

Vitamin and Mineral Guide

Use this guide to help you understand how much of a vitamin or mineral you need, the important role micronutrients play in maintaining health, and what foods to consume to meet your vitamin and mineral needs.

Dietary Reference Intakes (DRIs)

Refers to a set of evidence-based nutrition recommendations used to plan and evaluate nutrient intake. Micronutrient needs differ between people based on sex, age, and conditions. Specific conditions may require more or less of a micronutrient so always let your doctor know about any nutritional supplements you are taking. The values listed are for male and non-pregnant and non-lactating female adults ages ≥ 19 years, ≥ 51 years, and ≥ 70 years old.

The DRIs important for you to know include:

- **Recommended Dietary Allowance (RDA):** minimum recommended daily intake level that is sufficient to meet the nutrient requirements of nearly all (97%-98%) healthy people.
- **Adequate Intake (AI):** evidence is insufficient to develop an RDA so nutrient recommendations are set at a daily intake level assumed to ensure nutritional adequacy in most healthy people.
- **Tolerable Upper Intake Level (UL):** maximum daily intake level where exceeding this level may cause harmful side effects in most people, especially with fat-soluble vitamins. The UL for some nutrients is undetermined.
- **Daily Value (DV):** DVs are not recommended intakes but rather how much of a nutrient a serving of the food or dietary supplement provides in the context of a total daily diet that is based on an average of 2,000 calories a day. You may need more or less of the DV. DVs are presented on food and supplement labels as a percentage (%DV). They help you compare one product with another.

Fat-Soluble Vitamins

RDA/AI	UL	FUNCTIONS	FOOD SOURCES	DID YOU KNOW...?
Vitamin A RDA (minimum): Male: 900 mcg/d Female: 700 mcg/d (19 - >70 yrs.)	Vitamin A UL (maximum): Male: 3000 mcg/d Female: 3000 mcg/d (19 - >70 yrs.)	<ul style="list-style-type: none"> ✓ Vision health ✓ Immunity ✓ Hormone for gene expression & regulation ✓ Cell differentiation and recognition ✓ Reproduction ✓ Growth and development (including bone development & tooth formation) ✓ Carotenoids act as antioxidants 	Animal (Retinoids): beef, egg yolk, fish, fortified milk, shrimp, turkey. Plant (Carotenoids): apricots, broccoli, Brussel sprouts, carrots, cantaloupe, mango, orange juice, peaches, pumpkin, sweet potatoes, squash, spinach, tomato, turnip greens.	<ul style="list-style-type: none"> • Deeper colors of fruits and vegetables are associated w/ higher levels of carotenoids. • Excessive intake of retinoids (>100x RDA) can be toxic leading to liver disease. • Adequate intake of foods containing forms of vitamin A is adequate to meet nutritional needs.
Vitamin D (Calciferol) RDA (minimum): Male: 15 mcg/d (19 - > 70 yrs.) Female: 15 mcg/d (< 70 yrs.) 20 mcg/d (> 70 yrs.) (19 - > 70 yrs.) 1 mcg/d = 40 IU	Vitamin D (Calciferol) UL (maximum): Male: 100 mcg/d Female: 100 mcg/d (19 - > 70 yrs.) 1 mcg/d = 40 IU	<ul style="list-style-type: none"> ✓ Prohormone that performs as a steroid hormone ✓ Gene transcription & regulation ✓ Growth & development ✓ Formation & maintenance of bones & teeth ✓ Absorption & metabolism of the mineral's calcium & phosphorus ✓ Anti-inflammatory ✓ Reduces insulin resistance 	Animal (D₃): fortified dairy (milk, yogurt, cheese, etc.), salmon, mackerel, tuna, sardines, liver, egg yolk. Plant (D₂): Fortified OJ, fortified cereals. Sunshine!	<ul style="list-style-type: none"> • Known as the “sunshine vitamin” because vitamin D can be synthesized in the body w/ exposure to sunlight that reacts with cholesterol in the skin. • Intake of vitamin D food sources and adequate weekly sunlight is sufficient for most people to synthesize their own vitamin D.
Vitamin E RDA (minimum): Male: 15 mg/d Female: 15 mg/d (19 - > 70 yrs.)	Vitamin E UL (maximum): Male: 1,000 mg/d Female: 1,000 mg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> ✓ Most important fat-soluble antioxidant ✓ May prevent oxidative damage of unsaturated fatty acids and vitamin A ✓ Red blood cell integrity ✓ Skin health ✓ Hormone synthesis 	Animal: milk, egg yolk, flounder. Plant: plant oils, wheat germ, nuts, apricots, leafy greens, asparagus, fortified cereals.	<ul style="list-style-type: none"> • The antioxidant actions of vitamin E can decline without adequate zinc, copper, selenium and manganese. • Although Vit E is toxic at high levels and interferes with the body's ability to use other fat-soluble vitamins, it's the least toxic of the fat-soluble vitamins.

