

FLUID AND ELECTROLYTE BALANCE

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ELECTROLYTES

**A substance that is dissolved in solution and
Some of its molecules split or dissociate into
Electrically charged atoms or ions.**

MEASUREMENT

- The metric system is used to measure volumes of fluids—liters (L) or milliliters (mL).**
- The unit of measure that expresses the combining activity of an electrolyte is the milliequivalent (mEq).**

CONT.....

- The atom is composed of particles known as the proton(positive charge), neutron (neutral), and electron (negative charge).

Cation:

- A cation is an ion that carries a positive charge and has given away or lost electrons.

Anion:

- An anion is an ion that has gained electrons and therefore carries a negative charge.

BODY FLUID COMPARTMENT

- **Intravascular compartment:** Refers to fluid inside a blood vessel
- **Intracellular compartment:** The intracellular compartment refers to all fluid inside the cell.
- **The extracellular compartment :** Refers to fluid outside the cell.e.g. The extracellular compartment includes the interstitial fluid, which is fluid between cells (sometimes called the third space), blood, lymph, bone, connective tissue, water, and transcellular fluid.

EDEMA

- ❖ Edema is an excess accumulation of fluid in the interstitial space.
- ❖ **Localized edema** occurs as a result of traumatic injury from accidents or surgery, local inflammatory processes, or burns.
- ❖ **Generalized edema**, also called anasarca, is an excessive accumulation of fluid in the interstitial space throughout the body and occurs as a result of conditions such as cardiac, renal, or liver failure.

BODY FLUID

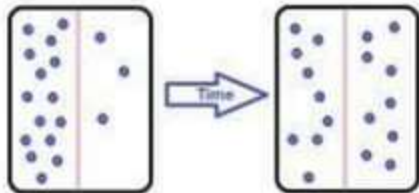
Total body fluid (intracellular and extracellular) amounts to about 60% of body weight in the adult, 55% in the older adult, and 80% in the infant.

BODY FLUID TRANSPORT

1. Diffusion

Diffusion is the process whereby a solute (substance that is dissolved) may spread through a solution or solvent (solution in which the solute is dissolved).

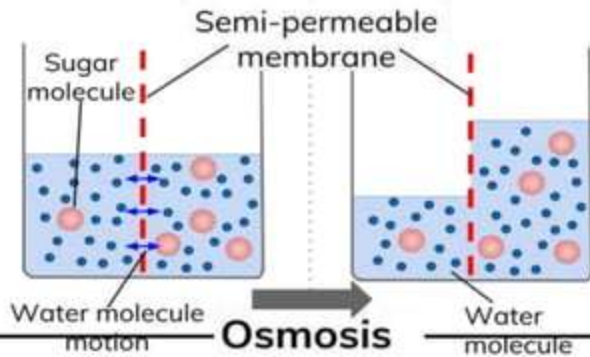
Diffusion of a solute spreads the molecules from an area of higher concentration to an area of lower concentration.



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2. Osmosis

Osmotic pressure is the force that draws the solvent from a less concentrated solute through a selectively permeable membrane into a more concentrated solute, thus tending to equalize the concentration of the solvent.



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3. Filtration

Filtration is the movement of solutes and solvents by hydrostatic pressure.

4. Hydrostatic Pressure

Hydrostatic pressure is the force exerted by the weight of a solution.

- osmotic pressure is measured in milliosmoles (mOsm).
- The normal osmolality of plasma is 270 to 300 milliosmoles/kilogram (mOsm/kg) water.

MOVEMENT OF BODY FLUID

1. Isotonic solutions

Both sides of a selectively permeable membrane have established equilibrium or are equal in concentration, they are isotonic.

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2. Hypotonic solutions

solution contains a lower concentration of salt or Solute than another more concentrated solution, it is considered hypotonic. Less salt or more water than an isotonic solution.

CONT....

