

Magnesium

© [Elson M. Haas M.D.](#)

(Excerpted from *Staying Healthy with Nutrition: The Complete Guide to Diet and Nutritional Medicine*
Published by [Celestial Arts](#))



Magnesium is a very important essential macromineral, even though there are only several ounces in the body (0.05 percent of body weight). It is involved in several hundred enzymatic reactions, many of which contribute to production of energy and cardiovascular function. The great amount of research on magnesium done in the last decade has resulted in major changes in our knowledge. Decreases in magnesium intake have been more prevalent in our American diet with additions of supplemental vitamin D and calcium, dietary phosphorus, and refined or processed carbohydrate foods. Drinking soft water decreases magnesium intake, while diuretic drugs cause magnesium loss, as do alcohol, caffeine, and sugar. Decreased blood and tissue levels of magnesium have been shown to be related to high blood pressure, kidney stones, heart disease and, particularly, heart attacks due to coronary artery spasm (magnesium helps relax and dilate coronary arteries). Studies have indicated that a decreased concentration of magnesium is found in the heart and blood of heart attack victims, though it is not clear whether this is a cause or a result of the problem. Magnesium's role in alleviating premenstrual syndrome (PMS) has made big news as well.

Magnesium, like calcium, is an earth alkali mineral. The word magnesium comes from the name of the Greek city, Magnesia, where large deposits of magnesium carbonate ($MgCO_3$) were found. This "salt" was first used as a laxative; magnesium carbonate and magnesium sulfate are still used in this way. Magnesium is the "iron" of the plant world-as iron is to hemoglobin, magnesium is to chlorophyll, the "blood" pigment of plants. The central atom of the chlorophyll structure is magnesium.

About 65 percent of our magnesium is contained in the bones and teeth. As with calcium, the bones act as a reservoir for magnesium in times of need. The remaining 35 percent of magnesium is contained in the blood, fluids, and other tissues; there is a high concentration, actually higher than in the blood, in the brain. Magnesium is present in significant amounts in the heart. Most of it, like potassium, is inside the cells.

The process of digestion and absorption of magnesium is very similar to that of calcium. The suggested ratio of intake of these two vital nutrients is about 2:1, calcium to magnesium. Magnesium also requires an acidic stomach environment for best absorption, so taking it between meals or at bedtime is recommended. Meals high in protein or fat, a diet high in phosphorus or calcium (calcium and magnesium can compete), or alcohol use may decrease magnesium absorption. It is possible that some of the hangover symptoms related to alcohol are in part due to magnesium depletion. Taking this mineral with some thiamine (B1) and drinking extra water can help prevent hangover symptoms.

Usually, about 40-50 percent of the magnesium we consume is absorbed, though this may vary from 25-75 percent depending on stomach acid levels, body needs, and dietary habits. Stress may increase magnesium excretion, and the resulting temporary magnesium depletion may make the heart more sensitive to electrical abnormalities and vascular spasm that could lead to cardiac ischemia. The kidneys can excrete or conserve magnesium according to body needs. The intestines can also eliminate excess magnesium in the feces. Otherwise, magnesium absorption is generally affected by the factors shown in the table (see Calcium) entitled Factors Affecting Calcium Absorption.

Sources: Almost all of our magnesium supplies come from the vegetable kingdom, though seafood has fairly high amounts. As a component of chlorophyll, this mineral is important to plant photosynthesis; therefore, the dark green vegetables are good sources of magnesium. Most nuts, seeds, and legumes have high amounts of magnesium; soy products, especially soy flour and tofu, and nuts such as almonds, pecans, cashews, and brazil nuts are good examples. The whole grains, particularly wheat (especially the bran and germ), millet, and brown rice, and fruits such as avocado and dried apricot are other sources. Hard water can also be a valuable source of magnesium. Dolomite and bonemeal are good sources of magnesium, as they are of calcium.

Many factors affect magnesium availability from foods. One is the amount of magnesium in the soil in which the food is grown. Much magnesium can be lost in the processing and refining of foods and in making oils from the magnesium-rich nuts and seeds. Nearly 85 percent of the magnesium in grains is lost during the milling of flours. Soaking and boiling foods can leach magnesium into the water, so the "pot liquor" from cooking vegetables may be high in magnesium and other minerals. Oxalic acid in vegetables such as spinach and chard and phytic acid in some grains may form insoluble

salts with magnesium, causing it to be eliminated rather than absorbed. For these reasons and those previously discussed, many people get insufficient magnesium from their diets.

