



EVALUATION SEMINAR ON  
**FLUID AND ELECTROLYTE BALANCE**

**SUBMITTED BY:**

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MYSURU

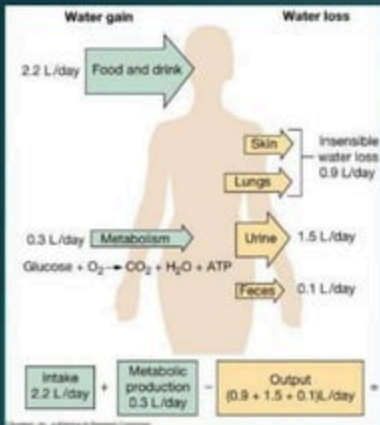
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# DEFINITION

- ▶ Dynamic process Balance between body fluids and electrolytes
- ▶ Attraction between ions (electrolytes) and water (fluids) causes fluids to move across membranes and leave their compartments

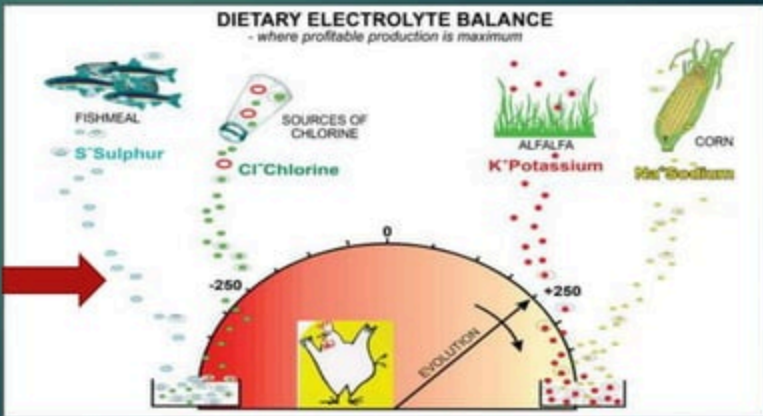
## **ELECTROLYTE BALANCE**

- ▶ a chemical substance that, when dissolved in water or melted, dissociates into electrically charged particles and thus is capable of conducting an electric current
- ▶ Work with fluids to keep the body healthy and in balance
- ▶ They are solutes that are found in various concentrations and measured in terms of milliequivalent (mEq) units
- ▶ Can be negatively charged (anions) or positively charged (cations)
- ▶ For homeostasis body needs:  
Total body ANIONS = Total body CATIONS

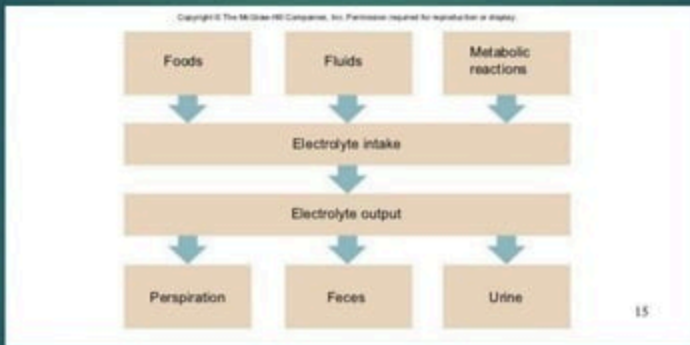


## Fluid balance (HOMEOSTASIS)

## ELECTROLYTE BALANCE



An Electrolyte balance occurs when the quantities of electrolyte of the body gains equals those lose



# INDICATIONS

- ▶ Acute Kidney Failure
- ▶ Dehydration in Children
- ▶ Diabetic Ketoacidosis
- ▶ Fever (in Adults)
- ▶ Gastroenteritis (Stomach Flu)
- ▶ Hyponatremia (Low Sodium)
- ▶ Kidney Diseases
- ▶ Low Potassium (Hypokalemia)
- ▶ Muscle Cramp

