

MINERALS AND WATER

OBJECTIVES/RATIONALE

Knowledge of nutrients is important in understanding energy production and use. The student will identify the minerals necessary for health and wellness and relate their function to physiological processes.

TEKS 121.24 1C, 6A

TAKS ELA 1, 3, 4, 5, 6
Science 2, 4

KEY POINTS

- I. Minerals
 - A. Inorganic elements
 1. Not changed by the body – they are excreted as an inorganic element.
 2. Are not destroyed by heat, oxygen, acid or mixing with chemicals
 3. Can be leached into water when cooking food.
 4. Some are easily absorbed and transported freely in blood and excreted by the kidneys.
 5. Can be toxic when taken in massive doses
- II. Major minerals – those minerals present in the body in amounts greater than 5 grams.
 - A. Sodium – the main cation (+) in extracellular fluid and the primary regulator of its volume.
 1. Functions
 - a. Critical in maintaining fluid and electrolyte balance
 - b. Important in nerve transmission
 - c. Important in muscle contraction.
 2. Deficiencies – rare
 - a. May occur with vomiting, diarrhea and heavy sweating.
 - b. Strict low sodium diets can also deplete the body's stores of sodium.
 - c. Abuse of diuretics will deplete the body's stores of sodium.
 - B. Chloride
 1. Functions
 - a. Aids in maintaining normal electrolyte and fluid balances.
 - b. Part of HCl
 2. Deficiencies – rare
 - a. May occur with vomiting and diarrhea .
 - C. Potassium – the major cation in intracellular fluid.
 1. Functions
 - a. Helps to maintain fluid and electrolyte balance.
 - b. Maintains cellular integrity

- c. Important in transmission of nerve impulses and in muscle contraction.
 - d. Affects many aspects of homeostasis including steady heartbeats.
2. Deficiencies are most often due to excessive fluid loss.

D. Calcium

- 1. The most abundant mineral in the body.
- 2. Functions
 - a. Principle mineral of bones and teeth.
 - b. Involved in many physiological processes.
 - aa. muscle contraction
 - bb. nerve impulse transmission
 - cc. blood clotting
 - dd. secretion of hormones
 - ee. blood pressure
 - ff. immune system
- 3. Absorption of Ca is dependant on Ca binding protein.
 - a. Vitamin D helps the GI tract make Ca binding protein.
 - b. A vitamin D deficiency will cause less Ca to be absorbed.

E. Deficiencies - Osteoporosis

F. Phosphorus

- 1. The second most abundant mineral in the body
- 2. Functions
 - a. Assist in energy transfer during metabolism (Part of ATP).
 - b. Part of RNA and DNA.
 - c. Activates enzymes and some of the B vitamins
 - d. Phospholipids are part of the cell membrane.
- 3. Dietary deficiencies are unknown.

G. Magnesium

- 1. Functions
 - a. Involved in many enzyme systems.
 - b. Helps build protein.
 - c. Needed for energy metabolism
 - d. Helps prevent tooth decay by keeping Ca in the tooth enamel.
- 2. Deficiencies – may cause hallucinations during alcohol detoxification.

H. Sulphur – used as part of larger molecules.

III. Trace minerals – those minerals present in amounts less than 5 grams. Although very little is required, trace minerals have very important functions to carry out. Their concentration in food depends on the soil and water quality as well as food preparation.

A. Iron

- 1. Main function is to carry and release oxygen in hemoglobin.
- 2. Absorption is enhanced by Vitamin C.
- 3. Deficiencies – most common nutrient deficiency worldwide.
 - a. Lost any time blood is lost
 - b. Iron deficiency

