



Facts About Dietary Supplements

Clinical Nutrition Service, Warren Grant Magnuson Clinical Center • Office of Dietary Supplements •
National Institutes of Health

Selenium

As a consumer, you need information you can trust to help you make thoughtful decisions about eating a healthful diet and using vitamin and mineral supplements. Registered dietitians at the Warren Grant Magnuson Clinical Center, the clinical research hospital at the National Institutes of Health (NIH) in Bethesda, MD, developed this series of Fact Sheets in conjunction with the Office of Dietary Supplements in the Office of the Director of NIH to provide responsible information about the role of vitamins and minerals in health and disease and to help guide your decisions on the use of vitamin and mineral supplements. Each fact sheet in this series received extensive scientific review by recognized experts from the academic and research communities. The information is not intended to be a substitute for professional medical advice. It is important that you seek the advice of a physician about any medical condition or symptom. It is also important to seek the advice of a physician, registered dietitian, pharmacist, or other qualified health care professional about the appropriateness of taking dietary supplements and their potential interactions with medications.

Selenium: What is it?

Selenium is an essential trace mineral in the human body (1). This nutrient is an important part of antioxidant enzymes that protect cells against the effects of free radicals that are produced during normal oxygen metabolism. The body has developed defenses such as antioxidants to control levels of free radicals because they can damage cells and contribute to the development of some chronic diseases (2). Selenium is also essential for normal functioning of the immune system and thyroid gland (3-5).

What foods provide selenium?

Plant foods are the major dietary sources of selenium in most countries throughout the world. The amount of selenium in soil, which varies by region, determines the amount of selenium in the plant foods that are grown in that soil. Researchers know that soils in the high plains of northern Nebraska and the Dakotas have very high levels of selenium. People living in those regions generally have the highest selenium intakes in the United States (6). Soils in some parts of China and Russia have very low amounts of selenium and dietary selenium deficiency is often reported in those regions.

Selenium also can be found in some meats and seafood. Animals that eat grains or plants that were grown in selenium-rich soil have higher levels of selenium in their muscle. In the United States, meats and bread are common sources of dietary selenium (7, 8). Some nuts, in particular Brazil nuts and walnuts, are also very good sources of selenium. The table of food sources of selenium suggests many dietary sources of selenium.

What is the Recommended Dietary Allowance for selenium for adults?

The Recommended Dietary Allowance (RDA) is the average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (97-98%) individuals in each life-stage and gender group (9). The 2000 RDAs for selenium for adults (9), in micrograms (mcg), are:

Life Stage	Men	Women	Pregnancy	Lactation
Ages 19+	55 mcg	55 mcg		
All ages			60 mcg	70 mcg

Results of the Total Diet Study, a national survey conducted by the U.S. Food and Drug Administration (1982-86), indicated that the diets of most adult men and women provide recommended amounts of selenium (10).

When can selenium deficiency occur?

Selenium deficiency is most commonly seen in parts of China where the selenium content in the soil, and therefore selenium intake, is very low. Selenium deficiency is linked to Keshan Disease. The most common signs of selenium deficiency seen in Keshan Disease are an enlarged heart and poor heart function (11). Keshan disease has been observed in low-selenium areas of China, where dietary intake is less than 19 mcg per day for men and less than 13 mcg per day for women (12). This intake is significantly lower than the current RDA for selenium.

Selenium deficiency also may affect thyroid function because selenium is essential for the synthesis of active thyroid hormone (4). Researchers also believe selenium deficiency may worsen the effects of iodine deficiency on thyroid function, and that adequate selenium nutritional status may help protect against some of the neurologic effects of iodine deficiency (5).

Selenium deficiency has been seen in people who rely on total parenteral nutrition (TPN) as their sole source of nutrition (13, 14). TPN is a method of feeding nutrients through an intravenous (IV) line to people whose digestive systems do not function. Forms of nutrients that do not require digestion are dissolved in liquid and infused through the IV line. It is important for TPN solutions to provide selenium in order to prevent a deficiency (15). Physicians can monitor the selenium status of individuals receiving TPN to make sure they are receiving adequate amounts.

