Key Vitamins and Minerals Needed During Pregnancy

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Hello, I'm Dr. Judi,

I am a wife of 19 years and the mother of 7 children ages 18 to 2. I was raised knowing nothing about herbs or natural health care. As my children grew and had continual health issues I reached a point where I was going to the medical doctor at least once a week. I remember thinking there had to be a better way. I knew God had to have a purpose for the things that grew around us so I began my voyage in Naturopathy.

Naturopathy is based on the belief that God has designed the human body with the ability to heal itself, if it is given the appropriate internal and external environment.

I was certified as an herbalist in August of 2001 through Natural Solution Training Institute and became a Doctor of Naturopathy through Trinity College of Natural Health, April 19, 2004.

I can't diagnose, prescribe medication, or treat, but my education has greatly benefited my own family. We only see medical doctors in emergencies and when necessary, which is not very often any more.

I want to pass on what I've learned to help benefit as many people as possible both online and in my community. So we began Stirred Water Herbs to help you create that environment and take control of your health.

**Stirred Water Herbs** is a Christian owned business which strives to provide you with the best vitamins and herbs available. I look hard for great quality so you don't have to. I also strive to keep the cost down to prove that treating yourself or your family naturally doesn't have to cost an arm and a leg. My concern is your health, not our bottom line. We are dedicated to serving others as God intended.....NATURALLY!

May God bless you through our family owned business and may you come to know the Creator more fully as you experience the best health you possibly can!

If you're looking for an alternative to modern medicine or wonder if the Naturopathy way may address a need you have, you can email me at AskDrJudi@stirredwater.com.

**Dr. Judi**

John 5:6
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The purpose of this report is to help educate. The author and publisher do not warrant that the information contained in this report is fully complete and shall not be responsible for any errors or omissions.
Key Vitamins and Minerals Needed During Pregnancy

Reading nutritional labels on supplements can be quite confusing at times. What standard are they using? Does it take into account the differences between men, women, and children? What are the specific needs for me just before, during, and after my pregnancy? Can’t someone just tell me how much I need of each vitamin and mineral in a clear and concise way?

This report is designed to do just that. Below are two charts giving recommendations on the needs of 12 key vitamins and 9 key minerals for women before, during, and after pregnancy. The following pages describe each one and how they relate to pregnancy.

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<thead>
<tr>
<th>Vitamin</th>
<th>Need During Pregnancy</th>
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</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>5,000 IU</td>
</tr>
<tr>
<td>Vitamin B1—Thiamine</td>
<td>25-100 mg</td>
</tr>
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<td>Vitamin B2—Riboflavin</td>
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<td>Vitamin B12</td>
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<td>Vitamin C</td>
<td>1,000-2,000 mg</td>
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<td>Vitamin D</td>
<td>400 IU</td>
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<td>400 IU</td>
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<td>Biotin</td>
<td>25-100 mg</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>400-2,000 mcg</td>
</tr>
<tr>
<td>Pantothenic Acid</td>
<td>25-100 mg</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Need During Pregnancy</th>
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</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>1,200 mg</td>
</tr>
<tr>
<td>Chromium</td>
<td>150-200 mcg</td>
</tr>
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<td>Copper</td>
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<tr>
<td>Iodine</td>
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<td>Iron</td>
<td>18-30 mg</td>
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<td>Manganese</td>
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<td>Zinc</td>
<td>20-35 mg</td>
</tr>
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Vitamins

Vitamin A

Also indexed as: Retinol (A)

How does it work?
Vitamin A is a fat-soluble vitamin with four major functions in the body:

- It helps cells reproduce normally—a process called differentiation. Cells that have not properly differentiated are more likely to undergo pre-cancerous changes.
- It is required for vision. It maintains healthy cells in various structures of the eye and is required for the transduction of light into nerve signals in the retina.
- It is required for normal growth and development of the embryo and fetus, influencing genes that determine the sequential development of organs.
- It may be required for normal reproductive function, with influences on the function and development of sperm, ovaries and placenta.
- By maintaining healthy cell membranes, vitamin A may help prevent invasion by disease-causing microorganisms. Vitamin A is also needed for formation of bone, protein, and several hormones. Beta-carotene is a substance from plants the body converts to vitamin A.

Key uses for vitamin A

- **Cystic fibrosis (CF):** The fat malabsorption associated with CF often leads to a deficiency of fat-soluble vitamins. Oral supplementation of fat-soluble vitamins is considered crucial to maintaining good nutritional status in CF, which in turn may provide some protection against respiratory infections that are frequent complications of this disease.
- **Infection:** A number of studies have shown that supplementation with vitamin A decreased morbidity and mortality from measles in children in developing countries. The amount used in many of these studies was 200,000 IU per day for two days, an extremely large amount that must be monitored by a physician.
- **Leukoplakia**
- **Measles** (for deficiency)
- **Night blindness:** Night blindness can be an early sign of vitamin A deficiency.

Other potential uses for vitamin A

- **Bronchitis**
- **Celiac disease** (for deficiency): Vitamin A deficiency resulting in abnormal dark-adaptation (night vision) may occur in celiac disease, even in people who are undergoing appropriate treatment with a gluten-free diet.

- **Heart attack**

- **Immune function**: Vitamin A plays an important role in immune system function. However, it is not clear whether supplementing with vitamin A enhances the immune function of people whose diet already contains adequate amounts of the vitamin.

- **Iron-deficiency anemia**: Taking vitamin A and iron together has been reported to help overcome iron deficiency more effectively than iron supplements alone. The optimal amount of vitamin A needed for this purpose has not been determined, but some doctors recommend 10,000 IU per day.

- **Measles** (for severe cases)

- **Menorrhagia** (heavy menstruation): In a preliminary study of 40 women with menorrhagia who took 25,000 IU of vitamin A twice per day for 15 days, 93% showed significant improvement and 58% had a complete normalization of menstrual blood loss.

- **Minor injuries/wound healing**: Although vitamin A plays a central role in wound healing, the effect of supplemental vitamin A in people who are not vitamin A-deficient, but who have suffered a minor injury or wound, remains unclear.

- **Peptic ulcer**: Vitamin A is needed for the healing of mucosal tissue, including the lining of the stomach and intestines. In one study, vitamin A (50,000 IU taken three times per day) facilitated healing in a small group of people with stomach ulcer. Whether lower amounts of vitamin A can help people with peptic ulcer is not known.

- **Retinitis pigmentosa**

**Where is it found?**

- Liver, dairy products, and cod liver oil are good sources of vitamin A.
- Vitamin A is also available in supplement form.

**Which form of vitamin A is best?**

For some individuals, water-soluble forms of vitamin A supplements appear to be better absorbed than fat-soluble vitamin A.

**How much is usually taken?**

The amount of vitamin A used to prevent or treat various health conditions in adults ranges from 10,000 to 300,000 IU per day or more. However, vitamin A can cause significant toxicity, and intakes above those generally considered safe (see below) should be taken only with the supervision of a doctor.
Are there any side effects or precautions?

- Excessive intake of vitamin A can cause a wide range of toxic effects, including headaches, joint pain, fatigue, hair loss, liver disease, brain swelling, and even death.

- For most individuals, up to 25,000 IU (7,500 mcg) of vitamin A per day is considered safe. However, people over age 65 and those with liver disease should probably not supplement with more than 15,000 IU per day, unless supervised by a doctor.

- In women who could become pregnant, the maximum safe intake is being reevaluated; less than 10,000 IU (3,000 mcg) per day is generally accepted as safe. However, there is concern that intakes larger than that could cause birth defects.

- Long-term vitamin A supplementation may increase triglycerides and total cholesterol. Although the research findings are not conclusive, people at risk for cardiovascular disease should use caution when considering long-term vitamin A supplementation.

- A preliminary study suggested that vitamin A intake in amounts greater than 5,000 IU per day may promote bone loss. However, additional research is needed to confirm that finding.

Potential adverse drug interactions

- Isotretinoin (Accutane®): Vitamin A may increase isotretinoin toxicity.

- Minocycline (Minocin®): Vitamin A may increase minocycline toxicity.

- Tretinoin (All-Trans-Retinoic Acid, ATRA, Atragen®, Avita®, Renova®, Retin-A®, Vesanoid®, Vitinoin®): Vitamin A may increase tretinoin toxicity.

Vitamin B1—Thiamine

Also indexed as: Thiamin, Thiamine

How does it work?

Vitamin B1 is needed to process carbohydrates, fat, and protein. Every cell of the body requires vitamin B1 to form ATP—the fuel the body runs on. Nerve cells require vitamin B1 in order to function normally.

Key uses for vitamin B1

None
Other potential uses for vitamin B1

- Alzheimer’s disease: Vitamin B1 is involved in nerve transmission in parts of the brain (called cholinergic neurons) that deteriorate in Alzheimer’s disease. The activity of vitamin B1-dependent enzymes has been found to be decreased in the brains of people with Alzheimer’s disease. It has therefore been suggested that vitamin B1 supplementation could slow the progression of Alzheimer’s disease. Two double-blind studies have reported small but significant improvements in mental function in people with Alzheimer’s disease who took 3 grams a day of vitamin B1, compared to those who took placebo. However, another double-blind study using the same amount for a year found no effect on mental function.

- Canker sores: Several reports have found a surprisingly high incidence of B vitamin deficiency among people with recurrent canker sores. Supplementing daily with B vitamins—300 mg vitamin B1, 20 mg vitamin B2, and 150 mg vitamin B6—has been reported to provide some people with relief. Vitamin B1 deficiency specifically has been linked to an increased risk.

- Diabetes: Blood levels of vitamin B1 have been found to be low in people with type 1 (insulin-dependent) diabetes. In the 1930s, a trial using 10 mg of vitamin B1 per day for four weeks reported reduced blood sugar levels in six of eleven diabetics. More recently, administration of both vitamin B1 (25 mg per day) and vitamin B6 (50 mg per day) to a group of people from a vitamin-deficient population with diabetic neuropathy led to significant improvement after four weeks.

- Low back pain: Three short-term double-blind studies have shown that supplementing with large amounts of the combination of vitamin B1, vitamin B6, and vitamin B12 enhanced the beneficial effect of anti-inflammatory medication in people with painful vertebral syndromes.

Where is it found?
Wheat germ, whole wheat, peas, beans, enriched flour, fish, peanuts, and meat are all good sources of vitamin B1.

How much is usually taken?
- While the ideal intake is uncertain, one study reported the healthiest people consumed more than 9 mg per day.
- The amount found in many multivitamin supplements (20–25 mg) is more than adequate for most people.

Are there any side effects or precautions?
Vitamin B1 works hand in hand with vitamin B2 and vitamin B3. Therefore, nutritionists usually suggest that vitamin B1 be taken as part of a B-complex vitamin or other multivitamin supplement.

Potential adverse drug interactions
None reported
Vitamin B2—Riboflavin

Also indexed as: Riboflavin

How does it work?
Vitamin B2 is needed to process amino acids and fats, activate vitamin B6 and folic acid, and help convert carbohydrates into ATP, the fuel the body runs on. Under some conditions, vitamin B2 can act as an antioxidant.

Key uses for vitamin B2
Migraine headaches: One group of researchers treated 49 migraine patients with large amounts of vitamin B2 (400 mg per day). Both the frequency and severity of migraines decreased by more than two-thirds. The beneficial effect of vitamin B2 was later confirmed in a double-blind study.

Other potential uses for vitamin B2
- Canker sores: Several reports have found a surprisingly high incidence of B vitamin deficiency among people with recurrent canker sores. Supplementing daily with B vitamins—300 mg vitamin B1, 20 mg vitamin B2, and 150 mg vitamin B6—has been reported to provide some people with relief.
- Cataracts: Vitamin B2 and vitamin B3 are needed to protect glutathione, an important antioxidant in the eye. Vitamin B2 deficiency has been linked to cataracts. Older people taking 3 mg of vitamin B2 and 40 mg of vitamin B3 per day were partly protected against cataracts in a Chinese trial. However, the intake of vitamin B2 in China is relatively low, and it is not clear whether supplementation would help prevent cataracts in populations where vitamin B2 intake is higher.

Where is it found?
- Dairy products, eggs, and meat contain significant amounts of vitamin B2.
- Leafy green vegetables, whole grains, and enriched grains contain some vitamin B2.