<p>Vitamin K</p> <p>AI (minimum): Male: 120 mcg/d Female: 90 mcg/d (19 - > 70 yrs.)</p>	<p>Vitamin K</p> <p>UL (maximum): Undetermined (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Blood clotting ✓ Bone formation ✓ Regulation of enzymes (many for the brain) ✓ Assists in binding calcium ✓ Regulation of inflammatory processes 	<p>Animal: dairy, eggs, turkey.</p> <p>Plant: leafy greens, broccoli, asparagus, cabbage, green beans, carrots, avocado.</p>	<ul style="list-style-type: none"> • K₁ is synthesized by green plants. • K₂ is synthesized by intestinal bacteria that accounts for ½ of vitamin K needs. • K₃ is a synthetic form of vitamin K. • If you take an anticoagulant, keep your vitamin K intake consistent. • As with all fat-soluble vitamins, large doses, especially K₃, can be toxic, but this is rare with vitamin K. • Adequate intake with foods should be sufficient as the microbiome can synthesize vitamin K.
---	--	--	--	---

Water-Soluble Vitamins

RDA/AI	UL	FUNCTIONS	FOOD SOURCES	DID YOU KNOW...?
Vitamin C RDA (minimum): Male: 90 mg/d Female: 75 mg/d (19 - > 70 yrs.)	Vitamin C UL (maximum): Male: 2,000 mg/d Female: 2,000 mg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> ✓ Collagen (<i>connective tissue that knits together wounds and supports blood vessels</i>) synthesis ✓ Carnitine (<i>Metabolism of fatty acids</i>) synthesis ✓ Metabolism of some amino acids ✓ Folate metabolism and iron absorption ✓ Antioxidant and immune support ✓ Forms the neurotransmitters serotonin and norepinephrine ✓ Maintains proper lung function 	Animal: organ meats Plant: citrus fruits (orange, grapefruit, etc.), strawberries, mango, cantaloupe, broccoli, bell peppers, spinach, tomatoes, Brussels sprouts, kale.	<ul style="list-style-type: none"> • During periods of stress, urinary output of vitamin C increases when adrenal hormones are high so managing stress and/or increasing intakes of vitamin C rich foods during stress can be beneficial. • Sodium bicarbonate added to cooked vegetables to preserve and improve color, destroys vitamin C. • Excessively high doses of vitamin C can contribute to kidney stones due to the oxalates produced from the metabolism of vitamin C.
Thiamin (B₁) RDA (minimum): Male: 1.2 mg/d Female: 1.1 mg/d (19 - > 70 yrs.)	Thiamin (B₁) UL (maximum): Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> ✓ Coenzyme for energy production ✓ Carbohydrate metabolism ✓ Neurological function ✓ Needed for healthy skin, hair, muscles, and brain 	Animal: Liver, pork chop, ham, tuna. Plant: Yeast, whole-grain cereal grains, sunflower seeds, green peas, watermelons, acorn squash.	<ul style="list-style-type: none"> • Thiamin is in many foods but in low concentrations. • In the late 1800's - early 1900's, a condition known as beriberi was a public health issue which was a result of a thiamin deficiency from eating refined (white) rice and little dietary variety.
Riboflavin (B₂) RDA (minimum): Male: 1.3 mg/d Female: 1.1 mg/d (19 - > 70 yrs.)	Riboflavin (B₂) UL (maximum): Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> ✓ Coenzyme ✓ Essential for metabolism of all macronutrients ✓ Supports antioxidant processes ✓ Needed for healthy skin, hair, blood, and brain 	Animal: beef liver, pork, dark meat chicken, dairy (milk, yogurt, cottage cheese, etc.), clams, eggs. Plant: leafy greens (spinach, etc.), broccoli, banana, whole grains, enriched grains and fortified cereals.	<ul style="list-style-type: none"> • Riboflavin is found in many foods bound to proteins. • A bright pink tongue is a sign of riboflavin deficiency as well as cracks in the corners of the mouth (<i>angular stomatitis</i>), and burning and itching eyes.

