

Body fluid and electrolytes disorders

Dehydration

Introduction : Dehydration occurs when you lose more fluid than you take in and your body doesn't have enough water and other fluids to carry out its normal functions. Normally water makes up about 60 percent of your body weight.

If you're an average adult, everyday you lose about 3 liters of water simply by sweating, breathing and eliminating waste. You also lose electrolytes — minerals such as sodium, potassium and calcium that maintain the balance of fluids in your body. Sometimes dehydration occurs for simple reasons: You don't drink enough because you're sick ,or busy, or when you are hiking or camping.

Common causes of dehydration include :

- 1. Severe diarrhea,**
- 2. Severe vomiting,**
- 3. Illnesses with fever**
- 4. Excessive sweating.**
- 5. Inadequate intake of water during hot weather or exercise ,**
- 6. Burns,**
- 7. Increased urination.**

Signs and symptoms : Mild to moderate dehydration is likely to cause:

- Dry, sticky mouth
- weakness, dizziness and fatigue
- Sleepiness or tiredness — children are likely to be less active than usual
- Thirst
- Decreased urine output
- Few or no tears when infants are crying
- Muscle weakness
- Headache
- Lightheadedness

Severe dehydration can cause:

- Extreme thirst
- Extreme fussiness or sleepiness **in infants and children;** irritability and confusion **in adults**
- Very dry mouth, skin and mucous membranes
- Lack of sweating
- Little or no urination — any urine that is produced will be dark yellow or amber
- Sunken eyes
- Shriveled and dry skin that lacks elasticity and doesn't "bounce back" when pinched into a fold
- **In infants,** sunken fontanelles — the soft spots on the top of a baby's head
- Low blood pressure
- Rapid heart rate
- Fever
- **In the most serious cases,** delirium or unconsciousness

Risk factors

- **Infants and children.** dehydration caused by diarrhea is the leading cause of death in children..
- **Older adults.** As you age, you become more susceptible to dehydration for several reasons: Your body's ability to conserve water is reduced, your thirst sense becomes less acute and you're less able to respond to changes in temperature. What's more, older adults, especially people in nursing homes or living alone, tend to eat less than younger people do and sometimes may forget to eat or drink altogether.
- **People with chronic illnesses.** Having uncontrolled or untreated diabetes puts you at high risk of dehydration. But other chronic illnesses also make you more likely to become dehydrated. These include kidney disease, cystic fibrosis, alcoholism and adrenal gland disorders.
- **Endurance athletes.** Anyone who exercises can become dehydrated, especially in hot, humid conditions or at high altitudes.
- **People living at high altitudes.** Living, working and exercising at high altitudes can cause a number of health problems. One is dehydration, which commonly occurs when your body tries to adjust to high elevations through increased urination and more rapid breathing — the faster you breathe to maintain adequate oxygen levels in your blood, the more water vapor you exhale.

Screening and diagnosis:

diagnosis of dehydration depends on :

- **Blood tests.** These may be used to check your electrolytes, especially sodium and potassium; to look for signs of concentrated blood; and to evaluate how well your kidneys are working.
- **Urinalysis.** The color and clarity of your urine, the presence of carbon compounds (ketones) and your urine's specific gravity — that is, the mass of the urine as compared with equal amounts of distilled water — all help show whether you're dehydrated and to what degree. A high specific gravity, for example, indicates significant dehydration.
- the physical signs and symptoms of dehydration

Complications:

Dehydration can lead to serious complications, **including:**

- **Heat injury.** Inadequate fluid intake combined with vigorous exercise and heavy perspiration can lead to heat injury, ranging in severity from mild heat cramps to heat exhaustion to potentially life-threatening heatstroke.
- **Swelling of the brain (cerebral edema).** Most often, the fluid you lose when you're dehydrated contains the same amount of sodium your blood does (isotonic dehydration). In some instances, though, you may lose more sodium than fluid (hypotonic dehydration). To compensate for this loss, your body produces particles that pull water back into the cells

- **Seizures.** These occur when the normal electrical discharges in your brain become disorganized, leading to involuntary muscle contractions and sometimes to a loss of consciousness.
- **Hypovolemic shock.** This is one of the most serious complications of dehydration. It occurs when low blood volume causes a drop in blood pressure and a corresponding reduction in the amount of oxygen reaching your tissues.
- **Kidney failure.** This potentially life-threatening problem occurs when your kidneys are no longer able to remove excess fluids and waste from your blood.
- **Coma and death.** When not treated promptly and appropriately, severe dehydration can be fatal.

