



MINERALS IN THE DIET

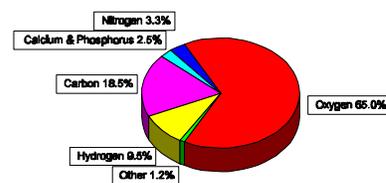
Leader's Guide

This is a comprehensive guide to accompany several publications, including HE3-230, *Trace Minerals in Your Diet*; HE3-516, *Calcium*; HE3-517, *Copper*; HE3-519, *Iron*; HE3-520, *Magnesium*; HE3-521, *Potassium*; HE3-522, *Zinc*; and CFS-643 (NCR-540), *Vitamins & Minerals in the Food Guide Pyramid*; and the factsheet, *A Condensed Summary of Minerals*. You may want to handout the CFS-643 publication and *Summary* factsheet and use the appropriate publications as guides for your leaders.

More than one-third of the dietary nutrients needed for a healthy body are minerals. Seventeen minerals are among the nearly 45 dietary nutrients known to be necessary for life and account for four percent of body weight. The mineral composition of the human body is seen in the following figure. The "other" category includes potassium, sodium, sulfur, chlorine, iron, zinc, magnesium, iodine and other trace minerals.

Although minerals represent only a very small fraction of human body weight, they play important roles in all areas of the body. They help form bones and teeth, aid in normal muscle and nerve activity, act as catalysts in many enzyme systems, help control water levels in the body and are components of such compounds in the body as hemoglobin and the hormone thyroxine. Evidence is mounting that certain minerals like calcium and selenium may help prevent cancer. And that deficiencies of zinc may decrease the ability of the immune system to function. A condensed summary of minerals is attached.

Mineral Composition
of the Body



Minerals that are essential to the body fall under one of two categories, major and minor.

1. Major minerals are needed in amounts greater than 100 mg/day and include calcium, phosphorus, magnesium, sodium, chloride, potassium, and sulfur. Sodium, chloride and potassium are also known as body electrolytes. Sulfur is a part of the essential amino acid, methionine so is easily obtained by eating protein rich foods.
2. Minor minerals are trace elements needed in amounts of less than a few mg/day and include iron, zinc, iodine, fluoride, copper, selenium, chromium, cobalt, manganese and molybdenum. Iron, zinc, selenium and iodine are the only minor minerals that have been studied sufficiently to establish required dietary amounts (RDA). For the remainder with the exception of cobalt, safe and adequate daily ranges have been estimated by the Food and Nutrition Board of the National Academy of Sciences.

There are several minerals that may be essential for humans, but research has not established their importance, including tin, nickel, silicon and vanadium. There are also other minerals found in the body that are regarded as contaminants including lead, mercury, arsenic, aluminum, silver, cadmium, barium, strontium and others.

The functions of individual minerals are included in the following information. Refer to the factsheet A Condensed Summary of Minerals for RDA's and major food sources to include in the discussion as you go.

Major Minerals

Calcium

Bones contain twice as much calcium as phosphorus which are the two major minerals found in bones. These minerals form deposits of calcium phosphate, which are held within the skeleton by soft, fibrous, organic materials.

Bones are constantly being reformed by calcium entering and leaving the bones each day. This calcium must come from body stores and the diet. The turnover of bone calcium varies with age, with infants turning over their calcium so rapidly that by age one, they have entirely new bones. As adults get older, the bones begin to lose calcium and bone mass begins to decrease. In certain individuals, this can lead to osteoporosis. Osteoporosis is defined as an age-related disorder, characterized by decreased bone mineral content and increased risk of fractures. The National Institutes of Health recommends that women increase their consumption of calcium-rich foods to decrease their risk of developing osteoporosis. Supplementation may be recommended by some physicians.

Calcium also plays a vital role in nerve and muscle function. Everytime you blink your eyes, kick a soccer ball or do a sit-up, calcium is used as the nerve sends impulses to the muscles and then helps the muscles contract.

