

# Micronutrients for Health

Listed below are all the vitamins and nutritionally essential minerals and their functions, some common dietary sources, and the intake recommendations set by the Institute of Medicine. The Linus Pauling Institute's recommendations are noted when different. All recommendations are for adults 19 years and older and expressed in micrograms ( $\mu\text{g}$ ), milligrams (mg), or International Units (IU).

MICRONUTRIENT AND FUNCTION	COMMON DIETARY SOURCES	DAILY INTAKE RECOMMENDATIONS
<b>Vitamin A (Retinol)</b> <ul style="list-style-type: none"> <li>Essential for normal vision and immune function</li> <li>Needed for cell growth and development</li> <li>Carotenoids like <math>\beta</math>-carotene can be converted to vitamin A by the liver as needed</li> </ul>	<i>Retinol</i> : beef liver, fortified cereal, eggs, butter, fortified milk  <i><math>\beta</math>-Carotene</i> : sweet potatoes, pumpkins, carrots, cantaloupes, mangoes, spinach, broccoli, kale, collards, butternut squash	Men: 900 $\mu\text{g}$ RAE* Women: 700 $\mu\text{g}$ RAE Pregnancy: 770 $\mu\text{g}$ RAE Breast-feeding: 1,300 $\mu\text{g}$ RAE  *Retinol Activity Equivalents
<b>Thiamin (Vitamin B<sub>1</sub>)</b> <ul style="list-style-type: none"> <li>Assists the release of energy from carbohydrates and protein</li> </ul>	Fortified cereal, bread, pork, enriched white rice, brown rice, peas, macadamia nuts, sunflower seeds, beans, lentils, cantaloupes	Men: 1.2 mg Women: 1.1 mg Pregnancy: 1.4 mg Breast-feeding: 1.4 mg
<b>Riboflavin (Vitamin B<sub>2</sub>)</b> <ul style="list-style-type: none"> <li>Assists the release of energy from fat, carbohydrates, and protein</li> <li>Assists several antioxidant enzymes</li> </ul>	Milk, fortified cereal, bread, eggs, almonds, clams, spinach, chicken, beef, asparagus, salmon, cheese, broccoli	Men: 1.3 mg Women: 1.1 mg Pregnancy: 1.4 mg Breast-feeding: 1.6 mg
<b>Niacin (Vitamin B<sub>3</sub>)</b> <ul style="list-style-type: none"> <li>Assists the release of energy from fat, carbohydrates, and protein</li> </ul>	Fortified cereal, bread, fish, light-meat chicken and turkey, beef, mushrooms, peanuts, avocados	Men: 16 mg Women: 14 mg Pregnancy: 18 mg Breast-feeding: 17 mg
<b>Pantothenic Acid (Vitamin B<sub>5</sub>)</b> <ul style="list-style-type: none"> <li>Assists the release of energy from fat, carbohydrates, and protein</li> <li>Assists fat, cholesterol, steroid hormones, and hemoglobin synthesis</li> </ul>	Avocados, yogurt, chicken, sweet potatoes, milk, lentils, eggs, peas, mushrooms, fish, broccoli	Adults: 5 mg Pregnancy: 6 mg Breast-feeding: 7 mg
<b>Vitamin B<sub>6</sub></b> <ul style="list-style-type: none"> <li>Supports a wide variety of metabolic reactions</li> <li>Assists neurotransmitters, hemoglobin, and DNA production</li> <li>Influences steroid hormone action</li> </ul>	Turkey, chicken, fortified cereal, bread, potatoes (with skin), fish, prunes, bananas, hazelnuts, walnuts, pork, beans	Adults: 1.3 mg Pregnancy: 1.9 mg Breast-feeding: 2.0 mg Men over 50: 1.7 mg Women over 50: 1.5 mg