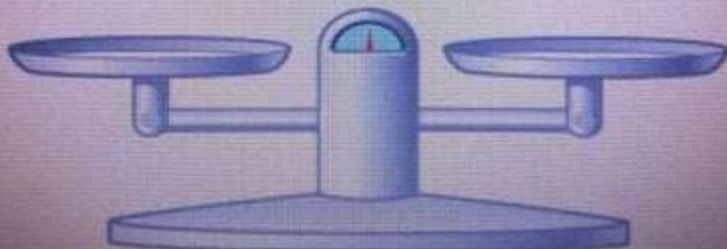
3. Hypertonic solutions

A solution that has a higher concentration of solutes than another less concentrated solution is hypertonic.

BODY FLUID INTAKE AND OUT PUT

Fluid intake	
Ingested water	1200-1500 mL
Ingested food	800-1100 mL
Metabolic oxidation	300 mL
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TOTAL	2300-2900 mL

Fluid output	
Kidneys	1500 mL
Insensible loss through skin	600-800 mL
Insensible loss through lungs	400-600 mL
Gastrointestinal tract	100 mL
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TOTAL	2600-3000 mL



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- **Water lost through the skin is called insensible loss (the individual is unaware of losing that water).**
- **The adrenal glands, through the secretion of aldosterone, also aid in controlling extracellular fluid volume by regulating the amount of sodium reabsorbed by the kidneys.**

CONT....

Antidiuretic hormone from the pituitary gland regulates the osmotic pressure of extracellular fluid by regulating the amount of water Reabsorbed by the kidney.

FLUID VOLUME DEFICIT /HYPOVOLEMIA

DEFINITION :

Dehydration occurs when the fluid intake of the body is not sufficient to meet the fluid needs of the body.

TYPES OF FLUID VOLUME DEFICITS

1. Isotonic dehydration

Water and dissolved electrolytes are lost in equal proportions.

2. Hypertonic dehydration

Water loss exceeds electrolyte loss.

3. Hypotonic dehydration

Electrolyte loss exceeds water loss.

CAUSES OF FLUID VOLUME DEFICITS

1. Isotonic dehydration

- a. Inadequate intake of fluids and solutes
- b. Fluid shifts between compartments
- c. Excessive losses of isotonic body fluids

2. Hypertonic dehydration—conditions that increase fluid loss, such as excessive perspiration, hyperventilation, ketoacidosis, prolonged fevers, diarrhea, early-stage renal failure, and diabetes insipidus

CONT.....

3. Hypotonic dehydration

- a. Chronic illness**
- b. Excessive fluid replacement (hypotonic)**
- c. Renal failure**
- d. Chronic malnutrition**

CLINICAL MANIFESTATION

CARDIOVASCULAR

- **Thready, increased pulse rate**
- **Decreased blood pressure and orthostatic (postural)**
- **hypotension**
- **Flat neck and hand veins in**
- **dependent positions**
- **Diminished peripheral pulses**
- **Decreased central venous pressure**
- **Dysrhythmias**

CONT....

RESPIRATORY

- Increased rate and depth of respirations
- Dyspnea

NEUROMUSCULAR

- Decreased central nervous system activity, from lethargy to coma
- Fever, depending on the amount of fluid loss
- Skeletal muscle weakness

CONT.....

RENAL

Decreased urine output

INTEGUMENTARY

Dry skin

Poor turgor, tenting

Dry mouth

GASTROINTESTINAL

Decreased motility and diminished bowel sounds

Constipation

Thirst

Decreased body weight

LABORATORY FINDINGS

- **Increased serum osmolality**
- **Increased hematocrit.**
- **Increased blood urea nitrogen (BUN) level**
- **Increased serum sodium level**
- **Increased urinary specific gravity**

FLUID VOLUME EXCESS/HYPERVOLEMIA

DEFINITION:

Fluid intake or fluid retention exceeds the fluid needs of the body. Fluid volume excess is also called over hydration or fluid overload.

ETIOLOGY

1. Isotonic over hydration

- a. Inadequately controlled IV therapy**
- b. Renal failure**
- c. Long-term corticosteroid therapy**

2. Hypertonic over hydration

- a. Excessive sodium ingestion**
- b. Rapid infusion of hypertonic saline**
- c. Excessive sodium bicarbonate therapy**

Cont...

