

Magnificent Magnesium

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The Neglected Mineral We Cannot Live Without

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Magnesium is an alkaline earth metal, the eighth most abundant mineral found in the earth's crust. Because of its ready solubility in water, magnesium is the third most abundant mineral in sea water, after sodium and chloride. In the human body, magnesium is the eleventh most plentiful element by mass—measuring about two ounces. Most magnesium contained in the body is found in the skeleton and teeth—at least 60 to 65 percent of the total. Nearly the entire remaining amount resides in muscle tissues and cells, while only one percent is contained in our blood.

The importance of magnesium ions for all life itself, as well as for overall vibrant health, is hard to overstate. Magnesium is required to give the “spark of life” to metabolic functions involving the creation of energy and its transport (ATP, the body's fundamental energy currency), and the creation of proteins—the nucleic acid chemistry of life—RNA and DNA, in all known living organisms. In plants, a magnesium ion is found at the center of every chlorophyll molecule, vital for the creation of energy from sunlight. Magnesium is an essential element for both animals and plants, involved in literally hundreds of enzymatic reactions affecting virtually all aspects of life.

Every single cell in the human body demands adequate magnesium to function, or it will perish. Strong bones and teeth, balanced hormones, a healthy nervous and cardiovascular system, well-functioning detoxification pathways and much more depend upon cellular magnesium sufficiency. Soft tissue containing the highest concentrations of magnesium in the body include the brain and the heart—two organs that produce a large amount of electrical activity, and which can be especially vulnerable to magnesium insufficiency.

Magnesium works in concert with calcium to regulate electrical impulses in the cell—magnesium concentration inside healthy cells is ten thousand times greater than calcium, and there are crucial reasons for this safeguard. Cellular calcium channels allow that mineral to enter the cell only as long as needed to conduct an impulse; it is ushered out immediately by magnesium once its task is fulfilled. This vigilance is necessary to prevent calcium accumulation in the cell, which could cause dangerous hyper-excitability, calcification, cell dysfunction and even cell death. When excess calcium enters the cells because of insufficient magnesium, muscle contraction is sustained for too long, and we suffer, for example, twitches and tics in mild cases. When magnesium deficiency becomes chronic, we suffer the symptoms of heart disease such as angina pectoris, hypertension and arrhythmia, or the spasms and contractions characteristic of asthma, migraine headache or painful menstrual cramping.

Magnesium operates as a natural calcium channel blocker and is responsible for relaxation—counter to calcium's contraction. Thus magnesium is pivotally important to the healthy functioning of our parasympathetic nervous system. It may be hard to believe, but our bodies were actually designed to operate for the most part in a calm, relaxed parasympathetic state, rather than in the heart-pounding, stress- and adrenaline-driven mode of sympathetic nervous system dominance that is nearly constant for many of us today, and which uses up great quantities of magnesium.

Magnesium is so important to so many vital body functions, and its deficiency is integrally involved in so many diseases, that more than one researcher has dubbed magnesium a miracle in its ability to resolve or improve numerous disorders. The current list of disorders with direct and confirmed relationships to chronic and acute magnesium deficiency is long, and includes many diseases whose conventional medical treatment does not commonly address magnesium insufficiency (see below). Ongoing research promises to uncover further associations between magnesium deficiency and other illnesses.

MAGNESIUM DEFICIENCY IS ENDEMIC

Unfortunately, it is difficult to reliably supply our bodies with sufficient magnesium, even from a good, balanced whole foods diet. First of all, modern agricultural methods favor the universal use of NPK fertilizers (nitrogen, phosphorus, and potassium). Both potassium and phosphorus are antagonists of magnesium in the soil, and on calcareous soils create a relative magnesium deficiency (the magnesium present is bound and therefore unavailable to the crop). On sandy or loamy soils that are slightly acid, an actual magnesium deficiency often exists, as the magnesium leaches from the soil and is also unavailable to the crop. This leaching also occurs in response to acid rain. Magnesium, in fact, is one of the most depleted minerals in farm soils. To add insult to injury, new plant hybrids are continually introduced that have been bred to survive on these mineral-depleted soils. Of course, when mineral-depleted crops are eaten by animals or by us, they will sooner or later cause disease. Even though organically raised crops should be a better bet nutritionally, this isn't always the case, and it pays in terms of your health to learn how your farmer replenishes the minerals on his fields.