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<p><b>Biotin (Vitamin B<sub>7</sub>)</b></p> <ul style="list-style-type: none"> <li>Assists the release of energy from fat, carbohydrates, and protein</li> <li>Assists in glucose production</li> </ul>	<p>Beef liver, eggs, salmon, avocados, yeast, whole-wheat bread, pork, cheese</p>	<p>Adults: 30 µg Pregnancy: 30 µg Breast-feeding: 35 µg</p>
<p><b>Folate (Vitamin B<sub>9</sub>)</b></p> <ul style="list-style-type: none"> <li>Required for DNA synthesis</li> <li>Assists red blood cell production</li> <li>Prevents neural tube defects</li> <li>Folic acid, found in supplements and fortified food, is more readily absorbed than naturally occurring folate</li> </ul>	<p><i>Folate:</i> beans, lentils, asparagus, spinach, peanuts, peas, corn, chicken, orange juice</p> <p><i>Folic Acid:</i> enriched rice or products made with enriched flours, such as cereal, pasta, or bread</p>	<p>Adults: 400 µg DFE* Pregnancy: 600 µg DFE Breast-feeding: 500 µg DFE</p> <p>*Dietary Folate Equivalents</p>
<p><b>Vitamin B<sub>12</sub></b></p> <ul style="list-style-type: none"> <li>Assists the release of energy from fat and protein</li> <li>Assists hemoglobin and red blood cell production</li> <li>Required for nerve function</li> </ul>	<p>Clams, mussels, crab meat, salmon, beef, rockfish, milk, cheese, eggs, chicken, turkey, fortified cereal</p>	<p>Adults: 2.4 µg Pregnancy: 2.6 µg Breast-feeding: 2.8 µg</p> <p><b>LPI: 100-400 µg from supplements for adults over 50</b></p>
<p><b>Vitamin C</b></p> <ul style="list-style-type: none"> <li>Antioxidant in blood and cells</li> <li>Augments functional activity of immune cells</li> <li>Assists collagen, carnitine, serotonin, and adrenaline production</li> </ul>	<p>Chili peppers, sweet peppers, guavas, kiwifruits, strawberries, oranges, kale, spinach, broccoli, grapefruit, potatoes, tomatoes</p>	<p>Men: 90 mg (125 mg*) Women: 75 mg (110 mg*) Pregnancy: 85 mg Breast-feeding: 120 mg</p> <p><b>LPI: At least 400 mg for all adults</b></p> <p>* Smokers</p>
<p><b>Vitamin D</b></p> <ul style="list-style-type: none"> <li>Maintains calcium and phosphorus balance</li> <li>Promotes bone health and immune function</li> <li>Influences cell growth and development</li> </ul>	<p><i>Dietary:</i> fish (especially salmon, tuna, herring, sardines, and mackerel), eggs, fortified soy milk, fortified orange juice, fortified milk, fortified cereal</p> <p><i>Sunlight:</i> influenced by season, latitude, skin pigmentation, area of skin exposed, sunscreen use, and age</p>	<p>Adults: 600 IU Pregnancy: 600 IU Breast-feeding: 600 IU Adults over 70: 800 IU</p> <p><b>LPI: 2,000 IU from supplements for all adults</b></p>
<p><b>Vitamin E</b></p> <ul style="list-style-type: none"> <li>Antioxidant in cell membranes</li> <li>Supports normal nerve function</li> <li>Augments functional activity of immune cells</li> </ul>	<p>Olive oil, safflower oil, sunflower oil, almonds, hazelnuts, peanuts, spinach, carrots, avocados</p>	<p>Adults: 22.5 IU Pregnancy: 22.5 IU Breast-feeding: 28.5 IU</p>

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<b>Vitamin K</b> <ul style="list-style-type: none"> <li>Assists in blood clotting</li> <li>Modifies certain proteins to allow for calcium binding</li> </ul>	Kale, chard, parsley, broccoli, spinach, watercress, leaf lettuce, cashews, peas, soybean oil, canola oil, olive oil, mayonnaise, naturally fermented food	Men: 120 µg Women: 90 µg Pregnancy: 90 µg Breast-feeding: 90 µg
<b>Calcium</b> <ul style="list-style-type: none"> <li>Structural component of bones and teeth</li> <li>Required for proper nerve transmission and muscle contraction</li> <li>Influences blood vessel constriction and dilation, and may reduce blood pressure</li> </ul>	Milk, yogurt, cheese, tofu (calcium set), fortified beverages, fortified cereal, rhubarb, spinach, almonds, white beans, bok choy, kale, pinto beans, red beans, broccoli	Adults: 1,000 mg Pregnancy: 1,000 mg Breast-feeding: 1,000 mg Men over 70: 1,200 mg Women over 50: 1,200 mg
<b>Chromium</b> <ul style="list-style-type: none"> <li>Assists insulin action</li> </ul>	Broccoli, grape juice, sweet potatoes, orange juice, beef, turkey, chicken, apples (with peel), green beans, tomatoes, bananas	Men: 35 µg Men over 50: 30 µg Women: 25 µg Pregnancy: 30 µg Breast-feeding: 45 µg Women over 50: 20 µg
<b>Copper</b> <ul style="list-style-type: none"> <li>Assists in energy production and iron utilization</li> <li>Assists in neurotransmitter synthesis</li> <li>Maintains integrity of connective tissue</li> <li>Assists antioxidant enzymes</li> </ul>	Beef liver, oysters, crab meat, clams, sunflower seeds, kale, cashews, lentils, beans, mushrooms, cocoa powder, raisins, peanut butter	Adults: 900 µg Pregnancy: 1,000 µg Breast-feeding: 1,300 µg
<b>Fluoride</b> <ul style="list-style-type: none"> <li>Structural component of bones and teeth</li> </ul>	Fluoridated water, crab meat, beans, black tea, raisins, cereal, fish, fruit juice	Men: 4 mg Women: 3 mg Pregnancy: 3 mg Breast-feeding: 3 mg
<b>Iodine</b> <ul style="list-style-type: none"> <li>Component of thyroid hormones</li> </ul>	Cod, iodized salt, potatoes (with skin), milk, shrimp, turkey, navy beans, tuna, eggs, seaweed	Adults: 150 µg Pregnancy: 220 µg Breast-feeding: 290 µg
<b>Iron</b> <ul style="list-style-type: none"> <li>Component of hundreds of enzymes</li> <li>Needed for synthesis of hemoglobin</li> <li>Assists antioxidant enzymes</li> <li>Required for synthesis of DNA, amino acids, collagen, neurotransmitters, and certain hormones</li> <li>Critical for normal immune function</li> </ul>	Beef, fortified cereal, beans, oysters, molasses, lentils, firm tofu, kidney beans, cashews, spinach, potatoes (with skin), shrimp, light tuna, eggs, tomatoes, dark-meat chicken and turkey, raisins, prunes	Men: 8 mg* Women: 18 mg Pregnancy: 27 mg Breast-feeding: 9 mg Adults over 50: 8 mg*  *Men and postmenopausal women should avoid taking iron-containing supplements.
<b>Magnesium</b> <ul style="list-style-type: none"> <li>Structural component of bones</li> <li>Assists in hundreds of enzyme reactions involved in the synthesis of DNA and proteins</li> <li>Required for proper nerve conduction and muscle contraction</li> </ul>	Pumpkin seeds, almonds, cashews, beans, spinach, milk, figs, brown rice, cocoa powder, molasses, peanuts, pineapple, okra, milk, bananas	Men: 400 mg Men over 30: 420 mg Women: 310 mg Women over 30: 320 mg Pregnancy: 350-360 mg Breast-feeding: 310-320 mg

