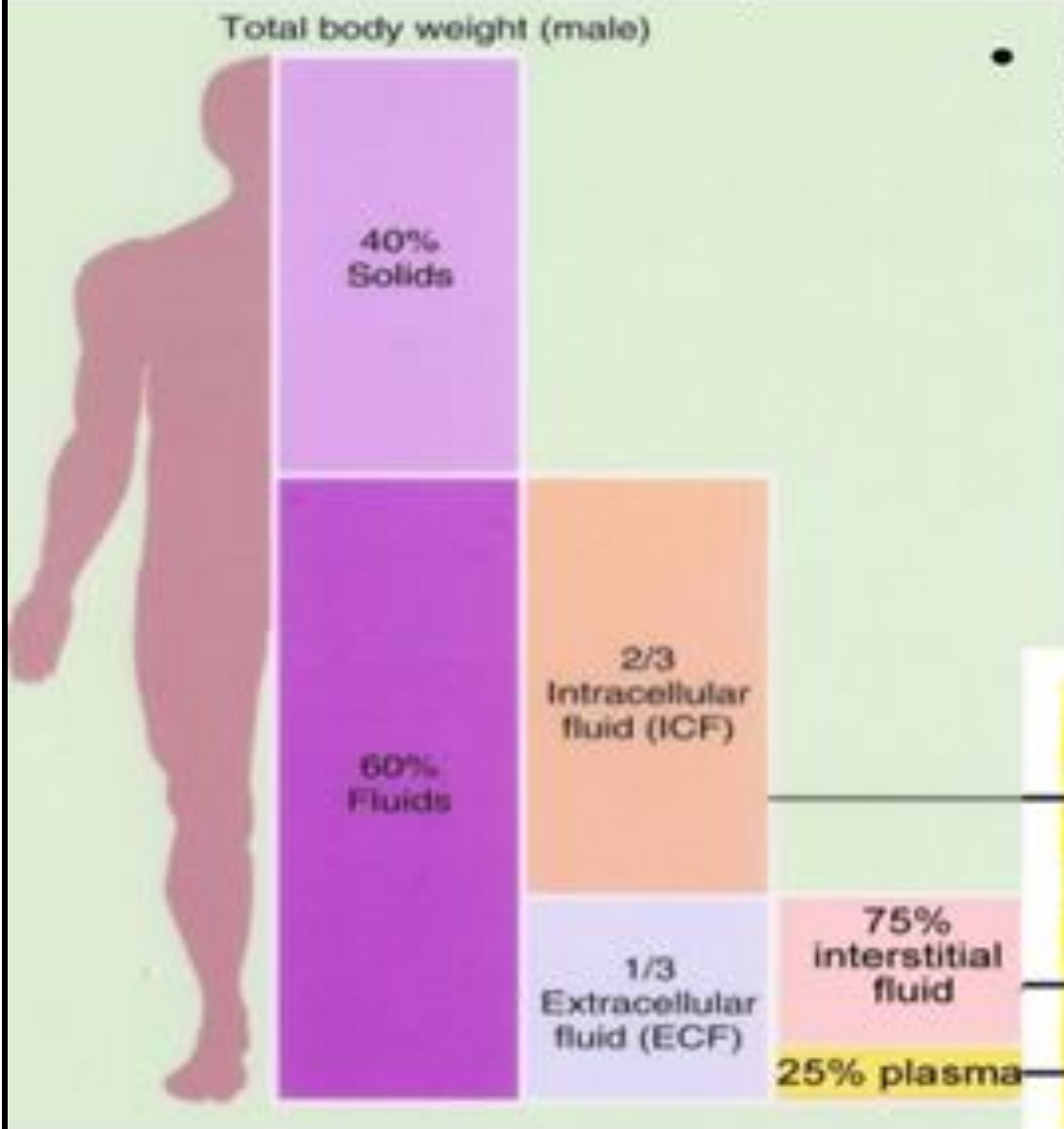
1- Intracellular fluid (ICF): this constitutes about **2/3** of the total body water (**40% BW = 28 L**).

2- Extracellular fluid (ECF): this constitutes about **1/3** of the total body water (**20% BW = 14 L**).