“Do you know that most of us today are suffering from certain dangerous diet deficiencies which cannot be remedied until depleted soils from which our food comes are brought back into proper mineral balance? The alarming fact is that foods (fruits, vegetables, grains) now being raised on millions of acres of land that no longer contain enough of certain minerals are starving us—no matter how much of them we eat. The truth is that our foods vary enormously in value, and some of them aren't worth eating as food.” These words of warning are from the 74th Congress, 2nd session, Senate document number 264, of 1936. It is truly sobering to learn that the decline in soil mineral balance was a topic of serious national concern more than seventy years ago, and the deficit has been affecting us—while steadily getting worse—since our grandparents' generation.

Magnesium and other nutrients are diminished or lost in produce after harvest, through handling, refrigeration, transport and storage, even if all these steps were done “properly.” Buying produce and then storing it for days in your own refrigerator continues the nutrient loss, whether the produce is from the supermarket or your local farmers' market.

Food processing causes enormous loss of magnesium in foods that are commonly fairly good sources of it, such as leafy greens, nuts, seeds and whole grains. Most of the magnesium in grain—found in the bran and germ—is lost in milling whole grains for white flour, which is used nearly exclusively for hundreds of devitalized processed food items. When nuts and seeds are roasted or their oils extracted, magnesium is lost. Cooking greens causes whatever magnesium they might contain to leach into the cooking water. Foods tend to lose less calcium than magnesium through these processes, adding to a troublesome dietary calcium overload that we will discuss shortly.

Fluoride in drinking water binds with magnesium, creating a nearly insoluble mineral compound that ends up deposited in the bones, where its brittleness increases the risk of fractures. Water, in fact, could be an excellent source of magnesium—if it comes from deep wells that have magnesium at their source, or from mineral-rich glacial runoff. Urban sources of drinking water are usually from surface water, such as rivers and streams, which are low in magnesium. Even many bottled mineral waters are quite low in magnesium, or have a very high concentration of calcium, or both.

A diet of processed, synthetic foods, high sugar content, alcohol and soda drinks all “waste” magnesium, as a lot of it is required for the metabolism and detoxification of these largely fake foods. According to Dr. Natasha Campbell-McBride, the body requires at least twenty-eight molecules of magnesium to metabolize a single molecule of glucose.

Phosphates in carbonated drinks and processed meats (so-called “luncheon meats” and hot dogs) bind with magnesium to create the insoluble magnesium phosphate, which is unusable by the body.

Tannins, oxalates, and phytic acid all bind with magnesium, making it unavailable to the body unless extra care is taken to neutralize some of these compounds during food preparation. It is interesting to note that foods commonly containing magnesium (provided they were grown in mineral-rich soil) also contain lots of these anti-nutrients, such as spinach (oxalates) and whole grains (phytates).

Many commonly prescribed pharmaceutical drugs cause the body to lose magnesium via the urine, such as diuretics for hypertension; birth control pills; insulin; digitalis; tetracycline and some other antibiotics; and corticosteroids and bronchodilators for asthma. With the loss of magnesium, all of the symptoms being “treated” by these drugs over time inevitably become worse.

Magnesium absorption is impeded with the use of supplemental iron. If you take calcium supplements, your need for magnesium increases, and in fact calcium will not be properly absorbed or metabolized if adequate magnesium is missing, and will mostly end up dangerously deposited in soft tissues. Magnesium is responsible for converting vitamin D to the active form that allows calcium to be absorbed, and also regulates calcium’s transport to hard tissues where it belongs. Lactose is another inhibitor of magnesium absorption (and milk is not a good source of the mineral to begin with), along with excess potassium, phosphorus and sodium.

