

# 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  $\geq 19$  years,  $\geq 51$  years, and  $\geq 70$  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...?
<b>Vitamin A</b>  <b>RDA (minimum):</b> <b>Male:</b> 900 mcg/d <b>Female:</b> 700 mcg/d (19 - >70 yrs.)	<b>Vitamin A</b>  <b>UL (maximum):</b> <b>Male:</b> 3000 mcg/d <b>Female:</b> 3000 mcg/d (19 - >70 yrs.)	<ul style="list-style-type: none"> <li>✓ Vision health</li> <li>✓ Immunity</li> <li>✓ Hormone for gene expression &amp; regulation</li> <li>✓ Cell differentiation and recognition</li> <li>✓ Reproduction</li> <li>✓ Growth and development (including bone development &amp; tooth formation)</li> <li>✓ Carotenoids act as antioxidants</li> </ul>	<b>Animal (Retinoids):</b> beef, egg yolk, fish, fortified milk, shrimp, turkey.  <b>Plant (Carotenoids):</b> apricots, broccoli, Brussel sprouts, carrots, cantaloupe, mango, orange juice, peaches, pumpkin, sweet potatoes, squash, spinach, tomato, turnip greens.	<ul style="list-style-type: none"> <li>• Deeper colors of fruits and vegetables are associated w/ higher levels of carotenoids.</li> <li>• Excessive intake of retinoids (&gt;100x RDA) can be toxic leading to liver disease.</li> <li>• Adequate intake of foods containing forms of vitamin A is adequate to meet nutritional needs.</li> </ul>
<b>Vitamin D (Calciferol)</b>  <b>RDA (minimum):</b> <b>Male:</b> 15 mcg/d (19 - > 70 yrs.) <b>Female:</b> 15 mcg/d (< 70 yrs.) 20 mcg/d (> 70 yrs.) (19 - > 70 yrs.)  <b>1 mcg/d = 40 IU</b>	<b>Vitamin D (Calciferol)</b>  <b>UL (maximum):</b> <b>Male:</b> 100 mcg/d <b>Female:</b> 100 mcg/d (19 - > 70 yrs.)  <b>1 mcg/d = 40 IU</b>	<ul style="list-style-type: none"> <li>✓ Prohormone that performs as a steroid hormone</li> <li>✓ Gene transcription &amp; regulation</li> <li>✓ Growth &amp; development</li> <li>✓ Formation &amp; maintenance of bones &amp; teeth</li> <li>✓ Absorption &amp; metabolism of the mineral's calcium &amp; phosphorus</li> <li>✓ Anti-inflammatory</li> <li>✓ Reduces insulin resistance</li> </ul>	<b>Animal (D<sub>3</sub>):</b> fortified dairy (milk, yogurt, cheese, etc.), salmon, mackerel, tuna, sardines, liver, egg yolk.  <b>Plant (D<sub>2</sub>):</b> Fortified OJ, fortified cereals.  <b>Sunshine!</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Intake of vitamin D food sources and adequate weekly sunlight is sufficient for most people to synthesize their own vitamin D.</li> </ul>
<b>Vitamin E</b>  <b>RDA (minimum):</b> <b>Male:</b> 15 mg/d <b>Female:</b> 15 mg/d (19 - > 70 yrs.)	<b>Vitamin E</b>  <b>UL (maximum):</b> <b>Male:</b> 1,000 mg/d <b>Female:</b> 1,000 mg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Most important fat-soluble antioxidant</li> <li>✓ May prevent oxidative damage of unsaturated fatty acids and vitamin A</li> <li>✓ Red blood cell integrity</li> <li>✓ Skin health</li> <li>✓ Hormone synthesis</li> </ul>	<b>Animal:</b> milk, egg yolk, flounder.  <b>Plant:</b> plant oils, wheat germ, nuts, apricots, leafy greens, asparagus, fortified cereals.	<ul style="list-style-type: none"> <li>• The antioxidant actions of vitamin E can decline without adequate zinc, copper, selenium and manganese.</li> <li>• 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.</li> </ul>

