My Maintenance 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

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</table>
| **Vitamin A** | **Vitamin A** | ✓ 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. | • 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. |
| RDA (minimum): Male: 900 mcg/d  
Female: 700 mcg/d (19 - >70 yrs.) | UL (maximum): Male: 3000 mcg/d  
Female: 3000 mcg/d (19 - >70 yrs.) | | |

| **Vitamin D (Calciferol)** | **Vitamin D (Calciferol)** | ✓ 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! | • 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. |
| RDA (minimum): Male: 15 mcg/d (19 - >70 yrs.)  
Female: 15 mcg/d (< 70 yrs.)  
20 mcg/d (> 70 yrs.) (19 - > 70 yrs.) | UL (maximum): Male: 100 mcg/d  
Female: 100 mcg/d (19 - > 70 yrs.)  
1 mcg/d = 40 IU | | |

| **Vitamin E** | **Vitamin E** | ✓ 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. | • 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. |
| RDA (minimum): Male: 15 mg/d  
Female: 15 mg/d (19 - > 70 yrs.) | UL (maximum): Male: 1,000 mg/d  
Female: 1,000 mg/d (19 - > 70 yrs.) | | |
| Vitamin K Al (minimum): Male: 120 mcg/d Female: 90 mcg/d (19 - > 70 yrs.) | Vitamin K UL (maximum): Undetermined (19 - > 70 yrs.) | ✓ Blood clotting ✓ Bone formation ✓ Regulation of enzymes (many for the brain) ✓ Assists in binding calcium ✓ Regulation of inflammatory processes | Animal: dairy, eggs, turkey. Plant: leafy greens, broccoli, asparagus, cabbage, green beans, carrots, avocado. | • 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