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<b>Manganese</b> <ul style="list-style-type: none"> <li>• Component of antioxidant enzymes</li> <li>• Facilitates bone development</li> <li>• Helps make and break down glucose and proteins</li> </ul>	Brown rice, oatmeal, spinach, pineapples, almonds, pecans, molasses, whole-wheat bread, sesame seeds, peanuts, beans, sweet potatoes, tea	Men: 2.3 mg Women: 1.8 mg Pregnancy: 2.0 mg Breast-feeding: 2.6 mg
<b>Molybdenum</b> <ul style="list-style-type: none"> <li>• Assists in the metabolism of proteins, DNA, drugs, and toxins</li> </ul>	Beans, lentils, peas, grain, nuts	Adults: 45 µg Pregnancy: 50 µg Breast-feeding: 50 µg
<b>Phosphorus</b> <ul style="list-style-type: none"> <li>• Structural component of bones and teeth</li> <li>• Structural component of DNA</li> <li>• Structural component of cell membranes</li> <li>• Assists in energy production and storage</li> </ul>	Milk, yogurt, salmon, halibut, lentils, beef, peanuts, sunflower seeds, beans, chicken, turkey, almonds, cheese, eggs, whole-wheat bread	Adults: 700 mg Pregnancy: 700 mg Breast-feeding: 700 mg
<b>Potassium</b> <ul style="list-style-type: none"> <li>• Maintains fluid and electrolyte balance</li> <li>• Required for proper nerve conduction and muscle contraction</li> <li>• Lowers blood pressure</li> </ul>	Beans, potatoes (with skin), prunes, raisins, acorn squash, bananas, spinach, tomato juice, artichokes, molasses, tomatoes, oranges	Adults: 4,700 mg Pregnancy: 4,700 mg Breast-feeding: 5,100 mg
<b>Selenium</b> <ul style="list-style-type: none"> <li>• Component of antioxidant enzymes</li> <li>• Influences thyroid hormone function</li> </ul>	Brazil nuts (from selenium-rich soil)*, crab meat, salmon, halibut, pasta, pork, shrimp, whole-wheat bread, brown rice, beef, light-meat chicken, milk, black walnuts *A single nut may exceed selenium recommendations.	Adults: 55 µg Pregnancy: 60 µg Breast-feeding: 70 µg
<b>Sodium</b> <ul style="list-style-type: none"> <li>• Maintains fluid and electrolyte balance</li> <li>• Required for proper nerve conduction and muscle contraction</li> <li>• Increases blood pressure</li> </ul>	Baked goods, processed meat, restaurant food, pizza, canned soups, table salt Most Americans consume too much sodium. The tolerable upper intake level for sodium is 2,300 mg, the amount found in one teaspoon of table salt.	Adults: 1,500 mg* Pregnancy: 1,500 mg Breast-feeding: 1,500 mg Adults over 50: 1,300 mg Adults over 70: 1,200 mg * the amount found in about 2/3 tsp of table salt
<b>Zinc</b> <ul style="list-style-type: none"> <li>• Assists in hundreds of enzyme reactions</li> <li>• Assists in hemoglobin production</li> <li>• Assists antioxidant enzymes</li> <li>• Supports immune function</li> </ul>	Oysters, beef, crab meat, dark-meat chicken and turkey, pork, yogurt, milk, cashews, chickpeas, almonds, peanuts, cheese	Men: 11 mg Women: 8 mg Pregnancy: 11 mg Breast-feeding: 12 mg