

The Magic of

Magnesium



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✧ **Abstract** Magnesium is the fourth most abundant mineral in the body and is essential to good health. Approximately 50% of total body magnesium is found in bone. The other half is found predominantly inside cells of body tissues and organs. Only 1% of magnesium is found in blood. Studies performed on the importance of magnesium and the medical conditions that may arise from inadequate magnesium in the body have increased the interest in magnesium supplementation. Magnesium, an important electrolyte needed for proper muscle, nerve, and enzyme function, is also used as a supplement to relieve premenstrual symptoms related to mood changes. Studies indicate that some of the medical conditions that may arise from inadequate magnesium are hypertension, heart arrhythmias, diabetes, osteoporosis, migraines, premature ejaculation, premenstrual syndrome, and insomnia, to list a few. Compounding pharmacists can consult with patients and assist them with magnesium supplements that are prepared specifically for their health needs.

All minerals are important to health, but I am especially fond of magnesium because of its versatility. Since magnesium deficiency is running rampant among Americans, virtually every patient that walks into your pharmacy can benefit from supplementation. One study, sponsored by the National Institutes of Health, shows that 68% of Americans are magnesium deficient;^{1,2} other experts put the number closer 80%.³ Even athletes, who might be expected to take greater care with their diets, are not immune from magnesium deficiency. For example, studies carried out in 1986 and 1987 revealed that gymnasts, and football and basketball players were consuming only around 70% of the recommended daily allowance (RDA),^{4,5} while female runners fared even worse, with reported intakes as low as 59% of the RDA.⁶ The typical American diet of many processed and refined foods, convenience foods, and junk foods leads to serious magnesium deficiencies. Just the process of refining foods strips nutrients, including magnesium. Cooking may substantially diminish the magnesium content of foods, with boiling of vegetables causing a loss of 50% of the magnesium. Examples of how magnesium levels can be affected by food processing and by a person's lifestyle are shown below:^{1,7,8}

- ✧ Milling flour from grains strips magnesium from the grain.
- ✧ Consumption of sugar

- ✧ Fluoridated, softened, and distilled water depletes magnesium.
- ✧ Carbonated beverages and some processed foods, like lunch meat, contain phosphates that bind to magnesium molecules and flush it out of the body.
- ✧ Alcohol blocks magnesium, especially if you have three or more drinks a day.
- ✧ Coffee works like a diuretic to flush magnesium from the body.
- ✧ Some foods (e.g., raw or roasted nuts and seeds, soybeans, spinach, chard) contain compounds called phytic acid and oxalic acid which can cause magnesium to be eliminated from the body.

RDA for Magnesium:

Age	Male (mg/day)	Female (mg/day)	Pregnancy (mg/day)	Lactation (mg/day)
1 to 3	80	80	N/A	N/A
4 to 8	130	130	N/A	N/A
9 to 13	240	240	N/A	N/A
14 to 18	410	360	400	360
19 to 30	400	310	350	310
31+	420	320	360	320

N/A = not applicable
 Source: Institute of Medicine of the National Academy of Sciences.



Examples of medical conditions that can result from inadequate magnesium are: hypertension, heart arrhythmias, diabetes, osteoporosis and osteopenia, migraines, insomnia, pre-eclampsia, fibromyalgia, premenstrual syndrome, premature ejaculation, ischemic heart disease, attention-deficit/hyperactivity disorder, leg cramps, anxiety and psychiatric disorders, nystagmus, asthma, chronic pain, hearing loss, cancer, C-reactive protein levels...and the list goes on. These medical conditions are valid reasons for a compounding pharmacist to consult with their patients about their magnesium levels. Certain medical conditions can upset the body's magnesium balance (e.g., intestinal flu with vomiting or diarrhea; stomach and bowel diseases such as irritable bowel, celiac sprue; diabetes; salt, alcohol intake). Other factors that can lower a person's magnesium levels are heavy menstrual periods, excessive sweating, and prolonged stress.⁹ The information below is a discussion on some of the medical problems associated with inadequate magnesium levels.

Sleep

Magnesium is often referred to as nature's all-natural, nonaddictive tranquilizer. Concerning the affects of magnesium deficiency on sleep, Werbach comments:

Insomnia is one of the central, or neurotic, symptoms of chronic magnesium deficiency. A number of parasomnias (night terrors; nocturnal verbal and motor automatisms; restless leg syndrome) may be related to magnesium deficiency. Sleep in magnesium deficiency is usually agitated with frequent nocturnal awakenings. Nocturnal instrument monitoring reveals major disorders of sleep organization. The deficiency may be severe enough to be diagnosed on the basis of clearly low blood magnesium levels. Conversely, a high magnesium, low aluminum diet has been found to be associated with high-quality sleep time and few nighttime awakenings, and magnesium supplementation

has been reported to reduce sleep latency and result in uninterrupted sleep.¹⁰

Diabetes

"Diabetes is a magnesium deficiency state," says Jerry Naddler, MD, of the University of Virginia School of Medicine. He finds 80% of diabetics have low intracellular magnesium. Indeed, research suggests low magnesium boosts your risk of developing type 2 diabetes by one-third. He also reports that supplements can improve insulin activity and may cut diabetes' risk and complications and that magnesium deficiency is also associated with insulin resistance in obese children.¹¹

Osteoporosis and Osteopenia

The emphasis for some time now has been on calcium, however, magnesium is as vital. In a Swedish study, magnesium, but not calcium, helped prevent hip fractures in older women. Tufts researchers found high magnesium intake predicted higher bone mass and less bone loss in older people.¹²