<p>Niacin (B₃)</p> <p>RDA (minimum): Male: 16 mg/d Female: 14 mg/d (19 - > 70 yrs.)</p>	<p>Niacin (B₃)</p> <p>UL (maximum): Male: 35 mg/d Female: 35 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Essential for cellular energy production and metabolism ✓ Coenzyme for the metabolism of all macronutrients ✓ Essential for healthy skin, blood cells, brain, and nervous system 	<p>Animal: poultry (chicken, etc.), fish (tuna, etc.), beef, milk and eggs (excellent sources of tryptophan which can be converted to niacin)</p> <p>Plant: whole and fortified grains and cereals, mushrooms, peanuts, yeast.</p>	<ul style="list-style-type: none"> • Niacin can also be made by your body from the amino acid tryptophan, with the help of Vitamin B₆. • Niacin is not 100% biologically available after digestion, especially in plant foods so foods like corn tortillas are treated with lime to increase niacin bioavailability.
<p>Pantothenic Acid (B₅)</p> <p>AI (minimum): Male: 5 mg/d Female: 5 mg/d (19 - > 70 yrs.)</p>	<p>Pantothenic Acid (B₅)</p> <p>UL (maximum): Undetermined (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Coenzyme for energy production and fatty acid synthesis. ✓ Helps make neurotransmitters, steroid hormones, and hemoglobin. 	<p>Animal: chicken, salmon, egg yolks, milk and yogurt.</p> <p>Plant: whole and fortified grains, broccoli, avocado, mushrooms, corn, sweet potatoes, banana, tomato products.</p>	<ul style="list-style-type: none"> • B₆ is found in a variety of foods and a deficiency is rare. • Deficiency causes tingling and burning sensations in the feet, depression, fatigue, insomnia, and weakness.
<p>Vitamin B₆</p> <p>RDA (minimum): Male: 1.3 mg/d (< 51 yrs.) 1.7 mg/d (> 51 yrs.) Female: 1.3 mg/d (< 51 yrs.) 1.5 mg/d (> 51 yrs.)</p>	<p>Vitamin B₆</p> <p>UL (maximum): Male: 100 mg/d Female: 100 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Coenzyme in the metabolism of amino acids. ✓ Cofactor for the synthesis or catabolism or neurotransmitters such as the synthesis of serotonin, epinephrine and norepinephrine. ✓ Assists in metabolism of glucose from glycogen ✓ Required for the conversion of tryptophan to niacin. 	<p>Animal: chicken, pork, beef, tuna.</p> <p>Plant: whole-grain wheat, vegetables, nuts, potatoes, banana, sunflower seeds, avocados, legumes, tofu and other soy products.</p>	<ul style="list-style-type: none"> • A riboflavin deficiency can reduce vitamin B₆ coenzyme functions. • B₆ derived from animal sources tends to be more bioavailable (absorbed more).

<p>Cobalamin (B₁₂)</p> <p>RDA (minimum): Male: 2.4 mcg/d Female: 2.4 mcg/d (19 - > 70 yrs.)</p>	<p>Cobalamin (B₁₂)</p> <p>UL (maximum): Undetermined (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Coenzyme for the metabolism of amino acids and other nutrients ✓ Essential for metabolism of cells in the GI, bone marrow, and nervous tissue 	<p>Animal: beef, clams, oysters, crab, tuna, halibut, beef, pork, dairy (milk, yogurt, cottage cheese), eggs.</p> <p>Plant: Brewer's yeast, fortified cereals, fortified soymilk</p>	<ul style="list-style-type: none"> • In well-nourished individuals, vitamin B₁₂ is stored in the liver for 5-7 yrs. • Vitamin B₁₂ is synthesized by bacteria in the body but has limited absorption so adequate intake of vitamin B₁₂ foods ensures levels are maintained. • Older adults are at risk of vitamin B₁₂ deficiency because of limited intake and declining digestion. • A lack of vitamin B₁₂ can cause anemia, memory loss and dementia.
<p>Folate</p> <p>RDA (minimum): Male: 400 mcg/d Female: 400 mcg/d (19 - > 70 yrs.)</p>	<p>Folate</p> <p>UL (maximum): Male: 1,000 mcg/d Female: 1,000 mcg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Coenzyme in synthesis reactions for amino acids ✓ Synthesis and repair of DNA ✓ Formation of red blood cells and white blood cells (immune cells) ✓ Normal cell division in embryo development-helps prevent brain and spine birth defects when adequately consumed and/or supplemented early in pregnancy 	<p>Animal: egg yolk.</p> <p>Plant: mushrooms, green leafy vegetables (spinach, turnip greens, broccoli, asparagus), potatoes, whole-wheat bread, OJ, legumes (black-eyed peas, lentils, beans), fortified grains and cereal, cabbage, banana.</p>	<ul style="list-style-type: none"> • Adequate folate and B₁₂ is necessary for healthy blood and a deficiency can cause other anemias because folate can mask a B₁₂ deficiency, which also causes anemia.
<p>Biotin</p> <p>AI (minimum): Male: 30 mcg/d Female: 30 mcg/d (19 - > 70 yrs.)</p>	<p>Biotin</p> <p>UL (maximum): Male: 1,000 mcg/d Female: 1,000 mcg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Assists in the metabolisms of folic acid, pantothenic acid, and vitamin B₁₂. ✓ Component of enzymes for synthesizing glucose and fatty acid formation and break down ✓ Healthy bones and hair 	<p>Animal: milk, yogurt, eggs.</p> <p>Plant: soy, peanuts, almonds, sweet potatoes.</p>	<ul style="list-style-type: none"> • Some biotin is made by bacteria in the GI tract however, it's not clear how much of this the body absorbs. • Avidin, found in raw egg whites, impairs biotin absorption.