Severe gastrointestinal disorders may decrease the absorption of selenium, resulting in selenium depletion or deficiency (16). Gastrointestinal problems that impair selenium absorption usually affect absorption of other nutrients as well, and require routine monitoring of nutritional status so that physicians can recommend appropriate treatment (16).

Who may need extra selenium?

Selenium supplementation is essential for anyone relying on TPN as the sole source of nutrition, and selenium supplementation has become routine during TPN administration since the relationship between selenium deficiency and TPN was discovered (15). Gastrointestinal disorders such as Crohn's disease can impair selenium absorption. Most cases of selenium depletion or deficiency are associated with severe gastrointestinal problems, such as in individuals who have had over half of their small intestines surgically removed (17). A physician, who will determine the need for selenium supplementation, should evaluate individuals who have gastrointestinal disease and depleted blood levels of selenium (18).

What are some current issues and controversies about selenium?

Selenium and cancer

Some studies indicate that mortality (death) from cancer, including lung, colorectal, and prostate cancers, is lower among people with higher selenium blood levels or intake (19-25). Also, the incidence of nonmelanoma skin cancer is significantly higher in areas of the United States with low soil selenium levels (22).

The effect of selenium supplementation on the recurrence of these types of skin cancers was studied in seven dermatology clinics in the US from 1983 through the early 1990s. Supplementation with 200 mcg selenium daily did not affect recurrence of skin cancer, but significantly reduced total mortality and mortality from cancers. In addition, incidence of prostate cancer, colorectal cancer, and lung cancer was lower in the group given selenium supplements (26).

However, not all studies have shown a relationship between selenium status and cancer. In 1982, over 60,000 participants of the Nurses Health Study with no history of cancer submitted toenail clippings for selenium analysis. Toenail analysis is thought to reflect selenium status over the previous year. After three and one-half years, researchers compared the toenail selenium levels of nurses with and without cancer. They did not find any apparent benefit of higher selenium levels (27).

These conflicting results emphasize the need for additional research on the relationship between selenium and chronic diseases such as cancer. A study that may help answer some of the questions about the effect of selenium supplementation on cancer risk has started in France. The Supplementation en Vitamines et Minéraux Antioxydants, or SU.VI.MAX Study, is a prevention trial that is providing doses of antioxidant vitamins and minerals that are one to three times higher than recommended intakes, including a daily supplement of 100 mcg selenium. More than 12,000 men and women are being followed for eight years to determine the effect of supplementation on the incidence of chronic disease, such as cancers and cardiovascular disease (28).

Selenium and heart disease

Some population surveys have indicated an association between a lower antioxidant intake with a greater incidence of heart disease (29). Additional lines of evidence suggest that oxidative stress from free radicals may promote heart disease (30). For example, it is the oxidized form of low-density lipoproteins (LDL, often called "bad" cholesterol) that promotes plaque build-up in coronary arteries (31). Selenium is one of a group of antioxidants that may help limit the oxidation of LDL cholesterol and thereby help to prevent coronary artery disease (30, 32). Currently there is insufficient evidence available to recommend selenium supplements for the prevention of coronary heart disease.

Selenium and arthritis

Surveys of patients with rheumatoid arthritis, a chronic disease that causes pain, stiffness, swelling, and loss of function in joints, have indicated that they have reduced selenium levels in their blood (33, 34). In addition, some individuals with arthritis have a low selenium intake (35).

The body's immune system naturally makes free radicals that can help destroy invading organisms and damaged tissue, but that can also harm healthy tissue (36). Selenium, as an antioxidant, may help control levels of free radicals and help to relieve symptoms of arthritis (37). Current findings are considered preliminary, and further research is needed before selenium supplements can be recommended for individuals with arthritis.

