

Chapter 10
Minerals:
Mining for Nutrients

Hewlings/Medeiros

PowerPoint presentation created by
Susan J. Hewlings, PhD, RD

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Classifying Minerals

- Essential components of the diet
- New and existing dietary minerals are still being researched.

- Classification of minerals
 - Macrominerals
 - Microminerals

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Macrominerals vs. Microminerals

Macrominerals	Microminerals
<ul style="list-style-type: none">• (Require 100 mg or more per day)• Calcium• Phosphorus• Sodium• Potassium• Chloride• Magnesium	<ul style="list-style-type: none">• (Require less than 100 mg per day)• Iron• Zinc• Copper• Selenium• Iodine• Fluoride• Chromium• Manganese• Boron• Molybdenum• Cobalt• Vanadium


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Calcium

- Bone
 - Synthesis and maintenance
 - Constant turnover
 - Storage place for calcium
- Muscle and nerves
- Importance of calcium and vitamin D in disease
 - Youth and adolescent intake
 - Critical period for building bone
 - Prevention of osteoporosis

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Osteoporosis

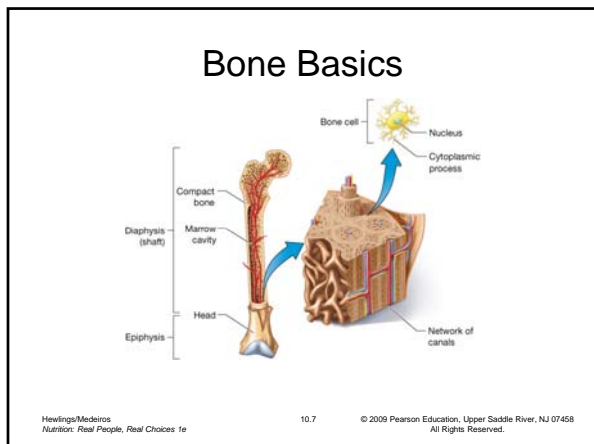


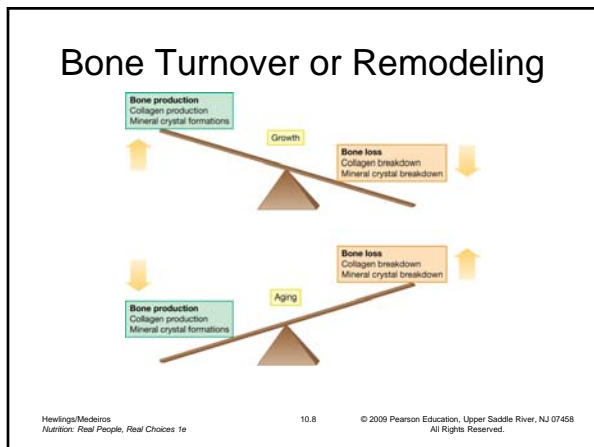
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To Prevent Osteoporosis

- Consume two or three servings per day from the milk and dairy group from MyPyramid
 - Spread throughout the day
- Participate in weight-bearing exercise such as strength training, walking, running, etc.
- Females should maintain estrogen levels by maintaining a healthy weight

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Other Uses of Calcium

- Metabolism
- Blood clotting
- Blood pressure
- Calcium in weight loss?

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Serum Calcium

- Calcium absorption
 - Parathyroid hormone (PTH)
 - Certain natural compounds can inhibit absorption of calcium
 - Phytate
 - Oxalate
- To increase calcium absorption:
- Spread intake throughout the day
 - Presence of lactose in the gut may also increase absorption.