Treatment

The only effective treatment for dehydration is to replace lost fluids. The best approach to dehydration treatment depends **on your age, the severity** of your dehydration and its **cause**.

Treating dehydration in sick children:

Use an oral rehydration solution. By using an oral rehydration solution such as Pedialyte for infants and children who have diarrhea, vomiting or fever. These solutions contain water and salts in specific proportions to replenish both fluids and electrolytes, or by using packets of a powdered oral rehydration solution, WHO-ORS, originally developed by the World Health

Organization to treat diarrhea and dehydration in infants with cholera.

- **Continue to breast-feed.** Don't stop breast-feeding when your baby is sick, but add an oral rehydration solution as well.
- **Avoid certain foods and drinks.** The best liquid for a sick child is an oral rehydration solution, and although sports drinks replenish electrolytes.

Treating dehydration in sick adults:

Most adults with mild to moderate dehydration from diarrhea, vomiting or fever can improve their condition by drinking more water.

Treating dehydration in athletes of all ages

For exercise-related dehydration, cool water , **sports drinks** containing electrolytes and a carbohydrate solution also may be helpful.

Treating severe dehydration

Children and adults who are severely dehydrated should be treated by giving them salts and fluids intravenously rather than by mouth.

Prevention:

To prevent dehydration, consume plenty of fluids and foods high in water such as fruits and vegetables.

Under certain circumstances, you may need to take in more fluids than usual:

- **Illness.** Start giving extra water or an oral rehydration solution at the first signs of illness .

- **Exercise.** it's best to start hydrating the day before strenuous exercise.
- **Environment.** You need to drink additional water in hot or humid weather to help lower your body temperature and to replace what you lose through sweating.

Electrolyte disorders

Definition:

An electrolyte disorder is an imbalance of certain ionized salts (i.e., bicarbonate, calcium, chloride, magnesium, phosphate, potassium, and sodium) in the blood.

Description:

Electrolytes are ionized molecules found throughout the blood, tissues, and cells of the body. These molecules, which are either **positive** (cations) or **negative** (anions), conduct an **electric current** and help **to balance pH** and **acid-base levels** in the body. **Electrolytes** also facilitate the passage of fluid between and within cells through a process known as osmosis and play a part in regulating the function of the neuromuscular, endocrine, and excretory systems.

The serum electrolytes include:

Sodium (Na). A positively charged electrolyte that helps to balance fluid levels in the body and facilitates neuromuscular functioning.

Potassium (K). A main component of cellular fluid, this positive electrolyte helps to regulate neuromuscular function and osmotic pressure.

Calcium (Ca). A cation, or positive electrolyte, that affects neuromuscular performance and contributes to skeletal growth and **blood coagulation.**

Magnesium (Mg). A cation. **Influences muscle** contractions and intracellular activity.

Chloride (Cl). An anion, or negative electrolyte, that **regulates blood pressure.**

Phosphate (HPO₄). Negative electrolyte that impacts metabolism and **regulates acid-base balance and calcium** levels.

Bicarbonate (HCO₃). A negatively charged electrolyte that assists in **the regulation of blood pH levels.**

Bicarbonate insufficiencies and elevations cause acid-base disorders (i.e., acidosis, alkalosis).

Sodium disorders

Hypernatremia : means the level of sodium in blood is too high.

Sodium helps the kidneys to regulate the amount of water the body retains or excretes. **In hypernatremia,** the body contains too little water for the amount of sodium . The sodium level in the blood becomes abnormally high when water loss exceeds sodium loss, as typically occurs in dehydration.

Hypernatremia can be caused by:

- 1-** not drinking enough fluids
- 2-** excessive fluid loss (i.e., diabetes insipidus, kidney disease, severe burns, and severe vomiting or diarrhea),

- 3- increased sodium retention (caused by excessive sodium intake or increased aldosterone secretion)
- 4- certain drugs, including loop diuretics, corticosteroids, and antihypertensive medications may cause elevated sodium levels.

