5.4.2 Osmoregulation

Osmoregulation is the process by which the body maintains the proper balance of water and salts in body fluids. Human beings need a stable internal environment for cells to function properly. The kidneys are the major organs responsible for osmoregulation.

Definition of Osmoregulation

Osmoregulation is the control of water and dissolved substances such as salts within the body. It helps maintain the concentration of body fluids at normal levels.

Importance of Osmoregulation

Osmoregulation is essential for survival because cells require a balanced environment to perform metabolic activities.

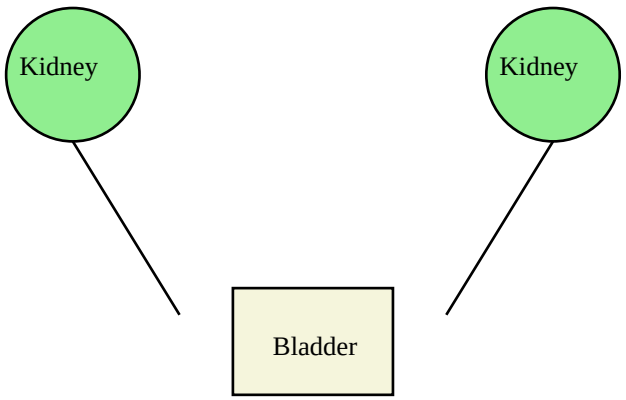
Maintains water balance in the body. Controls salt concentration. Prevents dehydration. Supports normal cell function. Helps remove waste products.

The Role of the Kidneys

The kidneys are bean-shaped organs located in the lower back region of the body. Their main function is filtering blood and removing waste products through urine.

Filter blood. Remove excess water. Control salt concentration. Maintain pH balance. Produce urine.

Diagram of the Human Urinary System



The Nephron

The nephron is the functional unit of the kidney. Each kidney contains millions of nephrons. Nephrons filter blood and reabsorb useful substances.

The process of urine formation involves: Filtration Selective reabsorption Tubular secretion

Role of Antidiuretic Hormone (ADH)

Antidiuretic hormone (ADH) helps regulate water balance in the body. It is produced in the hypothalamus and released by the pituitary gland.

When water level is low, more ADH is released. More water is reabsorbed into the blood. Urine becomes concentrated. When water is sufficient, less ADH is released. Urine becomes dilute.

Dehydration

Dehydration occurs when the body loses more water than it takes in. Heavy sweating, diarrhea, vomiting, and lack of water intake can cause dehydration.

Common signs of dehydration include: Dry mouth Thirst Dizziness Dark urine Weakness

Kidney Disorders

Failure of the kidneys to function properly affects osmoregulation.

Kidney stones: Hard deposits formed in kidneys. **Kidney failure:** Kidneys stop filtering blood effectively. **Urinary tract infection:** Infection in urinary organs. **Diabetes insipidus:** Disorder involving low ADH activity.

Comparison of Concentrated and Dilute Urine

Feature	Concentrated Urine	Dilute Urine
Water content	Low	High
Color	Dark yellow	Light yellow
ADH level	High	Low
Body condition	Dehydrated	Well hydrated

Important Notes

- Osmoregulation maintains water and salt balance.
- The kidneys are the main organs involved.
- ADH controls water reabsorption.
- Dehydration occurs when too much water is lost.
- The nephron is the functional unit of the kidney.

Summary

Osmoregulation is an important homeostatic process that regulates the balance of water and salts in the body. The kidneys, nephrons, and ADH hormone work together to maintain stable internal conditions. Proper osmoregulation helps maintain healthy cells and prevents dehydration.

Review Questions and Answers

1. What is osmoregulation?

Osmoregulation is the control of water and salt balance in the body.

2. Which organs mainly carry out osmoregulation?

The kidneys mainly carry out osmoregulation.

3. What is the function of ADH?

ADH controls water reabsorption in the kidneys.

4. What is the nephron?

The nephron is the functional unit of the kidney.

5. Mention one sign of dehydration.

Dry mouth or dizziness.

6. What happens when ADH level increases?

More water is reabsorbed and urine becomes concentrated.

Prepared for Grade 12 Biology Students – Jemal Online Academy