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Calcium DRI

- Adolescents – 1,300 mg/day
- Adults <51 yrs old – 1,000 mg/day
- Adults >50 yrs old – 1,200 mg/day
- Food sources
 - Dairy
 - Sardines
 - Greens
 - Spinach

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Phosphorus

- Second most abundant mineral in the body
 - Found in bones and soft tissue
 - DRI: 700 mg/day
 - Deficiency is rare
 - Excess may decrease blood calcium (controversial)
 - May be that people who drink a lot of soda don't consume dairy
- Food Sources:
- Meat
 - Fish
 - Poultry
 - Eggs
 - Milk and milk products
 - Cereals
 - Legumes
 - Grains
 - Tea
 - Coffee
 - Chocolate
 - Soft drinks

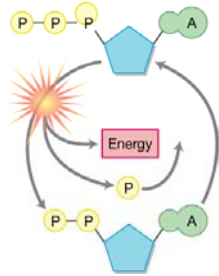
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Role of Phosphorus in the Body

- Bone and teeth
- ATP
- Enzyme support
- DNA and RNA
- Blood buffer



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Magnesium

- The macromineral found in the smallest amount in the body
- Several functions:
- Bone
 - Blood
 - Muscle relaxation
 - Cofactor

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Magnesium Deficiency

- Rare
- Can occur as a result of:
 - Severe diarrhea
 - Vomiting
 - Heavy sweating
 - Alcoholism
 - Certain medications

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Magnesium Requirements and Food Sources

- Absorbed in small intestines
- Men: 400 mg/day
- Women: 320 mg/day



Food Source

- Green leafy vegetables
- Grains
- Nuts
- Legumes
- Whole-grain cereals and breads
- Chocolate

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Microminerals

- Commonly referred to as trace minerals
- Need < 100 mg/day
- Equally as important as macrominerals
 - Several diseases and conditions are linked to micromineral deficiencies.

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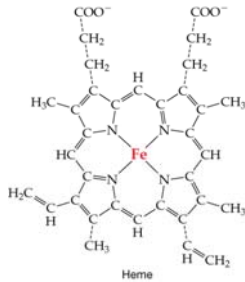
Iron

- Prevention of anemia
- Oxygen delivery
- The amount of iron absorbed in a typical diet is quite low.
- Absorption can be influenced by the body's need.

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Structure of the Heme Molecule



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Anemia

- Normal Hemoglobin:
 - Men: 13.8–17.2 g/100 ml of blood
 - Women: 12.1–15.1
- Hematocrit (%RBC in blood)
- Normal = 40–48
- Anemia if lower than normal
- Caused by:
 - Poor hemoglobin production
 - Decreased RBC formation
 - Increased blood loss
 - Deficiency of iron, B₆, B₁₂, folate

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Heme Iron vs. Non-Heme Iron

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| Heme Iron | Elemental Iron |
| - Found only in meats, fish, and poultry | From plant and animal sources |
| - Can cross small intestine wall more readily than can non-heme form | Absorption enhanced by vitamin C as well as presence of meat, fish, or poultry |

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Iron Requirements

- Higher for women than for men
 - Male DRI: 8 mg/day
 - Vegetarians – 14 mg/day
 - Women > 50 DRI: 8 mg/day
 - Women 19–50 DRI: 18 mg/day
 - Vegetarians: multiply DRI by 1.8 (need a supplement)
 - Pregnancy DRI: 27 mg/day
- Prenatal vitamins often contain DRI

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Food Sources of Iron

- Meat
- Fish
- Poultry
- Shellfish, especially oysters
- Beans
- Enriched cereal
- Green leafy vegetables
- Eggs
- Dried fruit



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Iron Toxicity

- Toxic in too great quantities
- Hemochromatosis
 - Genetic disorder
 - Store high amounts of iron

Symptoms of iron overload

Abdominal pain
Fatigue
Mental depression
Long term can lead to liver damage

Symptoms of iron toxicity

Infections
Joint pain
Skin pigmentation due to iron deposits
Diabetes
Blood in the stool
Shock

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Zinc

Functions of zinc include:

- 200 different enzymes
- Alcohol metabolism
- Hemoglobin synthesis
- Protein digestion
- Antioxidant enzyme function
- Blood pressure regulation
- DNA replication
- Protein synthesis, growth, and development
- Wound healing
- Immune function
- Development of sexual organs and bone growth
- Insulin release and function
- Gene regulation