Functions: Magnesium is considered the "antistress" mineral. It is a natural tranquilizer, as it functions to relax skeletal muscles as well as the smooth muscles of blood vessels and the gastrointestinal tract. (While calcium stimulates muscle contraction, magnesium relaxes them.) Because of its influence on the heart, magnesium is considered important in preventing coronary artery spasm, a significant cause of heart attacks. Spasms of the blood vessels lead to insufficient oxygen supply through them and pain, injury, or death of the muscle tissue that they nourish. To function optimally, magnesium must be balanced in the body with calcium, phosphorus, potassium, and sodium chloride. For example, with low magnesium, more calcium flows into the vascular muscle cells, which contracts them-leading to tighter vessels and higher blood pressure. Adequate magnesium levels prevent this.

Magnesium, like potassium, is primarily an intracellular nutrient. It activates enzymes that are important for protein and carbohydrate metabolism, and it is needed in DNA production and function. Magnesium also modulates the electrical potential across cell membranes, which allows nutrients to pass back and forth. It helps in the release of energy by transferring the key phosphate molecule to adenosine triphosphate (ATP), an energy source generated by the cytochrome system.

In summary, even though it is not as prevalent as the other macrominerals, magnesium has many essential metabolic functions in the body. It is important in the production and transfer of energy, in muscle contraction and relaxation, in nerve conduction, in protein synthesis, and in many biochemical reactions as a cofactor to enzymes. Magnesium is also thought to dilate the blood vessels.

Uses: As time goes on, magnesium is recommended and used in more and more treatments. Prevention or treatment of myocardial infarctions (MIs), prevention of kidney stones, and in treatment of premenstrual syndrome are some important recent uses. Magnesium has been used with some success in relieving certain kinds of angina and reducing the risks of coronary artery spasms, which can lead to angina or, more severely, heart attack. Deficient magnesium levels have been found in the blood and hearts of cardiac victims. Besides preventing heart attacks, magnesium has a mild effect on lowering blood pressure and so is used to treat and prevent hypertension and its effects. Magnesium supplementation can reduce many of the symptoms of mitral valve prolapse, such as palpitations or arrhythmias, and it may help in other cardiac arrhythmias such as atrial tachycardia or fibrillation, or those caused by taking excess digitalis, a cardiac drug. It may also reduce the bronchoconstriction in asthma by relaxing the muscle around the bronchial tubes. Intravenous solutions containing magnesium and other nutrients have been used successfully to break acute asthma attacks.

Magnesium sulfate has been used specifically to lower blood pressure in pregnant women with preeclampsia, which is characterized by edema, hypertension, and hyperreflexia. These problems could become more severe and lead to seizures (then termed "eclampsia") as well. Magnesium sulfate also acts as a mild anticonvulsant in this case. Through its nerve- and muscle-relaxing effect, magnesium may be helpful in reducing epileptic seizures caused by nerve excitability.

Problems that May be Helped by Magnesium

Atherosclerosis	Kidney stones
Arrhythmias	Menstrual pain
Angina pectori	Alcoholism
Hypertension	Fatigue
Bronchial asthma	Fatigue
Epilepsy	Osteoporosis
Autism	Anxiety
Hyperactivity	Insomnia
Premenstrual syndrome	Muscle cramps

By increasing calcium solubility, especially in the urine, magnesium can help prevent kidney stones, especially calcium oxalate stones. Research has shown this effect in a high percentage of people who form kidney stones regularly. Actually,

it is thought that calcium oxalate stones are most likely to form in people who are magnesium deficient, so we may just be correcting that deficiency. Through this same effect, magnesium is helpful in preventing other tissue and blood vessel calcification (and thereby atherosclerosis), as well as some problems of the teeth, including cavities. For these purposes, a daily dose of 50 mg. of vitamin B6 and 200-300 mg. of magnesium oxide is often given.

Supplementing magnesium has been shown to be very helpful in alleviating many symptoms related to the menstrual period. Menstrual cramps, irritability, fatigue, depression, and water retention have been lessened with magnesium, usually given along with calcium and often with vitamin B6. Magnesium is often at its lowest level during menstruation, and many symptoms of premenstrual syndrome (PMS) are relieved when this mineral is replenished. Supplementing magnesium in the same amount (or more) as calcium (about 500-1,000 mg. daily) is currently recommended for premenstrual problems.

Fatigue is often reduced with magnesium (and potassium) supplementation. The many enzyme systems that require magnesium help restore normal energy levels. Because of this function and its nerve and muscle support, magnesium may also be helpful for nervousness, anxiety, insomnia, depression, and muscle cramps. Magnesium is also given as part of a treatment for autism or hyperactivity in kids, usually along with vitamin B6. Getting children and fatigued adults to eat more green vegetables and chlorophyll is often helpful for supplying additional naturally-occurring magnesium. People tend to sleep better after taking magnesium before bed. Alcoholics tend to have low magnesium levels, and this mineral can be helpful during withdrawal and to prevent or reduce hangover symptoms.