<p>Choline</p> <p>AI (minimum): Male: 550 mg/d Female: 425 mg/d (19 - > 70 yrs.)</p>	<p>Choline</p> <p>UL (maximum): Male: 3.5 g/d Female: 3.5 g/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Structural component of membranes & the neurotransmitter acetylcholine (aids in nerve and brain activities) ✓ Component of platelet activation & pulmonary surfactant ✓ Amino acid (homocysteine) metabolism ✓ Lipid (fat) metabolism, absorption, and transport 	<p>Animal: milk, eggs, liver, beef.</p> <p>Plant: peanuts, soybeans.</p>	<ul style="list-style-type: none"> • Choline is not considered a vitamin but rather a “quasi-vitamin”. • Although rare, signs of deficiency include dermatitis, nausea, loss of appetite, depression, and high cholesterol.
--	--	---	--	---

Minerals

RDA/AI	UL	Functions	Food Sources	Did you know...?
<p>Boron</p> <p>RDA/AI (minimum): Male: Undetermined Female: Undetermined (19 - > 70 yrs.)</p>	<p>Boron</p> <p>UL (maximum): Male: 20 mg/d Female: 20 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Associated with cell membranes ✓ Necessary for brain composition and function ✓ Necessary for bone composition, structure and strength ✓ Required for normal reproductive and immune processes 	<p>Animal: animal foods are a poor source of boron.</p> <p>Plant: non-citrus fruits, vegetables, nuts, and legumes, also found in wine, cider, and beer.</p>	<ul style="list-style-type: none"> • The highest concentration of boron is found in bone, the spleen, and thyroid suggesting higher need in these areas.
<p>Calcium</p> <p>RDA (minimum): Male: 1,000 mg/d (< 70 yrs.) 1,200 mg/d (>70 yrs.) Female: 1,000 mg/d (19-50 yrs.) 1,200 mg/d (>51 yrs.)</p>	<p>Calcium</p> <p>UL (maximum): Male: 2,500 mg/d (19-50 yrs.) 2,000 mg/d (51-70 yrs.) Female: 2,500 mg/d (19-50 yrs.) 2,000 mg/d (51-70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Builds and maintains bones and teeth ✓ Nerve impulse transmission and heart contraction ✓ Assists in maintaining muscle tone and smooth muscle contraction ✓ Neurotransmitter release and hormone secretion ✓ Enzyme activation and cofactor for enzyme reactions ✓ Blood clotting ✓ Associated w/ reduced obesity by inhibiting lipogenesis (building of fat tissue) and increasing lipolysis (break down of fat tissue) 	<p>Animal: Dairy (milk, yogurt, cheese), clams, oysters, canned sardines and salmon (bones).</p> <p>Plant: tofu, fortified juice, fortified plant milks, almonds, blackstrap molasses, dark leafy greens* (kale, beet, turnip, mustard, collards, broccoli)</p> <p>*oxalates in spinach, chard, and beet greens are not great sources as they bind to calcium and so although present, absorption is minimal</p>	<ul style="list-style-type: none"> • Calcium is the most abundant mineral in the body. • Adults absorb roughly 30% of ingested calcium but absorption can vary depending on the calcium source. • Calcium enters the blood for use about 3-4hrs. after ingestion. • Vitamin D increases uptake but also, the greater the calcium need and the smaller the dietary supply, the more efficient the absorption. • Calcium is best absorbed w/ food and in the acidic environment of the stomach. • The stomach pH is increased with age (less acidic) which can limit calcium absorption.

