Chapter 6

Vitamins, Minerals, and General Nutrition
Chapter 6

Lesson 6.1
Learning Objectives

- List the characteristics of vitamins.
- Identify fat-soluble vitamins.
- Give an example of a source of each vitamin.
- Identify symptoms of specific vitamin deficiencies.
Learning Objectives

- Identify the components of a healthy diet.
- Understand the role of antioxidant agents in nutrition.
- Realize that nutrition can affect various bodily functions.
Basic Principles

- We are what we eat!
- The body needs a balance of nutrients for optimum health.
- Improper diet is related to various diseases and affects neurologic states.
- Proper diet includes minute amounts of organic compounds called *vitamins*.
- Vitamin deficiencies cause disease, a condition called *avitaminosis*. 
Basic Principles

- *Minerals* (nonorganic compounds) are essential to prevent conditions such as anemia.
- *Essential fatty acids* are not produced by the body but are necessary.
- *Antioxidants* are found in many foods and are needed to inhibit the damage caused by oxidation.
- Nondigestible plant matter, *fiber*, may help prevent some cancers.
Nomenclature of Vitamins

- Vitamins are named with letters (vitamin B has subscript numbers added).
- Vitamins are as follows:
  - Organic and required in very small amounts
  - Required preformed in the diet
  - Needed for normal growth and maintenance
  - Necessary for enzyme systems
Characteristics of Vitamins

- Vitamins are fat soluble or water soluble.
- *Fat-soluble* vitamins are A, D, K, and E.
- *Water-soluble* vitamins are B vitamins, folic acid, and vitamin C.
Vitamin A

- Sources: fish liver oils, dairy products, vegetables such as carrots and spinach
- Deficiency symptoms: night blindness, nerve degeneration, skin lesions
- Recommended daily allowance (RDA): 900 mcg
Vitamin D

- Sources: fish liver oils, dairy products, ultraviolet radiation (sunshine)
- Deficiency symptoms: in childhood, rickets; later, osteomalacia
- Activity: enables calcium and phosphorus deposition in bones
- RDA: ages 0 to 50: 5 mcg (200 units/day)
  ≥51 years: 10 to 15 mcg (400 to 600 units/day)
Vitamin K

- Sources: spinach, broccoli, alfalfa; synthesized by intestinal flora
- Deficiency symptoms: hemorrhagic tendency
- Activity: required for normal blood clotting
- RDA: 120 mcg/day
Vitamin E (alpha-tocopherol)

- **Sources:** wheat germ, vegetable oils, nuts, seeds
- **Deficiency symptoms:** none identified
- **Activity:** antioxidant (boosts immune system and wards off cataracts and atherosclerosis)
- **Toxic effects:** prolongs bleeding time, possible hemorrhage
- **RDA:** 15 mg/day as alpha-tocopherol equivalents
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Lesson 6.2
Learning Objectives

- State the function of vitamins in the body.
- Identify water-soluble vitamins.
- Give an example of a source of each vitamin.
- Identify symptoms of specific vitamin deficiencies.
Water-Soluble Vitamins

- Divided into two groups:
  - Those that release energy from foods (e.g., thiamine, riboflavin)
  - Those concerned with formation of red blood cells (RBCs) (e.g., folic acid, vitamin B₁₂)
Thiamine (Vitamin B₁)

- Sources: yeast, liver, lean meat
- Deficiency symptoms: produces beriberi (inflammation of peripheral nerves, paralysis, sensation changes, congestive heart failure [CHF], and edema)
- RDA: 1.2 mg/day
Riboflavin (Vitamin B_2)

- Sources: liver, kidney, milk
- Deficiency symptoms: cornea vascularization followed by ulcerations, dermatitis, lip lesions
- RDA: 1.3 mg/day
Nicotinamide (Niacinimide) and Nicotinic Acid (Niacin)

- Sources: liver, tuna, peanuts
- Deficiency symptoms: produces pellagra (raw-skin dermatitis, diarrhea, depression, death, appetite loss, dizziness, irritability)
- Side effect: facial flush with nicotinic acid but not common with nicotinamide
- RDA: 16 mg/day
Pyridoxine (Vitamin B₆)

- Source: liver, yeast, milk, meats, molasses
- Deficiency symptoms: skin lesions, hypochromic anemia, convulsions in some instances
- RDA: 1.0 to 1.7 mg/day
Pantothenic Acid (Vitamin B<sub>5</sub>)

- **Source**: meat, vegetables, cereals, legumes, eggs, milk
- **Deficiency symptoms**: none described (occurs in overall deficiency states)
- **RDA**: 5 mg/day
Folic Acid