How much is usually taken?
- The ideal level of intake is not known.
- The amounts found in many multivitamin supplements (20–25 mg) are more than adequate for most people.

Are there any side effects or precautions?
- At supplemental and dietary levels, vitamin B2 is nontoxic.
- Vitamin B2 works with vitamin B1, vitamin B3, and vitamin B6; consequently, vitamin B2 should be taken as part of a B-complex supplement.
Potential adverse drug interactions
None reported

Vitamin B3
Also indexed as: Inositol Hexaniacinate, Niacin/Niacinamide, Nicotinamide, Nicotinic Acid

How does it work?
- The body uses vitamin B3 in the process of releasing energy from carbohydrates. It is needed to form fat from carbohydrates and to process alcohol.
- Vitamin B3 comes in two basic forms—niacin (also called nicotinic acid) and niacinamide (also called nicotinamide). A variation on niacin, called inositol hexaniacinate, is also available in supplements. Because it has not been linked with any of the usual niacin toxicity in scientific research, some doctors recommend inositol hexaniacinate for individuals who need large amounts of niacin.

Key uses for vitamin B3
- Acne (topical niacinamide)
- High cholesterol: Niacin has been shown to reduce serum cholesterol levels, but niacinamide does not. Inositol hexaniacinate has also been reported to lower serum cholesterol, but it does not appear to be as effective as niacin.
- Intermittent claudication: Double-blind studies have shown that inositol hexaniacinate can increase walking distance in people with intermittent claudication.
- Osteoarthritis: In the 1940s, one doctor reported that supplemental niacinamide increased joint mobility, improved muscle strength, and decreased fatigue in people with osteoarthritis. These preliminary findings were followed by a more recent double-blind study confirming reduction in symptoms within 12 weeks. Although amounts used have varied from study to study, many doctors recommend 250–500 mg of niacinamide four or more times per day (with higher amounts reserved for people with more advanced arthritis).

Other potential uses for vitamin B3
- Dysmenorrhea (painful menstruation): In a preliminary study, niacin was reported to relieve menstrual cramps in 87% of a group of 40 women. The amount taken was 200 mg per day throughout the menstrual cycle, then 100 mg every two or three hours at the onset of menstrual cramps.
- High cholesterol (inositol hexaniacinate)
- High triglycerides: Niacin lowers triglyceride levels, but niacinamide does not.
- Peripheral vascular disease (inositol hexaniacinate)
- Raynaud's disease: In studies using 4 grams of inositol hexaniacinate per day for three months, spasm of arteries was improved.
- Schizophrenia: In early double-blind trials, 3 grams of niacin daily resulted in a doubling of the recovery rate, a 50% reduction in hospitalization rates, and a dramatic reduction in suicide rates. However, other double-blind studies have failed to find a beneficial effect, and the use of niacin or niacinamide to treat schizophrenia remains controversial.

**Where is it found?**
The best food sources of vitamin B3 are peanuts, brewer's yeast, fish, and meat. Some vitamin B3 is also found in whole grains.

**Which form of vitamin B3 is best?**
The different forms of vitamin B3 have somewhat different effects (see above) and different side-effects (see below).

**How much is usually taken?**
- In part because it is added to white flour, most people probably get enough vitamin B3 from their diets to prevent a deficiency.
- 10–25 mg of the vitamin can be taken as part of a B-complex or multivitamin supplement. Larger amounts are used for the treatment of various health conditions.

**Are there any side effects or precautions?**
- Large amounts of niacin or niacinamide (such as 3 grams or more per day) have occasionally caused liver damage. Niacin (particularly the time-release form) appears to put more stress on the liver than does niacinamide. Inositol hexaniacinate is said not to damage the liver; however, there has not been enough published research on this compound to know if that claim is true.
- Niacin, in amounts as low as 50–100 mg, may cause flushing, headache, and stomachache in some people. These side effects do not typically occur with the other forms of vitamin B3.
- Large amounts of niacin (such as 3,000 mg per day) can cause gastritis, raise blood sugar levels in people with diabetes, damage the eyes, and increase blood levels of uric acid (which can cause gout).
- Vitamin B3 in any form should not be taken in amounts greater than 1,000 mg per day, unless supervised by a doctor. Individuals with liver disease or diabetes should consult a doctor before taking vitamin B3.
Vitamin B3 works with vitamin B1 and vitamin B2 to release energy from carbohydrates. Therefore, these vitamins are often taken together in a B-complex or multivitamin supplement (although most B3 research uses niacin or niacinamide by itself).

**Potential adverse drug interactions**

- Glimepiride (Amaryl®): The use of niacin may increase the requirement for glimepiride.
- Repaglinide (Prandin®): The use of niacin may increase the requirement for repaglinide.

Supplementation with large amounts of niacin (and possibly other forms of vitamin B3) may cause severe muscle damage in people taking any one of the following HMG Co-A Reductase Inhibitors (cholesterol-lowering drugs):

- Atorvastatin (Lipitor®)
- Fluvastatin (Lescol®)
- Lovastatin (Mevacor®)
- Pravastatin (Pravachol®)
- Simvastatin (Zocor®)

**Vitamin B6**

Also indexed as: PLP, Pyridoxal-5’-Phosphate, Pyridoxine

**How does it work?**

Vitamin B6 is the master vitamin in the processing of amino acids—the building blocks of all proteins and some hormones. Vitamin B6 helps to make serotonin, melatonin, and dopamine and is therefore an essential nutrient in the regulation of mental processes and possibly mood. In combination with folic acid and vitamin B12, vitamin B6 lowers homocysteine levels—a substance linked to heart disease, stroke, osteoporosis, and Alzheimer’s disease.

**Key uses for vitamin B6**

- Autism: In double-blind studies, vitamin B6 supplementation has produced clinical improvement in autistic children.
- Depression (in women taking oral contraceptives)
- High homocysteine: Vitamin B6, folic acid, and vitamin B12 each function as cofactors for enzymes that can lower homocysteine levels.
• Morning sickness: In two double-blind studies, supplementation with vitamin B6 (10 or 25 mg three times per day) significantly reduced the severity of morning sickness.

• Premenstrual syndrome (PMS): A composite analysis of the best designed, controlled trials shows that vitamin B6 is more than twice as likely to reduce symptoms of PMS than is placebo.

Other potential uses for vitamin B6

• Age-related cognitive decline: Vitamin B6 deficiency is common among people over age 65. In a double-blind trial, correcting this deficiency with 2 mg of pyridoxine per day resulted in small psychological improvements among Finnish and Dutch elderly. However, the study found no direct correlation between amounts of vitamin B6 in the cells or blood and psychological parameters. A more recent double-blind study of 38 healthy men, aged 70 to 79 years, showed that 20 mg pyridoxine per day improved memory performance, especially long-term memory.

• Asthma: Vitamin B6 deficiency is common in asthmatics. This deficiency may relate to the asthma itself or to certain asthma drugs (such as theophylline and aminophylline) that deplete vitamin B6. Research remains somewhat inconsistent and one double-blind study found that high amounts of B6 supplements did not help asthmatics who required the use of steroid drugs.

• Canker sores

• Carpal tunnel syndrome (CTS): Some, but not all, studies have found vitamin B6 deficiency to be common in individuals with CTS. Supplementation with vitamin B6 has reportedly relieved the symptoms of CTS, but some researchers have not found this treatment to be beneficial.

• Depression: Several studies indicate that vitamin B6 supplementation helps alleviate depression associated with premenstrual syndrome (PMS), although the research remains inconsistent. Many doctors suggest that women who have depression associated with PMS take 100–300 mg of vitamin B6 per day—a level of intake that requires supervision by a doctor.

• Diabetes: Many diabetics have low blood levels of vitamin B6. Levels are even lower in diabetics with nerve damage. In some, but not all, studies, vitamin B6 supplements improved glucose tolerance in women with diabetes caused by pregnancy. Vitamin B6 has also been reported to relieve the symptoms of diabetic neuropathy.

• Low back pain (in combination with vitamin B1 and vitamin B12)

• MSG sensitivity

• Schizophrenia: Studies of the effects of vitamin B6 in schizophrenia have yielded differing results, with some studies reporting a benefit (at 100–150 mg per day) and others reporting no effect.

• Vertigo
Where is it found?
Potatoes, bananas, raisin bran cereal, lentils, liver, turkey, and tuna are all good sources of vitamin B6.

How much is usually taken?
The most common supplemental intake is 10–50 mg per day; however, higher amounts may be recommended for certain conditions by healthcare practitioners.

Are there any side effects or precautions?
- Although side effects from vitamin B6 supplements are rare, at very high levels (more than 200 mg per day) vitamin B6 can eventually damage sensory nerves, leading to numbness in the hands and feet as well as difficulty walking. Vitamin B6 supplementation should be stopped if any of these symptoms begin to develop. Side effects from vitamin B6 are dependent on the level of intake.
- Pregnant and lactating women should not take more than 100 mg of vitamin B6 per day. For other adults, vitamin B6 is usually safe in amounts of 200 mg per day, although occasional problems have been reported in this range.
- In occasional cases, doctors may need to recommend significantly higher amounts of vitamin B6.

Potential adverse drug interactions
Barbiturates (e.g., amobarbital [Amytal®], butabarbital [Busodium®, Butisol®], mephobarbital [Mebaral®], methohexital [Brevital®], pentobarbital [Nembutal®], phenobarbital [Phenobarbitone®], secobarbital [Seconal®], thiopental [Pentothal®, "Sodium Pentothal"]): One controlled study revealed that supplementing 200 mg of vitamin B6 daily for four weeks resulted in a significant reduction in phenobarbital blood levels. People taking barbiturates should probably avoid supplementing large amounts of vitamin B6.

Vitamin B12
Also indexed as: Adenosylcobalamin, Cobalamin, Cyanocobalamin, Hydroxocobalamin, Hydroxycyanocobalamin, Methylcobalamin

How does it work?
Vitamin B12 is needed for normal nerve cell activity, DNA replication, and production of the mood-affecting substance SAMe (S-adenosyl-L-methionine). Vitamin B12 acts with folic acid and vitamin B6 to control homocysteine levels.
Key uses for vitamin B12

- Depression (for deficiency): Depression caused by vitamin B12 deficiency can occur in the absence of anemia. Mood has been reported to sometimes improve with high amounts of vitamin B12 (given by injection), even in the absence of a B12 deficiency.

- High homocysteine (combination with folic acid and vitamin B6): Vitamin B12 deficiency may increase homocysteine levels, possibly leading to an increase in the risk of atherosclerosis and other diseases.

- Pernicious anemia: This condition, caused by malabsorption of vitamin B12, can be effectively treated with vitamin B12 injections, or by supplementing with large amounts (such as 1,000 mcg per day) of oral vitamin B12. People with pernicious anemia should be treated by a doctor.

Other potential uses for vitamin B12

- Age-related cognitive decline (ARCD): Supplementation with vitamin B12 may improve mental function in elderly people who have been diagnosed with a B12 deficiency.

- Bell's palsy

- Canker sores (for deficiency only)

- Chronic fatigue syndrome (CFS): A few studies suggest that people with fatigue (including CFS) may benefit from a series of vitamin B12 injections, even if their blood levels of the vitamin are normal. This use of vitamin B12 remains controversial.

- Cystic fibrosis (in people with vitamin B12 deficiency)

- Infertility (male): In a double-blind study, vitamin B12 injections increased sperm counts in some men with low numbers of sperm.

- Low back pain (in combination with vitamin B1 and vitamin B6).

- Sickle cell anemia: Sickle cell anemia appears to put people at greater risk for vitamin B12 deficiency and intramuscular injections of the vitamin (1 mg weekly for 12 weeks) have been reported to reduce symptoms in some cases.

Where is it found?

- Vitamin B12 is found in all foods of animal origin, including dairy products, eggs, meat, poultry, and fish.

- Small but inconsistent amounts occur in seaweed (including nori and chlorella) and tempeh.

Which form of vitamin B12 is best?

- Hydroxocobalamin is the preferred form for injection, although cyanocobalamin is much more widely available.
• Several different forms are available for oral use; it is not clear which one is preferable.
• It is not clear whether sublingual forms of vitamin B12 offer any advantage to oral supplements.