<b>Vitamin K</b>  <b>AI (minimum):</b> <b>Male:</b> 120 mcg/d <b>Female:</b> 90 mcg/d (19 - > 70 yrs.)	<b>Vitamin K</b>  <b>UL (maximum):</b> Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Blood clotting</li> <li>✓ Bone formation</li> <li>✓ Regulation of enzymes (many for the brain)</li> <li>✓ Assists in binding calcium</li> <li>✓ Regulation of inflammatory processes</li> </ul>	<b>Animal:</b> dairy, eggs, turkey.  <b>Plant:</b> leafy greens, broccoli, asparagus, cabbage, green beans, carrots, avocado.	<ul style="list-style-type: none"> <li>• K<sub>1</sub> is synthesized by green plants.</li> <li>• K<sub>2</sub> is synthesized by intestinal bacteria that accounts for ½ of vitamin K needs.</li> <li>• K<sub>3</sub> is a synthetic form of vitamin K.</li> <li>• If you take an anticoagulant, keep your vitamin K intake consistent.</li> <li>• As with all fat-soluble vitamins, large doses, especially K<sub>3</sub>, can be toxic, but this is rare with vitamin K.</li> <li>• Adequate intake with foods should be sufficient as the microbiome can synthesize vitamin K.</li> </ul>
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# Water-Soluble Vitamins

RDA/AI	UL	FUNCTIONS	FOOD SOURCES	DID YOU KNOW...?
<b>Vitamin C</b>  <b>RDA (minimum):</b> <b>Male:</b> 90 mg/d <b>Female:</b> 75 mg/d (19 - > 70 yrs.)	<b>Vitamin C</b>  <b>UL (maximum):</b> <b>Male:</b> 2,000 mg/d <b>Female:</b> 2,000 mg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Collagen (<i>connective tissue that knits together wounds and supports blood vessels</i>) synthesis</li> <li>✓ Carnitine (<i>Metabolism of fatty acids</i>) synthesis</li> <li>✓ Metabolism of some amino acids</li> <li>✓ Folate metabolism and iron absorption</li> <li>✓ Antioxidant and immune support</li> <li>✓ Forms the neurotransmitters serotonin and norepinephrine</li> <li>✓ Maintains proper lung function</li> </ul>	<b>Animal:</b> organ meats  <b>Plant:</b> citrus fruits (orange, grapefruit, etc.), strawberries, mango, cantaloupe, broccoli, bell peppers, spinach, tomatoes, Brussels sprouts, kale.	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Sodium bicarbonate added to cooked vegetables to preserve and improve color, destroys vitamin C.</li> <li>• Excessively high doses of vitamin C can contribute to kidney stones due to the oxalates produced from the metabolism of vitamin C.</li> </ul>
<b>Thiamin (B<sub>1</sub>)</b>  <b>RDA (minimum):</b> <b>Male:</b> 1.2 mg/d <b>Female:</b> 1.1 mg/d (19 - > 70 yrs.)	<b>Thiamin (B<sub>1</sub>)</b>  <b>UL (maximum):</b> Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Coenzyme for energy production</li> <li>✓ Carbohydrate metabolism</li> <li>✓ Neurological function</li> <li>✓ Needed for healthy skin, hair, muscles, and brain</li> </ul>	<b>Animal:</b> Liver, pork chop, ham, tuna.  <b>Plant:</b> Yeast, whole-grain cereal grains, sunflower seeds, green peas, watermelons, acorn squash.	<ul style="list-style-type: none"> <li>• Thiamin is in many foods but in low concentrations.</li> <li>• 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.</li> </ul>
<b>Riboflavin (B<sub>2</sub>)</b>  <b>RDA (minimum):</b> <b>Male:</b> 1.3 mg/d <b>Female:</b> 1.1 mg/d (19 - > 70 yrs.)	<b>Riboflavin (B<sub>2</sub>)</b>  <b>UL (maximum):</b> Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Coenzyme</li> <li>✓ Essential for metabolism of all macronutrients</li> <li>✓ Supports antioxidant processes</li> <li>✓ Needed for healthy skin, hair, blood, and brain</li> </ul>	<b>Animal:</b> beef liver, pork, dark meat chicken, dairy (milk, yogurt, cottage cheese, etc.), clams, eggs.  <b>Plant:</b> leafy greens (spinach, etc.), broccoli, banana, whole grains, enriched grains and fortified cereals.	<ul style="list-style-type: none"> <li>• Riboflavin is found in many foods bound to proteins.</li> <li>• 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.</li> </ul>