Selenium and HIV

HIV / AIDS related malabsorption can deplete levels of many nutrients. Selenium deficiency is commonly associated with HIV / AIDS, and has been associated with a high risk of death from this disease (38, 39). Of 24 children with HIV who were observed for five years, those with low selenium levels died at a younger age, which may indicate

faster disease progression (40). An examination of 125 HIV positive men and women also associated selenium deficiency with mortality (39). Researchers believe that selenium may be important in HIV disease because of its role in the immune system and as an antioxidant. Selenium also may be needed for the replication of the HIV virus, which could deplete host levels of selenium (38). Researchers are actively investigating the role of selenium in HIV / AIDS, and see a need for clinical trials that evaluate the effect of selenium supplementation on HIV disease progression (41).

What is the health risk of too much selenium?

There is a moderate to high health risk of too much selenium. High blood levels of selenium can result in a condition called selenosis (42). Symptoms include gastrointestinal upsets, hair loss, white blotchy nails, and mild nerve damage. Selenium toxicity is rare in the United States and the few reported cases have been associated with industrial accidents and a manufacturing error that led to an excessively high dose of selenium in a supplement (43, 44). The Institute of Medicine has set a tolerable upper intake level for selenium at 400 micrograms per day for adults to prevent the risk of developing selenosis. "Tolerable upper intake levels represent the maximum intake of a nutrient that is likely to pose no risk of adverse health effects in almost all individuals in the general population" (9).

Table of Food Sources of Selenium

The selenium content of foods varies according to the growing area. The following table lists the mean selenium content of foods identified in the Total Diet Study (45) and in the USDA data bank (46).

Table of Selected Food Sources of Selenium

<i>Food</i>	<i>Micrograms</i>	<i>% DV*</i>
Brazil nuts, dried, unblanched, 1 oz	840	1200
Tuna, canned in oil, drained, 3 1/2 oz	78	111
Beef / calf liver, 3 oz	48	69
Cod, cooked, dry heat, 3 oz	40	57

Table of Selected Food Sources of Selenium

<i>Food</i>	<i>Micrograms</i>	<i>% DV*</i>
Noodles, enriched, boiled, 1 c	35	50
Macaroni and cheese (box mix), 1 c	32	46
Turkey, breast, oven roasted, 3 1/2 oz	31	44
Macaroni, elbow, enriched, boiled, 1 c	30	43
Spaghetti w/ meat sauce, 1 c	25	36
Chicken, meat only, 1/2 breast	24	34
Beef chuck roast, lean only, oven roasted, 3 oz	23	33
Bread, enriched, whole wheat, 2 slices	20	29
Oatmeal, 1 c cooked	16	23
Egg, raw, whole, 1 large	15	21
Bread, enriched, white, 2 slices	14	20
Rice, enriched, long grain, cooked, 1c	14	20
Cottage cheese, lowfat 2%, 1/2 c	11	16
Walnuts, black, dried, 1 oz	5	7
Cheddar cheese, 1 oz	4	6

*DV = Daily Value. DVs are reference numbers based on the Recommended Dietary Allowance (RDA). They were developed to help consumers determine if a food contains very much of a specific nutrient. The DV for selenium is 70 micrograms (mcg). The percent DV (%DV) listed on the nutrition facts panel of food labels tells adults what percentage of the DV is provided by one serving. Even foods that provide lower percentages of the DV will contribute to a healthful diet.

This fact sheet was published by the Clinical Nutrition Service, Warren Grant Magnuson Clinical Center, National Institutes of Health (NIH), Bethesda, MD, in conjunction with the Office of Dietary Supplements (ODS) in the Office of the Director of NIH. The mission of ODS is to strengthen knowledge and understanding of dietary supplements by evaluating scientific information, stimulating and supporting research, disseminating research results, and educating the public to foster an enhanced quality of life and health for the U.S. population. The Clinical Nutrition Service and the ODS would like to thank the expert scientific reviewers for their role in ensuring the scientific accuracy of the information discussed in this fact sheet.

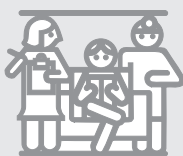
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