<p>Chloride</p> <p>AI (minimum): Male: 2.3 g/d (19-50 yrs.) 2.0 g/d (51-70 yrs.) 1.8 g/d (>70 yrs.) Female: 2.3 g/d (19-50 yrs.) 2.0 g/d (51-70 yrs.) 1.8 g/d (>70 yrs.)</p>	<p>Chloride</p> <p>UL (maximum): Male: 3.6 g/d Female: 3.6 g/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Primary anion (Cl⁻) ✓ Component of gastric hydrochloric acid that is essential to digestion ✓ Maintains electrolyte balance ✓ Maintains pH balance ✓ Assists in enzyme activation 	<p>Animal: Meat, seafood, dairy and dairy products, eggs.</p> <p>Plant: Salt (sodium chloride).</p>	<ul style="list-style-type: none"> • Most abundant anion (negative charge) in the extracellular fluid that neutralizes the positive charge of sodium (Na⁺).
<p>Chromium</p> <p>AI (minimum): Male: 35 mcg/d (<51 yrs.) 30 mcg/d (>51 yrs.) Female: 25 mcg/d (<51 yrs.) 20 mcg/d (>51 yrs.)</p>	<p>Chromium</p> <p>UL (maximum): Undetermined (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Influences the action of insulin and improves glucose metabolism ✓ Involved in the metabolism of all macronutrients ✓ Can minimize oxidative stress ✓ Regulates gene expression 	<p>Animal: seafood such as oysters, liver, beef, poultry, cheese.</p> <p>Plant: brewer's yeast, potatoes, bran and whole grains, broccoli, grape juice, OJ, garlic, apple, banana.</p>	<ul style="list-style-type: none"> • Absorption is increased by oxalates where other minerals have decreased absorption with oxalates. • Chromium deficiency results in insulin deficiency and lipid abnormalities.
<p>Cobalt</p> <p>RDA/AI (minimum): Male: Undetermined Female: Undetermined (19 - > 70 yrs.)</p>	<p>Cobalt</p> <p>UL (maximum): Undetermined (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Component of vitamin B₁₂ ✓ Essential for the maturation of red blood cells and the normal function of all cells ✓ Component of an enzyme needed for DNA and RNA translation 	<p>Animal: obtained through vitamin B₁₂ foods found in animal foods such as liver, oysters, clams, poultry, dairy and dairy products.</p> <p>Plant: soil remaining on some vegetables.</p>	<ul style="list-style-type: none"> • Most of the cobalt found in the body is found with vitamin B₁₂ stores in the liver therefore, a cobalt deficiency accompanies a vitamin B₁₂ deficiency.
<p>Copper</p> <p>RDA (minimum): Male: 900 mcg/d Female: 900 mcg/d (19 - > 70 yrs.)</p>	<p>Copper</p> <p>UL (maximum): Male: 10,000 mcg/d Female: 10,000 mcg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Constituent of blood and assists in red blood cell formation ✓ Component of important enzymes such as in bone marrow and in forming connective tissue (collagen, elastin) ✓ Component of proteins involved in energy production ✓ Antioxidant properties ✓ Promotes the synthesis of melanin (skin pigment), and hormones 	<p>Animal: liver, shellfish, organ meats.</p> <p>Plant: cocoa, nuts, whole cereal grains, legumes, dried fruits, cherries, OJ, mushrooms, sunflower seeds, cashews.</p>	<ul style="list-style-type: none"> • Competes with zinc for absorption. • Phytates, and fiber as well as high vitamin C intake can inhibit absorption. • Higher levels are found in women than in men.