<b>Niacin (B<sub>3</sub>)</b>  <b>RDA (minimum):</b> <b>Male:</b> 16 mg/d <b>Female:</b> 14 mg/d (19 - > 70 yrs.)	<b>Niacin (B<sub>3</sub>)</b>  <b>UL (maximum):</b> <b>Male:</b> 35 mg/d <b>Female:</b> 35 mg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Essential for cellular energy production and metabolism</li> <li>✓ Coenzyme for the metabolism of all macronutrients</li> <li>✓ Essential for healthy skin, blood cells, brain, and nervous system</li> </ul>	<b>Animal:</b> poultry (chicken, etc.), fish (tuna, etc.), beef, milk and eggs (excellent sources of tryptophan which can be converted to niacin)  <b>Plant:</b> whole and fortified grains and cereals, mushrooms, peanuts, yeast.	<ul style="list-style-type: none"> <li>• Niacin can also be made by your body from the amino acid tryptophan, with the help of Vitamin B<sub>6</sub>.</li> <li>• 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.</li> </ul>
<b>Pantothenic Acid (B<sub>5</sub>)</b>  <b>AI (minimum):</b> <b>Male:</b> 5 mg/d <b>Female:</b> 5 mg/d (19 - > 70 yrs.)	<b>Pantothenic Acid (B<sub>5</sub>)</b>  <b>UL (maximum):</b> Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Coenzyme for energy production and fatty acid synthesis.</li> <li>✓ Helps make neurotransmitters, steroid hormones, and hemoglobin.</li> </ul>	<b>Animal:</b> chicken, salmon, egg yolks, milk and yogurt.  <b>Plant:</b> whole and fortified grains, broccoli, avocado, mushrooms, corn, sweet potatoes, banana, tomato products.	<ul style="list-style-type: none"> <li>• B<sub>6</sub> is found in a variety of foods and a deficiency is rare.</li> <li>• Deficiency causes tingling and burning sensations in the feet, depression, fatigue, insomnia, and weakness.</li> </ul>
<b>Vitamin B<sub>6</sub></b>  <b>RDA (minimum):</b> <b>Male:</b> 1.3 mg/d (< 51 yrs.) 1.7 mg/d (> 51 yrs.) <b>Female:</b> 1.3 mg/d (< 51 yrs.) 1.5 mg/d (> 51 yrs.)	<b>Vitamin B<sub>6</sub></b>  <b>UL (maximum):</b> <b>Male:</b> 100 mg/d <b>Female:</b> 100 mg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Coenzyme in the metabolism of amino acids.</li> <li>✓ Cofactor for the synthesis or catabolism or neurotransmitters such as the synthesis of serotonin, epinephrine and norepinephrine.</li> <li>✓ Assists in metabolism of glucose from glycogen</li> <li>✓ Required for the conversion of tryptophan to niacin.</li> </ul>	<b>Animal:</b> chicken, pork, beef, tuna.  <b>Plant:</b> whole-grain wheat, vegetables, nuts, potatoes, banana, sunflower seeds, avocados, legumes, tofu and other soy products.	<ul style="list-style-type: none"> <li>• A riboflavin deficiency can reduce vitamin B<sub>6</sub> coenzyme functions.</li> <li>• B<sub>6</sub> derived from animal sources tends to be more bioavailable (absorbed more).</li> </ul>

<b>Cobalamin (B<sub>12</sub>)</b>  <b>RDA (minimum):</b> <b>Male:</b> 2.4 mcg/d <b>Female:</b> 2.4 mcg/d (19 - > 70 yrs.)	<b>Cobalamin (B<sub>12</sub>)</b>  <b>UL (maximum):</b> Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Coenzyme for the metabolism of amino acids and other nutrients</li> <li>✓ Essential for metabolism of cells in the GI, bone marrow, and nervous tissue</li> </ul>	<b>Animal:</b> beef, clams, oysters, crab, tuna, halibut, beef, pork, dairy (milk, yogurt, cottage cheese), eggs.  <b>Plant:</b> Brewer's yeast, fortified cereals, fortified soymilk	<ul style="list-style-type: none"> <li>• In well-nourished individuals, vitamin B<sub>12</sub> is stored in the liver for 5-7 yrs.</li> <li>• Vitamin B<sub>12</sub> is synthesized by bacteria in the body but has limited absorption so adequate intake of vitamin B<sub>12</sub> foods ensures levels are maintained.</li> <li>• Older adults are at risk of vitamin B<sub>12</sub> deficiency because of limited intake and declining digestion.</li> <li>• A lack of vitamin B<sub>12</sub> can cause anemia, memory loss and dementia.</li> </ul>
<b>Folate</b>  <b>RDA (minimum):</b> <b>Male:</b> 400 mcg/d <b>Female:</b> 400 mcg/d (19 - > 70 yrs.)	<b>Folate</b>  <b>UL (maximum):</b> <b>Male:</b> 1,000 mcg/d <b>Female:</b> 1,000 mcg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Coenzyme in synthesis reactions for amino acids</li> <li>✓ Synthesis and repair of DNA</li> <li>✓ Formation of red blood cells and white blood cells (immune cells)</li> <li>✓ Normal cell division in embryo development-helps prevent brain and spine birth defects when adequately consumed and/or supplemented early in pregnancy</li> </ul>	<b>Animal:</b> egg yolk.  <b>Plant:</b> 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.	<ul style="list-style-type: none"> <li>• Adequate folate and B<sub>12</sub> is necessary for healthy blood and a deficiency can cause other anemias because folate can mask a B<sub>12</sub> deficiency, which also causes anemia.</li> </ul>
<b>Biotin</b>  <b>AI (minimum):</b> <b>Male:</b> 30 mcg/d <b>Female:</b> 30 mcg/d (19 - > 70 yrs.)	<b>Biotin</b>  <b>UL (maximum):</b> <b>Male:</b> 1,000 mcg/d <b>Female:</b> 1,000 mcg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Assists in the metabolisms of folic acid, pantothenic acid, and vitamin B<sub>12</sub>.</li> <li>✓ Component of enzymes for synthesizing glucose and fatty acid formation and break down</li> <li>✓ Healthy bones and hair</li> </ul>	<b>Animal:</b> milk, yogurt, eggs.  <b>Plant:</b> soy, peanuts, almonds, sweet potatoes.	<ul style="list-style-type: none"> <li>• Some biotin is made by bacteria in the GI tract however, it's not clear how much of this the body absorbs.</li> <li>• Avidin, found in raw egg whites, impairs biotin absorption.</li> </ul>

