

Table 1

| Trace Minerals | | | |
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| Nutrient | Principal Sources | Functions | Effects of Deficiency and Toxicity |
| Chromium | Liver, processed meats, whole-grain cereals, nuts | Promotion of glucose tolerance | Deficiency: Possibly impaired glucose tolerance |
| Copper | Organ meats, shellfish, nuts, dried legumes, dried fruits, whole-grain cereals, peas, cocoa, mushrooms, tomato products | Enzyme component, hematopoiesis, bone formation | Deficiency: Anemia in undernourished children, Menkes (kinky-hair) syndrome Toxicity: Wilson disease, copper poisoning |
| Fluorine | Seafood, tea, fluoridated water (sodium fluoride 1.0–2.0 ppm) | Bone and tooth formation | Deficiency: Predisposition to dental caries, possibly osteoporosis Toxicity: Fluorosis, mottling and pitting of permanent teeth, exostoses of spine |
| Iodine | Seafood, iodized salt, eggs, cheese, drinking water (content varies) | Thyroxine (T ₄) and triiodothyronine (T ₃) synthesis, development of fetus | Deficiency: Simple (colloid, endemic) goiter, cretinism, deaf-mutism, impaired fetal growth and brain development Toxicity: Hyperthyroidism or hypothyroidism |
| Iron | Many foods (except dairy products)—soybean flour, beef, kidney, liver, fish, poultry, beans, clams, molasses, | Hemoglobin and myoglobin formation, cytochrome enzymes, iron-sulfur proteins | Deficiency: Anemia, pica, glossitis, angular cheilosis Toxicity: Hemochromatosis, |

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| | enriched grains and cereals (bioavailability variable in plant sources) | | cirrhosis, diabetes mellitus, skin pigmentation |
| Manganese | Whole-grain cereals, pineapple, nuts, tea, beans, tomato paste | Healthy bone structure Component of manganese-specific enzymes: glycosyltransferases, phosphoenolpyruvate carboxykinase, manganese-superoxide dismutase | Deficiency: Questionable Toxicity: Neurologic symptoms resembling those of parkinsonism or Wilson disease |
| Molybdenum | Milk, legumes, whole-grain breads and cereals, dark green vegetables | Component of coenzyme for sulfite oxidase, xanthine dehydrogenase, and one aldehyde oxidase | Deficiency: Tachycardia, headache, nausea, obtundation (sulfite toxicity) |
| Selenium | Meats, seafood, nuts, plant-based foods (selenium content varying with soil concentration) | Component of glutathione peroxidase and thyroid hormone iodinase | Deficiency: Keshan disease (viral cardiomyopathy), muscle weakness Toxicity: Hair loss, abnormal nails, nausea, dermatitis, peripheral neuropathy |
| Zinc | Meat, liver, oysters, seafood, fortified cereals, peanuts, whole grains (bioavailability variable in plant sources) | Enzyme component, skin integrity, wound healing, growth | Deficiency: Impaired growth and delayed sexual maturation, hypogonadism, hypogeusia Toxicity: RBC microcytosis, neutropenia, impaired immunity |