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<td><strong>Vitamin C</strong></td>
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| **RDA (minimum):**
  Male: 90 mg/d
  Female: 75 mg/d  
  (19 - > 70 yrs.) | **UL (maximum):**
  Male: 2,000 mg/d
  Female: 2,000 mg/d  
  (19 - > 70 yrs.) | ✓ Collagen (connective tissue that knits together wounds and supports blood vessels) synthesis
✓ Carnitine (Metabolism of fatty acids) 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. | • 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.) | **UL (maximum):**
  Undetermined  
  (19 - > 70 yrs.) | ✓ 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. | • 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.) | **UL (maximum):**
  Undetermined  
  (19 - > 70 yrs.) | ✓ 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. | • 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 (angular stomatitis), and burning and itching eyes.
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<tr>
<td>Niacin (B₃)</td>
<td>Male: 16 mg/d Female: 14 mg/d (19 - &gt; 70 yrs.)</td>
<td>Male: 35 mg/d Female: 35 mg/d (19 - &gt; 70 yrs.)</td>
<td>✓ Essential for cellular energy production and metabolism ✓ Coenzyme for the metabolism of all macronutrients ✓ Essential for healthy skin, blood cells, brain, and nervous system</td>
<td>Poultry (chicken, etc.), fish (tuna, etc.), beef, milk and eggs (excellent sources of tryptophan which can be converted to niacin)</td>
<td>Whole and fortified grains and cereals, mushrooms, peanuts, yeast.</td>
<td>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.</td>
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<tr>
<td>Pantothenic Acid (B₅)</td>
<td>Male: 5 mg/d Female: 5 mg/d (19 - &gt; 70 yrs.)</td>
<td>Undetermined (19 - &gt; 70 yrs.)</td>
<td>✓ Coenzyme for energy production and fatty acid synthesis. ✓ Helps make neurotransmitters, steroid hormones, and hemoglobin.</td>
<td>Chicken, salmon, egg yolks, milk and yogurt.</td>
<td>Whole and fortified grains, broccoli, avocado, mushrooms, corn, sweet potatoes, banana, tomato products.</td>
<td>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.</td>
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<tr>
<td>Vitamin B₆</td>
<td>Male: 1.3 mg/d (&lt; 51 yrs.) 1.7 mg/d (&gt; 51 yrs.) Female: 1.3 mg/d (&lt; 51 yrs.) 1.5 mg/d (&gt; 51 yrs.)</td>
<td>Male: 100 mg/d Female: 100 mg/d (19 - &gt; 70 yrs.)</td>
<td>✓ 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.</td>
<td>Chicken, pork, beef, tuna.</td>
<td>Whole-grain wheat, vegetables, nuts, potatoes, banana, sunflower seeds, avocados, legumes, tofu and other soy products.</td>
<td>A riboflavin deficiency can reduce vitamin B₆ coenzyme functions. B₆ derived from animal sources tends to be more bioavailable (absorbed more).</td>
</tr>
<tr>
<td>Vitamin</td>
<td>RDA (minimum)</td>
<td>UL (maximum)</td>
<td>Benefits</td>
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</table>
| Cobalamin (B₁₂) | Male: 2.4 mcg/d Female: 2.4 mcg/d (19 - > 70 yrs.) | Underdetermined (19 - > 70 yrs.) | ✓ Coenzyme for the metabolism of amino acids and other nutrients  
✓ Essential for metabolism of cells in the GI, bone marrow, and nervous tissue | Animal: beef, Clams, oysters, crab, tuna, halibut, beef, pork, dairy (milk, yogurt, cottage cheese), eggs.  
Plant: Brewer’s yeast, fortified cereals, fortified soymilk | • 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. |
| Folate           | Male: 400 mcg/d Female: 400 mcg/d (19 - > 70 yrs.) | Male: 1,000 mcg/d Female: 1,000 mcg/d (19 - > 70 yrs.) | ✓ 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 | Animal: egg yolk.  
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. | • 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. |
| Biotin           | Male: 30 mcg/d Female: 30 mcg/d (19 - > 70 yrs.) | Male: 1,000 mcg/d Female: 1,000 mcg/d (19 - > 70 yrs.) | ✓ 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 | Animal: milk, yogurt, eggs.  
Plant: soy, peanuts, almonds, sweet potatoes. | • 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. |
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<tr>
<td><strong>AI (minimum):</strong>&lt;br&gt;Male: 550 mg/d&lt;br&gt;Female: 425 mg/d (19 - &gt; 70 yrs.)</td>
<td><strong>UL (maximum):</strong>&lt;br&gt;Male: 3.5 g/d&lt;br&gt;Female: 3.5 g/d (19 - &gt; 70 yrs.)</td>
<td><strong>Animal:</strong> milk, eggs, liver, beef.</td>
<td><strong>-</strong> Choline is not considered a vitamin but rather a &quot;quasi-vitamin&quot;.</td>
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<td>✓ Structural component of membranes &amp; the neurotransmitter acetylcholine (aids in nerve and brain activities)</td>
<td>✓ Component of platelet activation &amp; pulmonary surfactant</td>
<td><strong>Plant:</strong> peanuts, soybeans.</td>
<td><strong>-</strong> Although rare, signs of deficiency include dermatitis, nausea, loss of appetite, depression, and high cholesterol.</td>
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<tr>
<td>✓ Amino acid (homocysteine) metabolism</td>
<td>✓ Lipid (fat) metabolism, absorption, and transport</td>
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</table>

- 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…?
|--------|----|-----------|--------------|----------------------
**Plant:** non-citrus fruits, vegetables, nuts, and legumes, also found in wine, cider, and beer. | • The highest concentration of boron is found in bone, the spleen, and thyroid suggesting higher need in these areas. |
| **Calcium** | **Calcium** | <ul><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 with reduced obesity by inhibiting lipogenesis (building of fat tissue) and increasing lipolysis (break down of fat tissue)</li></ul> | <strong>Animal:</strong> Dairy (milk, yogurt, cheese), clams, oysters, canned sardines and salmon (bones).  
**Plant:** 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 | • 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. |

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### Chloride

**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.)

**UL (maximum):**
- **Male:** 3.6 g/d (19 - > 70 yrs.)
- **Female:** 3.6 g/d (19 - > 70 yrs.)

- Primary anion (Cl-)
- Component of gastric hydrochloric acid that is essential to digestion
- Maintains electrolyte balance
- Maintains pH balance
- Assists in enzyme activation

**Animal:** Meat, seafood, dairy and dairy products, eggs.

**Plant:** Salt (sodium chloride).

- Most abundant anion (negative charge) in the extracellular fluid that neutralizes the positive charge of sodium (Na+).