<p>Fluoride</p> <p>AI (minimum): Male: 4 mg/d Female: 3 mg/d (19 - > 70 yrs.)</p>	<p>Fluoride</p> <p>UL (maximum): Male: 10 mg/d Female: 10 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Encourages strong bone and teeth formation and maintains bone health. 	<p>Animal: saltwater fish, soups and stews made with fish and meat bones.</p> <p>Plant: rice, soybeans, spinach, onions, lettuce, water that is fluoridated, tea leaves.</p>	<ul style="list-style-type: none"> • Found in nearly all drinking water and soil. • Harmful to children in excessive amounts
<p>Iodine</p> <p>RDA (minimum): Male: 150 mcg/d Female: 150 mcg/d (19 - > 70 yrs.)</p>	<p>Iodine</p> <p>UL (maximum): Male: 1,100 mcg/d Female: 1,100 mcg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Needed for the synthesis of thyroid hormones such as T₃ and T₄ which helps set body temperature and influences nerve and muscle function, reproduction, and growth. ✓ Prevents goiter (enlargement of the thyroid gland) and a congenital thyroid disorder. 	<p>Animal: seafood such as clams, lobster, oysters, sardines, and saltwater fish. Freshwater fish in smaller amounts; milk and eggs (variable depending on levels in animal's diet).</p> <p>Plant: vegetables (variable levels depending on soil), iodized salt.</p>	<ul style="list-style-type: none"> • More than 75% of the body's iodine is found in the thyroid gland. • Goitrogens (found naturally in foods such as cabbage, turnips, rapeseed, peanuts, cassava, sweet potatoes, kelp, and soybeans) can inhibit iodide uptake.
<p>Iron</p> <p>RDA (minimum): Male: 8 mg/d (>19 yrs.) Female: 18 mg/d (<50 yrs.) 8 mg/d (>51 yrs.)</p>	<p>Iron</p> <p>UL (maximum): Male: 45 mg/d Female: 45 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Highly reactive-oxidation and reduction reactions in metabolism ✓ Involved in red blood cell (carry oxygen to bodily tissues) formation and myoglobin (muscle reservoir of oxygen) activity - transports oxygen and carbon dioxide ✓ Involved in cellular respiration and energy generation ✓ Involved in heme and nonheme enzymes ✓ Necessary for proper immune function ✓ Needed for cognitive performance (brain cells need iron) ✓ Synthesizes neurotransmitters (chemical messengers) 	<p>Animal: Liver, seafood (shrimp, oysters), lean red meat, poultry, eggs (yolk).</p> <p>Plant: dried beans and lentils, dried fruit, molasses, spinach, whole-grains, soy, peanuts, enriched bread and grain products.</p>	<ul style="list-style-type: none"> • Iron deficiency anemia is the world's most common nutrient deficiency. • Women store lower amounts of iron than men. • Vitamin C in plant foods and amino acids found in beef, pork, lamb, seafood, and poultry enhance absorption. • Heme iron is found predominantly in animal foods and non-heme iron is found in plant foods. • Vegans may need to supplement with iron to meet needs.

<p>Magnesium</p> <p>RDA (minimum): Male: 400 mg/d (<31 yrs.) 420 mg/d (>31 yrs.) Female: 310 mg/d (<31 yrs.) 320 mg/d (>31 yrs.)</p>	<p>Magnesium</p> <p>UL (maximum): Male: 350 mg/d (male RDAs are > UL) Female: 350 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Stabilizes enzymatic reactions ✓ Cofactor for more than 300 enzymes involved in metabolism and fatty acid and protein synthesis ✓ Assists in the formation of molecules needed for cellular hormonal messaging ✓ Works w/ calcium in neuromuscular transmission and activity; calcium stimulates, and magnesium relaxes ✓ Associated w/ greater bone density, decreased hypertension, and in enhanced learning and memory 	<p>Animal: halibut, dairy and dairy products.</p> <p>Plant: dark green vegetables, nuts and seeds, raisins, legumes (beans, peas, lentils), whole cereals and whole-wheat bread, potato, cocoa, tofu prepared w/ magnesium.</p>	<ul style="list-style-type: none"> • 3rd most abundant mineral in the body. • Most magnesium (60%) is found in bones, 26% in muscle, and the rest is found in soft tissues and body fluids. • Absorption is approximately 35%-45%.
<p>Manganese</p> <p>AI (minimum): Male: 2.3 mg/d Female: 1.8 mg/d (19 - > 70 yrs.)</p>	<p>Manganese</p> <p>UL (maximum): Male: 11 mg/d Female: 11 mg/d</p>	<ul style="list-style-type: none"> ✓ Helps form connective and skeletal tissues ✓ Involved in growth and reproduction ✓ Activates many enzymes ✓ Essential for proper macronutrient metabolism ✓ Stimulates detoxification of free radicals 	<p>Animal: animal foods are poor sources.</p> <p>Plants: whole grains, legumes, nuts and seeds, fruits (blueberries) and vegetables (beet greens), negligible amounts in coffee and tea.</p>	<ul style="list-style-type: none"> • Completes with iron and cobalt for absorption. • Men absorb less manganese than women.
<p>Molybdenum</p> <p>RDA (minimum): Male: 45 mcg/d Female: 45 mcg/d (19 - > 70 yrs.)</p>	<p>Molybdenum</p> <p>UL (maximum): Male: 2,000 mcg/d Female: 2,000 mcg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Component of several enzymes involved in important homeostatic functions 	<p>Animal: dairy and dairy products,</p> <p>Plant: legumes, whole grain cereals, dark green leafy vegetables.</p>	<ul style="list-style-type: none"> • Molybdenum deficiencies are rare but when arise, are severe, including severe neurological damage.
<p>Nickel</p> <p>RDA/AI (minimum): Male: Undetermined Female: Undetermined (19 - > 70 yrs.)</p>	<p>Nickel</p> <p>UL (maximum): Male: 1.0 mg/d Female: 1.0 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ No essential metabolic role defined other than the ability to substitute for missing minerals 	<p>Animal: Fish, dairy and dairy product, eggs</p> <p>Plant: nuts, legumes (beans, peas, lentils), whole grains, cocoa, fruits & vegetables.</p>	<ul style="list-style-type: none"> • Nickel can substitute for magnesium, zinc, iron, and copper in some reactions.