How much is usually taken?
• Most people do not require vitamin B12 supplements. However, vegans (people who consume no animal products) should take at least 2–3 mcg per day.
• Pernicious anemia is usually treated with injections of vitamin B12; however, oral administration of 1,000 mcg per day can be used as an alternative.
• The elderly, who are often deficient, may benefit from 10–25 mcg per day of vitamin B12.
• When vitamin B12 is used for therapeutic purposes (as opposed to correcting a deficiency), injections are usually necessary to achieve results. However, oral vitamin B12 can be used to treat a vitamin B12 deficiency.

Are there any side effects or precautions?
• Vitamin B12 supplements are not generally associated with side effects. Although exceedingly rare, serious allergic reactions to injections of vitamin B12 have been reported.
• Supplementing with 1,000 mcg or more of folic acid per day can mask a laboratory diagnosis of vitamin B12 deficiency, possibly allowing an easily treatable condition to progress to the point of irreversible nerve damage. Individuals taking 1,000 mcg or more of folic acid per day should alert their physician, who can then order other lab tests if a vitamin B12 deficiency is suspected.

Potential adverse drug interactions
None reported

Vitamin C

Also indexed as: Ascorbate, Ascorbic Acid

How does it work?
Vitamin C is a powerful antioxidant, protecting cells in your body against damage by oxygen. Vitamin C may be the most important antioxidant protector of LDL cholesterol. Damage to LDL leads to the development of heart disease. Vitamin C is needed to make collagen, the “glue” that strengthens many parts of the body, such as muscles,
tendons, joints and blood vessels. Vitamin C also plays important roles in wound healing and as a natural antihistamine. Vitamin C aids in the formation of liver bile, helps to fight viruses, and detoxifies alcohol and other substances. Vitamin C is needed for the dilation of blood vessels and may be important in lowering blood pressure and preventing heart attacks.

**Key uses for vitamin C**

- **Athletic performance (for deficiency only):** Placebo-controlled research, some of it double-blind, has shown that taking 400–3,000 mg of vitamin C per day may reduce pain and speed up muscle strength recovery after intense exercise.

- **Bronchitis:** (200 mg per day) In a study of elderly patients hospitalized with acute bronchitis, those who were given vitamin C improved to a significantly greater extent than those who were given a placebo.

- **Bruising (for deficiency only):** Many Americans eat insufficient amounts of foods containing vitamin C. Scurvy, the disease caused by vitamin C deficiency, causes easy bruising. While very few people actually have scurvy, even minor deficiencies of vitamin C can increase bruising.

- **Burns (in combination with vitamin E for prevention of sunburn only)**

- **Capillary fragility:** Vitamin C supplementation may strengthen capillaries (tiny blood vessels) in people with diabetes and in people undergoing kidney dialysis. However, people with kidney disease should consult a doctor before supplementing with vitamin C.

- **Common cold/sore throat:** A review of 21 placebo-controlled studies using 1–8 grams of vitamin C per day found that “in each of the 21 studies, vitamin C reduced the duration of episodes and the severity of the symptoms of the common cold by an average of 23%."

- **Gingivitis (periodontal disease) (for deficiency only):** People who are deficient in vitamin C have been reported to be at increased risk for periodontal disease.

- **Glaucoma:** Several studies have shown that supplementing with vitamin C can significantly reduce elevated pressure in the eye in individuals with glaucoma.

- **Heart attack (for deficiency):** Blood levels of vitamin C are reported to be lower in people with a history of heart attack, compared to healthy individuals.

- **High cholesterol:** Like vitamin E, vitamin C protects LDL (“bad”) cholesterol from damage that can lead to hardening of the arteries (atherosclerosis).

- **Infection:** Vitamin C has antiviral activity and may help to prevent viral infections.

- **Infertility (male):** Vitamin C improves the quality of sperm and may increase the fertility of men with this condition.

- **Reflex sympathetic dystrophy (prevention):** A double-blind trial found that 500 mg of vitamin C per day for one year reduced the risk of developing reflex sympathetic dystrophy (a painful nerve condition of the extremities), after a wrist fracture.
Scurvy: While very few people in the United States actually have scurvy, many eat less than optimal amounts of vitamin C.

Wound healing: Vitamin C is needed to make collagen, the “glue” that strengthens many parts of the body, such as muscles and blood vessels. Improved collagen synthesis aids in wound healing.

Other potential uses for vitamin C

- Asthma
- Atherosclerosis
- Athletic performance (for exercise recovery): Vitamin C may help prevent exercise-related muscle injuries by neutralizing free radicals produced during strenuous activities.
- Autism: Large amounts of vitamin C may reduce symptom severity.
- Cataracts: Circumstantial evidence suggests that supplementing with vitamin C may help prevent cataracts; however, definitive studies have not been done.
- Cold sores: In test-tube studies, vitamin C has been shown to inactivate herpes simplex, the virus that causes cold sores. In one study, a combination of vitamin C and bioflavonoids reduced the duration of cold sores.
- Diabetes: Vitamin C may reduce organ damage caused by diabetes and improve glucose tolerance in some people.
- Dysmenorrhea (plus vitamin B3 [niacin] and rutin)
- Gastritis: Vitamin C may combat Helicobacter pylori, the organism that causes gastritis and ulcers.
- Gingivitis (periodontal disease) (in combination with flavonoids)
- Immune function: Vitamin C stimulates the immune system by elevating interferon levels and enhancing the activity of certain immune cells.
- Influenza: Dockworkers given vitamin C each day for ten months caught influenza 28% less often than did their coworkers not taking vitamin C. Other studies have shown that taking vitamin C in high amounts can lead to rapid improvement of influenza infections.
- Iron deficiency anemia: Vitamin C increases the absorption of iron. Some doctors advise iron-deficient people to take vitamin C (typically 100–500 mg) at the same time as their iron supplement.
- Lead toxicity
- Pancreatic insufficiency
- Pre- and post-surgery health (if deficient)
- Preeclampsia (in combination with vitamin E; for high risk only)
Schizophrenia: The amount of vitamin C required by schizophrenics may be greater than that of the general population. Up to 6 grams daily of vitamin C has been reported in case studies to be beneficial for people with schizophrenia.

- Skin ulcers
- Sprains and strains

**Where is it found?**

Broccoli, red peppers, currants, Brussels sprouts, parsley, potatoes, citrus fruit, and strawberries are good sources of vitamin C.

**How much is usually taken?**

- The recommended dietary allowance (RDA) for vitamin C in nonsmoking adults is 75 mg per day for women and 90 mg per day for men. For smokers, the RDAs are 110 mg per day for women and 125 mg per day for men.

- Most clinical vitamin C studies have investigated the effects of 100–1,000 mg per day, often not seeking (or finding) the “optimal” intake within that range. In terms of heart disease prevention, as little as 100–200 mg of vitamin C per day may be adequate. Although some doctors recommend 500–1,000 mg per day or more, additional research is needed to determine whether these larger amounts are necessary.

- Some scientists have recommended that healthy individuals take multi-gram amounts of vitamin C for the prevention of illness. However, there is little or no research support for that point of view, and it remains controversial. Some people with illnesses listed above may benefit from higher amounts of vitamin C, but research on this matter is inconclusive.

- In the case of the common cold, a review of published trials found that amounts of 2 grams per day in children appear to be more effective than 1 gram per day in adults, suggesting that large intakes of vitamin C may be more effective than smaller amounts, at least for this condition.

**Are there any side effects or precautions?**

- Some individuals develop diarrhea after as little as a few grams of vitamin C per day, while others are not bothered by ten times this amount. Strong scientific evidence to define and defend an upper tolerable limit for vitamin C is not available. A review of the available research concluded that high intakes (2–4 grams per day) are well-tolerated by healthy people. However, high levels of vitamin C can deplete the body of copper—an essential nutrient. People should be sure to maintain adequate copper intake at higher intakes of vitamin C. Copper is found in many multivitamin/mineral supplements.

- Vitamin C increases the absorption of iron.

- Vitamin C helps recycle the antioxidant vitamin E.
- People with the following conditions should consult their doctor before supplementing with vitamin C:
  - Glucose-6-phosphate dehydrogenase deficiency
  - Iron overload (hemosiderosis or hemochromatosis)
  - Kidney failure
- Until more is known, people with kidney stones or a history of stone formation should not take large amounts (more than 1 gram per day) of supplemental vitamin C. Significantly lower amounts (100–200 mg per day) appear to be safe.
- Despite possible therapeutic effects of vitamin C in diabetics at lower intakes, one case of increased blood sugar levels was reported after taking 4.5 grams per day.

**Potential adverse drug interactions**

- Cardec (DM®, which contains pseudoephedrine): Greater than 5 grams of vitamin C per day may acidify the urine and increase the elimination of ephedrine from the body, potentially reducing the action of the drug. However, it is not known if vitamin C would interact similarly with pseudoephedrine.
- Tetracycline (Achromycin®, Sumycin®, Helidac®): Taking 500 mg vitamin C simultaneously with tetracycline was shown to increase blood levels of tetracycline in one study.
- Warfarin (Coumadin®): Although case reports have suggested that vitamin C might increase the activity of anticoagulants in a potentially dangerous way, this interaction has not been confirmed in research studies. In fact, a possible interference by vitamin C with the effect of anticoagulants has also been reported. People taking warfarin should consult with their physician before taking vitamin C supplements.

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**Vitamin D**

Also indexed as: 1,25-dihydroxyvitamin D, Calciferol, Calcipotriol, Cholecalciferol, Ergocalciferol (D2), Irradiated Ergocalciferol

**How does it work?**

- Vitamin D’s most important role is maintaining blood levels of calcium, which it accomplishes by increasing the absorption of calcium from food, reducing urinary calcium loss and, when necessary, transferring calcium from the bones into the bloodstream. Although the overall effect of vitamin D on the bones is complicated, some vitamin D is necessary for healthy bones and teeth.
- Vitamin D plays a role in immunity and blood cell formation and also helps cells “differentiate”—a process that may reduce the risk of cancer.
Key uses for vitamin D

- Crohn’s disease: Vitamin D malabsorption is common in Crohn’s disease and can lead to a deficiency.

- Cystic fibrosis: The fat malabsorption associated with cystic fibrosis often leads to deficiency of fat soluble vitamins, including vitamin D. Oral supplementation of these nutrients is considered crucial to maintaining good nutritional status.

- Osteoporosis: Some people with osteoporosis have low blood levels of vitamin D. Several double-blind studies have shown that supplementation with vitamin D can slow bone loss in people with osteoporosis. The amount of vitamin D used has varied from study to study. Many doctors recommend 400–800 IU per day of supplemental vitamin D, depending upon dietary intake and exposure to sunlight.

- Rickets: Amounts needed to treat rickets should be determined by a doctor and will depend on the age, weight, and condition of the child. For prevention of rickets, 400 IU of vitamin D per day is considered reasonable.

- Osteomalacia (softening of the bones): This condition is treated with vitamin D, sometimes in combination with calcium supplements. Osteomalacia should be diagnosed, and its treatment monitored, by a doctor.

Other potential uses for vitamin D

- Celiac disease (for deficiency only): The malabsorption that occurs in celiac disease can lead to multiple nutritional deficiencies, including vitamin D.

- Depression: In a small double-blind study, supplementation by healthy individuals with vitamin D3 (400–800 IU per day) for 5 days during late winter significantly enhanced mood, compared to placebo. This study suggests that vitamin D deficiency may play a role in seasonal affective disorder, but additional studies are needed.

Where is it found?

- Cod liver oil is an excellent dietary source of vitamin D, as are vitamin D–fortified foods.

- Traces of vitamin D are found in egg yolks and butter.

- The majority of vitamin D in the body is created during a chemical reaction that starts with sunlight exposure to the skin.

How much is usually taken?

- People who get plenty of sun exposure don’t require supplemental vitamin D, because sunlight stimulates vitamin D synthesis when it strikes bare skin.

- Although the recommended dietary allowance for vitamin D is 200 IU per day for adults, there is some evidence that elderly individuals need 800–1,000 IU per day for maximum effects on preserving bone density and preventing fractures.
Are there any side effects or precautions?