### Chromium

**AI (minimum):**
- **Male:** 35 mcg/d (<51 yrs.)
- 30 mcg/d (>51 yrs.)
- **Female:** 25 mcg/d (<51 yrs.)
- 20 mcg/d (>51 yrs.)

**UL (maximum):** Undetermined (19 - > 70 yrs.)

- Influences the action of insulin and improves glucose metabolism
- Involved in the metabolism of all macronutrients
- Can minimize oxidative stress
- Regulates gene expression

**Animal:** seafood such as oysters, liver, beef, poultry, cheese.

**Plant:** brewer's yeast, potatoes, bran and whole grains, broccoli, grape juice, OJ, garlic, apple, banana.

- Absorption is increased by oxalates where other minerals have decreased absorption with oxalates.
- Chromium deficiency results in insulin deficiency and lipid abnormalities.

### Cobalt

**RDA/AI (minimum):**
- **Male:** Undetermined
- **Female:** Undetermined (19 - > 70 yrs.)

**UL (maximum):** Undetermined (19 - > 70 yrs.)

- 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

**Animal:** obtained through vitamin B12 foods found in animal foods such as liver, oysters, clams, poultry, dairy and dairy products.

**Plant:** soil remaining on some vegetables.

- 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.
- 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.

### Copper

**RDA (minimum):**
- **Male:** 900 mcg/d
- **Female:** 900 mcg/d (19 - > 70 yrs.)

**UL (maximum):**
- **Male:** 10,000 mcg/d
- **Female:** 10,000 mcg/d (19 - > 70 yrs.)

- 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

**Animal:** liver, shellfish, organ meats.

**Plant:** cocoa, nuts, whole cereal grains, legumes, dried fruits, cherries, OJ, mushrooms, sunflower seeds, cashews.

- 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.
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| AI (minimum): Male: 4 mg/d Female: 3 mg/d (19 - > 70 yrs.) | Ul (maximum): Male: 10 mg/d Female: 10 mg/d (19 - > 70 yrs.) | - Promotes the synthesis of melanin (skin pigment), and hormones  
- Encourages strong bone and teeth formation and maintains bone health. | Animal: saltwater fish, soups and stews made with fish and meat bones.  
Plant: rice, soybeans, spinach, onions, lettuce, water that is fluoridated, tea leaves.  
- Found in nearly all drinking water and soil.  
- Harmful to children in excessive amounts |
| **Iodine** | RDA (minimum): Male: 150 mcg/d Female: 150 mcg/d (19 - > 70 yrs.) | Ul (maximum): Male: 1,100 mcg/d Female: 1,100 mcg/d (19 - > 70 yrs.) | - 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.  
- Prevents goiter (enlargement of the thyroid gland) and a congenital thyroid disorder. | 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).  
Plant: vegetables (variable levels depending on soil), iodized salt.  
- 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. |
| **Iron** | RDA (minimum): Male: 8 mg/d (>19 yrs.) Female: 18 mg/d (<50 yrs.) 8 mg/d (>51 yrs.) | Ul (maximum): Male: 45 mg/d Female: 45 mg/d (19 - > 70 yrs.) | - 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) | Animal: Liver, seafood (shrimp, oysters), lean red meat, poultry, eggs (yolk).  
Plant: dried beans and lentils, dried fruit, molasses, spinach, whole-grains, soy, peanuts, enriched bread and grain products.  
- 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. |
## Magnesium

**RDA (minimum):**
- **Male:** 400 mg/d (<31 yrs.)
- 420 mg/d (>31 yrs.)
- **Female:** 310 mg/d (<31 yrs.)
- 320 mg/d (>31 yrs.)

**UL (maximum):**
- **Male:** 350 mg/d (RDA RDAs are > UL)
- **Female:** 350 mg/d

- 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 with calcium in neuromuscular transmission and activity; calcium stimulates, and magnesium relaxes
- Associated with greater bone density, decreased hypertension, and enhanced learning and memory

**Animal:** halibut, dairy and dairy products.

**Plant:** Dark green vegetables, nuts and seeds, raisins, legumes (beans, peas, lentils), whole cereals and whole-wheat bread, potato, cocoa, tofu prepared with magnesium.