When given orally, magnesium sulfate (Epsom salts) is not absorbed but attracts water into the colon and thus acts as an effective laxative. Epsom salts in a bath are absorbed slightly and are known to be relaxing. For injuries, a concentrated solution is used as a compress to help drain toxins. Magnesium is also thought to reduce lead toxicity and its buildup, possibly through competing for absorption. Since magnesium is an alkaline mineral, it is used in several over-the-counter antacids.

Deficiency and toxicity: Toxicity due to magnesium overload is almost unknown in a nutritional context, as excesses are usually eliminated in the urine and feces. However, symptoms of magnesium toxicity can occur more likely if calcium intake is low. These symptoms may include depression of the central nervous system, causing muscle weakness, fatigue, sleepiness, or even hyperexcitability. In extreme states, magnesium overload can cause death.

Magnesium deficiency is actually fairly common; however, it is usually not looked for, and therefore, not found or corrected. Deficiency is more likely in those who eat a processed-food diet; in people who cook or boil all foods, especially vegetables; in those who drink soft water; in alcoholics; and in people who eat food grown in magnesium-deficient soil, where synthetic fertilizers containing no magnesium are often used. Deficiency is also more common when magnesium absorption is decreased, such as after burns, serious injuries, or surgery and in patients with diabetes, liver disease, or malabsorption problems; and when magnesium elimination is increased, as in people who use alcohol, caffeine, or excess sugar, or who take diuretics or birth control pills.

Early symptoms of magnesium deficiency can include fatigue, anorexia, irritability, insomnia, and muscle tremors or twitching. Psychological changes, such as apathy, apprehension, decreased learning ability, confusion, and poor memory may occur. Tachycardia (rapid heartbeat) and other cardiovascular changes are likely with moderate deficiency, while severe magnesium deficiency may lead to numbness, tingling, and tetany (sustained contraction) of the muscles as well as delirium and hallucinations.

Arterial spasm, specifically of the coronary arteries, is a significant recent concern with magnesium deficiency. This could lead to angina symptoms or even a heart attack. Blood pressure can rise with magnesium deficiency, while an increased likelihood of kidney stones and other tissue calcification is possible.

Requirements: The current Recommended Daily Allowance (RDA) is about 300-350 mg. for adults-350 mg. for men and 300 mg. for women, increasing to about 450 mg. during pregnancy and lactation. The minimum is also expressed as about 6 mg. per kg. (2.2 pounds) of body weight. Many authorities feel that the RDA should be doubled, to about 600-700 mg. daily. An average diet usually supplies about 120 mg. of magnesium per 1,000 calories, for an estimated daily intake of about 250 mg. Unless absorption is great, that is not going to produce adequate tissue levels of magnesium for most people.

Magnesium chelated with amino acids is probably the most absorbable form. Less absorbable forms include magnesium bicarbonate, magnesium oxide, and magnesium carbonate. Magnesium oxide is probably somewhat better than

magnesium carbonate (dolomite). The newly available salts of magnesium aspartate or citrate, both known as mineral transporters, have a better percentage of absorption.

Calcium-magnesium balance is important. It is usually suggested that when we supplement calcium we take about half that amount in magnesium. If we increase calcium intake, we should likewise increase magnesium. We should also increase magnesium intake when we consume more phosphorus, vitamin D, or protein or when we have higher blood cholesterol. Those on birth control pills or diuretics, postmenopausal women, and those who drink alcohol need more magnesium.

The levels of magnesium used by physicians are commonly in the range of 600-1,000 mg.; however, the researchers in the kidney stone studies used only 200-300 mg. of supplemental magnesium oxide. Calcium and magnesium are both alkaline minerals, so they are not taken with or after meals, as they can reduce stomach acid as well as being absorbed poorly when taken with food. They are absorbed better when taken between meals or on an empty stomach, especially with a little vitamin C as ascorbic acid. Many calcium-magnesium combinations are formulated with hydrochloric acid and vitamin D to aid the mineral absorption. And taking them before bedtime may be very helpful in increasing utilization of both these important minerals and lead to a sleep-filled night.

[Elson M. Haas, MD](#) has been in medical practice for over 25 years and was instrumental in the development of the field that he has termed Integrated Medicine. He is the founder and director of the Preventive Medical Center of Marin, an integrated health care facility in San Rafael, California, where he specializes in Family and Nutritional Medicine, Detoxification, and Individualized Health Programs. His books include: [Staying Healthy with Nutrition](#), Staying Healthy with the Seasons (fully revised 20th Anniversary 2003 edition), The False Fat Diet, The Staying Healthy Shopper's Guide, The Detox Diet, and A Cookbook for All Seasons.