- Excessive vitamin D intake can lead to headaches, weight loss, and kidney stones and rarely to deafness, blindness, increased thirst, increased urination, diarrhea, irritability, failure to gain weight in children, and even death.
- Most people take 400 IU per day, a safe amount for adults. Some researchers believe that amounts up to 10,000 IU per day are safe for the average healthy adult. Nevertheless, people wishing to take more than 1,000 IU per day for long periods of time should consult a physician.
- Remember: The total daily intake of vitamin D includes vitamin D from fortified milk and other fortified foods, cod liver oil, supplements that contain vitamin D, and sunlight.
- Individuals with hyperparathyroidism should not take vitamin D without consulting a physician.
- People with sarcoidosis should not supplement with vitamin D unless a doctor has determined their calcium levels are not elevated.
- Vitamin D has been reported to increase the absorption of aluminum.
- Some, but not all, research suggests that vitamin D may slightly raise blood levels of cholesterol in humans.

Potential adverse drug interactions

Verapamil (Calan®): Vitamin D may interfere with the effectiveness of verapamil.

Vitamin E

Also indexed as: Alpha Tocopherol, Tocopherol, Tocopheryl (acetate, succinate)

How does it work?

- Vitamin E is a fat soluble vitamin and a powerful antioxidant that protects cell membranes and other fat-soluble parts of the body, such as LDL (“bad”) cholesterol. Protection of LDL cholesterol may reduce the risk of heart disease.
- Vitamin E also plays some role in the body’s ability to process glucose. Some, but not all, studies have reported that vitamin E supplementation may eventually prove to be helpful in the prevention and treatment of diabetes.
Key uses for vitamin E

- Epilepsy (for children): Vitamin E has been studied as a possible add-on to conventional drug treatment for epilepsy. A double-blind study in children found that adding 400 IU per day of vitamin E reduced seizure frequency without side effects.

- Immune function (for elderly people): Vitamin E enhances some measures of immune cell activity in the elderly.

- Intermittent claudication: Vitamin E supplementation has been shown in controlled trials to increase both walking distance and blood flow through arteries of the lower legs in people with intermittent claudication.

- Osteoarthritis: Vitamin E has reduced symptoms of osteoarthritis in both preliminary and double-blind research.

- Rheumatoid arthritis (RA): The concentration of vitamin E has been found to be low in the joint fluid of individuals with RA. This reduction in vitamin E levels is believed to be caused by utilization of the vitamin during the inflammatory process. Clinical trials have shown that 1,200–1,800 IU per day can decrease inflammation and pain in people with RA, although laboratory measures of inflammation remained unchanged.

- Sunburn (oral and topical): Antioxidants may protect the skin from sunburn due to free radical-producing ultraviolet rays. Double-blind research has also shown that topical application of antioxidants protects against sunburn if used before, but not after, exposure.

- Tardive dyskinesia: Vitamin E has been found in several studies to reduce the severity of tardive dyskinesia. 1,600 IU of vitamin E per day may be the optimal amount. Vitamin E is most effective when started within the first five years of “neuroleptic” drug therapy. Although it is not known how vitamin E works, some doctors believe it prevents neuroleptic-induced oxidation damage of certain parts of the brain.

Other potential uses for vitamin E

- Alzheimer's disease: Large amounts of vitamin E may slow the progression of Alzheimer’s disease, according to researchers from the Alzheimer’s Disease Cooperative Study.

- Angina: Low levels of antioxidant vitamins in the blood, particularly vitamin E, are associated with greater rates of angina.

- Atherosclerosis: Vitamin E protects LDL cholesterol from oxidative damage and has been linked to prevention of heart disease in double-blind research. In some, but not all, studies, vitamin E supplementation has increased HDL (“good”) cholesterol levels

- Athletic performance (for exercise recovery and high-altitude exercise performance only)
- Bronchitis: Vitamin E may prevent oxidative damage to the lung lipids by environmental pollution and cigarette smoke exposure. It has been suggested that amounts in excess of the RDA (recommended dietary allowance) are necessary to protect against air pollution levels currently present in North America, though it is not known how much vitamin E is needed to produce that protective effect.
- Cold sores: Topical application of cotton saturated with vitamin E oil may ease pain and accelerate healing, according to preliminary research.
- Dermatitis herpetiformis
- Diabetes: Some, but not all, double-blind studies have shown that vitamin E improves glucose tolerance in people with type 2 diabetes. Three months or more of supplementation may be required for benefits to become apparent. The most common amount used was 900 IU of vitamin E per day.
- Heart attack: Two studies have shown that both men and women who supplement with at least 100 IU of vitamin E per day for at least two years have a 37–41% drop in the risk of heart disease. Even more impressive was a 77% drop in nonfatal heart attacks reported in the double-blind CHAOS study, in which people were given 400–800 IU vitamin E per day. However, a recent double-blind trial found no benefit from 400 IU vitamin E in the prevention of non-fatal heart attacks.
- Leukoplakia
- Lung cancer (reduces risk)
- Pancreatic insufficiency
- Preeclampsia (in combination with vitamin C; for high risk only)
- Premenstrual syndrome (PMS): Although women with PMS do not appear to be deficient in vitamin E, double-blind research has shown that 300 IU of vitamin E per day may decrease symptoms of PMS.
- Prostate cancer (reduces risk)
- Retinopathy (diabetic retinopathy and retrolental fibroplasia)
- Skin ulcers (oral vitamin E)
- Wound healing
- Yellow nail syndrome

**Where is it found?**
- Wheat germ oil, nuts and seeds, whole grains, egg yolks, and leafy green vegetables all contain vitamin E. Certain vegetable oils should contain significant amounts of vitamin E; however, many of the vegetable oils sold in supermarkets have had the vitamin E removed in processing.
- The high amounts found in supplements, often 100–800 IU per day, are not obtainable from eating food.
Which form of vitamin E is best?

- The names of all types of vitamin E begin with either “d” or “dl,” which refer to differences in chemical structure. The “d” form is natural (also known as RRR-alpha tocopherol) and “dl” is synthetic (also known as all-rac-alpha tocopherol). The natural form is more active and better absorbed.

- Natural vitamin E can be found either as alpha (as in “d-alpha tocopherol) or in combination with beta, gamma, and delta—this combination is labeled “mixed” (as in mixed natural tocopherols).

- Vitamin E forms are listed as either “tocopherol” or “tocopheryl” followed by the name of what is attached to it, as in “tocopheryl acetate.” The two forms are not greatly different; however, tocopherol may be absorbed a little better, while tocopheryl forms have slightly better shelf life. Both forms are active when taken by mouth.

- The skin utilizes the tocopheryl forms very slowly, so those planning to apply vitamin E to the skin should buy tocopherol.

How much is usually taken?

- The most commonly recommended amount of vitamin E for adults is 400–800 IU per day.

- Some leading researchers suggest taking only 100–200 IU per day as studies that have explored the long-term effects of different supplemental levels suggest no further benefit beyond that amount. In addition, research reporting positive effects with 400–800 IU per day have not investigated the effects of lower intakes.

- For tardive dyskinesia, the best results have been achieved with 1,600 IU per day, a large amount that should be supervised by a healthcare practitioner.

Are there any side effects or precautions?

- Vitamin E toxicity is very rare; supplements are widely considered to be safe.

- Most studies suggest that vitamin E supplementation improves glucose tolerance in diabetics; however, one trial reported that 600 IU per day of vitamin E led to impairment of glucose tolerance in obese diabetics. The reason for the discrepancy between reports is not known.

Potential adverse drug interactions

Aspirin: A double-blind study of smokers found the combination of aspirin plus 50 IU per day of vitamin E led to a statistically significant increase in the extent of bleeding gums compared with taking aspirin alone. Such an effect has not been observed with warfarin (Coumadin®) or other blood-thinners.
Biotin

How does it work?
Biotin, a water-soluble B vitamin, acts as a coenzyme during the metabolism of protein, fats, and carbohydrates.

Key uses for biotin
None

Other potential uses for biotin
- Brittle nails: Biotin is known to strengthen hooves in animals. Women with brittle nails in a Swiss study, using 2.5 mg of biotin per day, had nail thickness increased by 25% after six to fifteen months. As a result, splitting of nails was reduced. In a follow-up study of people who had been taking biotin for brittle nails in America, 63% showed improvement from taking biotin.
- Diabetes: Biotin is needed to process glucose. Biotin may also reduce pain from diabetic nerve damage.

Where is it found?
- Good dietary sources of biotin include organ meats, oatmeal, egg yolk, soy, mushrooms, bananas, peanuts, and brewer’s yeast.
- Bacteria in the intestine also produce significant amounts of biotin, but evidence is conflicting as to whether biotin produced by intestinal bacteria is present at a location or is in a form that permits significant absorption by the body.

How much is usually taken?
- Researchers have estimated that 30 mcg per day appears to be an adequate intake for adults. Typically, consumption from a Western diet has been estimated to be 30–70 mcg per day.
- Larger amounts of biotin (8–16 mg per day) may be helpful for diabetics by lowering blood glucose levels and by preventing diabetic neuropathy.
- Biotin in the amount of 2.5 mg per day strengthened the fingernails of two-thirds of individuals with brittle nails, according to the clinical trial mentioned above.

Are there any side effects or precautions?
- Excess intake of biotin is excreted in the urine; no toxicity symptoms have been reported.
- Biotin works with some other B vitamins, such as folic acid, pantothenic acid (vitamin B5), and vitamin B12; however, no solid evidence indicates that people supplementing with biotin also need to take these other vitamins. Symptoms of
pantothenic acid or zinc deficiency have been reported to be lessened with biotin supplementation, though people with these deficiencies should supplement with the nutrients in which they are deficient.

- Researchers have speculated that biotin and alpha lipoic acid may compete with each other for absorption or uptake into cells, but little is known about the importance of these interactions in humans.

### Potential adverse drug interactions

- **Glyburide** (Diabeta®, Glibenclamide, Glynase Prestab®, Glynase™, Micronase®, Pres Tab®): Biotin may increase the blood sugar lowering effect of glyburide. Do not combine without a doctor’s supervision.

- **Insulin** (Iletin®, Humalog®, Humulin®, Novolin®, Novolin®, NovoRapid®, Oralin®): Biotin may increase the blood sugar lowering effect of insulin. Do not combine without a doctor’s supervision.

### Folic Acid

Also indexed as: Folate, Methylfolate, Vitamin B8

#### How does it work?

- Folic acid is a B vitamin needed for cell replication and growth. Folic acid helps form building blocks of DNA, the body’s genetic information, and building blocks of RNA needed for protein synthesis in all cells. Therefore, rapidly growing tissues, such as those of a fetus, and rapidly regenerating cells, like red blood cells and immune cells, have a high need for folic acid. Folic acid deficiency results in a form of anemia that responds quickly to folic acid supplementation.

- In 1996, the FDA began to require that all enriched flour, rice, pasta, cornmeal and other grain products contain 140 mcg of folic acid per 100 grams. Among people who do not take vitamin supplements, this amount of food fortification has been associated with increased folic acid levels in the blood and decreased blood levels of homocysteine.

#### Key uses for folic acid

- Birth defects prevention
- Depression: A deficiency of folic acid can disturb mood; a large percentage of depressed people have low folic acid levels.
• Gingivitis (periodontal disease) (rinse only): A 0.1% solution of folic acid used as a mouth rinse (5 ml taken twice a day for 30 to 60 days) has reduced gum inflammation and bleeding in people with gingivitis in double-blind studies.

• High homocysteine (in combination with vitamin B6 and vitamin B12): Folic acid is needed to keep blood levels of homocysteine (an amino acid by-product) from rising. A growing body of evidence suggests that an elevated homocysteine level is a risk factor for many diseases, especially heart disease. Of the B vitamins with a role in homocysteine metabolism, folic acid appears to be the most important in lowering homocysteine levels for the average person.

• Pap smear (abnormal): Large amounts of folic acid—10 mg per day—have been shown to improve the abnormal Pap smears of women who are taking birth control pills. Folic acid does not improve the Pap smears of women who are not taking oral contraceptives.

• Pregnancy and postpartum support: The requirement for folic acid doubles during pregnancy, while deficiencies of folic acid during pregnancy are associated with low birth weight and an increased incidence of neural tube defects (e.g., spina bifida) in infants. Most doctors, many other healthcare professionals, and the March of Dimes recommend that all women of childbearing age supplement with 400 mcg per day of folic acid. If a woman waits until after pregnancy has been discovered to begin taking folic acid supplements, it will probably be too late to prevent a neural tube defect.