# TYPES

WATER BALANCE

SODIUM BALANCE

POTTASSIUM BALANCE

CALCIUM BALANCE

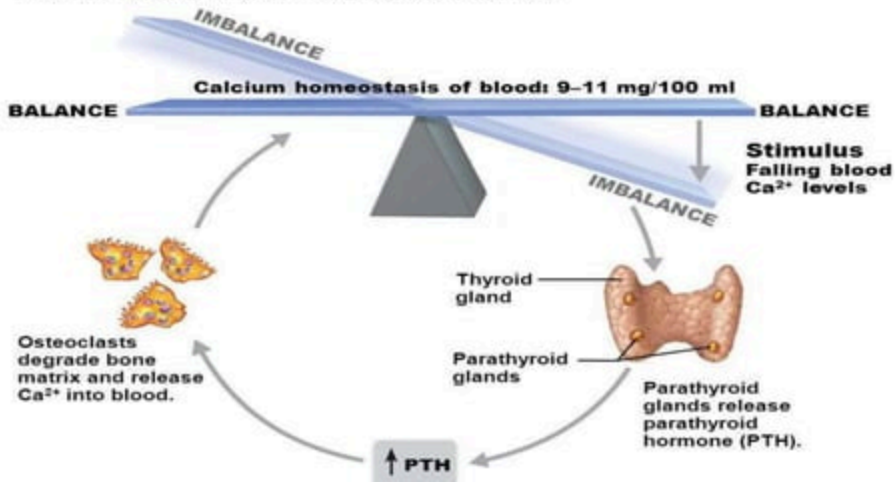
BICARBONATE BALANCE

MEGNISUM BALANCE

# Calcium Balance

- ▶ 'Calcitonin,' is something that promotes bone growth and decreases calcium levels in a person's blood.
- ▶ Calcium is bound to the proteins in a person's bloodstream.

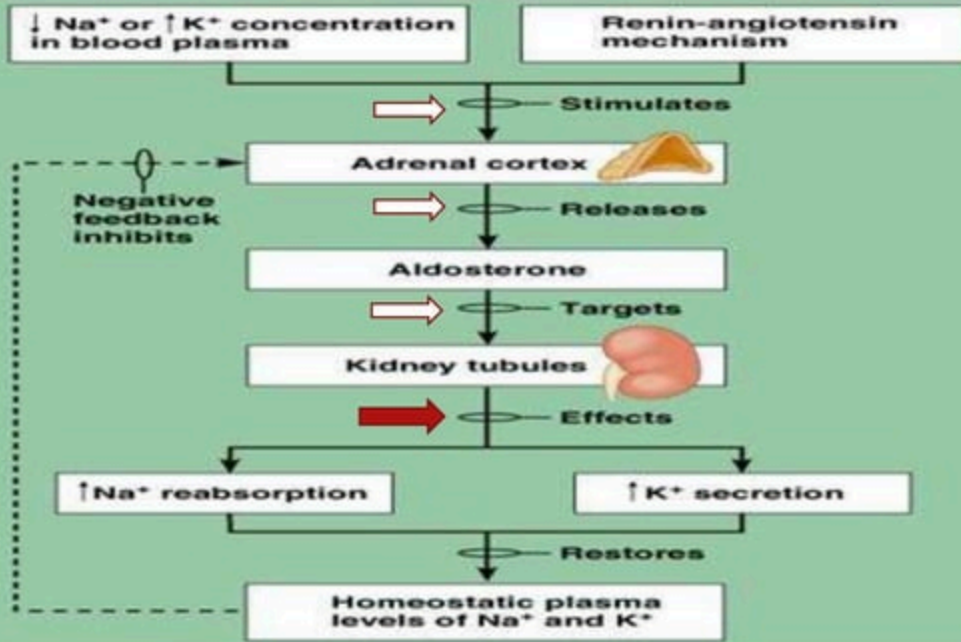
Figure 6.12 Parathyroid hormone (PTH) control of blood calcium levels.



