Chapter-10

Water and Electrolytes

Water and Electrolytes

- Distribution, functions of water in the body
- Water turnover and balance
- Electrolyte composition of the body fluids, Dietary intake of electrolyte and Electrolyte balance
- Dehydration, causes of dehydration and oral rehydration therapy

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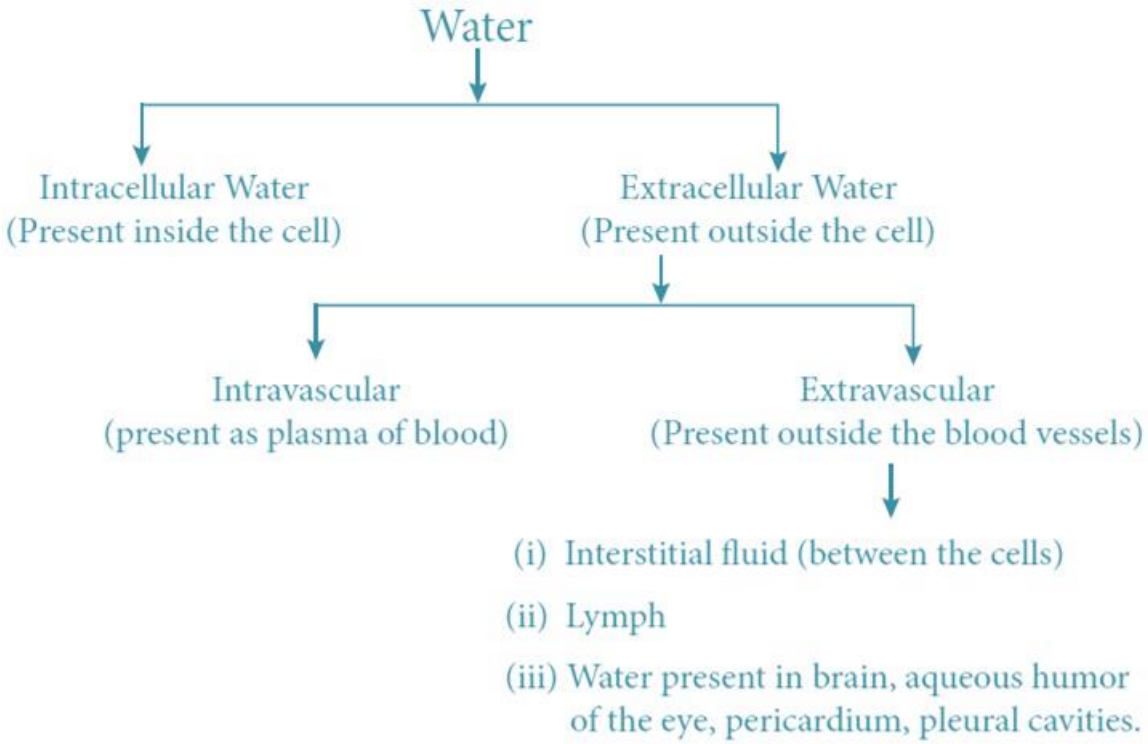
Water and Electrolytes:

Water and the principal electrolytes (sodium, potassium, and chloride) are often excluded from lists of nutrients, these substances are essential dietary components, in that they must be acquired from the diet either exclusively or—in the case of water—in amounts well in excess of that produced by metabolism in the body.

WATER

Water is the most abundant constituent of the human body, accounting for one-half to four-fifths of body weight, depending mainly on body fat content. Accordingly, body water, as a percentage of body mass, is higher in men than in women and tends to fall with age in both.

Distribution:



Functions of Water:

Major functions of water:

- **Carrier of Food Nutrients:** Every nutrient in soluble form in water is carried from intestines to tissues through blood.
- **Constituent of Liquid:** Water is the major constituent of all liquids of body as blood, urine, sweat, lymph.
- **Regulate body temperature:** Water helps to regulate and control body temperature. Heat is produced when food is burnt for energy. Water is evaporated through respiration and sweat and body temperature is maintained normal. Body's heat is lost through the skin, lungs, urine and faeces.
- **Safety/Security of Delicate Organs:** Water is around lungs, heart, brain which protects them from outer injury. Thus provide security to these organs and thereby to human being.
- **Water as lubricant:** Water acts as lubricant in joints. Water around joints help normal circulation process in cells. It is an essential constituent of all the cells of the body and the internal environment.

Water turnover and balance

- Water is an essential component of the human body, making up about 60% of body weight in adults. The balance of water in the body is regulated by several mechanisms to maintain proper hydration levels.
- Water turnover refers to the process by which water is continually exchanged between the body and the environment. This turnover can occur through various routes such as the skin, lungs, and gastrointestinal tract.
- Water balance refers to the balance between water intake and water excretion. The body must maintain water balance to prevent dehydration or overhydration.

Mechanisms involved in water turnover and balance:

1. Thirst mechanism: The body's thirst mechanism helps regulate water intake by stimulating the desire to drink water when there is a need to replace fluids lost through sweat, urine, and breathing.