Mental and physical stress, with its related continuous flow of adrenaline, uses up magnesium rapidly, as adrenaline affects heart rate, blood pressure, vascular constriction and muscle contraction— actions that all demand steady supplies of magnesium for smooth function. The nervous system depends upon sufficient magnesium for its calming effects, including restful sleep. Hibernating animals, by the way, maintain very high levels of magnesium. Magnesium deficiency will accelerate a vicious cycle and amplify the effects of chronic stress, leading to more anxiety, irritability, fatigue and insomnia—many of the symptoms of adrenal exhaustion—as well as to hypertension and heart pains— symptoms of heart disease.

Depression is related to stress and magnesium deficiency as well. Serotonin, the “feel good” hormone, requires magnesium in its delicate balance of release and reception by cells in the brain. Only when adequate levels are present can we enjoy mental and emotional equilibrium.

For reasons not fully understood, the body does not retain magnesium very well; certainly not as well as it holds onto calcium or iron, for example. Heavy sweating from endurance sports such as marathon running or strenuous exercise workouts can dangerously deplete magnesium stores and other electrolytes—although calcium is not wasted, by the way— resulting in trembling, faintness and even seizures and death. The drenching sweats that some menopausal women suffer cause magnesium loss as well, and their diminishing magnesium levels worsen their jagged nerves, sleep disturbances, panic attacks, body aches and depression. If these women have been tempted to consume modern soy products in a misguided attempt to moderate their symptoms, they will in fact lose even more magnesium because it will be bound to the abundant phytates in these concoctions.

A healthy gut environment is necessary for proper absorption of magnesium from the diet. Irritable bowel syndrome, leaky gut, candidiasis and other gut disorders can severely limit the amount of magnesium that the body will be able to absorb. Older adults often experience decreased stomach hydrochloric acid production, which can impair mineral absorption in general. And with so many treating their “heartburn” with antacids, a healthy digestive environment is hard to maintain.

CALCIUM AND MAGNESIUM PARTNERSHIP

Both calcium and magnesium are necessary for the healthy body—in proper balance to one another, as well as to other necessary minerals. Considered biochemical antagonists, one cannot act without eliciting the opposite reaction of the other. Yet calcium and magnesium must both be present in balanced amounts for either one to function

normally in the body. Some researchers suggest that the healthy ratio of calcium to magnesium in the diet should be 2:1. Others consider 1:1 to reflect ratios that we evolved with based on our diet prior to the advent of agriculture. In modern industrialized countries the ratio from diet is from 5:1 to as much as 15:1. The imbalance of these two very important minerals produces many dire consequences in the body that are often overlooked by medical practitioners when treating the disease states they cause.

Aside from the intricate electrical dance that calcium and magnesium perform together, magnesium is necessary to keep calcium in solution in the body, preventing its inappropriate deposition in soft tissues. As long as we have sufficient hydrochloric acid in our stomachs we can dissolve calcium from the foods we eat. After calcium leaves the acidic environment of the stomach and enters the alkaline milieu of the small intestine however, it is magnesium that is necessary to keep calcium soluble. Without sufficient magnesium, a whole host of physiological aberrations can occur with serious health consequences.

As Dr. Carolyn Dean, author of *The Magnesium Miracle*, explains, “In the large intestine it [precipitated calcium] interferes with peristalsis, which results in constipation. When calcium precipitates out in the kidneys and combines with phosphorus or oxalic acid, kidney stones are formed. Calcium can deposit in the lining of the bladder and prevent it from fully relaxing, and therefore from filling completely with urine. This leads to frequent urination problems, especially in older people. Calcium can precipitate out of the blood and deposit in the lining of the arteries, causing hardening (arteriosclerosis). . . It can coat and stiffen. . . plaque in the arteries. . . [and] can cause blood pressure to rise as well as increase the risk of heart attack and stroke. Calcium can even deposit in the brain. Many researchers are investigating it as a possible cause of dementia, Alzheimer’s and Parkinson’s disease. Calcium can deposit in the lining of the bronchial tubes and cause asthma symptoms. Calcium in extracellular fluid. . . can decrease the permeability of cell membranes. This makes it increasingly difficult for glucose (a large molecule) to pass through the cell membrane to be converted to ATP in the cells’ mitochondria. High glucose levels created by excess calcium may be misdiagnosed as diabetes.”