# Potassium Balance

- ▶ Potassium is most concentrated, which is inside of the cells
- ▶ 'Hyperkalemia,' is a potentially life-threatening condition because it causes abnormal electrical conduction in a person's heart and potentially life-threatening heart rhythm issues.
- ▶ 'Hypokalemia,' is most often experienced when a person's body loses too much potassium from things such as diarrhea, vomiting, sweating, or medications such as laxatives or diuretics.





## Magnesium Balance

- ▶ Magnesium is an electrolyte that is involved with a variety of metabolic activities in a person's body,
- ▶ Magnesium acts as a cofactor in a number of the body's enzyme activities.
- ▶ Too little magnesium stimulates absorption from the person's intestine and too much decreases the absorption itself.

## Sodium Balance

- ▶ Sodium is most often found outside the cell in the plasma of a person's bloodstream and is a significant part of water regulation in their body, since water goes where the sodium does.
- ▶ If there is too much sodium in a person's body, possibly due to high salt intake in their diet, it is excreted by the person's kidney and water follows.

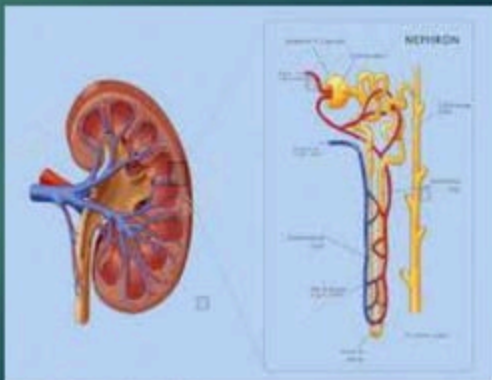
# REGULATION OF ELECTROLYTES

## ➤ Electrolyte Intake

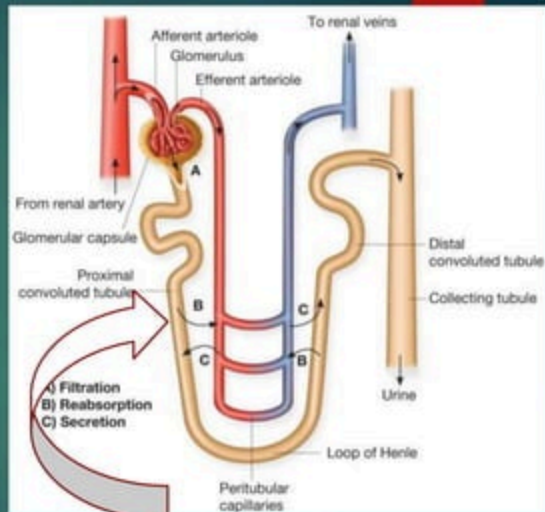
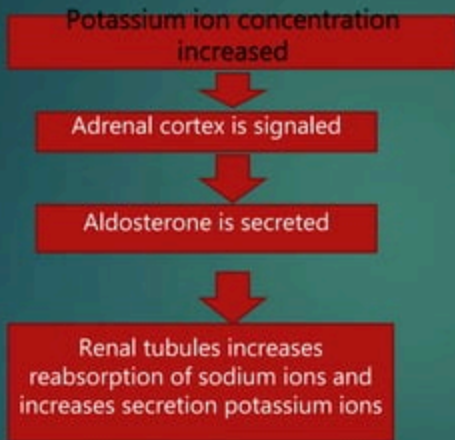
- ▶ The electrolyte of greatest importance to cellular functions release sodium, potassium, calcium, magnesium, chloride phosphate, bicarbonate... Etc
- ▶ these ions are primarily obtained from
  - Foods
  - Water
  - beverages
- ▶ Ordinarily a person obtains sufficient electrolytes by responding to thirst and hunger

# Electrolyte output

- ❑ The body loses some of the electrolytes perspiring during warmer days and during strenuous exercise
- ❑ Some are lost in the feces
- ❑ The greatest output is as a result of
  - Kidney function
  - Urine output