• Schizophrenia: People with schizophrenia may have a greater tendency to be deficient in folic acid than the general population and may show improvement when given supplements.

Other potential uses for folic acid

• Anemia (for deficiency): Folic acid deficiency results in a form of anemia that responds quickly to folic acid supplementation.

• Atherosclerosis and heart attack: While several trials have consistently shown that folic acid lowers homocysteine levels, the amounts used vary from study to study. Many doctors recommend 500–800 mcg of folic acid per day.

• Breast cancer (reduces risk in women who consume alcohol)

• Canker sores (for deficiency only)

• Celiac disease: The malabsorption that occurs in celiac disease can lead to multiple nutritional deficiencies, including folic acid deficiency.

• Colon cancer (prevention): Folic acid appears to protect against alcohol-induced DNA damage. Increasingly, researchers believe that folic acid may be able to protect against some of the colon cancer-causing effects of alcohol.

• Preeclampsia: In one preliminary study, women with high homocysteine and a previous pregnancy complicated by preeclampsia who supplemented with 5 mg of folic acid and 250 mg of vitamin B6 per day successfully lowered homocysteine levels.
Sickle cell anemia: Deficiencies of folic acid occur more frequently in people with sickle cell anemia than in others and are a cause of high homocysteine levels. A double-blind study of children with sickle cell anemia found that children given 5 mg per day of folic acid had less painful swelling of the hands and feet compared with those receiving placebo, but blood abnormalities and impaired growth rate associated with sickle cell anemia were not improved. These amounts of folic acid are much higher than is typically used and should only be taken under the supervision of a doctor. In the treatment of sickle cell anemia, folic acid is typically supplemented in amounts of 1,000 mcg daily.

Ulcerative colitis (UC): Studies have found that people with UC who have been taking folic acid supplements or who have high blood levels of folic acid have a reduced risk of colon cancer compared with other individuals with UC. Individuals with UC who are taking the drug sulfasalazine, which inhibits the absorption of folic acid, are at particularly high risk of developing folic acid deficiency.

Where is it found?
Beans, leafy green vegetables, citrus fruits, beets, wheat germ, and meat are good sources of folic acid.

How much is usually taken?
- Most doctors recommend that all women who are or who could become pregnant take 400 mcg per day in order to reduce the risk of birth defects. Some doctors also extend this recommendation to other people, as well, in an attempt to reduce the risk of heart disease by lowering homocysteine levels.
- For people who frequently eat grain products, the amount needed to be taken in supplement form may be lowered by approximately 100 mcg per day, because of the FDA’s mandated addition of folic acid to many grain products.

Which form of folic acid is best?
Folate naturally found in food is much less available to the body compared with synthetic folic acid found both in supplements and added to grain products in the United States.

Are there any side effects or precautions?
- Folic acid is not generally associated with side effects. However, folic acid supplementation can interfere with the laboratory diagnosis of vitamin B12 deficiency, possibly allowing the deficiency to progress undetected to the point of irreversible nerve damage. Although vitamin B12 deficiency is uncommon, no one should supplement with 1,000 mcg or more of folic acid without consulting a doctor.
- Folic acid is needed by the body to utilize vitamin B12.
- Proteolytic enzymes and antacids inhibit folic acid absorption. People taking either of these are advised to supplement with folic acid.
- Folic acid–containing supplements may interfere with methotrexate therapy in people with cancer. People using methotrexate for cancer treatment should consult their prescribing doctor before using any folic acid–containing supplements.

- People with rheumatoid or psoriatic arthritis who are taking methotrexate should supplement with relatively large amounts of folic acid in order to reduce the toxicity of the drug. However, a physician should be consulted to determine the proper way to combine folic acid with methotrexate.

- A preliminary study showed that people taking diuretics for at least six months had significantly lower blood levels of folic acid as well as significantly higher levels of homocysteine, compared with people not taking diuretics.

**Potential adverse drug interactions**

- Chemotherapy (Methotrexate only)
- Medroxyprogesterone (Cycrin®, Depo-Provera®, Provera®): Folic acid may interfere with the drug’s effects.
- Methotrexate (Abitrexate): Folic acid may interfere with the drug’s anticancer effects. However, folic acid is often recommended when methotrexate is being used for rheumatoid arthritis. Consult a physician.
- Piroxicam (Feldene®): Folic acid may interfere with the drug’s effects.
- Sulindac (Clinoril®): Folic acid may interfere with the drug’s effects.

**Pantothenic Acid**

Also indexed as: Calcium Pantothenate, Pantethine, Vitamin B5

**How does it work?**

Pantothenic acid, sometimes called vitamin B5, is involved in the Kreb’s cycle of energy production and is needed to make the neurotransmitter acetylcholine. It is also essential in producing, transporting, and releasing energy from fats. Synthesis of cholesterol (needed to manufacture vitamin D and steroid hormones) depends on pantothenic acid. Pantothenic acid also activates the adrenal glands. Pantethine—a byproduct of pantothenic acid—has been reported to lower blood levels of cholesterol and triglycerides.
Key uses for pantothenic acid

- High cholesterol: The pantethine form of vitamin B5, in amounts of 300 mg two to four times per day, has been shown to significantly lower serum cholesterol levels and to increase HDL (“good”) cholesterol.
- High triglycerides: Several studies have shown that 300 mg of the pantethine form of vitamin B5 taken three times per day will lower triglyceride levels.
- Pantothenic acid itself does not appear to affect cholesterol or triglyceride levels.

Other potential uses for pantothenic acid

Rheumatoid arthritis (RA): Research suggests that people with RA may be partially deficient in pantothenic acid. In one placebo-controlled trial, people with RA had less morning stiffness, disability, and pain when they took 2,000 mg of pantothenic acid per day. Many doctors recommend pantothenic acid (sometimes in lower amounts, such as 500–1,000 mg per day) for people with RA.

Where is it found?

- Liver, yeast, and salmon have high concentrations of pantothenic acid.
- Most other foods, including vegetables, dairy, eggs, grains, and meat provide some pantothenic acid.

How much is usually taken?

- Most people do not need to supplement with pantothenic acid. However, the 10–25 mg found in many multivitamin supplements might improve pantothenic acid status, as so-called primitive human diets provided greater amounts of this nutrient than are found in modern diets.
- Most cholesterol researchers using pantethine have given people 300 mg three times per day (for a total of 900 mg per day).

Are there any side effects or precautions?

- No serious side effects have been reported, even at intakes up to 10,000 mg (10 grams) per day.
- Very large amounts of pantothenic acid (several grams per day) can cause diarrhea.

Potential adverse drug interactions

None reported
Minerals

Calcium

How does it work?

- Calcium is the most abundant mineral in the human body. Of the two to three pounds of calcium contained in the average body, 99% is located in the bones and teeth. Calcium is needed to form bones and teeth and is also required for blood clotting, transmission of signals in nerve cells, and muscle contraction. The importance of calcium for preventing osteoporosis is probably its most well-known role.

- Although calcium plays at least some minor role in lowering blood pressure, the mechanisms involved appear complex and somewhat unclear.

- By reducing absorption of oxalate, a substance found in many foods, calcium may be able to indirectly reduce the risk of kidney stones. However, people with a history of kidney stones must talk with a doctor before supplementing calcium because such supplementation might actually increase the risk of forming stones for the small number of people who absorb too much calcium.

- Calcium also appears to partially bind some fats and cholesterol in the gastrointestinal tract. Perhaps as a result, some older research suggests that calcium supplementation may help lower cholesterol levels.

- Animal studies have established a role of calcium in the activation and maturation of female egg cells (oocytes). Although the precise role of calcium is not clearly defined, normalization of calcium levels in humans has potential applications for conditions of the human ovary, such as polycystic ovary syndrome (PCOS).

- People with a high dietary intake of calcium were found to have a lower incidence of polyps in the colon and rectum (colorectal adenomas). In one preliminary study, high dietary calcium intake was associated with a decreased risk, while calcium supplementation was not. However, a double-blind study demonstrated a lower risk of developing colorectal adenomas in people taking 3 grams of calcium carbonate (providing 1,200 mg of elemental calcium) per day compared to those taking a placebo.

Key uses for calcium

- Gestational hypertension (GH): Calcium supplementation has significantly reduced the incidence of GH in preliminary studies and in many, though not all, double-blind trials.

- Lactose intolerance: As lactose-containing foods are among the best dietary sources of calcium, alternative sources of calcium (from food or supplements) are important for lactose-intolerant people.
• Osteoporosis: Calcium is needed to form bones and teeth. The importance of calcium for preventing osteoporosis is probably its most well-known role.

• Preeclampsia: Calcium deficiency has been associated with preeclampsia. In numerous controlled studies, oral calcium supplementation has been studied as a possible preventive measure.

• Premenstrual syndrome: Disturbances in calcium regulation may underlie the development of PMS symptoms. Women who consume more calcium from their diets are less likely to suffer severe PMS.

• Rickets: Vitamin D and calcium supplements should be used to treat rickets only if a medical professional has diagnosed rickets in a child and has also determined the cause is a nutritional deficiency. Amounts needed to treat rickets should be determined by a doctor and will depend on the age, weight, and condition of the child.

**Other potential uses for calcium**

• Celiac disease (for deficiency only): The malabsorption that occurs in celiac disease can lead to multiple nutritional deficiencies, including calcium.

• High blood pressure: 800–1,500 mg per day.

• High cholesterol: 800–1,000 mg per day.

• High triglycerides: In a preliminary trial, supplementation with 800 mg of calcium per day for one year resulted in a statistically significant 35% reduction in the average triglyceride level among people with elevated cholesterol and triglycerides.

**Where is it found?**

• Most dietary calcium comes from dairy products.

• Other good sources include sardines, canned salmon, green leafy vegetables, and tofu.

**Which form is best?**

• Choosing a form of calcium supplement can be confusing. While fewer pills of the calcium carbonate form are needed, this form doesn’t absorb as well as some other forms of calcium.

• Most, but not all, studies suggest that calcium citrate is better absorbed than calcium carbonate.

• Virtually all comparative studies find that calcium citrate/malate (CCM) absorbs somewhat better than calcium carbonate. CCM is increasingly the form of calcium recommended by doctors.

• Microcrystalline hydroxyapatite (MCHC), a variation on the bone meal form of calcium, has been shown to improve bone mass, but the absorption of MCHC appears to be poor.
Only preliminary research exists regarding the amino acid chelates of calcium, so conclusions cannot be drawn at this time.

How much is usually taken?
- For ages 19 to 50, calcium intake is recommended to be 1,000 mg daily.
- For adults over age 51, the recommendation is 1,200 mg daily.
- The most common supplemental amount for adults is 800–1,000 mg per day.
- General recommendations for higher intakes (1,200–1,500 mg) usually include the several hundred milligrams of calcium most people consume from their diets.

Are there any side effects or precautions?
- Constipation, bloating, and gas are sometimes reported with the use of calcium supplements. A very high intake of calcium from dairy taken with calcium carbonate used to cause a condition called "milk alkali syndrome." This toxicity is rarely reported today because most medical doctors no longer tell people with ulcers to take this combination.
- People with hyperparathyroidism or chronic kidney disease should not supplement with calcium without consulting a physician. People who have had kidney stones should read the section on kidney stones before considering supplementation. For other adults, the highest amount typically suggested by doctors (1,200 mg per day) is considered quite safe.
- In some cases, calcium supplements in the forms of bonemeal (including MCHC), dolomite, and oyster shell have higher lead levels than permitted by California regulations, though generally less than the levels set by the federal government. "Refined" forms (which would include CCM, calcium citrate, and most calcium carbonate) had low levels. In that report, only bonemeal exceeded federal levels. People who decide to take bonemeal, dolomite, or oyster shell for long periods of time should contact the supplying supplement company to request independent laboratory analysis showing minimal lead levels.
- Vitamin D is needed for calcium to absorb. Therefore, many doctors recommend that those supplementing with calcium also supplement with 400 IU of vitamin D per day.
- Animal studies have shown that essential fatty acids (EFAs) increase calcium absorption from the gut, in part by enhancing the effects of vitamin D and reducing loss of calcium in the urine.
- Calcium competes for absorption with a number of other minerals. Therefore, individuals taking calcium for more than a few weeks should also take a multimineral supplement.
- Lysine supplementation increases the absorption of calcium and may reduce its excretion. As a result, some researchers believe that lysine may eventually be shown to have a role in the prevention and treatment of osteoporosis.
Potential adverse drug interactions

- **Ciprofloxacin (Ciloxan®, Cipro®):** Minerals such as calcium can bind to ciprofloxacin, greatly reducing the absorption of the drug.