Signs and symptoms of hypernatremia include:

- Muscle twitching and/or seizures
- Being thirsty
- Orthostatic hypotension
- Muscle weakness or muscle cramps
- Decreased urination
- Weight loss
- Lightheadedness
- Irritability
- Confusion
- Muscle twitching
- Lethargy
- irregular heartbeat (tachycardia)
- dark, concentrated urine
- dry mouth and mucous membranes
- Signs of dehydration

Hyponatremia: means the level of sodium in blood is too little .

Hyponatremia can be caused by:

1-Diuretics, certain psychoactive drugs (i.e., fluoxetine), specific antipsychotics (lithium)

2- inadequate dietary intake of sodium, excessive perspiration, water intoxication, and impairment of adrenal gland or kidney function.

Symptoms of hyponatremia include:

- nausea, abdominal cramping, and/or vomiting
- headache
- edema (swelling)
- muscle weakness and/or tremor
- paralysis
- disorientation
- slowed breathing
- seizures, and coma

Potassium disorders

Hyperkalemia: means the level of potassium in blood is too high.

Hyperkalemia may be caused by:

- 1- ketoacidosis (diabetic coma),
- 2- myocardial infarction (heart attack),
- 3- severe burns,
- 4- kidney failure,
- 5- fasting ,
- 6- gastrointestinal bleeding,
- 7- adrenal insufficiency,
- 8- Addison's disease.
- 9- **Diuretic drugs**, cyclosporin, lithium, heparin, ACE inhibitors, beta blockers,

Symptoms may include:

- weakness
- nausea and/or abdominal pain
- irregular heartbeat (arrhythmia)
- diarrhea
- muscle pain

Hypokalemia: means the level of potassium in blood is too little.

can be caused by:

- 1- Severe dehydration,
- 2- aldosteronism,
- 3- Cushing's syndrome
- 4- kidney disease,
- 5- long-term diuretic therapy,
- 6- certain penicillins,
- 7- laxative abuse,
- 8- congestive heart failure,
- 9- adrenal gland impairments

Symptoms of hypokalemia include:

- weakness
- Paralysis
- increased urination
- irregular heartbeat (arrhythmia)
- orthostatic hypotension
- muscle pain
- Tetany

Calcium disorders

Hypercalcemia: means the level of calcium in blood is too high

Blood calcium levels may be elevated in cases of :

- 1- parathyroid disorder,
- 2-multiple myeloma,
- 3-metastatic cancer,
- 4-multiple bone fractures,
- 5-milk-alkali syndrome,
- 6- Paget's disease.

7- Excessive use of calcium-containing supplements and certain over-the-counter medications (**i.e., antacids**) .

Symptoms include:

- fatigue
- constipation
- depression
- confusion
- muscle pain
- nausea and vomiting
- dehydration
- increased urination
- irregular heartbeat (arrhythmia)

Hypocalcemia: means the level of calcium in blood is too little.

Can be caused by:

- 1- parathyroid disorders,
- 2- kidney failure,
- 3- severe burns,
- 4- sepsis,
- 5- vitamin D deficiency,
- 6- medications such as heparin and glucocorticoids .

Signs and symptoms:

- muscle cramps and spasms
- tetany and/or convulsions
- mood changes (depression, irritability)
- dry skin
- brittle nails
- facial twitching

Diagnosis:

-If a calcium imbalance is suspected, the physician will also check for Chvostek's sign, a reflex test that triggers an involuntary facial twitch, and Trousseau's sign, a muscle spasm that occurs in response to pressure on the upper arm.

-Serum electrolyte imbalances can be detected through blood tests. Blood is drawn from a vein on the back of the hand or inside of the elbow .

Normal levels of electrolytes are:

Sodium. 135-145 mEq/L (serum)

Potassium. 3.5-5.5 mEq/L (serum)

Calcium. 8.8-10.4 mg/dL (total Ca; serum); 4.7-5.2 mg/dL (unbound Ca; serum)

Treatment:

Treatment of electrolyte disorders depends on the **underlying cause** of the problem and the type of electrolyte involved. If the disorder is caused by **poor diet or improper fluid intake**, nutritional changes may be prescribed. If medications such as diuretics triggered the imbalance, discontinuing or adjusting the drug therapy may effectively treat the condition. **Fluid and electrolyte replacement therapy**, either intravenously or by mouth, can reverse electrolyte depletion.

Hemodialysis treatment may be required to reduce serum potassium levels in hyperkalemic patients with impaired kidney function.