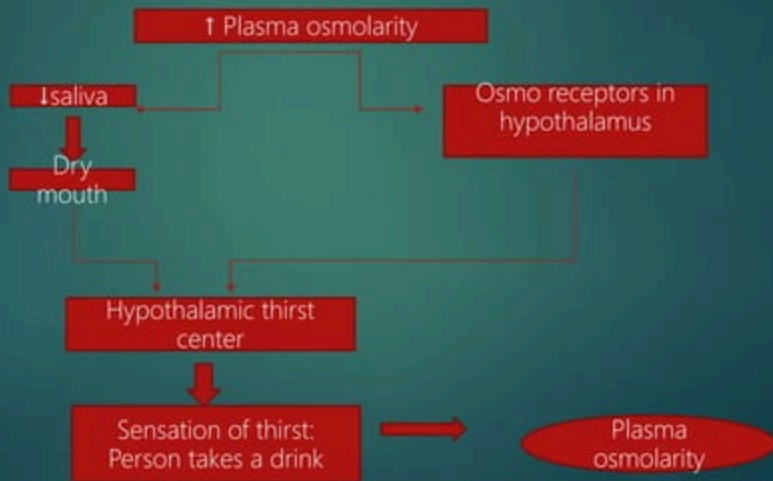
# Electrolyte output



Sodium ions are conserved and potassium ions are excreted

# Regulation of Fluids

- ▶ **Hypothalamus** – Thirst receptors (osmoreceptors) continuously monitor serum osmolarity (concentration). If it rises, thirst mechanism is triggered.  
+ Vasopressin (AKA ADH) – increasing H<sub>2</sub>O reabsorption



# Regulation of Fluids

## Pituitary regulation-

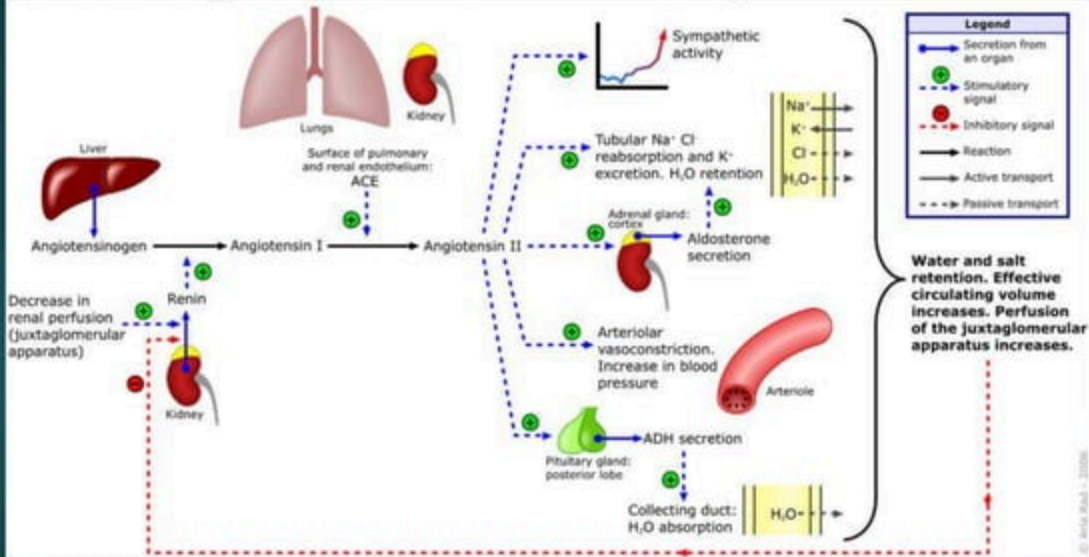
- ▶ posterior pituitary releases ADH (antidiuretic hormone) in response to increasing serum osmolarity. Causes renal tubules to retain H<sub>2</sub>O.
- ▶ Thirst is a late sign of water deficit

