The human body requires a variety of minerals in different amounts to perform numerous metabolic tasks.

The Nature of Body Minerals

Classes of body minerals

- Major minerals (>100 mg/day)
- Trace elements (<100 mg/day)

Functions of minerals

Mineral metabolism

- Digestion
- Absorption
- Transport

A mixed diet of varied foods and adequate energy value is the best source of the minerals necessary for health.

Of the total amount of minerals a person consumes, only a relatively limited amount is available to the body.
• Major Minerals
• Calcium
• Phosphorus
• Sodium
• Potassium
• Chloride
• Magnesium
• Sulfur
• Calcium

• Functions
  — Bone and tooth formation
  — Blood clotting
  — Muscle and nerve action
  — Metabolic reactions
    • Absorption of B12
    • Activation of pancreatic lipase
    • Secretion of insulin
    • Cell membrane permeability

• Calcium, cont’d
  — Requirements
    • 1000 mg/day
Deficiency states
- Osteoporosis

Toxicity symptoms

Food sources
- Milk is the major food source
- Green vegetables, fish with bones, fortified food
- Osteoporosis
- Phosphorus
- Functions
  - Bone and tooth formation
  - Energy metabolism
    - Oxidation of carbohydrate, fat, and protein
    - Energy and protein metabolism
    - Cell function and genetic inheritance
      - Component of enzymes, thiamin, DNA/RNA
  - Acid-base balance

Phosphorus, cont’d

Requirements
- 700 mg/day

Deficiency states

Toxicity symptoms

Food sources
Milk, milk products, fish, eggs

Sodium

Functions
- Water balance
- Acid-base balance
- Muscle action
- Nutrient absorption

Sodium, cont’d

Requirements
- AI: 1.5 g/day
- UL: 2.3 g/day

Deficiency states

Toxicity symptoms
- Salt sensitivity and hypertension

Food sources
- Table salt, cured meat, canned soups, processed food

Potassium

Functions
- Water balance
- Metabolic reactions
  - Conversion of blood glucose to glycogen
• Storage of nitrogen in muscle protein
  • Production of energy
  — Muscle action
  — Insulin release
  — Blood pressure

• Potassium, cont’d

• Requirements
  — AI: 4.7 g/day

• Deficiency states

• Toxicity symptoms

• Food sources
  — Fruits, vegetables, whole grains, fresh meats

• Chloride

• Functions
  — Digestion
    • Key element in hydrochloric acid secretion
  — Respiration

• Chloride shift

• Chloride, cont’d

• Requirements
AI: 2.3 g/day

- Deficiency states
- Toxicity symptoms
- Food sources
  - Table salt
- Magnesium

- Functions
  - General metabolism
    - Necessary catalyst for ~300+ reactions in cells
  - Protein synthesis
    - Activates amino acids
    - Role in synthesis and maintenance of DNA
  - Muscle action
  - Basal metabolic rate
    - Influences secretion of thyroxine

- Magnesium, cont’d

- Requirements
  - ~300 to 400 mg/day
- Deficiency states
- Toxicity symptoms
- Food sources
  - Nuts, soybeans, cocoa, seafood, peas, green vegetables
Sulfur

Functions
- Hair, skin, and nails
- General metabolic functions
  - High-energy bond
  - Transfer energy
- Vitamin structure
- Collagen structure

Sulfur, cont’d

Requirements
- Not stated, obtained through amino acids methionine and cysteine

Deficiency states

Toxicity symptoms

Food sources
- Meat, nuts, soy, fish, cheese, eggs

Chapter 8

Lesson 8.3

Key Concepts

- A mixed diet of varied foods and adequate energy value is the best source of the minerals necessary for health.
- Of the total amount of minerals a person consumes, only a relatively limited amount is available to the body.
- Trace Elements
- Iron
- Iodine
- Zinc
- Selenium
- Fluoride
- Copper
- Manganese
- Chromium
- Molybdenum
- Cobalt
- Boron
- Vanadium
- Nickel

- Iron
  - Functions
    - Hemoglobin synthesis
    - General metabolism
      - Proper glucose metabolism
      - Antibody production
      - Drug detoxification in the liver
      - Collagen and purine synthesis
Conversion of carotene to vitamin A

- Iron, cont’d
  - Requirements
    - 8 to 11 mg/day for males
    - 8 to 18 mg/day for females
  - Deficiency states
    - Anemia
  - Toxicity symptoms
    - Hemochromatosis
  - Food sources
    - Heme
    - Nonheme

- Heme and Nonheme Iron Sources
  - Heme
    - Food sources
      - Animal sources only, such as meat and poultry; 40% of iron in animal sources
    - Absorption rate: rapid
  - Nonheme
    - Food sources
      - All iron in plant sources; 60% of iron in animal sources
    - Absorption rate: slow

- Iodine
Functions

- Participation in thyroid gland's synthesis of thyroxine

Requirements

- 150 mcg/day

Uptake of Iodine

Iodine, cont'd

Deficiency states

- Goiter
- Cretinism
- Hypothyroidism
- Hyperthyroidism

Toxicity symptoms

Food sources

- Iodized table salt, seafood; depends on soil content

Goiter

Zinc

Functions

- Enzyme constituent
- Immune system
- Other functions

Requirements
- 11 mg/day for males
- 8 mg/day for females

- Zinc, cont’d

- Deficiency states
  - Poor wound healing
  - Impaired taste and smell

- Toxicity symptoms

- Food sources
  - Meat, seafood, legumes, whole grains

- Selenium

- Functions
  - Aids in protection from free radicals

- Requirements
  - RDA: 55 mcg/day

- Deficiency states

- Toxicity symptoms

- Food sources
  - Seafood, kidney, liver; depends on soil content

- Other Trace Elements

- Fluoride
  - Functions by preventing dental caries
Exceeding UL may cause fluorosis

- Copper
  - “Iron twin”

- Manganese
  - Inhalation toxicity

- Other Trace Elements, cont’d

- Chromium
  - Previously thought to reduce insulin resistance

- Molybdenum
  - Inadequate dietary intake improbable

- Other essential trace elements
  - Aluminum, arsenic, boron, nickel, silicon, tin, vanadium

- Chapter 8
  - Lesson 8.4

- Key Concepts

- The human body requires a variety of minerals in different amounts to perform numerous metabolic tasks.

- Mineral Supplementation

- Life cycle needs
  - Pregnancy and lactation
  - Adolescence
-- Adulthood

- Clinical needs
  - Iron-deficiency anemia
  - Zinc deficiency

- Summary
  - Minerals are single, inorganic elements.
  - Minerals are classified according to their relative amounts in the body.
  - Major minerals make up 60% to 80% of all inorganic material in the body.
  - Trace elements make up less than 1% of the body’s inorganic material.

- Summary, cont’d
  - RDAs have not been set for all minerals.
  - Als or ULs have been set for almost all essential minerals without RDAs.
  - Mineral supplementation is still under much debate.