<p>Phosphorous</p> <p>RDA (minimum): Male: 700 g/d Female: 700 g/d (19 - > 70 yrs.)</p>	<p>Phosphorous</p> <p>UL (maximum): Male: 4 g/d (<70 yrs.) 3 g/d (>70 yrs.) Female: 4 g/d (< 70 yrs.) 3 g/d (>70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Builds & protects bones and teeth ✓ Part of DNA & RNA for genetic expression ✓ Enzyme activation & deactivation ✓ Helps convert food into energy ✓ Buffer system for acid/base balance ✓ Maintains cellular structure, are cellular secondary messengers, and help shuttle nutrients in and out of cells 	<p>Animal: dairy and dairy products, meat, poultry, fish, eggs (yolk), liver</p> <p>Plant: nuts, legumes (beans, peas, lentils), whole grain cereals and grains, broccoli and cauliflower, potatoes</p> <p>Other: food additives, soda</p>	<ul style="list-style-type: none"> • Ranks 2nd to calcium in abundance in human tissue. • Absorption for adults is 60%-70%, far higher than calcium; enters blood 1 hr. after meal. • In vegetarian foods, phosphorous exists as phytate which is indigestible because humans lack the necessary digestive enzyme however, GI bacteria can digest phytates.
<p>Potassium</p> <p>AI (minimum): Male: 4.7 g/d Female: 4.7 g/d (19 - > 70 yrs.)</p>	<p>Potassium</p> <p>UL (maximum): Undetermined (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Major action of intracellular fluid ✓ Along with sodium, responsible for maintaining water balance, osmotic equilibrium, and acid-base balance. ✓ Along with calcium, regulates neuromuscular activity ✓ Along with sodium, determines membrane potentials in nerve and muscle ✓ Promotes cellular growth ✓ Needed for muscle formation ✓ Helps maintain steady heartbeat and sends nerve impulses needed for muscle contractions 	<p>Animal: fresh meat, dairy and dairy products.</p> <p>Plant: Most fruits and vegetables, legumes, nuts and seeds, cocoa.</p>	<ul style="list-style-type: none"> • A deficiency resulting in hypertension and cardiac arrhythmias is hypothesized to be from poor fruit and vegetable intake.
<p>Selenium</p> <p>RDA (minimum): Male: 55 mcg/d Female: 55 mcg/d (19 - > 70 yrs.)</p>	<p>Selenium</p> <p>UL (maximum): Male: 400 mcg/d Female: 400 mcg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Exists in several proteins in the body. ✓ Main component of glutathione peroxidase, an enzyme found in almost all cells that acts as an antioxidant ✓ Involved in iodine metabolism 	<p>Animal: seafood, liver, beef, poultry, eggs, milk.</p> <p>Plant: Brazil nuts, grains, wheat germ, sunflower seeds, asparagus, onions.</p>	<ul style="list-style-type: none"> • Interestingly, absorption is more efficient under deficiency; increased intake frequently results in increased excretion. • Content in food is dependent on level in soil.

