

Copper

Facts:

- ◆ Copper is involved in the absorption, storage, and metabolism of iron. It may also have antioxidant activity.¹
- ◆ The human body contains approximately 50 milligrams (mg) to 120 mg of copper. Copper concentrates in the brain, heart, kidney, but is highest in the liver where it contributes to energy and detoxification processes.¹ Blood values typically average 120 mg/dl for women and 109 mg/dl for men.
- ◆ Copper is absorbed primarily in the small intestine and, to a certain extent, the stomach.
- ◆ Increased consumption of fructose can significantly worsen a copper deficiency, according to researchers with the U.S. Department of Agriculture. Individuals who consumed 20 percent of their daily calories from fructose showed decreased levels of red blood cell superoxide dismutase (SOD), a copper-dependent enzyme essential for antioxidant protection within the red blood cell.²

Functions:

- ◆ Aids in the formation of bone, hemoglobin, red blood cells.² Copper aids in the conversion and transport of iron from the intestinal lumen into red blood cells.
- ◆ Works in balance with zinc and vitamin C to form elastin.²
- ◆ Involved in the healing process, energy production, hair and skin coloring, and taste sensitivity.²
- ◆ Involved in the development and maintenance of the cardiovascular system.
- ◆ Helps maintain the myelin, which sheaths nerves and aids in the transmission signals from the brain to the body and vice versa.
- ◆ Involved in producing and regulating neurotransmitters in the brain, including norepinephrine.
- ◆ Plays a role in the activation of superoxide dismutase, an antioxidant enzyme that is a free radical scavenger. Copper also protects against oxidative damage especially in the thyroid, uterus, lungs, liver, brain, red blood cells, kidneys and pituitary.

Requirements:

The Food and Nutrition Board of the U.S. National Academy of Sciences has recommended the following Estimated Safe and Adequate Daily Dietary Intakes (ESADDI)³:

Age:	ESADDI (milligrams):
Infants 0-6 mos.	0.4 to 0.6 mg
6 mos.-1 year	0.6 -0.7 mg
1 to 3 yr	0.7-1.0 mg
4-6 years	1.0 -1.5 mg
7-10 years	1.0-2.0 mg
11 + years	1.5 to 2.5
Adults	1.5-3.0

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Signs of Deficiency:

Signs of copper deficiency include: general weakness, osteoporosis, anemia, baldness, diarrhea, general weakness, skin sores, poor respiratory function.^{2,4}

Safety:

Too much copper can cause an upset stomach and nausea. Copper absorption can be decreased by an excess of intake of dietary iron or zinc. Vitamin C supplementation results in decreased copper.³ Those with Wilson's disease, chronic liver and kidney failure should avoid taking copper. Pregnant women and nursing mothers should avoid doses greater than the ESADDI.

Toxicity:

If consumed by a child, copper (3 grams) can be fatal. Occasional copper toxicity has been reported in individuals consuming drinking water that passes through copper water pipes where the mineral has leached into the drinking water. Symptoms of copper toxicity include: nausea, anemia, weakness, diarrhea, headache, a metallic taste in the mouth,² depigmentation, dermatitis and neurologic impairments.

¹ Wilson's disease is a genetic disorder where there is an excessive accumulation of copper in the soft tissues that can result in damage to the kidneys, brain and liver.

Current Research:

Heart Disease: Copper deficiency may play a role in the development of heart disease. According to the *Physicians' Desk Reference*, "There is no doubt that copper deficiency can contribute to heart disease. It seems likely that supplemental copper might be helpful in preventing and treating cardiovascular disease even in those with marginal copper deficiency." Animal studies have shown that copper deficiency increases the susceptibility of lipoprotein and tissues to peroxidation.⁴

Osteoporosis: Copper is involved in cross linking of collagen in bone and, therefore, has implications for osteoporosis. In postmenopausal women, supplementation of copper and zinc has been associated with conservation of bone density and prevention of spinal bone loss.⁴ In one study, researchers at the University of Ulster in Ireland reported that copper plays an important role in the prevention of osteoporosis. Seventy-three postmenopausal women supplemented their diets with either 3 milligrams of copper or a placebo. Two years later, when the study ended, the supplemented group maintained bone mineral density while the placebo group lost significant amounts of bone⁶.

Immune Function: A copper-deficient diet can result in impaired immune function long after increased intakes return blood copper levels to normal.⁷ The study, conducted at the U.S. Department of Agriculture's Western Human Nutrition Research Center in San Francisco found that healthy men fed a copper-poor diet for two months followed by a diet replenished with 2-3 mg of copper (within the

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recommended range) showed that indices of immune function declined during the copper-deficient period and remained compromised even after the increased dietary intakes of copper had returned blood copper levels to normal.

Growth: Copper "...reduces growth rate through effects on both food intake and efficiency of food utilization for growth," conclude researchers at the University of California at Davis.⁹ The study, using rats, found that a copper-deficient diet stunted growth.

Pregnancy: According to W. Thomas Johnson of the USDA's Grand Forks Human Nutrition Research Center, preliminary research indicates that long-lasting heart defects occur in the offspring of rats fed a low-copper diet during pregnancy and lactation.⁹ Copper is one of several minerals whose requirements are increased during pregnancy and lactation. During pregnancy, the RDA for copper increases to 1 mg per day, and increases to 1.3 mg daily during lactation. Although these seem like small amounts of copper, results from food-intake surveys show the average copper intake in 14-30 year-old women range from 0.44-0.76 mg per day. These surveys also indicate that up to 75 percent of pregnant women and 90 percent of women who are nursing may have dietary copper intakes below the RDA.⁹ Further studies are needed, but this particular finding suggests that low copper intakes by pregnant or nursing female rats may have irreversible consequences on mitochondrial function and oxygen radical production in the hearts of their offspring.⁹

References:

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