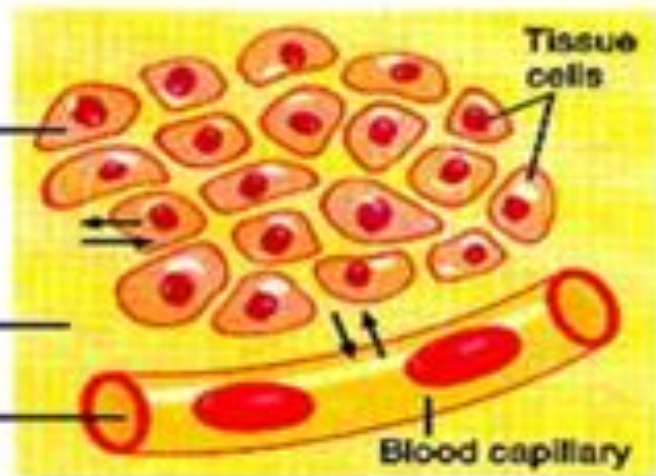
It includes the following subdivisions:

- a. Intravascular fluid: (i.e. the plasma): This is normally about 1/4 of the ECF volume.
- b. Extravascular fluid: This is normally about 3/4 of the ECF volume, it includes:
 - Interstitial fluid: the fluid in spaces between the tissue cells.
 - Transcellular fluids: fluid present in closed spaces surrounded by epithelium as cerebrospinal fluid, synovial fluid in joints, intraocular fluid
.....

Body fluid distribution



- Body fluids are distributed in two distinct areas:
 - intracellular fluid (ICF)
40% body weight
 - Extracellular fluid (ECF)
20% body weight
 - Interstitial fluid -15% body weight
 - Plasma -5% body weight



- Fluid compartments are separated by membranes that are freely permeable to water.
- Movement of fluids due to hydrostatic pressure and osmotic pressure

TBW = 0.6 x Body weight

Total Body Water (TBW)
(70Kg man)
42 litres

Extracellular Fluid Volume (ECF)
1/3 of Total Body Weight =
14 Litres

Intracellular Fluid Volume (ICF)
2/3 of Total Body Weight =
28 Litres

Interstitial Fluid
3/4 of ECF=
10.5 Litres

Plasma
1/4 of ECF =
3 Litres

Transcellular Fluid
0.5 Litre

Calculate the total body water content of a 40-year-old 70kg man?

- **Since Total Body Water (TBW) = 60% of Body weight**
- **So, The TBW = $60/100 \times 70$
 $= 0.6 \times 70 = 42L$**
- ***How many litres present intracellularly?***
 $42 \times \frac{2}{3} = 28L$ *OR* $70 \times 40/100 = 28L$.
- ***How many litres present extracellularly?***
 $42 \times \frac{1}{3} = 14L$ *OR* $70 \times 20/100 = 14L$.

Test Your Self

- **Calculate the total body water content of a 40-year-old man weighing 90kg?**

Functions of Body Water

1. It is the **medium** for the chemical and enzymatic reactions.
2. It is the **medium** for the physical processes e.g. diffusion and filtration.
3. It **regulates** the body temperature through heat absorption, distribution and evaporation.
4. It is a **lubricant** in the joints and potential spaces (e.g. the pleura).
5. It is a **refractive medium** in the eye.
6. The cerebrospinal fluid is a **mechanical buffer** that protects the brain.
7. It is the **medium for exchange** of O_2 and CO_2 in the lungs and tissues.