Calcium is important for blood clotting, normal functioning of heart muscle cells and activation of certain enzymes and hormone secretion. There is some evidence that calcium may help prevent high blood pressure. Some researchers have also suggested that calcium may help prevent bowel cancer by binding bile salts in the colon. Excess bile salts in the colon have been associated with increased risk of colon cancer.

Phosphorus

Phosphorus represents one percent of the

human body weight and teams up with calcium in forming bones and teeth. Most of the body's phosphorus is in the skeleton with the remainder in the muscle, skin, nerves and other organs. Phosphate is involved in the metabolism of carbohydrate, lipids and protein, helps regulate the acid-base balance in the body and functions as a cofactor in many enzyme systems. Phosphorus is involved in high energy systems where phosphate bonds capture and then release vital energy in the cells of many tissues, especially those involved in muscle contractions.

Magnesium

Magnesium is the most abundant element in plant cells, the second common in the oceans, the third most common on land and the fourth most abundant in living organisms.

Sixty percent of magnesium in the body is in the skeleton, 20 percent is in the skeletal muscle, 19 percent is in other body cells and one percent is in different body fluids. Magnesium is essential for more than 300 different enzyme systems of the body. It is indispensable in the formation and use of high-energy phosphate bonds known as ATP. The use and storage of carbohydrate, fat and protein in the body involves magnesium. It is also essential in nerve and muscle activity.

The Electrolytes: Sodium, Potassium and Chloride

Minerals like sodium, chloride and potassium are referred to as electrolytes because in water they can conduct electrical currents. Sodium and potassium ions carry positive charges whereas chloride ions are negatively charged. Sodium and chloride ions tend to concentrate outside of body cells (extracellular). Potassium tends to concentrate inside of body cells (intracellular). This arrangement is essential in maintaining tissue fluid balance inside and outside of the cells. It works like a tiny batter, with just enough electrical potential of difference to allow the movement of nutrients and waste products in and out of the cell.

Chloride also forms hydrochloric acid which is required in the stomach to help gastric juices digest protein and assists the blood in carrying large amounts of carbon dioxide to the lungs for expulsion. Sodium, potassium and chloride in conjunction with bicarbonate, regulate the acid-base balance of the body. Sodium has an important role in regulating muscle tone. Potassium influences both skeletal and heart muscle activity.

The kidney is the primary organ that controls the electrolyte levels in the body. Excess electrolytes are readily excreted by the kidney and the skin (salty sweat) when extra amounts are present in the body.

Minor Minerals

Iron

Although the amount of iron in the body is small, it is one of the most important elements in health. Iron is an important component of hemoglobin, myoglobin and a number of enzymes. Hemoglobin is found in red blood cells and carries oxygen to the body tissues. Myoglobin carries oxygen from the blood to the muscle cells. Seventy percent of the total iron found in the body is in hemoglobin, myoglobin, and enzymes. The remainder is stored in the bone marrow (where red blood cells are made), liver and spleen.

The other minor minerals also known as trace minerals are covered well in HE3-230, *Trace Minerals in Your Diet*.

Activities

1. Discuss each mineral and their food sources, including the RDA or safe and adequate levels.
2. Discuss where the minerals are hidden in the Food Guide Pyramid. How cooking methods affect minerals could also be covered.
3. From a group of common grocery foods, have individuals identify as many minerals as possible within a specified time. Discuss the differences in fresh, canned and highly processed foods. Show where they fit in the Food Guide Pyramid.
4. Prepare 7 pairs of cards with the names of the major minerals on one of the pair and food sources on the other card. Place them face down on the table and allow two cards at a time to be turned up, trying to match the mineral name with the food sources. Play continues until all matches are found.

**By Sandra Bastin, Ph.D., R.D., L.D.
Extension Food & Nutrition Specialist**

Pre- and Post-Test

1. What are the seven major minerals?
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
2. Name the three electrolytes in the body.
 - a.
 - b.
 - c.
3. What is the most abundant mineral in the human body and important for strong bones?
4. What is an important component of hemoglobin?
5. What mineral is involved in more than 70 enzyme systems?

1.	calcium, phosphorus, magnesium, sodium, chloride, potassium and sulfur
2.	potassium, chloride, sodium
3.	calcium
4.	iron
5.	zinc