- 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%.

## Manganese

**AI (minimum):**
- **Male:** 2.3 mg/d
- **Female:** 1.8 mg/d

**UL (maximum):**
- **Male:** 11 mg/d
- **Female:** 11 mg/d

- Helps form connective and skeletal tissues
- Involved in growth and reproduction
- Activates many enzymes
- Essential for proper macronutrient metabolism
- Stimulates detoxification of free radicals

**Animal:** animal foods are poor sources.

**Plants:** whole grains, legumes, nuts and seeds, fruits (blueberries) and vegetables (beet greens), negligible amounts in coffee and tea.

- Completes with iron and cobalt for absorption.
- Men absorb less manganese than women.

## Molybdenum

**RDA (minimum):**
- **Male:** 45 mcg/d
- **Female:** 45 mcg/d

**UL (maximum):**
- **Male:** 2,000 mcg/d
- **Female:** 2,000 mcg/d

- Component of several enzymes involved in important homeostatic functions

**Animal:** dairy and dairy products,

**Plant:** legumes, whole grain cereals, dark green leafy vegetables.

- Molybdenum deficiencies are rare but when arise, are severe, including severe neurological damage.

## Nickel

**RDA/AI (minimum):**
- **Male:** Undetermined
- **Female:** Undetermined

**UL (maximum):**
- **Male:** 1.0 mg/d
- **Female:** 1.0 mg/d

- No essential metabolic role defined other than the ability to substitute for missing minerals