- Sources: green leafy vegetables, cantaloupe, breakfast cereals
- Deficiency symptoms: macrocytic anemia
- Very important for pregnant and nursing women (prevents open neural tube defects during fetal development)
- RDA: 0.4 mg/day
Vitamin B$_{12}$ (Cyanocobalamin)

- Sources: animal tissue, especially liver
- Deficiency symptoms: pernicious anemia (lack of intrinsic factor from stomach to act with vitamin B$_{12}$ results in severe anemia because of decreased RBC production)
- RDA: 2.4 mcg/day
Vitamin C (Ascorbic Acid or Cevitamic Acid)

- **Sources**: green vegetables, berries, fresh citrus fruits, red bell peppers
- **Deficiency symptoms**: produces scurvy (gingivitis, loose teeth, slow wound healing)
- **Activity**: large doses used controversially to prevent or reduce respiratory viral illness (but megadoses not recommended); antioxidant properties
- **RDA**: 90 mg/day
Multiple Vitamin Preparations

- Typically one vitamin deficiency exists with other vitamin deficiencies.
- Multiple vitamin supplements are prescribed.
- Over-the-counter preparations generally have lower vitamin content than prescription preparations, especially of fat-soluble vitamins.
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Lesson 6.3
Learning Objectives

- State the function of minerals in the body.
- Identify symptoms of mineral deficiencies.
- Understand the significance of the food pyramid.
Minerals

- These are essential elements needed for normal body functions.
- Most are required in trace amounts and are freely found in the environment: copper, cobalt, fluorine, manganese, and zinc.
- Some have dynamic functions and must be ingested regularly. These include:
  - Iron
  - Calcium and phosphorus
  - Potassium
Iron

- Essential component of hemoglobin
- Dietary deficiency, malabsorption, or blood loss causes iron deficiency anemia
- Sources: meat, green vegetables, legumes, fortified cereals
- RDA: 8 mg/day
Iron

- Commercial preparations:
  - Ferrous sulfate (Feosol)
  - Ferrous gluconate (Fergon)
  - Iron dextran injection (INFeD)—severe iron deficiency; given by Z-track technique

- Iron overload symptoms:
  - Hemosiderosis
  - Fever
  - Urticaria
  - Headache
Calcium and Phosphorus

- Deficiency usually because of metabolic conditions
- Serum calcium should vary only slightly.
  - Too low—tetany occurs
  - Too high—cardiac irregularities
- Kidney damage can cause renal rickets.
- Osteoporosis treated with calcium supplements
- Calcium used intravenously during cardiopulmonary resuscitation (CPR) for life support
- Sources: nonfat milk (vitamin D aids calcium absorption)
Calcium and Phosphorus

- Commercial preparations of calcium include the following:
  - Calcium lactate
  - Calcium gluconate
  - Calcium chloride
  - Calcium carbonate

- Calcium taken for prevention of osteoporosis needs to be taken with vitamin D to assist absorption.
Potassium

- Important in maintaining water and electrolyte concentrations
- Unique function in nerve impulses and cardiac rhythm control
- Depletion results from metabolic changes:
  - Diabetic acidosis, from prolonged vomiting or diarrhea, or debilitation from surgery
  - Accidentally induced by prolonged diuretic use
Potassium

- Commercial preparations include the following:
  - Potassium chloride (KCl)
  - Slow-K (coated tablet)—coated to minimize gastrointestinal upset
  - TEN-K or K-DUR 10

- Potassium given by intravenous route needs to be diluted and given over 1 hour.
  - Extremely irritating to veins and fatal if given by intravenous push method
Copper

- Needed for red cell membrane integrity and for the transport of ferrous iron
- Deficiency has been associated with anemia, neutropenia, thrombocytosis, poor balance, peripheral neuropathy, and leg spasticity
Fluoride

- Added to municipal water supplies to reduce dental caries
- Also present in many processed food items, leading to potential overdose:
  - Disfigurement of teeth in children
  - Increased risk for bone fracture in older adults and those with diabetes
Omega-3 Fatty Acids

- Part of “essential fatty acids” group
- May aid in prevention of heart disease, arthritis, skin conditions, and mental health condition
- Major food sources: salmon, tuna, anchovies, herring, mackerel, sardines
Changing Nutritional Information

* Basic food groups:
  - Traditional divisions: proteins (meat, fish, eggs); breads and grains; fruits; vegetables; dairy products
  - New information cautions against overnutrition, especially meats and fat/oil groups
  - MyPlate serves as a reminder to make healthier food choices
Changing Nutritional Information

- Caloric requirements vary with age and activity.
  - Children, active teenagers, adult males: up to 2800 calories daily
  - Sedentary adults: may need only 1600 calories daily

- Be cautious about food labels. Cholesterol free does not mean fat free. Saturated fats increase the rate of atherosclerosis and heart disease.