## Renal regulation-

- ▶ Nephron receptors sense decreased pressure (low osmolarity) and kidney secretes RENIN.  
Renin – Angiotensin I – Angiotensin II
- ▶ Angiotensin II causes Na and H<sub>2</sub>O retention by kidneys and Stimulates Adrenal Cortex to secrete Aldosterone which causes kidneys to excrete K and retain Na and H<sub>2</sub>O



# Renin-angiotensin-aldosterone system





# *ELECTROLYTE IMBALANCE*

- ▶ Electrolyte imbalance is the state in which the serum concentrations of an electrolyte that are either higher or lower than normal.
- ▶ Electrolytes refer to minerals that include calcium, chloride, magnesium, phosphate, potassium, and sodium. They are present in your blood, body fluids, and urine. They are ingested with food, drink, and medicines and supplements.

## Effects of Electrolyte Imbalance

- ▶ *Hyponatremia*
- ▶ *Hypernatremia*
- ▶ Hypocalcemia
- ▶ Hypercalcemia
- ▶ Hypophosphatemia
- ▶ Hyperphosphatemia

## Hypernatremia [ $\text{Na}^+$ $\geq 145\text{mEq}$ ]

- ▶ It is a common electrolyte problem that is defined as a rise in serum sodium concentration to a value exceeding 145 mmol/L.
- ▶ It is strictly defined as a hyperosmolar condition caused by a decrease in total body water (TBW) relative to electrolyte content. Hypernatremia is a "water problem," not a problem of sodium homeostasis.

# Hypernatremia

► Indications

You are **fried**

**F** Fever

**R** Restless (irritation)

**I** Increased fluid retention & BP ↑

**E** Edema

**D** Decreased urine

# Hyponatremia [Na<sup>+</sup> ≤ 135mEq]

- ▶ The normal serum sodium level is 135-145 mEq/L. Hyponatremia is defined as a serum sodium level of less than 135 mEq/L. Joint European guidelines classify hyponatremia in adults according to serum sodium concentration, as follows:
- ▶ Mild: 130-134 mmol/L
- ▶ Moderate: 125-129 mmol/L
- ▶ Profound: <125 mmol/L

# Hyponatremia

## Indications

- ▶ Excessive vomiting
- ▶ Diarrhea
- ▶ Heart, Kidney & Liver problems
- ▶ Diuretics
- ▶ dehydration

## Hypokalemia ( $K^+$ $<3.5$ mEq/L)

- ▶ Decrease in  $K^+$  causes decreased excitability of cells, therefore cells are less responsive with normal stimuli
- ▶ Normal potassium levels are between 3.5 and 5.0 mmol/L (3.5 and 5.0 mEq/L) with levels below 3.5 mmol/L defined as hypokalemia.

### Indications

- Feeling tired
- Leg cramps
- Weakness
- constipation
- It increases the risk of an abnormal heart rhythm such as bradycardia and cardiac arrest.