MAGNESIUM IS A POTENT DETOXIFIER

Magnesium is utilized by the body for all sorts of detoxification pathways and is necessary for the neutralization of toxins, overly acidic conditions that arise in the body, and for protection from heavy metals. It plays a vital role in protecting us from the onslaught of man-made chemicals all around us. Glutathione, an antioxidant normally produced by the body and a detoxifier of mercury, lead and arsenic among others, requires magnesium for its synthesis. According to Mark Sircus, in *Transdermal Magnesium Therapy*, a deficiency of magnesium increases free radical generation in the body and “causes glutathione loss, which is not affordable because glutathione helps to defend the body against damage from cigarette smoking, exposure to radiation, cancer chemotherapy, and toxins such as alcohol and just about everything else.”

When our bodies are replete with magnesium (and in balance with the other essential minerals) we are protected from heavy metal deposition and the development of associated neurological diseases. As Dr. Carolyn Dean explains, “Research indicates that ample magnesium will protect brain cells from the damaging effects of aluminum, beryllium, cadmium, lead, mercury and nickel. We also know that low levels of brain magnesium contribute to the deposition of heavy metals in the brain that heralds Parkinson’s and Alzheimer’s. It appears that the metals compete with magnesium for entry into the brain cells. If magnesium is low, metals gain access much more readily.

“There is also competition in the small intestine for absorption of minerals. If there is enough magnesium, aluminum won’t be absorbed.”

MAGNESIUM DEFICIENCY IN TOOTH DECAY AND OSTEOPOROSIS

Ask anyone—your neighbor or even your dentist or doctor—what bones and teeth require to be strong and healthy, and you will undoubtedly hear the response, “Plenty of calcium.” Bones and teeth certainly do require calcium—as well as phosphorus and magnesium, but without adequate amounts of the latter, calcium will not be deposited in these

hard tissues, and the structures will not be sound. “When you load up your system with excess calcium,” writes William Quesnell, in *Minerals: the Essential Link to Health*, “you shut down magnesium’s ability to activate thyrocalcitonin, a hormone that under normal circumstances would send calcium to your bones.” Instead of providing benefits to the body, the displaced calcium actually becomes toxic, causing trouble in soft tissues of the kinds we’ve already discussed.

Numerous studies, in fact, have established the fact that it is dietary magnesium, not calcium, (and certainly not fluoride) that creates glassy hard tooth enamel that resists decay, and strong and resilient bones. Regardless of the amount of calcium you consume, your teeth can only form hard enamel if magnesium is available in sufficient quantities.

According to J. I. Rodale, in *Magnesium: the Nutrient that Could Change Your Life*, “For years it was believed that high intakes of calcium and phosphorus inhibited decay by strengthening the enamel. Recent evidence, however, indicates that an increase in these two elements is useless unless we increase our magnesium intake at the same time. It has even been observed that dental structures beneath the surface can dissolve when additional amounts of calcium and phosphorus diffuse through the enamel at different rates. Thus milk, poor in magnesium, but high in the other two elements, not only interferes with magnesium metabolism, but also antagonizes the mineral responsible for decay prevention.”

To revisit Deaf Smith County, Texas, and the justly famous residents whose teeth refused to succumb to decay, Rodale quotes the observations of Dr. Lewis Barnett, presented in a paper before the Texas Medical Association in Dallas, 1952. Dr. Barnett, an orthopedic surgeon, remarked on the low incidence of tooth decay and rapid healing of broken bones among these residents, and offered this explanation: “[The local] water and foods have a very high magnesium and iodine content and recently we have proven that all of the trace minerals known to be essential are present in the water and foods grown in that area.” Further, Dr. Barnett had found that the magnesium bone content of the average Deaf Smith County resident was up to five times higher than that of a resident of Dallas, while the concentrations of calcium and phosphorus were about the same in both groups. His observations led him to state that “[o]ne of the most important aspects of the disease osteoporosis has been almost totally overlooked. That aspect is the role played by magnesium.”