Cardiac Concerns

Cardiac specialist Michael Brodsky, College of Medicine of the University of California, Irvine, California, states: "People need

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to know magnesium deficiency predisposes them to serious, even deadly, heart arrhythmias.” A British study confirmed that daily magnesium for six weeks reduced arrhythmias between 25% and 50% and tests conducted by the U.S. Department of Agriculture showed that women skimping on magnesium developed irregular heartbeats within three months. Researchers at the Centers for Disease Control say that high blood magnesium cuts your odds of dying from common “ischemic” heart disease by one-third. And, Cornell’s Lawrence Resnick has documented that the higher the magnesium inside your cells, the more apt you are to have lower blood pressure, more elastic blood vessels, and a less enlarged heart. He calls magnesium a natural calcium-channel blocker.^{13,14}

Migraine

In a German study, adults who took 600 mg magnesium daily for a month had a 42% drop in headache frequency. Magnesium alters the duration, intensity, and frequency of migraines. Italian children given 122 mg to 366 mg magnesium daily had two-thirds fewer migraines after a month.^{15,16}

Pain Relief

From leg and muscle cramps, restless legs, fibromyalgia, and patients living with chronic pain conditions, supplements from 100 mg to 400 mg may bring relief.

Anxiety and Mood

Magnesium deficiency can cause numerous psychological changes, including depression. The symptoms of magnesium deficiency are nonspecific and include poor attention, memory loss, fear, restlessness, insomnia, tics, cramps, and dizziness. Plasma magnesium levels have been found to be significantly lower in depressed patients than in controls. These levels increased significantly after recovery. In a study of more than 200 patients with depression

and/or chronic pain, 75% had white blood cell magnesium levels below normal. In many of these patients, intravenous magnesium administration led to rapid resolution of symptoms. Muscle pain responded most frequently, but depression also improved.¹⁷

Magnesium has also been used to treat premenstrual mood changes. In a double-blind trial, 32 women with premenstrual syndrome were randomly assigned to receive 360 mg/day of magnesium or placebo for two months. The treatments were given daily from day 20 of the menstrual cycle until the onset of menstruation. Magnesium was significantly more effective than placebo in relieving premenstrual symptoms related to mood changes.¹⁸

Possible Drug Interactions

A pharmacist shouldn’t “assume” that a patient’s physician will consider all the patient’s current medications before presenting a prescription to the patient and/or the pharmacist, just as a pharmacist shouldn’t “assume” that he has a complete list of medications being taken by the patient. Therefore, the pharmacist should inquire or have the patient complete a questionnaire to record all medications they are taking. This information will help eliminate the potential for side effects and interactions that magnesium supplements may have with other medications. Some of those drugs that interact with magnesium supplements are:⁹

- ✱ Antibiotics (specifically quinolone antibiotics such as ciprofloxacin and moxifloxacin, and tetracycline antibiotics such as tetracycline, doxycycline, and minocycline)
- ✱ Calcium channel blockers
- ✱ Diabetic medications (specifically magnesium hydroxide commonly found in antacids)
- ✱ Digoxin
- ✱ Diuretics (specifically loop diuretics, such as furosemide; and thiazide diuretics, including hydrochlorothiazide)
- ✱ Levothyroxine
- ✱ Penicillamine
- ✱ Tiludronate

Conclusion

Magnesium is the fourth most abundant mineral in the body and is essential to good health. Approximately 50% of total body magnesium is found in bone. The other half is found predominantly inside cells of body tissues and organs. Only 1% of magnesium is found in blood, but the body works hard to keep blood levels of magnesium constant.² The relationship between total serum magnesium and intracellular levels is less clear.¹⁹ Total body magnesium levels may decrease 20% during a fast, with no change in blood levels. While low blood magnesium levels may correctly indicate serious disease, a “normal” magnesium blood level by traditional laboratory tests may exist concurrently with a deficit in intracellular magnesium.²⁰ No reliable test of tissue magnesium level is currently available. An inconvenient but accurate method to measure magnesium levels is by a 24-hour urine measurement for magnesium after intravenous magnesium loading. This is seldom done due to patient compliance issues. This is one bandwagon that all health-care providers should jump on—low cost, readily available over the counter, or compounded specialty dosage formulations—which has a major impact on health. A Win-Win for all! Included within this

Rx

MAGNESIUM 10% CREAM

For 100 g

Magnesium chloride	21.34 g
Dimethyl sulfoxide	10 mL
Purified water	15 mL
Peppermint oil	1 mL
Emulsifix base	5 mL
Versabase cream	qs 100 g

Note: The magnesium chloride used in this formula is the hexahydrate form. Each 42.68 g contains 20 g of magnesium chloride.

METHOD OF PREPARATION

1. Calculate the required quantity of each ingredient for the total amount to be prepared.
2. Weigh and/or measure each ingredient accurately.
3. Dissolve the magnesium chloride in water.
4. Add the dimethyl sulfoxide.
5. Add the Versabase cream and the Emulsifix base.
6. Add the flavoring and mix well.
7. Run the mixture through an ointment mill.
8. Dispense the solution in a plastic ointment tube. Note: A 1-inch length of cream will weigh about 500 mg and contain about 50 mg of magnesium.

Rx

MAGNESIUM GLYCINATE 15% 600-MG CAPSULE

For 100 capsules

Magnesium glycinate (15% magnesium)	60 g
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METHOD OF PREPARATION

1. Calculate the required quantity of magnesium glycinate.
2. Encapsulate 600 mg into a #0 capsule.

article are some formulations within which magnesium is the main ingredient. Your local compounding pharmacist can provide details on the availability and choices in magnesium supplementation.

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