<p>Silicon</p> <p>RDA/AI (minimum): Male: Undetermined Female: Undetermined (19 - > 70 yrs.)</p>	<p>Silicon</p> <p>UL (maximum): Undetermined (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Essential for normal formation, growth, and development of bone, connective tissue and cartilage 	<p>Animal: poor silicon source.</p> <p>Plant: whole-grain cereals, root vegetables, water.</p>	<ul style="list-style-type: none"> • Silicon is second to oxygen in earth-wide abundance; quartz (crystallized silica) is the most abundant mineral in the earth's crust.
<p>Sodium</p> <p>AI (minimum): Male: 1.5 g/d (<51 yrs.) 1.3 g/d (51-70 yrs.) 1.2 g/d (>70 yrs.) Female: 1.5 g/d (<51 yrs.) 1.3 g/d (51-70 yrs.) 1.2 g/d (>70 yrs.)</p>	<p>Sodium</p> <p>UL (maximum): Male: 2.3 g/d Female: 2.3 g/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Major cation of extracellular fluid (ECF), regulates ECF and plasma ✓ Component of bile and pancreatic juice ✓ Component of the skeleton ✓ Important for neuromuscular function and maintenance of acid-base balance ✓ Facilitates transport of glucose, amino acids, and other nutrients into the cell. ✓ Contributes to hypertension (elevated BP); even modest reductions in salt consumption can lower BP 	<p>Animal: small amounts naturally occurring in meat</p> <p>Plant: sea salt, small but negligible amounts in fruits and vegetables</p>	<ul style="list-style-type: none"> • Although an important electrolyte, needs may be as low as 200 mg/d.
<p>Sulfur</p> <p>RDA/AI (minimum): Male: Undetermined Female: Undetermined (19 - > 70 yrs.)</p>	<p>Sulfur</p> <p>UL (maximum): Undetermined (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Component of connective tissue ✓ Component of amino acids (cysteine, cysteine, methionine) ✓ Component of heparin (anticoagulant) ✓ Component of bone & cartilage ✓ Component of vitamin's: thiamin, biotin, and pantothenic acid ✓ Provides structure for the activation of enzymes, protein, and the hormone insulin 	<p>Animal: meat, poultry, fish, eggs, dairy and dairy products.</p> <p>Plant: nuts, legumes (beans, peas, lentils), broccoli and cauliflower.</p>	<ul style="list-style-type: none"> • Sulfur deficiency or toxicity is rare; adequacy is related to protein intake.
<p>Vanadium</p> <p>RDA/AI (minimum): Male: Undetermined Female: Undetermined (19 - > 70 yrs.)</p>	<p>Vanadium</p> <p>UL (maximum): Male: 1.8 mg/d Female: 1.8 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Primary pharmacological effects - inhibits and stimulates several metabolic processes ✓ Mimics the action of insulin by stimulating cellular glucose uptake, enhances glucose metabolism, and inhibits lipolysis (fat break down) 	<p>Animal: shellfish, oysters.</p> <p>Plant: oils, black pepper, parsley, dill seed, apple juice, mushrooms, grains and cereals.</p>	<ul style="list-style-type: none"> • Can substitute for other minerals in the body such as zinc, copper, and iron.

<p style="text-align: center;">Zinc</p> <p>RDA (minimum): Male: 11 mg/d Female: 8 mg/d (19 - > 70 yrs.)</p>	<p style="text-align: center;">Zinc</p> <p>UL (maximum): Male: 40 mg/d Female: 40 mg/d (19 - > 70 yrs.)</p>	<ul style="list-style-type: none"> ✓ Intracellular ion (+/- charged) ✓ Component of several proteins ✓ Functions in over 300 enzymes in metabolism of all macronutrients ✓ Fundamental to central nervous system functioning ✓ Involved in transport processes and immune function ✓ Stabilizes RNA and DNA in genetic expression ✓ Involved in taste and smell ✓ Bone health and wound healing ✓ Delays the progression of age-related macular degeneration 	<p>Animal: Beef, pork, fish, shellfish, poultry, dairy and dairy products.</p> <p>Plants: fortified cereals, wheat bran, soy, dry beans, nuts, raisins.</p>	<ul style="list-style-type: none"> • Functions in association with over 300 enzymes. • Competes with calcium, iron, copper, and cadmium for absorption, phytates and fiber decrease absorption. • Absorption enhanced by glucose, lactose, and soy.
---	---	---	---	--