- c. Anemia - depletion of iron stores that result in low hemoglobin concentration.
 - d. Hemoglobin and hematocrit are tests that are used to evaluate iron status.
 - 4. Toxicities
 - a. Hemochromatosis – usually caused by a genetic defect.
 - b. Hemosiderosis – caused by long term over consumption.
 - c. May increase the risk of heart disease in people that have high blood iron and LDL cholesterol levels.
 - B. Iodine
 - 1. Functions - Part of two hormones produced in the thyroid
 - 2. Deficiencies
 - a. Goiter
 - b. Cretinism
 - C. Selenium – acts as an anti-oxidant
 - D. Fluoride
 - 1. Functions – helps decrease tooth decay by changing the structure of tooth enamel.
 - 2. Toxicity
 - a. Causes fluorosis if excess amounts are consumed
 - b. Fl is a poison if consumed in extremely large amounts.
 - E. Other trace minerals
- IV. Water – all life processes take place in H₂O
- A. Two types of fluid
 - 1. Intracellular – inside cells
 - 2. Interstitial – between cells
 - B. Functions
 - 1. Carries nutrients and waste products.
 - 2. Forms parts of larger molecules.
 - 3. Participates in chemical reactions.
 - 4. Acts as a solvent.
 - 5. Lubricates and cushions joints.
 - 6. Acts as a shock absorber.
 - 7. Helps to regulate body temperature.
 - 8. Maintains blood volume.
 - C. Deficiencies
 - 1. Dehydration
 - a. Kidney failure
 - b. Cardiovascular collapse
 - D. Water Toxicity

ACTIVITIES

- I. Prepare a case study of a deficiency in one of the minerals. Use **Case Study Guidelines**.

MATERIALS NEEDED

Internet
Periodicals
Journals

ASSESSMENT

Case Study Guidelines

ACCOMMODATIONS

For reinforcement, the student will create a chart of minerals including functions, deficiencies, and toxicities.

For enrichment, the student will survey literature for recent information about the relationship between carbonated drinks and osteoporosis.

REFLECTIONS

CASE STUDY GUIDELINES

NAME OF DISEASE/CONDITION _____

1. **PATHOPHYSIOLOGY/ETIOLOGY**: What is the cause of the disease/ Condition? Is it acute or chronic? Is it caused by a specific pathogen? How is it transmitted? What is the incubation period? Describe any anatomical/pathophysiological changes associated with it.
2. **SIGNS & SYMPTOMS**: List the common signs and symptoms associated with this disease/condition.
3. **DIAGNOSIS**: How was the diagnosis made? What were the findings on the History & Physical Exam? Laboratory tests? Radiology/Nuclear medicine tests? Any other diagnostic procedures used?
4. **MEDICAL/SURGICAL TREATMENT**: How was this condition treated By the physician(s)? Medications? Surgical intervention? Chemotherapy? Radiation? P.T./O.T.? Exercise? Respiratory therapy? Counseling? Dietary requirements/restrictions? Other methods of treatment?
5. **PROGNOSIS**: What is the probable outcome of this disease/condition? What course has it presently taken? Is there any lasting damage/body alterations?
6. **PSYCHOLOGICAL/SOCIAL**: How will (has) this disease/condition affect(ed) the patient's mental or psychological outlook? Will it affect body image? Lifestyle? Social life? Ability to work and/or take care of the home and family? Will it affect relationships with others? What about leisure time – will it be altered or affected?

THIS REPORT MUST BE WRITTEN IN COMPLETE SENTENCES USING CORRECT SPELLING AND PROPER GRAMMAR. HANDWRITING MUST BE NEAT AND LEGIBLE MAKE SURE THAT YOU COMPLETELY AND CLEARLY COVER EACH TOPIC.

ATTACH SHEET LISTING AT LEAST 3 REFERNCES, INCLUDING AUTHOR, TITLE, PUBLISHER, YEAR, AND PAGES USED.

GRADING:

1. PATHOPHYSIOLOGY/ETIOLOGY (15 POINTS)
2. SIGNS & SYMPTOMS (10 POINTS)
3. DIAGNOSIS (15 POINTS)
4. TREATMENT (15 POINTS)
5. PROGNOSIS (15 POINTS)
6. PSYCHOLOGICAL (15 POINTS)
7. WRITTEN REPORT (10 POINTS)
8. REFERENCES (5 POINTS)