# **K<sup>+</sup>** POTASSIUM DEFICIT

\* **A**lkalosis

\* **S**hallow Respirations

\* **I**rritability

\* **C**onfusion, Drowsiness

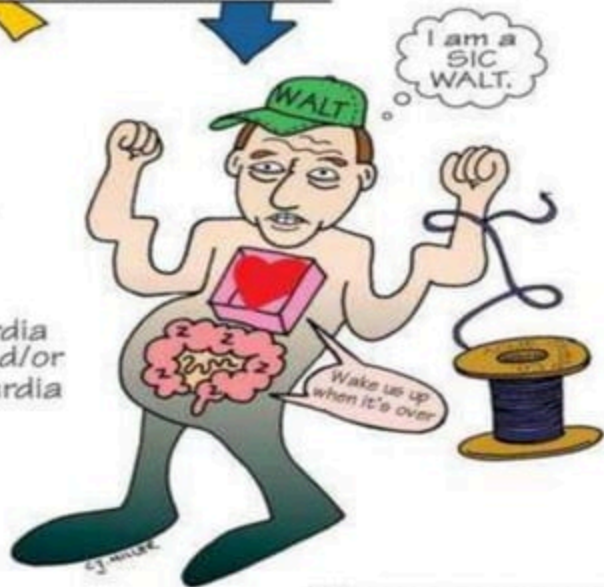
\* **W**eakness, Fatigue

\* **A**rrhythmias - Tachycardia  
Irregular Rhythm and/or  
Bradycardia

\* **L**ethargy

\* **T**hready Pulse

\* **↓** Intestinal Motility  
Nausea  
Vomiting  
Ileus

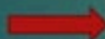




# Hyperkalemia ( $K^+ > 5.0\text{mEq/L}$ )

- ▶ Increase in potassium causes increase in the excitability of the cell

Indications



**$K^+$**   
HYPERKALEMIA **↑**

- \* MUSCLE CRAMPS → WEAKNESS → PARALYSIS
- \* DROWSINESS
- \* ↓ BP
- \* EKG CHANGES
- \* DYSRHYTHMIAS
- \* ABDOMINAL CRAMPING
- \* DIARRHEA
- \* OLIGURIA



# Hypocalcemia ( $\text{Ca}^{2+}$ < 2.1 mEq/L)

- ▶ **Hypocalcemia** is low calcium levels in the blood serum
- ▶ The normal range is 2.1–2.6 mmol/L (8.8–10.7 mg/dL, 4.3–5.2 mEq/L)
- ▶ with levels less than 2.1 mmol/L defined as hypocalcemia.
- ▶ Common causes
  - ✓ Hypoparathyroidism and vitamin D deficiency
  - ✓ Kidney failure
  - ✓ Pancreatitis
  - ✓ Calcium channel blocker overdose

## Hypercalcemia ( $\text{Ca}^{2+}$ > 2.6 mEq/L)

- ▶ **Hypercalcemia** is a high calcium ( $\text{Ca}^{2+}$ ) level in the blood serum.
- ▶ The normal range is 2.1–2.6 mmol/L (8.8–10.7 mg/dL, 4.3–5.2 mEq/L)
- ▶ The levels greater than 2.6 mmol/L defined as hypercalcemia.
- ▶ Those with a mild increase that has developed slowly typically have no symptoms.
- ▶ Rapid onset symptoms may include
  - Abdominal pain, bone pain
  - Confusion, depression, weakness
  - kidney stones , or an abnormal heart rhythm including cardiac arrest

# MCO

▶ A patient presents with thirst, dry skin and mouth, and decreased urine output. What diagnosis would you suspect?

- A. Hypocalcemia
- B. Fluid Volume Excess
- C. Fluid Volume Deficit


D. Hyperkalemia

C. Fluid Volume Deficit

▶ Which electrolyte is the major intracellular ion?

- A. Sodium
- B. Potassium
- C. Magnesium
- D. Calcium

B. Potassium



▶ Which of the following is not a function of Fluids?

A. Engulfing dead cells

B. Excretion of waste products

C. Regulation of body temp

D. Transportation of nutrients, electrolytes, and O to the cells

A. Engulfing dead cells

▶ Which value falls within the normal range for sodium?

A. 148 mmol/L

B. 142 mmol/L

C. 160 mmol/L

D. 120 mmol/L

B. 142 mmol/L {normal range is btn 135-145 mmol/L}



- ▶ Fever, Restless (irritation), Increased fluid retention, Edema, Decreased urine are the symptoms of which electrolyte deficiency?

- A. Hypokalemia
- B. Hypercalcemia
- C. Hyponatremia
- D. Hypocalcemia
- C. Hyponatremia

- ▶ What is the normal range for potassium?

- A. 120-190 mmol/L
- B. 3.5-5 mmol/L
- C. 8.5-10 mmol/L
- D. 2.6-5mmol/L
- B.) 3.5-5 mmol/L

**THANKS FOR LISTENING ANY QUESTIONS**



**GO TO THE NILE RIVER AND ASK IT**

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