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

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



<b>Chloride</b>  <b>AI (minimum):</b> <b>Male:</b> 2.3 g/d (19-50 yrs.) 2.0 g/d (51-70 yrs.) 1.8 g/d (>70 yrs.) <b>Female:</b> 2.3 g/d (19-50 yrs.) 2.0 g/d (51-70 yrs.) 1.8 g/d (>70 yrs.)	<b>Chloride</b>  <b>UL (maximum):</b> <b>Male:</b> 3.6 g/d <b>Female:</b> 3.6 g/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Primary anion (Cl<sup>-</sup>)</li> <li>✓ Component of gastric hydrochloric acid that is essential to digestion</li> <li>✓ Maintains electrolyte balance</li> <li>✓ Maintains pH balance</li> <li>✓ Assists in enzyme activation</li> </ul>	<b>Animal:</b> Meat, seafood, dairy and dairy products, eggs.  <b>Plant:</b> Salt (sodium chloride).	<ul style="list-style-type: none"> <li>• Most abundant anion (negative charge) in the extracellular fluid that neutralizes the positive charge of sodium (Na<sup>+</sup>).</li> </ul>
<b>Chromium</b>  <b>AI (minimum):</b> <b>Male:</b> 35 mcg/d (<51 yrs.) 30 mcg/d (>51 yrs.) <b>Female:</b> 25 mcg/d (<51 yrs.) 20 mcg/d (>51 yrs.)	<b>Chromium</b>  <b>UL (maximum):</b> Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Influences the action of insulin and improves glucose metabolism</li> <li>✓ Involved in the metabolism of all macronutrients</li> <li>✓ Can minimize oxidative stress</li> <li>✓ Regulates gene expression</li> </ul>	<b>Animal:</b> seafood such as oysters, liver, beef, poultry, cheese.  <b>Plant:</b> brewer's yeast, potatoes, bran and whole grains, broccoli, grape juice, OJ, garlic, apple, banana.	<ul style="list-style-type: none"> <li>• Absorption is increased by oxalates where other minerals have decreased absorption with oxalates.</li> <li>• Chromium deficiency results in insulin deficiency and lipid abnormalities.</li> </ul>
<b>Cobalt</b>  <b>RDA/AI (minimum):</b> <b>Male:</b> Undetermined <b>Female:</b> Undetermined (19 - > 70 yrs.)	<b>Cobalt</b>  <b>UL (maximum):</b> Undetermined (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Component of vitamin B<sub>12</sub></li> <li>✓ Essential for the maturation of red blood cells and the normal function of all cells</li> <li>✓ Component of an enzyme needed for DNA and RNA translation</li> </ul>	<b>Animal:</b> obtained through vitamin B <sub>12</sub> foods found in animal foods such as liver, oysters, clams, poultry, dairy and dairy products.  <b>Plant:</b> soil remaining on some vegetables.	<ul style="list-style-type: none"> <li>• Most of the cobalt found in the body is found with vitamin B<sub>12</sub> stores in the liver therefore, a cobalt deficiency accompanies a vitamin B<sub>12</sub> deficiency.</li> </ul>
<b>Copper</b>  <b>RDA (minimum):</b> <b>Male:</b> 900 mcg/d <b>Female:</b> 900 mcg/d (19 - > 70 yrs.)	<b>Copper</b>  <b>UL (maximum):</b> <b>Male:</b> 10,000 mcg/d <b>Female:</b> 10,000 mcg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Constituent of blood and assists in red blood cell formation</li> <li>✓ Component of important enzymes such as in bone marrow and in forming connective tissue (collagen, elastin)</li> <li>✓ Component of proteins involved in energy production</li> <li>✓ Antioxidant properties</li> <li>✓ Promotes the synthesis of melanin (skin pigment), and hormones</li> </ul>	<b>Animal:</b> liver, shellfish, organ meats.  <b>Plant:</b> cocoa, nuts, whole cereal grains, legumes, dried fruits, cherries, OJ, mushrooms, sunflower seeds, cashews.	<ul style="list-style-type: none"> <li>• Competes with zinc for absorption.</li> <li>• Phytates, and fiber as well as high vitamin C intake can inhibit absorption.</li> <li>• Higher levels are found in women than in men.</li> </ul>