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Signs of Zinc Deficiency

- Dwarfism in young teens, particularly males
- Poor sexual development (underdeveloped testes in males)
- Deformed bones
- Poor healing of wounds
- Abnormal hair and nails; loss of hair
- Hypoguesia, or the inability to taste food
- Gastrointestinal disturbances, impaired lipid absorption
- Central nervous system defects
- Impaired folate and vitamin A absorption

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Dwarfism in a Young Boy Suffering from Zinc Deficiency

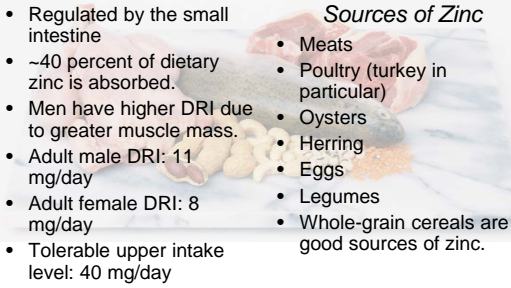


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Zinc Absorption and DRI

- Regulated by the small intestine
 - ~40 percent of dietary zinc is absorbed.
 - Men have higher DRI due to greater muscle mass.
 - Adult male DRI: 11 mg/day
 - Adult female DRI: 8 mg/day
 - Tolerable upper intake level: 40 mg/day
- Sources of Zinc*
- Meats
 - Poultry (turkey in particular)
 - Oysters
 - Herring
 - Eggs
 - Legumes
 - Whole-grain cereals are good sources of zinc.
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Copper

- A cofactor for enzymes
- Iron use and incorporation into hemoglobin and red blood cells
- Antioxidant defense against free radicals
- Strengthens collagen and therefore connective tissue
- Immune defense
- Synthesis of neurotransmitters
- Energy production via ATP synthesis

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Copper Absorption and DRI

- Absorbed in small intestine and, to a certain extent, the stomach
- Regulated by the same protein as zinc
- Usually more than half of the dietary copper is absorbed
- DRI: 900 micrograms/day
 - Deficiency rare
- Tolerable Upper Intake Level of copper is 10 mg per day.
- Good sources of copper include organ meats, shellfish, mushrooms, chocolate, nuts, legumes, the germ and bran portions of cereals, and drinking water from copper pipes.

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Selenium

<ul style="list-style-type: none">• Antioxidant defense<ul style="list-style-type: none">- Glutathione peroxidase• Thyroid hormone• Adult DRI: 55 micrograms/day• Tolerable upper intake level: 400 micrograms/day	<h3 style="text-align: center;">Food Sources</h3> <ul style="list-style-type: none">• Seafood is an excellent source of selenium• Fish (especially tuna)• Meats• Egg• Wheat-based cereals*• Sunflower seeds* <p style="text-align: center;">*Only if grown in selenium-rich soils</p>
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Iodine

<ul style="list-style-type: none">• Synthesis of thyroxin• Iodine deficiency<ul style="list-style-type: none">- Goiter- Cretinism• DRI: 150 micrograms/day• Tolerable Upper Intake Level: 1,000 micrograms per day	<h3 style="text-align: center;">Food Sources</h3> <ul style="list-style-type: none">• Iodized salt• Plants (grown in areas with sufficient iodine)
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Iodine Deficiency Leads to a Goiter



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Fluoride

- Healthy teeth
 - Hard teeth for resistance to decay
- Excessive fluoride can lead to fluorosis.
- DRI for women: 3 mg/day
- DRI for men: 4 mg/day
- Found in fluoridated water and processed foods that use water
- Tolerable Upper Intake Level for adults: 8 mg/day

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Chromium

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| <ul style="list-style-type: none">• Glucose uptake• Chromium picolinate• Doesn't seem to influence body composition in humans• DRI for women: 25 micrograms/day• DRI for men: 35 micrograms/day | <p><i>Food Sources</i></p> <ul style="list-style-type: none">• Brewer's yeast• Liver• Nuts• Whole grains• Cheese |
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