3. Hypotonic over hydration

- a. Early renal failure**
- b. Congestive heart failure**
- c. Syndrome of inappropriate anti-diuretic hormone secretion**
- d. Inadequately controlled IV therapy**
- e. Replacement of isotonic fluid loss with hypotonic fluids**
- f. Irrigation of wounds and body cavities with hypotonic fluids**

LABORATORY FINDING

- **Decreased serum osmolality**
- **Decreased hematocrit**
- **Decreased BUN level**
- **Decreased serum sodium level**
- **Decreased urine specific gravity**

Management

- **Administer diuretics; osmotic diuretics typically are prescribed first to prevent severe electrolyte imbalances.**
- **Restrict fluid and sodium intake as prescribed.**
- **Monitor intake and output; monitor weight.**

HYPONATREMIA

Definition : Hyponatremia is a serum sodium level lower than 135 mEq/L (135 to 145 mEq/L)

Etiology :

1. Increased sodium excretion
2. Inadequate sodium intake
3. Dilution of serum sodium

Management:

1. Sodium chloride infusions are administered to restore sodium content and fluid volume.
2. Increase oral sodium intake.

HYPERNATREMIA

Definition : Hyponatremia is a serum sodium level that exceeds 145 mEq/L.

Etiology :

- Decreased sodium excretion
- Increased sodium intake
- Decreased water intake
- Increased water loss.

Management:

- Administer diuretics that promote sodium loss.
- Restrict sodium and fluid intake.

HYPOKALEMIA

Definition : Hypokalemia is a serum potassium level lower than 3.5 mEq/L (3.5 to 5.1 mEq/L). Potassium deficit is Potentially life-threatening because every body system is affected.

Management:

- Monitor electrolyte values.
- Administer potassium supplements orally or **IV**.

HYPERKALEMIA

- Hyperkalemia is a serum potassium level that exceeds 5.1 mEq/L.

Management:

- Discontinue Oral & IV potassium.
- Initiate a potassium-restricted diet.
- Prepare the client for dialysis if potassium levels are critically high.
- Prepare for the IV administration of hypertonic glucose with regular insulin to move excess potassium into the cells.

HYPOCALCEMIA & HYPERCALCEMIA

Hypocalcemia is a serum calcium level lower than 8.6 mg/dL (8.6 to 10 mg/dL).

Hypercalcemia is a serum calcium level that exceeds 10 mg/dL.

Management:

- Administer calcium supplements orally or calcium intravenously.
- Keep 10% calcium gluconate available for treatment of acute calcium deficit.

HYPOMAGNESEMIA

Hypomagnesemia is a serum magnesium level lower than 1.6 mg/dL (1.6 to 2.6 mg/dL)

Management :

Administer magnesium sulfate by the IV route in severe cases (intramuscular injections cause pain and tissue damage); monitor serum magnesium levels frequently.

HYPERMAGNESEMIA

Hyper magnesemia is a serum magnesium level That exceeds 2.6 mg/dL.

Management :

- Diuretics are prescribed to increase renal excretion of magnesium.
- Intravenously administered calcium chloride or calcium gluconate may be prescribed to reverse the effects of magnesium on cardiac muscle.

Note : Calcium gluconate is the antidote for magnesium Overdose.

HYPOPHOSPHATEMIA

Hypo phosphatemia is a serum phosphorus level lower than 2.7 mg/dL. A decrease in the Serum phosphorus level is accompanied by an increase in the serum calcium level. (2.7 to 4.5 mg/dL)

Management :

- Administer phosphorus orally along with a vitamin D supplement.**
- Prepare to administer phosphorus intravenously when serum phosphorus levels fall below 1 mg/dL.**

HYPERPHOSPHATEMIA

- 1. Hyperphosphatemia is a serum phosphorus level that exceeds 4.5 mg/dL.**
- 2. Most body systems tolerate elevated serum phosphorus levels well.**
- 3. An increase in the serum phosphorus level accompanied by a decrease in the serum calcium level.**

Management :

- Instruct the client to avoid phosphate-containing medications, including laxatives and enemas.**

Thank You