Rodale emphasizes the fact that Dr. Barnett gave much of the credit for these health benefits to the high magnesium content of the local water, and noted many signs of superior bone development among people in the area: “Dr. Barnett makes mention of the fact that people in older years frequently have fracture of the cervical neck of the femur and these are very difficult to heal in many localities. However, he noted that this fracture rarely occurs in Deaf Smith County, whereas it was common in Dallas County, Texas, where he also practiced. When a fracture did occur in Deaf Smith, healing was easy and rapid even in people eighty to one hundred years old. In contrast, fractures in Dallas were common and very difficult to heal, if not impossible.”

Over fifty years ago Dr. Barnett tested the magnesium levels of five thousand people and found sixty percent of them to be deficient. How much more of the population is deficient today, when all of the negative conditions contributing to that deficiency have been certainly amplified?

FOOD SOURCES OF MAGNESIUM

As we’ve mentioned, if farm soils are well-mineralized, leafy green vegetables, seeds, tree nuts and whole grains are fairly good sources of magnesium. Certain wild-crafted forage foods really stand out, however, such as nettles (860 mg per 100 grams) and chickweed (529 mg per 100 grams), and add many tonic and nutritive benefits to both human and livestock diets largely due to their high mineral content. Kelp, ancient denizen of the sea, contains spectacular levels, as do most sea vegetables. Remember that they are continually bathed in a solution whose third most abundant mineral is magnesium. And authentic, unrefined sea salt is a very good source of magnesium, along with trace minerals. Utilizing bone broths on a daily basis will provide another excellent source of minerals, including magnesium, in a highly assimilable form.

STRATEGIES FOR MAGNESIUM SUPPLEMENTATION

Even with ideal digestive conditions, only a percentage of magnesium in foods will be absorbed—less when amounts in the body are adequate and more if there is a deficiency. This is also true of magnesium supplements, and there are many of them on the market to confuse you. For the average person, magnesium supplementation is safe to experiment with on your own, especially if you know you have symptoms that could be related to magnesium deficiency or are under extra stress, and so on. Excess magnesium is excreted in urine and the stool, and the most common response to too much magnesium is loose stools. Those with renal insufficiency or kidney disease, extremely slow heart rate, or bowel obstruction should avoid magnesium therapy.

General dosage recommendations range from about 3 to 10 milligrams per pound of body weight, depending upon physical condition, requirements for growth (as in children), and degree of symptoms.

Oral magnesium supplements are available in organic salt chelates, such as magnesium citrate and magnesium malate. These are fairly well absorbed, especially in powder forms to which you add water and can tailor your dosage. It is important to divide your dosage during the day so that you do not load your body with too much magnesium in any single dose. Carolyn Dean recommends taking your first dose early in the morning and another in the late afternoon—these correspond to times when magnesium levels are low in the body. Is it just a coincidence that these times of low magnesium and low energy also correspond to the cultural rituals of morning coffee and afternoon tea?

Loose stools indicate you are not absorbing the magnesium, but that it is acting as a laxative. When the magnesium travels through the intestines in less than twelve hours, it is merely excreted rather than absorbed. If you find you cannot overcome the laxative effect by varying your dosages, you may want to try an oral supplement that is chelated to an amino acid, such as magnesium taurate and magnesium glycinate, which some consider to be better absorbed than the salt forms and less likely to cause loose stools. For those who need a little help with digestion, such as young children, older adults, and anyone with reduced stomach acid or bowel dysbiosis, consider homeopathic magnesium, also referred to as tissue salts or cell salts. *Magnesia phosphorica 6X* is the appropriate dosage, and it works to usher magnesium into the cells where it belongs. It is also indicated as a remedy for muscle spasms and cramps of many varieties. *Mag phos* can help reduce and eliminate loose stools while you are supplementing with oral magnesium, giving you a positive sign that your body is indeed taking the magnesium into the cells.