- **Doxycycline (Atridox®, Doryx®, Doxy®, Monodox®, Periostat®, Vibramycin®):** Many minerals can decrease the absorption and reduce effectiveness of doxycycline, including calcium.

- **Nadolol (Corgard®):** Calcium supplements, if taken at the same time as some beta-blocker drugs, may reduce blood levels of the drug. However, whether calcium affects nadolol in this manner is unknown. Until more information is available, people on nadolol should take calcium supplements an hour before or two hours after the drug.

- **Ofloxacin (Floxin®, Ocuflox®):** Minerals, including calcium, can bind to ofloxacin, greatly reducing drug absorption. Ofloxacin should be taken four hours before or two hours after consuming.

- **Tetracycline (Achromycin®, Sumycin®):** Many minerals, including calcium, can decrease the absorption of tetracycline, thus reducing its effectiveness.

- **Thyroid hormones (Armour® Thyroid, Cytomel®, Synthroid®, and others):** Simultaneous ingestion of calcium carbonate and one form of thyroid hormone (levothyroxine) reduces the absorption of the thyroid hormone. Separating calcium and thyroid hormones by at least four hours is recommended.

- **Verapamil (Calan®, Covera-HS®, Isoptin®, Verelan®):** Calcium supplementation has been reported to reverse the blood pressure-lowering actions of verapamil when used to treat arrhythmias. It remains unclear whether people taking verapamil for the purpose of lowering blood pressure should avoid calcium supplementation. These people should discuss the matter with the prescribing doctor.

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**Chromium**

Also indexed as: Glucose Tolerance Factor (GTF Chromium)

**How does it work?**

Chromium is an essential trace mineral that helps the body maintain normal blood sugar levels. In addition to its well-studied effects in diabetes, preliminary research has found that chromium supplementation also improves glucose tolerance in people with Turner’s syndrome—a disease linked with glucose intolerance.
Key uses for chromium

- Diabetes: Chromium is an essential trace mineral that helps the body maintain normal blood sugar levels.
- High cholesterol: Chromium may play a role in increasing HDL ("good") cholesterol, while lowering total cholesterol levels.
- Hypoglycemia: Research has shown that supplementing with chromium (200 mcg per day) can prevent blood sugar levels from falling excessively in people with hypoglycemia.

Other potential uses for chromium

- High triglycerides
- Insulin resistance syndrome (Syndrome X): Chromium is an essential trace mineral that helps the body maintain normal blood sugar levels. The high incidence of adult-onset diabetes suggests to some doctors that many people should be supplementing with small amounts of chromium.

Where is it found?

- The best source of chromium is true brewer’s yeast. Nutritional yeast and torula yeast do not contain significant amounts of chromium and are not suitable substitutes for brewer’s yeast.
- Chromium is also found in grains and cereals, though much of the chromium is lost when these foods are refined.
- Some brands of beer contain significant amounts of chromium.

Which form of chromium is best?

Brewer’s yeast should not be confused with nutritional yeast or torula yeast, which are low in chromium.

How much is usually taken?

A daily intake of 200 mcg is recommended by many doctors. No one should take more than 300 mcg per day of chromium without the supervision of a doctor.

Are there any side effects or precautions?

- In supplemental amounts (typically 50–300 mcg per day), chromium has not been found to cause toxicity in humans. While there are a few reports of individuals developing medical problems while taking chromium, a cause-effect relationship was not proven.
- One study found that very high concentrations of chromium could cause chromosomal mutations in hamster ovarian cells in a test tube.
Potential adverse drug interactions
Diabetes drugs: Chromium supplementation may enhance the effects of drugs for diabetes (e.g., insulin and other blood sugar-lowering drugs) and possibly lead to hypoglycemia. Therefore, diabetics taking these medications should supplement chromium only under the supervision of a doctor.

Copper

How does it work?
Copper is needed to absorb and utilize iron. It is also part of the antioxidant enzyme superoxide dismutase (SOD). Copper supplementation has been shown to increase SOD levels in humans. Copper is needed to make adenosine triphosphate, the energy the body runs on. Synthesis of some hormones requires copper, as does the synthesis of collagen (the “glue” that holds connective tissue together). In addition, the enzyme tyrosinase (which plays a role in the production of skin pigment, requires copper to function.

Key uses for copper
None

Other potential uses for copper

- High cholesterol: In a controlled trial, daily supplementation with 3.4 mg of copper for eight weeks decreased blood levels of total cholesterol and LDL cholesterol in a group of people over 50 years of age.

- Menkes’ disease (injectable copper histidine): Some studies have shown favorable effects of injectable copper on brain and nerve development in Menkes patients when the degree of genetic defect was mild and treatment was begun early. However, copper therapy does not benefit Menkes patients if the genetic defects are severe, or if therapy is begun after the physical defects manifest.

- Osteoporosis: Copper is needed for normal bone synthesis. A recent controlled two-year study reported that 3 mg of copper per day prevented bone loss. Although evaluation of the importance of copper for people with osteoporosis requires further research, many doctors recommend 2–3 mg per day, particularly if zinc is supplemented.

- Wound healing: Copper is a required cofactor for the enzyme lysyl oxidase, which plays a role in the cross-linking (and strengthening) of connective tissue. Doctors often recommend a copper supplement as part of a comprehensive nutritional program to promote wound healing. A typical amount recommended is 2–4 mg per day, beginning two weeks prior to surgery and continuing for four weeks after surgery.
Where is it found?
- The best source of copper is oysters.
- Nuts, dried legumes, cereals, potatoes, vegetables, and meat also contain copper.

Which form of copper is best?
- Cupric oxide (CuO) is a form of copper frequently used in vitamin-mineral supplements sold over-the-counter. However, animal studies have shown this form of copper is poorly absorbed from the gut; it should therefore not be used in supplements.
- Several other forms of copper (including copper sulfate, cupric acetate, and alkaline copper carbonate) are better absorbed, and are therefore preferable to cupric oxide.
- Other forms of copper, including copper aspartate, copper sebacate, and copper gluconate, are also used in nutritional supplements.

How much is usually taken?
Most people consume less than the recommended amount of this mineral. Some doctors recommend supplementing the average diet with 1–3 mg of copper per day. While the necessity of supplementing a normal diet with copper has not been proven, most people who take zinc supplements, including the zinc found in vitamin-mineral supplements should probably take additional copper.

Are there any side effects or precautions?
- The level at which copper causes problems is unclear. But in combination with zinc, up to 3 mg per day is considered safe. People drinking tap water from new copper pipes should consult their doctor before supplementing, since they might be getting enough (or even too much) copper from their water.
- People with Wilson’s disease should never take copper.
- Zinc interferes with copper absorption. People taking zinc supplements for more than a few weeks should also take copper (unless they have Wilson’s disease).
- Prolonged supplementation with large amounts of vitamin C, such as 3 grams per day or more, may interfere with copper absorption, possibly leading to a deficiency.
- Copper improves absorption and utilization of iron.

Potential adverse drug interactions
Ciprofloxacin (Ciloxan®, Cipro®): Minerals such as copper can bind to ciprofloxacin, greatly reducing the absorption of the drug. People are advised to take ciprofloxacin at least two hours after consuming copper-containing supplements.
Iodine

How does it work?
Iodine is needed to make thyroid hormones, which are necessary for maintaining normal metabolism in all cells of the body. Reports suggest that iodine may have a number of other important functions in the body unrelated to thyroid function that might help people with a wide variety of conditions; these other uses for iodine are only supported by minimal research.

Key uses for iodine
Iodine deficiency-induced goiter: People who avoid dairy, seafood, processed food, and iodized salt can become deficient in iodine. Iodine deficiencies are now uncommon in Western societies, due largely to the introduction of iodized salt in 1922. Nevertheless, the U.S. population has shown a trend of significantly decreasing iodine intake from 1988 to 1994. If this trend continues, iodine deficiency diseases may become more common. Iodine is required by the body to form thyroid hormones. Iodine deficiency can cause low thyroid function and goiter. Severe and prolonged iodine deficiency can potentially lead to serious types of hypothyroidism, such as myxedema or cretinism.

Other potential uses for iodine
Hypothyroidism

Where is it found?
• Seafood, iodized salt, and sea vegetables—for example, kelp—are high in iodine.
• Processed food may contain added iodized salt.
• Iodine is frequently found in dairy products.
• Vegetables grown in iodine-rich soil also contain this mineral.

How much is usually taken?
• Since the introduction of iodized salt, iodine supplements are unnecessary and not recommended for most people.
• For strict vegetarians who avoid salt and sea vegetables, 150 mcg per day is commonly supplemented. This amount is adequate to prevent a deficiency and larger amounts are not necessary.

Are there any side effects or precautions?
• High amounts (several milligrams per day) of iodine can interfere with normal thyroid function and should not be taken without consulting a doctor. The average diet provides about four times the recommended amount of iodine; for susceptible individuals, that amount of iodine may be enough to cause health problems. In fact,
goiter, traditionally a disease of iodine deficiency, is now linked sometimes to high iodine intake.

- Possible links between high iodine consumption and thyroid cancer have been reported.
- Some people have a hypersensitivity reaction to supplemental iodine, the first symptom of which is usually an acne-like rash.

**Potential adverse drug interactions**
None reported

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**Iron**

Also indexed as: Ferrous Sulfate

**How does it work?**

- Iron is part of hemoglobin, the oxygen-carrying component of the blood. Iron-deficient people tire easily because their bodies are starved for oxygen. Iron is also part of myoglobin, which helps muscle cells store oxygen. Without enough iron, ATP (the fuel the body runs on) cannot be properly synthesized. As a result, some iron-deficient people become fatigued even when their hemoglobin levels are normal.

- Although iron is part of the antioxidant enzyme catalase, iron is not generally considered an antioxidant, because too much iron can cause oxidative damage.

**Key uses for iron**

- Athletic performance (for deficiency only): Athletes who experience undue fatigue (a possible early warning sign of iron deficiency) should have their iron status evaluated by a doctor.

- Depression (for deficiency only): Iron deficiency is known to affect mood and can exacerbate depression.

- Iron-deficiency anemia: Iron-deficiency anemia can be diagnosed by a blood test. Because iron deficiency is sometimes a manifestation of a serious illness, including cancer, a doctor should be consulted to search for the cause of the deficiency.

- Menorrhagia (heavy menstruation) (for deficiency only): The relationship between iron deficiency and menorrhagia is complicated. Not only can the condition lead to iron deficiency, but iron deficiency can lead to or aggravate menorrhagia by reducing the capacity of the uterus to stop the bleeding. Supplementing with iron decreases excess menstrual blood loss in iron-deficient women who have no other underlying cause for their condition.
Other potential uses for iron

- Canker sores (for deficiency only)
- Celiac disease (for deficiency only): The malabsorption that occurs in celiac disease can lead to multiple nutritional deficiencies (including iron), which can be severe enough to cause anemia.
- Pre- and post-surgery health (if deficient or for major surgery)
- Restless legs syndrome (for deficiency only)

Where is it usually found?

- The most absorbable form of iron, called “heme” iron, is found in oysters, meat, poultry, and fish.
- Non-heme iron is found in the above foods, as well as in dried fruit, molasses, leafy green vegetables, wine, and most iron supplements.
- Acidic foods (such as tomato sauce) cooked in an iron pan can also be a source of dietary iron.

How much is usually taken?

- If a doctor diagnoses iron deficiency, iron supplementation is essential. To treat iron deficiency, a common recommended amount for an adult is 100 mg per day; that amount is usually reduced after the deficiency is corrected.
- Some pre-menopausal women become marginally iron deficient unless they supplement with iron. However, the 18 mg of iron present in many multiple-vitamin/mineral supplements are often adequate to prevent deficiency. A doctor should be consulted to determine the amount of iron needed.

