



## COMMENTARY

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# Selenium as an Antioxidant: Its Deficiencies and Toxicities

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## Description

Selenium is a trace element, meaning that the body only needs a small amount. It occurs naturally in foods or as a supplement. Selenium is an important component of various enzymes and proteins called selenoproteins that help make DNA and protect cells from damage and infection; these proteins are also involved in reproduction and thyroid hormone metabolism. Most of the body's selenium is stored in muscle tissue, although the thyroid gland contains the highest concentration of selenium due to various selenoproteins that aid thyroid function. Seleno proteins help protect cell membranes from free radical damage and prevent platelets from becoming sticky, which can lead to heart disease.

## Food sources

The amount of selenium in foods can vary widely depending on the selenium content of the soil in which they are grown. The content of the soil varies greatly depending on the region. Plant foods get selenium from the soil, which then affects the amount of selenium in the animals that eat those plants. Animal protein foods are usually good sources of selenium. Seafood, organ meats and Brazil nuts are the foods highest in selenium, although Americans get most of their selenium from everyday foods such as breads, cereals, poultry, red meat and eggs.

- Brazil nuts
- Fin fish and shellfish
- Beef
- Turkey
- Chicken
- Fortified cereals
- Whole-wheat bread
- Beans, lentils

## Signs of selenium deficiency and toxicity

**Deficiency:** Selenium deficiency is rare in the US because North American soil is generally rich in selenium. Even if people live in areas with low levels of selenium in the soil, transporting food around the region and using fortified foods and supplements reduces the risk of deficiency. Two conditions are associated with severe selenium deficiency: 1) Keshan disease, a type of cardiomyopathy, or disease of the heart muscle, and 2) Kashin-Beck disease, a form of osteoarthritis.

**Keshena disease:** Initial symptoms may include low blood pressure, nausea, fever or chills, body aches, and fatigue. Although the exact cause or causes of Keshan's disease are not fully known, the condition is commonly associated with low selenium intake. It may also be due to the existence of the Coxsackie B3 virus in the body.

**Kashin-Beck disease:** The aetiology of Kashin-Beck Disease (CBD) remains elusive. Four factors have been conclusively linked to the disease: selenium deficiency, iodine deficiency, grain contamination by mycotoxin-producing fungi, and water contamination by organic materials and fulvic acids.

### Symptoms

- Nausea, vomiting
- Headaches
- Change in mental state, confusion
- Lethargy
- Cramps
- Coma

### Groups at risk for deficiency

- People living in regions with low levels of selenium that also eat a mostly plant-based diet. It is rare in the US, but populations in China, Russia, and Europe are at risk because their soil is typically low in selenium. The risk is further increased in people who live in these areas and follow

a vegetarian or vegan diet.

- **People with HIV:** The virus can cause diarrhoea, malabsorption of nutrients, and decreased appetite.

- **People with kidney failure undergoing dialysis:** This mechanical process of filtering the blood can remove some selenium. The dietary restrictions required in renal failure may also reduce total food intake, leading to the risk of selenium deficiency.

### Toxicity

Chronically high selenium intake can lead to health problems ranging from muscle tremors, hair loss, stomach upset, and dizziness to the more severe outcomes of heart attack, respiratory distress, or kidney failure. Brazil nuts are exceptionally high in selenium even when grown in low selenium soil, with even one nut containing more than the Recommended Dietary Allowances (RDA).

Eating too many of these nuts daily can reach toxic levels, as can dietary supplements that contain selenium above the recommended daily intake. Early symptoms are:

- Metallic taste, bad breath
- Nausea, diarrhoea
- Hair loss
- Brittleness or discoloration of nails
- Skin rash or lesions
- Redness of the skin
- Fatigue
- Irritability
- Muscle soreness