**Animal:** Fish, dairy and dairy product, eggs

**Plant:** nuts, legumes (beans, peas, lentils), whole grains, cocoa, fruits & vegetables.

- Nickel can substitute for magnesium, zinc, iron, and copper in some reactions.
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<tr>
<td><strong>Phosphorous</strong></td>
<td>Male: 700 g/d Female: 700 g/d (19 - &gt; 70 yrs.)</td>
<td>Male: 4 g/d (&lt;70 yrs.) 3 g/d (&gt;70 yrs.) Female: 4 g/d (&lt; 70 yrs.) 3 g/d (&gt;70 yrs.)</td>
<td>✓ Builds &amp; protects bones and teeth ✓ Part of DNA &amp; RNA for genetic expression ✓ Enzyme activation &amp; 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</td>
<td>Animal: dairy and dairy products, meat, poultry, fish, eggs (yolk), liver Plant: nuts, legumes (beans, peas, lentils), whole grain cereals and grains, broccoli and cauliflower, potatoes Other: food additives, soda</td>
<td>• 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.</td>
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<td><strong>Potassium</strong></td>
<td>Male: 4.7 g/d Female: 4.7 g/d (19 - &gt; 70 yrs.)</td>
<td>Undetermined (19 - &gt; 70 yrs.)</td>
<td>✓ 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</td>
<td>Animal: fresh meat, dairy and dairy products. Plant: Most fruits and vegetables, legumes, nuts and seeds, cocoa.</td>
<td>• A deficiency resulting in hypertension and cardiac arrhythmias is hypothesized to be from poor fruit and vegetable intake.</td>
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<td><strong>Selenium</strong></td>
<td>Male: 55 mcg/d Female: 55 mcg/d (19 - &gt; 70 yrs.)</td>
<td>Male: 400 mcg/d Female: 400 mcg/d (19 - &gt; 70 yrs.)</td>
<td>✓ 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</td>
<td>Animal: seafood, liver, beef, poultry, eggs, milk. Plant: brazil nuts, grains, wheat germ, sunflower seeds, asparagus, onions.</td>
<td>• Interestingly, absorption is more efficient under deficiency; increased intake frequently results in increased excretion. • Content in food is dependent on level in soil.</td>
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<td>Element</td>
<td>RDA/AI (minimum)</td>
<td>UL (maximum)</td>
<td>Notes</td>
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<td>Female: Undetermined (19 - &gt; 70 yrs.)</td>
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<td>Plant: whole-grain cereals, root vegetables, water.</td>
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<td>Silicon is second to oxygen in earth-wide abundance; quartz (crystallized silica) is the most abundant mineral in the earth’s crust.</td>
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<td>Sodium</td>
<td>Male: 1.5 g/d (&lt;51 yrs.) 1.3 g/d (51-70 yrs.) 1.2 g/d (&gt;70 yrs.)</td>
<td>Male: 2.3 g/d</td>
<td>Major cation of extracellular fluid (ECF), regulates ECF and plasma.</td>
<td>Animal: small amounts naturally occurring in meat.</td>
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<td>Female: 1.5 g/d (&lt;51 yrs.) 1.3 g/d (51-70 yrs.) 1.2 g/d (&gt;70 yrs.)</td>
<td>Female: 2.3 g/d (19 - &gt; 70 yrs.)</td>
<td>Component of bile and pancreatic juice.</td>
<td>Plant: sea salt, small but negligible amounts in fruits and vegetables.</td>
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<td>Component of the skeleton.</td>
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<td>Important for neuromuscular function and maintenance of acid-base balance.</td>
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<td>Facilitates transport of glucose, amino acids, and other nutrients into the cell.</td>
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<td>Contributes to hypertension (elevated BP); even modest reductions in salt consumption can lower BP.</td>
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<td>Female: Undetermined (19 - &gt; 70 yrs.)</td>
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<td>Sulfur deficiency or toxicity is rare; adequacy is related to protein intake.</td>
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<td>Component of amino acids (cysteine, cysteine, methionine).</td>
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<td>Component of heparin (anticoagulant).</td>
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<td>Component of bone &amp; cartilage.</td>
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<td>Component of vitamin’s: thiamin, biotin, and pantothenic acid.</td>
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<td>Provides structure for the activation of enzymes, protein, and the hormone insulin.</td>
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<td>Vanadium</td>
<td>Male: 1.8 mg/d</td>
<td>Undetermined (19 - &gt; 70 yrs.)</td>
<td>Primary pharmacological effects - inhibits and stimulates several metabolic processes.</td>
<td>Animal: Shellfish, oysters.</td>
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<td>Female: 1.8 mg/d (19 - &gt; 70 yrs.)</td>
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<td>Mimics the action of insulin by stimulating cellular glucose uptake, enhances glucose metabolism, and inhibits lipolysis (fat break down).</td>
<td>Plant: oils, black pepper, parsley, dill seed, apple juice, mushrooms, grains and cereals.</td>
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<td>Can substitute for other minerals in the body such as zinc, copper, and iron.</td>
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<td><strong>RDA (minimum):</strong>&lt;br&gt;<strong>Male:</strong> 11 mg/d&lt;br&gt;<strong>Female:</strong> 8 mg/d (19 - &gt; 70 yrs.)</td>
<td>✓ Intracellular ion (+/- charged)&lt;br&gt;✓ Component of several proteins&lt;br&gt;✓ Functions in over 300 enzymes in metabolism of all macronutrients&lt;br&gt;✓ Fundamental to central nervous system functioning&lt;br&gt;✓ Involved in transport processes and immune function&lt;br&gt;✓ Stabilizes RNA and DNA in genetic expression&lt;br&gt;✓ Involved in taste and smell&lt;br&gt;✓ Bone health and wound healing&lt;br&gt;✓ Delays the progression of age-related macular degeneration</td>
<td><strong>Plants:</strong> fortified cereals, wheat bran, soy, dry beans, nuts, raisins.</td>
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<td><strong>UL (maximum):</strong>&lt;br&gt;<strong>Male:</strong> 40 mg/d&lt;br&gt;<strong>Female:</strong> 40 mg/d (19 - &gt; 70 yrs.)</td>
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<td>• Functions in association with over 300 enzymes.</td>
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<td>• Competes with calcium, iron, copper, and cadmium for absorption, phytates and fiber decrease absorption.</td>
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<td>• Absorption enhanced by glucose, lactose, and soy.</td>
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Intracellular ion (+/- charged)<br>Component of several proteins<br>Functions in over 300 enzymes in metabolism of all macronutrients<br>Fundamental to central nervous system functioning<br>Involved in transport processes and immune function<br>Stabilizes RNA and DNA in genetic expression<br>Involved in taste and smell<br>Bone health and wound healing<br>Delays the progression of age-related macular degeneration