Are there any side effects or precautions?

- Iron should not be taken by anyone who has not been diagnosed by a doctor with iron deficiency. Excess iron intake has been linked with increased risk of many diseases, including diabetes, cancer, increased risk of infection, systemic lupus erythematosus (SLE), exacerbation of rheumatoid arthritis, and Huntington’s disease.
- Iron (as ferrous sulfate) is the leading cause of accidental poisonings in children. Deaths in children have occurred from ingesting as little as 200 mg to as much as 5.85 grams of iron. Keep iron-containing supplements out of a child’s reach.
- Supplementing with iron can be quite dangerous for people with hemochromatosis, hemosiderosis, polycythemia, and iron-loading anemias (such as thalassemia and sickle cell anemia). All of these are conditions involving excessive storage of iron.
- Supplemental amounts required to overcome iron deficiency can cause constipation. Sometimes switching the form of iron, getting more exercise, or treating the constipation with fiber and fluids is helpful, though fiber can reduce iron
absorption (see below). Sometimes the amount of iron must be reduced if constipation occurs.

- Coffee, tea, high-fiber foods, and calcium supplements reduce iron absorption. Phytic acid, found in flat breads like pita, matzos, and some rye crackers, but also available as a supplement called IP-6, significantly reduces absorption of iron.
- Vitamin C slightly increases iron absorption.
- Taking vitamin A with iron helps treat iron deficiency, since vitamin A improves the absorption and/or utilization of iron.
- Iron has been reported to potentially interfere with manganese absorption. Supplementing with multi-minerals that include manganese may protect against manganese deficiencies that might be triggered by taking isolated iron supplements.

Potential adverse drug interactions

- Carbidopa (Lodosyn®): Iron supplements taken with carbidopa may interfere with the action of the drug.
- Carbidopa/levodopa (Sinemet®): (See Carbidopa)
- Chlorhexidine (Peridex®, Periogard®): Iron may increase the tooth staining effect of chlorhexidine.
- Ciprofloxacin (Ciloxan®, Cipro®): Minerals, including iron, can bind to ciprofloxacin, greatly reducing the absorption of the drug.
- Deferoxamine (Desferal®): Because it is used to treat acute iron poisoning, chronic iron overload, and aluminum accumulation in people with kidney failure, people taking deferoxamine to treat iron overload must not take iron supplements, including the amounts found in many multivitamin/minerals.
- Doxycycline (Vibramycin®): Iron can decrease the absorption and reduce the effectiveness of doxycycline.
- Indomethacin (Indocin®): Iron supplements can cause stomach irritation. Use of iron supplements with indomethacin increases the risk of stomach irritation and bleeding. Whether the same effect occurs with other anti-inflammatory drugs is not known.
- Levofloxacin (Levaquin®): Taking iron supplements with levofloxacin can reduce the absorption of the drug.
- Methyldopa (Aldomet®): Iron supplements have been found to decrease methyldopa absorption.
- Ofloxacin (Floxin®, Ocuflox®): Minerals, including iron, can bind to ofloxacin, greatly reducing the absorption of the drug.
- Penicillamine (Cuprimine®, Depen®): Penicillamine binds iron. When taken with iron, penicillamine absorption and activity are reduced. Four cases of penicillamine-induced kidney damage were reported when concomitant iron
therapy was stopped, which presumably led to increased penicillamine absorption and toxicity.

- Sulfasalazine (Azulfidine®): Iron can bind with sulfasalazine, decreasing sulfasalazine absorption and possibly decreasing iron absorption as well.
- Tetracycline (Achromycin®, Sumycin®): Many minerals, including iron, can decrease the absorption of tetracycline, thus reducing its effectiveness.

Thyroid hormones (e.g., levothyroxine, Synthroid®): People taking thyroid hormone medications and iron-containing products should separate them by at least two hours or consult with their doctor.

Warfarin (Coumadin®): Iron may bind to warfarin, decreasing its absorption.

**Magnesium**

**How does it work?**

Magnesium is needed for bone, protein, and fatty acid formation, making new cells, activating B vitamins, relaxing muscles, clotting of blood, and forming ATP—the energy the body runs on. The secretion and action of insulin also require magnesium.

**Key uses for magnesium**

- Cardiac arrhythmia: Lower serum concentrations of magnesium were found to be associated with a higher incidence of arrhythmia in a large population study.
- Congestive heart failure (CHF): Magnesium deficiency frequently occurs with this disease, and a deficiency of magnesium can lead to heart arrhythmias. Magnesium supplements have reduced this risk. Also, people with CHF are often given drugs that deplete both magnesium and potassium; a deficiency of either of these minerals could lead to an arrhythmia.
- Diabetes: Insulin secretion and function require magnesium. People with diabetes tend to have lower magnesium levels compared with those who have normal glucose tolerance. Supplementation with magnesium may help correct a deficiency and may help some diabetics improve glucose tolerance.
- Gestational hypertension: Magnesium deficiency has been implicated as a possible cause of gestational hypertension. Dietary intake of magnesium is below recommended levels for many women during pregnancy.
- Kidney stones (magnesium citrate): Supplementation with 500 mg of magnesium per day (or 300 mg per day in combination with 10 mg per day of vitamin B6) has reduced the recurrence rate of calcium oxalate kidney stones in recurrent stone formers.
- Migraine headaches: Compared with healthy people, individuals with migraines have been found to have lower levels of magnesium in their blood and brain. Supplementation with magnesium has been reported to reduce the recurrence rate of migraines.

- Mitral valve prolapse: Magnesium deficiency has been proposed as one cause of symptoms associated with this condition. In preliminary studies, magnesium supplementation has resulted in an improvement of symptoms in people with mitral valve prolapse.

**Other potential uses for magnesium**

- Asthma
- Attention Deficit Disorder (ADD/ADHD) (200 mg of magnesium per day for six months)
- Celiac disease (for deficiency): The malabsorption that occurs in celiac disease can lead to multiple nutritional deficiencies (including magnesium). Magnesium deficiency may contribute to the development of osteoporosis, which is common in people with celiac disease.
- Heart attack (intravenous magnesium): People with a history of heart attack, or who are at risk, should consult with their cardiologist about the possible use of immediate intravenous magnesium should they suffer a heart attack.
- High blood pressure: Some, but not all, studies show that magnesium supplements—typically 350–500 mg per day—lower blood pressure.
- Osteoporosis: Preliminary evidence shows that magnesium may be deficient in people with osteoporosis and supplementation may help preserve bone mineral density.
- Premenstrual syndrome: Women with PMS are often deficient in magnesium. Supplementing with magnesium may help reduce symptoms and effects of PMS. Symptom relief may begin to appear after two to three months.
- Urinary urgency (women): (350 mg of magnesium hydroxide [providing 147 mg elemental magnesium] twice daily for four weeks) Magnesium may be beneficial for bladder problems in women, especially common disturbances such as bladder control and the sense of “urgency.”

**Where is it found?**

Nuts and grains are good sources of magnesium. Beans, dark green vegetables, fish, and meat also contain significant amounts.

**How much is usually taken?**

- Most people don’t consume enough magnesium in their diets.
- Many nutritionally oriented doctors recommend 250–350 mg per day of supplemental magnesium for adults.
Are there any side effects or precautions?

Comments in this section are limited to effects of taking oral magnesium. Side effects from intravenous use of magnesium are not addressed.

- Taking too much magnesium often leads to diarrhea. For some people this can happen with amounts as low as 350–500 mg per day. More serious problems can develop with excessive magnesium intake from magnesium-containing laxatives; however, the amounts of magnesium found in nutritional supplements are unlikely to cause such problems.
- People with kidney disease should not take magnesium supplements without consulting a doctor.
- Vitamin B6 increases the amount of magnesium that can enter cells. As a result, these two nutrients are often taken together.
- Magnesium may compete for absorption with other minerals, particularly calcium. Taking a multimineral supplement avoids this potential problem.

Potential adverse drug interactions

- Alendronate (Fosamax®): Absorption of tiludronate, a drug related to alendronate, is reduced when taken with magnesium. This interaction has not yet been reported with alendronate.
- Amiloride (Midamor®, Moduretic®): taking magnesium with this drug may lead to a potentially dangerous increase in the level of magnesium in the body.
- Azithromycin (Zithromax®): A magnesium- and aluminum-containing antacid was reported to interfere with azithromycin absorption.
- Cimetidine (Tagamet®): In healthy volunteers, a magnesium hydroxide/aluminum hydroxide antacid, taken with cimetidine, decreased cimetidine absorption by 20–25%.
- Ciprofloxacin (Ciloxan®, Cipro®): Minerals, such as magnesium, can bind to ciprofloxacin, greatly reducing the absorption of the drug.
- Doxycycline (Atridox®, Doryx®, Doxy®, Monodox®, Periostat®, Vibramycin®): Many minerals, including magnesium, can decrease the absorption and reduce effectiveness of doxycycline.
- Famotidine (Mylanta-AR®, Pepcid®, Pepcid® AC): A magnesium hydroxide/aluminum hydroxide antacid, taken with famotidine, decreased famotidine absorption by 20–25%.
- Hydroxychloroquine (Plaquenil®): Magnesium supplementation may reduce blood levels of chloroquine, a compound similar to hydroxychloroquine, and decrease its effectiveness.
- Levofoxacin (Levaquin®): Taking magnesium supplements at the same time as levofoxacin can reduce the intestinal absorption—and thus the effectiveness—of the drug.
- Misoprostol (Cytotec®, Arthrotec®): A common side effect of misoprostol is diarrhea, which is aggravated by taking magnesium.
- Nitrofurantoin (Furadantin®, Macrobid®, Macrodantin®): Magnesium may inhibit absorption of nitrofurantoin, reducing the effectiveness of the drug.
- Nizatidine (Axid®, Axid® AR): A magnesium hydroxide/aluminum hydroxide antacid, taken with nizatidine, decreased nizatidine absorption by 12%.
- Ofloxacin (Floxin®, Ocuflox®): Minerals, including magnesium, can bind to ofloxacin, greatly reducing drug absorption.
- Spironolactone (Aldactone®, Aldactazide®): Taking magnesium with this drug may lead to a potentially dangerous increase in the level of magnesium in the body.
- Tetracycline (Achromycin®, Sumycin®, Helidac®): Magnesium can decrease the absorption of tetracycline, thus reducing its effectiveness.
- Warfarin (Coumadin®): Magnesium may bind with warfarin, potentially decreasing its absorption and activity.

## Manganese

### How does it work?
Manganese is a trace mineral needed for healthy skin, bone, and cartilage formation, as well as glucose tolerance. It also helps activate superoxide dismutase (SOD)—an important antioxidant enzyme.

### Key uses for manganese
None

### Other potential uses for manganese
Tardive dyskinesia: One doctor has found that administering manganese can prevent the development of tardive dyskinesia and that higher amounts can reverse tardive dyskinesia that has already developed. Others have reported similar improvements with manganese.

### Where is it found?
Nuts and seeds, tea, wheat germ, wheat bran, leafy green vegetables, beet tops, and pineapple are all good sources of manganese.
How much is usually taken?

- Whether most people would benefit from manganese supplementation remains unclear. While there is no recommended dietary allowance, the National Research Council’s “estimated safe and adequate daily dietary intake” is 2–5 mg.
- The 5–15 mg often found in a high-potency multivitamin/mineral supplement is generally considered to be a reasonable level by many doctors.
- For tardive dyskinesia, 15 mg per day has been used for prevention; up to 60 mg per day has been used for existing disease, but this level of supplementation must be supervised by a doctor.

Are there any side effects or precautions?

- Amounts found in supplements (5–20 mg) have not been linked with any toxicity. Excessive intake of manganese can lead to the rare side effects of dementia, psychiatric symptoms, or symptoms resembling Parkinson’s disease. However, nearly all reports of manganese toxicity in otherwise healthy individuals have been in people who chronically inhaled manganese dust (such as miners).
- Preliminary research suggests that individuals with cirrhosis may not be able to properly excrete manganese; until more is known, these people should not supplement with manganese.
- Several minerals, such as calcium and iron and possibly zinc, reduce the absorption of manganese. Of these interactions, the link to iron may be the most important. In one study, women with high iron status had relatively poor absorption of manganese. In another report studying manganese/iron interactions in women, increased intake of “non-heme iron”—the kind of iron found in most supplements—decreased manganese status. These interactions suggest that taking multi-minerals that include manganese may protect against manganese deficiencies that might otherwise be triggered by taking isolated mineral supplements, particularly iron.
- Zinc and copper work together with manganese to activate superoxide dismutase.