2. Kidneys: The kidneys play a crucial role in water balance by regulating the amount of water excreted in urine. When the body needs to conserve water, the kidneys reduce urine output by reabsorbing more water back into the body.

3. Antidiuretic hormone (ADH): ADH is a hormone produced by the pituitary gland that regulates water balance by controlling the amount of water excreted in urine. When the body needs to conserve water, ADH levels increase, causing the kidneys to reabsorb more water and produce less urine.

4. Sweating: Sweating is a mechanism by which the body cools itself down and removes excess heat. However, excessive sweating can lead to dehydration, which can be dangerous.

5. Breathing: Water is lost through breathing as water vapor in the air we exhale. This loss is more significant in dry environments and during physical exertion.

6. Gastrointestinal tract: Water is lost through the gastrointestinal tract through feces. The body can reabsorb some of this water in the large intestine to maintain water balance.

Factors affecting water balance:

1. Temperature: Hot environments or physical exertion can increase water loss through sweating and breathing, leading to dehydration.

2. Dietary intake: Drinking fluids and eating foods with high water content, such as fruits and vegetables, can help maintain water balance.

3. Medications: Some medications can affect water balance by increasing or decreasing urine output.

4. Medical conditions: Certain medical conditions, such as diabetes insipidus, can affect the body's ability to regulate water balance.

Dietary intake of electrolyte:

- Electrolytes are minerals that carry an electric charge in the body and include sodium, potassium, calcium, magnesium, chloride, and phosphate.
- Electrolytes play a crucial role in various bodily functions such as maintaining fluid balance, regulating blood pressure, and facilitating muscle contractions and nerve impulses.
- Dietary sources of electrolytes include foods such as fruits, vegetables, dairy products, and meats.
- Sodium is commonly found in table salt, processed foods, and condiments, while potassium is abundant in fruits and vegetables.
- Calcium and magnesium can be obtained from dairy products, leafy greens, nuts, and seeds.
- Chloride and phosphate are found in foods such as processed meats, dairy products, and grains.
- Adequate electrolyte intake is important for overall health, but excessive intake of certain electrolytes such as sodium can lead to health issues such as high blood pressure and increased risk of cardiovascular disease.

Electrolyte balance:

- Electrolyte balance refers to the proper distribution of electrolytes in the body's fluid compartments, including the blood, cells, and extracellular spaces.
- Electrolyte balance is maintained by various mechanisms, including the kidneys, hormones such as aldosterone and antidiuretic hormone (ADH), and the thirst mechanism.
- Electrolyte imbalances can occur due to a variety of reasons, including excessive fluid loss through sweating, vomiting, or diarrhea, or due to certain medical conditions such as kidney disease.
- An electrolyte imbalance can have various symptoms depending on the specific electrolyte affected, including muscle weakness or spasms, cramping, irregular heartbeat, confusion, or seizures.
- Treatment of an electrolyte imbalance may involve dietary changes or supplements, medications, or in severe cases, hospitalization for intravenous electrolyte replacement.

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Dehydration, causes of dehydration and oral rehydration therapy

Dehydration:

Dehydration refers to a condition where the body lacks adequate fluids to carry out normal physiological functions. It can occur when the body loses more fluids than it takes in, leading to an imbalance in the body's electrolytes and dehydration.

Causes of Dehydration:

There are several causes of dehydration, including:

1. Inadequate Fluid Intake: The most common cause of dehydration is not drinking enough fluids. This can occur if a person is not thirsty or if they are unable to access water.
2. Excessive Fluid Loss: Dehydration can also occur if the body loses too much fluid through sweating, urination, or diarrhea.
3. Medical Conditions: Certain medical conditions can also cause dehydration, including diabetes, kidney disease, and fever.
4. Medications: Some medications can cause dehydration as a side effect.

Oral Rehydration Therapy:

Oral rehydration therapy (ORT) is a simple and effective way to treat dehydration. It involves drinking a solution of water, salt, and sugar to replace fluids and electrolytes lost due to dehydration.

ORT is often used to treat dehydration caused by diarrhea, vomiting, and other illnesses that cause fluid loss.

ORT is recommended by the World Health Organization (WHO) as the first-line treatment for dehydration. It can be given at home or in a healthcare setting and is suitable for all age groups.

ORT solution can be made by dissolving the following in one liter of clean water:

- 6 level teaspoons of sugar
- 1/2 level teaspoon of salt

The solution should be sipped slowly over a period of four to six hours. If vomiting occurs, the solution should be paused for 10 minutes and then restarted. ORT should be continued until the individual is rehydrated, and fluid losses have been replaced.

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Oral rehydration salt (ORS):

Oral rehydration therapy is a type of fluid replacement used to prevent and treat dehydration, especially due to diarrhea.

It involves drinking water with modest amounts of sugar and salts, specifically sodium and potassium. Oral rehydration therapy can also be given by a nasogastric tube.

- It is expanded as Oral rehydration salt.
- It is composed of 4 constituents, sodium chloride, trisodium citrate, potassium chloride, and glucose.
- It helps in preventing dehydration caused by diarrhea.
- The combination improves fluid absorption in the intestines, allowing fluids to be restored more quickly.

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