<b>Fluoride</b>  <b>AI (minimum):</b> <b>Male:</b> 4 mg/d <b>Female:</b> 3 mg/d (19 - > 70 yrs.)	<b>Fluoride</b>  <b>UL (maximum):</b> <b>Male:</b> 10 mg/d <b>Female:</b> 10 mg/d (19 - > 70 yrs.)	✓ Encourages strong bone and teeth formation and maintains bone health.	<b>Animal:</b> saltwater fish, soups and stews made with fish and meat bones.  <b>Plant:</b> rice, soybeans, spinach, onions, lettuce, water that is fluoridated, tea leaves.	<ul style="list-style-type: none"> <li>Found in nearly all drinking water and soil.</li> <li>Harmful to children in excessive amounts</li> </ul>
<b>Iodine</b>  <b>RDA (minimum):</b> <b>Male:</b> 150 mcg/d <b>Female:</b> 150 mcg/d (19 - > 70 yrs.)	<b>Iodine</b>  <b>UL (maximum):</b> <b>Male:</b> 1,100 mcg/d <b>Female:</b> 1,100 mcg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Needed for the synthesis of thyroid hormones such as T<sub>3</sub> and T<sub>4</sub> which helps set body temperature and influences nerve and muscle function, reproduction, and growth.</li> <li>✓ Prevents goiter (enlargement of the thyroid gland) and a congenital thyroid disorder.</li> </ul>	<b>Animal:</b> 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).  <b>Plant:</b> vegetables (variable levels depending on soil), iodized salt.	<ul style="list-style-type: none"> <li>More than 75% of the body's iodine is found in the thyroid gland.</li> <li>Goitrogens (found naturally in foods such as cabbage, turnips, rapeseed, peanuts, cassava, sweet potatoes, kelp, and soybeans) can inhibit iodide uptake.</li> </ul>
<b>Iron</b>  <b>RDA (minimum):</b> <b>Male:</b> 8 mg/d (>19 yrs.) <b>Female:</b> 18 mg/d (<50 yrs.) 8 mg/d (>51 yrs.)	<b>Iron</b>  <b>UL (maximum):</b> <b>Male:</b> 45 mg/d <b>Female:</b> 45 mg/d (19 - > 70 yrs.)	<ul style="list-style-type: none"> <li>✓ Highly reactive-oxidation and reduction reactions in metabolism</li> <li>✓ Involved in red blood cell (carry oxygen to bodily tissues) formation and myoglobin (muscle reservoir of oxygen) activity - transports oxygen and carbon dioxide</li> <li>✓ Involved in cellular respiration and energy generation</li> <li>✓ Involved in heme and nonheme enzymes</li> <li>✓ Necessary for proper immune function</li> <li>✓ Needed for cognitive performance (brain cells need iron)</li> <li>✓ Synthesizes neurotransmitters (chemical messengers)</li> </ul>	<b>Animal:</b> Liver, seafood (shrimp, oysters), lean red meat, poultry, eggs (yolk).  <b>Plant:</b> dried beans and lentils, dried fruit, molasses, spinach, whole-grains, soy, peanuts, enriched bread and grain products.	<ul style="list-style-type: none"> <li>Iron deficiency anemia is the world's most common nutrient deficiency.</li> <li>Women store lower amounts of iron than men.</li> <li>Vitamin C in plant foods and amino acids found in beef, pork, lamb, seafood, and poultry enhance absorption.</li> <li>Heme iron is found predominantly in animal foods and non-heme iron is found in plant foods.</li> <li>Vegans may need to supplement with iron to meet needs.</li> </ul>

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

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

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

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