Regulates body temperature



Moistens tissues such as those in the mouth, eyes and nose



Protects body organs and tissues



Lubricates joints



Helps prevent constipation



Lessens the burden on the kidneys and liver by flushing out waste products



Helps dissolve minerals and other nutrients to make them accessible to the body



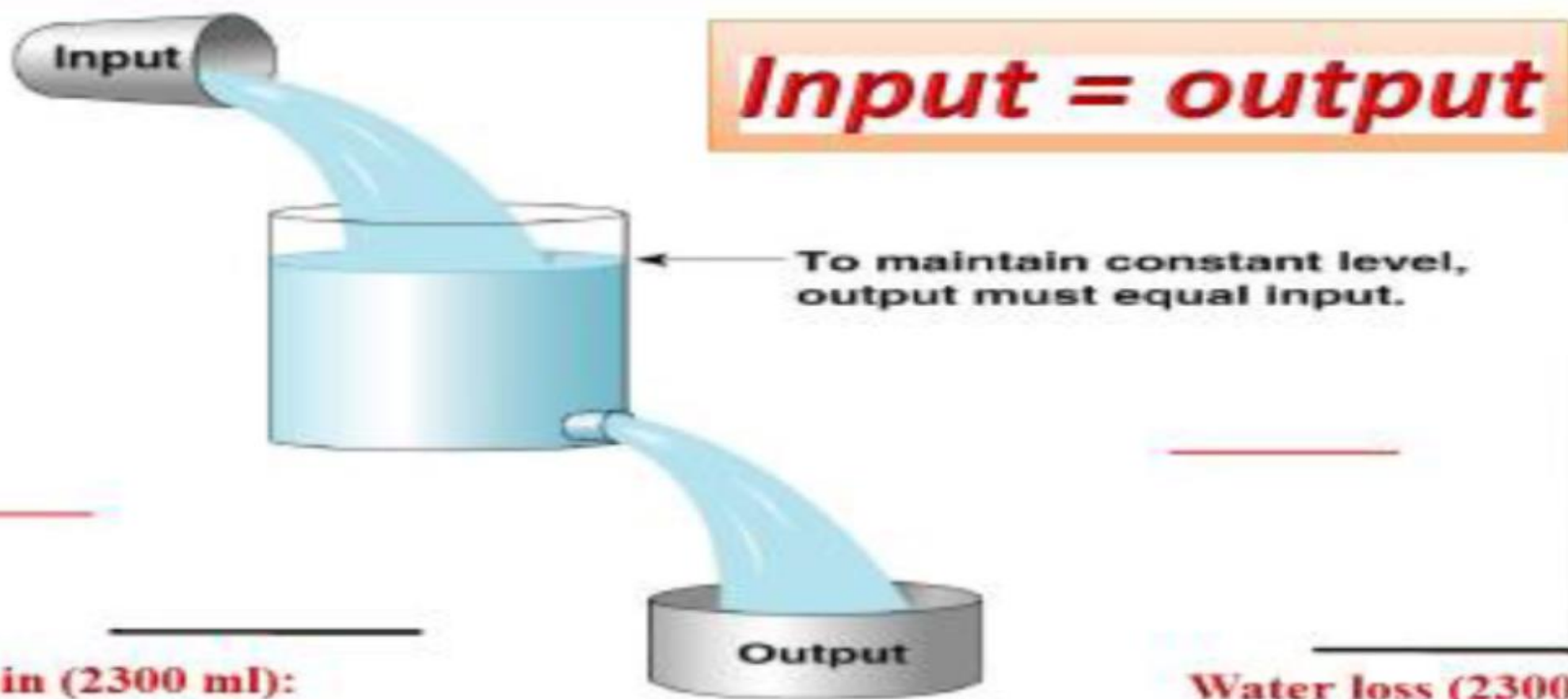
Carries nutrients and oxygen to cells



Composition of the ICF and ICF

	ECF	ICF
Main cation	<u>Na⁺ (142mEq/L).</u> Others: K (4mEq/L). small amounts of Ca ²⁺ and Mg ²⁺	<u>K⁺ (140mEq/L).</u> and Mg ²⁺ small amounts of Na ⁺ and very little Ca ²⁺
Main anion	Cl⁻. Others: HCO ₃ , proteins and HPO ₄	HPO₄ and protein. Small amounts of Cl ⁻ , HCO ₃ and SO ₄
pH	About 7.4	About 7 due to low HCO ₃ ⁻
Osmolarity	The same	The same

Maintenance of Fluid Balance



Water gain (2300 ml):

- **Exogenous water (2000 ml):**
 - (a) Water & fluids drunk (about 1400ml/day).
 - (b) Water present in the eaten food (about 600 ml/day).
- **Endogenous water (300):**
 - formed inside the body as a result of oxidation of H₂ in the foodstuffs