Potential adverse drug interactions

Ciprofloxacin (Ciloxan®, Cipro®): Several minerals, including manganese, can bind to ciprofloxacin, greatly reducing the absorption of the drug.
Selenium

How does it work?

- Selenium activates an antioxidant enzyme called glutathione peroxidase, which may help protect the body from cancer. Yeast-derived forms of selenium have induced programmed cell death in cancer cells in test tubes and in animals.

- Selenium is also essential for healthy immune functioning. Selenium supplementation has reduced the incidence of viral hepatitis in selenium-deficient populations, presumably by enhancing immune function. Even in a non-deficient population of elderly people, selenium supplementation has been found to stimulate the activity of white blood cells—primary components of the immune system.

- Selenium is also needed to activate thyroid hormones.

Key uses for selenium

None

Other potential uses for selenium

- Asthma: People with low levels of selenium have a high risk of asthma. In a small double-blind trial, supplementation with selenium for fourteen weeks resulted in clinical improvement in six of eleven patients, compared with only one of ten in the placebo group.

- Atherosclerosis: In some studies, people who consumed more selenium in their diet had a lower risk of heart disease. In one double-blind report, individuals who already had one heart attack were given selenium or placebo for six months. At the end of the trial, there were four deaths from heart disease in the placebo group but none in the selenium group (however, the number of patients was too small for this difference to be statistically significant).

- Colon cancer (reduces risk): Selenium activates an antioxidant enzyme called glutathione peroxidase, which may help protect the body from cancer.

- Depression

- Dermatitis herpetiformis

- Halitosis (if gum disease)

- Heart attack: The relation between selenium and protection from heart attacks remains uncertain. However, there is some evidence that assuring adequate intake of selenium may reduce the risk of developing a heart attack.

- HIV support: Selenium deficiency is associated with high mortality among HIV-infected people. HIV-infected people who received selenium supplements experienced fewer infections, better intestinal function, and improved appetite. In a
preliminary study of individuals with HIV-related cardiomyopathy supplementation with selenium resulted in improvements in heart function.

- Immune function (for elderly people)
- Infections (to prevent hospital-acquired infections in very low birth weight infants)
- Infertility (male): In a double-blind study of 64 infertile men with reduced sperm motility, supplementation with selenium significantly increased sperm motility. Five (11%) of 46 men receiving selenium achieved paternity, compared with none of 18 men receiving a placebo.
- Lung cancer (reduces risk)
- Pancreatic insufficiency
- Phenylketonuria (PKU): Research suggests that selenium deficiency may contribute to the neurological disorders associated with PKU.
- Prostate cancer (reduces risk)
- Rheumatoid arthritis (RA): Patients with RA have been found to have lower selenium levels than healthy individuals. In a small double-blind trial, women with RA were given selenium or a placebo for three months. Of those taking selenium, 75% experienced a significant reduction in pain and joint inflammation, whereas there was no significant improvement in the placebo group. However, another double-blind study found no beneficial effect of selenium.

Where is it found?
- Brazil nuts are the best source of selenium.
- Yeast, whole grains, and seafood are also good sources.

Which form of selenium is best?
In the study that showed a reduction in the risk of human cancers, high-selenium yeast was used. Other commonly used forms of selenium include sodium selenite, selenomethionine, and selenocysteine; it is not clear whether any of these three are preferable to the others.

How much is usually taken?
- An adult intake of 100–200 mcg of selenium per day is recommended by many doctors.
- The following amounts have been used in research studies on selenium: cancer risk reduction, 200 mcg per day; asthma, 45 mcg per day; atherosclerosis, 100 mcg per day; HIV support, 400 mcg per day; male infertility, 100 mcg per day; rheumatoid arthritis, 200 mcg per day; liver cirrhosis, 100 mcg per day; Osgood-Schlatter disease, 50 mcg three times daily plus 400 IU of vitamin E.

Are there any side effects or precautions?
- Selenium is safe at the level people typically supplement (100–200 mcg per day).
- Selenium toxicity can result in loss of fingernails, skin rash, and changes in the nervous system.
- Intakes over 900 mcg per day have been reported to cause adverse effects in some people. The National Academy of Sciences recommends that selenium intake not exceed 400 mcg per day, unless the higher intake is monitored by a healthcare professional.
- In the presence of iodine-deficiency-induced goiter, selenium supplementation has been reported to exacerbate low thyroid function.
- Selenium enhances the antioxidant effect of vitamin E.

Potential adverse drug interactions
None reported

Zinc

How does it work?
Zinc is a mineral and a component of more than 300 enzymes needed to repair wounds, maintain fertility in adults and growth in children, synthesize protein, help cells reproduce, preserve vision, boost immunity, and protect against free radicals, among other functions.

Key uses for zinc
- Acne
- Acrodermatitis enteropathica: Supplementation with zinc brings about complete remission in hereditary acrodermatitis enteropathica.
- Common cold/sore throat: Zinc has antiviral and immune-enhancing effects. In double-blind studies, zinc lozenges have reduced the duration of colds in adults, but have been ineffective in children. Lozenges containing zinc gluconate or zinc gluconate-glycine have been effective, whereas most other forms of zinc and lozenges flavored with citric acid, tartaric acid, sorbitol, or mannitol have been ineffective.
- Infertility (male): A lack of zinc can reduce testosterone levels. For men with low testosterone levels, zinc supplementation raises testosterone and also increases fertility. For men with low semen zinc levels, zinc supplements may increase both sperm counts and fertility.
Night blindness: Zinc deficiency can reduce the activity of retinol dehydrogenase, an enzyme needed to help vitamin A work in the eye. Zinc supplementation helps night blindness in people who are zinc-deficient.

Wilson’s disease: Zinc is known for its ability to reduce copper absorption and is used by some doctors to treat Wilson’s disease, a condition of excess copper accumulation.

Minor injuries and wound healing: Zinc is a component of many enzymes, including some that are needed to repair wounds. Even a marginal deficiency of zinc can interfere with optimal recovery from everyday tissue damage as well as more serious trauma. Topical zinc-containing preparations have improved healing of skin wounds even when there is no deficiency, but oral zinc has helped tissue healing only when an actual deficiency exists.

Other potential uses for zinc

- Anorexia nervosa: There are a number of case reports of zinc supplementation resulting in normalization of eating behavior in people with anorexia nervosa.
- Birth defects prevention
- Canker sores (for deficiency only)
- Celiac disease (for deficiency only): Zinc malabsorption occurs frequently in celiac disease and may result in zinc deficiency, even in people who are otherwise in remission. Individuals with newly diagnosed celiac disease should be treated for nutritional deficiencies by a doctor.
- Cold sores: Topical zinc sulfate solution has helped people with recurrent herpes simplex infections. However, because an excessive concentration of zinc can cause skin irritation, topical zinc should be used only with the supervision of a doctor knowledgeable in its use.
- Common cold (as nasal spray)
- Crohn’s disease: Crohn’s disease often leads to malabsorption. As a result, inadequate levels of many nutrients are common, including zinc. Zinc is needed to repair intestinal cells damaged by Crohn’s disease. Some doctors recommend 25–50 mg of zinc per day (balanced with 2–4 mg of copper per day).
- Diabetes (preferably for those with a documented deficiency)
- Genital herpes
- Gingivitis (zinc plus bloodroot toothpaste)
- Halitosis (zinc chloride rinse or toothpaste)
- HIV support: Zinc levels are frequently low in people with HIV infection. Zinc supplements in amounts of 45 mg per day have been shown to reduce the number of infections in individuals with AIDS.
- Immune function (for elderly people)
- Infection: Marginal deficiencies of zinc result in impairments of immune function.
- Liver cirrhosis: Alcoholic liver cirrhosis is associated with zinc deficiency. Short-term, high level zinc supplementation has improved portal-systemic encephalopathy, a related brain disorder caused by insufficient detoxification of waste products by the liver. Zinc supplements may also improve impaired taste function that commonly occurs with liver cirrhosis.
- Macular degeneration
- Peptic ulcer: Zinc is needed for the repair of damaged tissue and has protected rats from stomach ulceration. In a small controlled trial, high amounts of zinc accelerated the healing of gastric ulcers compared with placebo.
- Pregnancy support: In a preliminary study, pregnant women who used a zinc-containing nutritional supplement in the three months before and after conception had a 36% decreased chance of having a baby with a neural tube defect and women who had the highest dietary zinc intake (but took no multivitamin supplement) had a 30% decreased risk.
- Sickle cell anemia
- Skin ulcers (oral and topical zinc)
- Sprains and strains (if deficient)
- Tinnitus (for deficiency only)

Where is it found?
Good sources of zinc include oysters, meat, eggs, seafood, black-eyed peas, tofu, and wheat germ.

How much is usually taken?
- Moderate intake of zinc, approximately 15 mg daily, is adequate to prevent deficiencies.
- Higher levels (up to 50 mg taken three times per day) are reserved for people with certain health conditions under the supervision of a doctor.
- For the alleviation of cold symptoms, lozenges providing 13–23 mg of zinc gluconate or zinc gluconate-glycine are used, typically every 2 hours while awake, but only for several days. The best effect is obtained when lozenges are used at the first sign of a cold.

Are there any side effects or precautions?
- Zinc inhibits copper absorption; copper deficiency can result in anemia, lower levels of HDL ("good") cholesterol, or cardiac arrhythmias. Copper intake should be increased if zinc supplementation continues for more than a few days (except for individuals with Wilson’s disease).
- Zinc intake in excess of 300 mg per day has been reported to impair immune function.
- Some people report that zinc lozenges lead to stomach ache, nausea, mouth irritation, and a bad taste.
- One source reports that gastrointestinal upset, metallic taste in the mouth, blood in the urine and lethargy can occur from chronic oral zinc supplementation over 150 mg per day, but those claims are unsubstantiated.
- In topical form, zinc has no known side effects when used as recommended.
- Zinc competes for absorption with copper, iron, calcium, and magnesium. A multimineral supplement will help prevent mineral imbalances that can result from taking high amounts of zinc for extended periods of time.

Potential adverse drug interactions

Zinc can bind with the following drugs, greatly reducing their absorption:
- Ciprofloxacin (Ciloxan®, Cipro®)
- Doxycycline (Atridox®, Doryx®, Doxy®, Monodox®, Periostat®, Vibramycin®)
- Ofloxacin (Floxin®, Ocuflox®)
- Penicillamine (Cuprimine®, Depen®): Some people with Wilson’s disease can take this combination safely.
- Warfarin (Coumadin®)
# Key Vitamins and Minerals Needed During Pregnancy

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Need During Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>5,000 IU</td>
</tr>
<tr>
<td>Vitamin B1—Thiamine</td>
<td>25-100 mg</td>
</tr>
<tr>
<td>Vitamin B2—Riboflavin</td>
<td>25-100 mg</td>
</tr>
<tr>
<td>Vitamin B3—Niacin</td>
<td>25-100 mg</td>
</tr>
<tr>
<td>Vitamin B6—Pyridoxine</td>
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</tr>
<tr>
<td>Vitamin B12</td>
<td>25-100 mg</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>1,000-2,000 mg</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>400 IU</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>400 IU</td>
</tr>
<tr>
<td>Biotin</td>
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</tr>
<tr>
<td>Folic Acid</td>
<td>400-2,000 mcg</td>
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<tr>
<td>Pantothenic Acid</td>
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<table>
<thead>
<tr>
<th>Mineral</th>
<th>Need During Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
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</tr>
<tr>
<td>Chromium</td>
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<tr>
<td>Copper</td>
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<tr>
<td>Iodine</td>
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<tr>
<td>Iron</td>
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<tr>
<td>Magnesium</td>
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<tr>
<td>Manganese</td>
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</tr>
<tr>
<td>Selenium</td>
<td>100-200 mcg</td>
</tr>
<tr>
<td>Zinc</td>
<td>20-35 mg</td>
</tr>
</tbody>
</table>