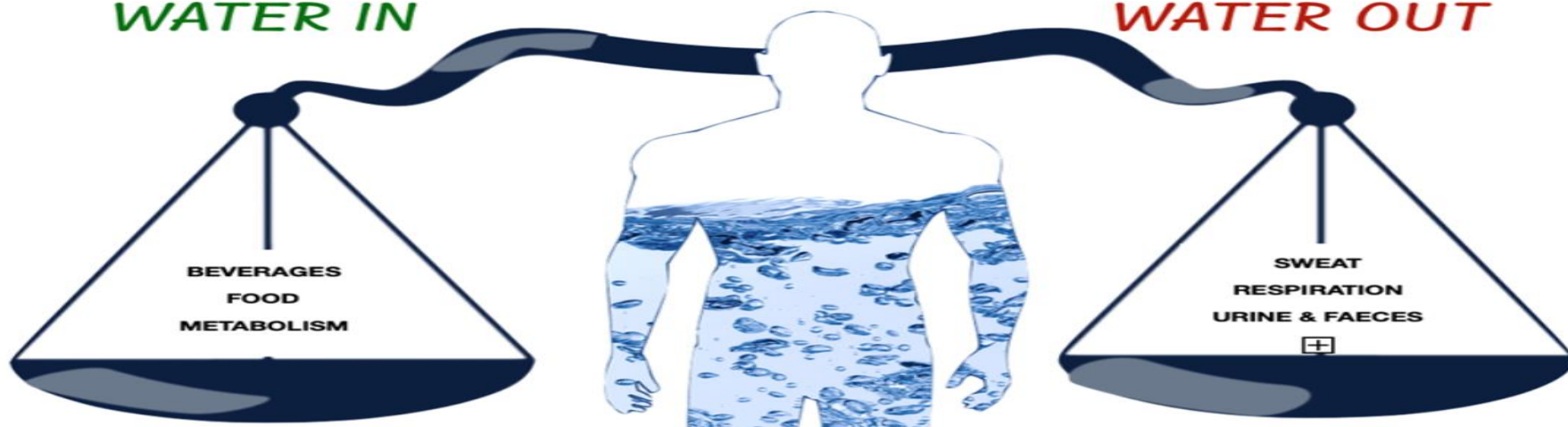
Water loss (2300):

- **Urine (1400 ml).**
- **Feces (100 ml).**
- **Sweat (100 ml).**
- **Insensible loss (700 ml).**

FLUID BALANCE

WATER IN

WATER OUT



Water Intake

Water Output



Disorders of Water Balance:

I. Dehydration:

- This is a condition of negative water balance that occurs when the amount of water loss exceeds that of water gain

Causes:

- Due to excessive sweating, vomiting or diarrhea and in cases of prolonged water deprivation.

- Infants and children are **more vulnerable** to develop dehydration than adults **why?**
- **Because in the young individuals;**
 - (a) The ECF/ICF ratio is higher in infants than adults.
 - (b) The kidneys are less able to retain water.



- **Correction of Dehydration:**

- A. Role of the body:**

As a result of hypovolemia

1. **ADH release is increased** → which increase water reabsorption from distal convoluted tubules of the kidney → ↓ water loss
2. **Thirst center is stimulated** → excessive intake of water → ↑ water gain.

- B. Treatment:**

Giving the patient **fluids** either orally or i.v. (**e.g.** isotonic saline 0.9 % NaCl or glucose 5% solutions).

- **Over Hydration (i.e. Water intoxication):**

This is a condition of positive water balance that occurs when the amount of water gain exceeds that of water loss

(1) Excessive secretion of ADH which lead to \uparrow water retention in the body, and \downarrow water excretion in the urine.

(2) Or if a person drinks excessive water more than the kidneys can remove in the urine.

- **Correction of Over Hydration:**

- A. Role of the body:**

- As a result of hypervolemia

- ADH secretion is decreased → ↓ water reabsorption from distal convoluted tubules of the kidney → ↑ water loss

- Thirst center is not stimulated → minimal ingestion of water → ↓ water gain.

- B. Treatment:**

- Diuretic drugs:** These are drugs which increase urine output, e.g. **Lasix**.



THANK

YOU