Yet another option for oral magnesium supplementation is ionic magnesium in liquid form, such as that offered by Trace Minerals Research. This is a sodium-reduced concentration of sea water from the Great Salt Lake in Utah. Only about a teaspoon is needed to deliver about 400 milligrams of magnesium (along with seventy-two other trace minerals), which should be taken in divided amounts during the day. I recommend adding this to soups (made with bone-broth bases of course) as the strong mineral taste is hard to take straight. You can also add this to spring and other drinking water to up the magnesium content and use it in cooking. By “micro-dosing” your food and water in this fashion you greatly reduce any laxative effects a large dose of magnesium might elicit.

Another potential way to get more magnesium into your system is via the pleasant method of soaking in a bath of magnesium sulfate, otherwise known as Epsom salts. Commonly used to ease muscle aches and pains, magnesium sulfate also importantly helps with detoxification when sulfur is needed by the body for this purpose. When used intravenously, magnesium sulfate can save lives in such crises as acute asthma attack, onset of myocardial infarction, and eclampsia in pregnancy.

A couple of cups of Epsom salts added to a hot bath will induce sweating and detoxification; after the water cools a bit the body will then absorb the magnesium sulfate. According to Mark Sircus in *Transdermal Magnesium Therapy*, the effects from a bath of Epsom salts, although pleasant, are brief as magnesium sulfate is difficult to assimilate and is rapidly lost in the urine. Magnesium chloride, which can also be used in baths, is more easily assimilated and metabolized, and so less is needed for absorption.

Finally, magnesium may be applied topically in a form commonly called magnesium “oil.” This is actually not an oil at all, but a supersaturated concentration of magnesium chloride and water. It does feel oily and slippery when applied to the skin, but it absorbs quickly, leaving a slightly tacky, “sea salt” residue that can be washed off. There are many advantages to transdermal magnesium therapy, since the gastrointestinal tract is avoided altogether and there is no laxative effect. Next to intravenous magnesium administration, transdermal therapy provides a greater amount of magnesium to be absorbed than even the best tolerated oral supplements, and can restore intracellular concentrations in a matter of weeks rather than the months required for oral supplementation.

MISSING LINK?

It is likely safe to say that most people would benefit from an increased supply of magnesium in their diets, especially in these times of so many dietary, environmental, and social stressors. Of course no single nutrient stands alone in relation to the body, and the first priority is to eat a varied diet of whole plant and animal foods from the best sources near you. Adding extra magnesium, however, might be the missing nutritional link to help us guard against heart disease, stroke, depression, osteoporosis and many other disorders. In the prevention and alleviation of these diseases, magnesium can be truly miraculous.

SIDEBARS

THE MANY EFFECTS OF MAGNESIUM DEFICIENCY

- ADD/ADHD
- Alzheimer’s
- Angina pectoris
- Anxiety disorders
- Arrhythmia
- Arthritis—rheumatoid and osteoarthritis
- Asthma
- Autism
- Auto-immune disorders
- Cerebral palsy in children of Mg deficient mothers
- Chronic Fatigue Syndrome
- Congestive Heart Failure • Constipation
- Crooked teeth/narrow jaw in children from Mg deficient mothers
- Dental caries
- Depression
- Diabetes, types I and II
- Eating disorders—bulimia and anorexia
- Fibromyalgia
- Gut disorders including peptic ulcer, Crohn’s disease, colitis
- Heart disease
- Hypertension
- Hypoglycemia
- Insomnia
- Kidney stones
- Lou Gehrig’s disease
- Migraines
- Mitral valve prolapse
- Multiple sclerosis
- Muscle cramping, weakness, fatigue

- Myopia—in children from Mg deficient mothers
- Obesity—especially associated with high carbohydrate diet
- Osteoporosis
- Parkinson's disease
- PMS—including menstrual pain and irregularities
- PPH (Primary pulmonary hypertension)
- Reynaud's syndrome
- SIDS (Sudden Infant Death Syndrome)
- Stroke
- Syndrome X
- Thyroid disorders

Source: *Primal Body—Primal Mind*, by Nora Gedgaudas.

THE MAGNESIUM CONTENT OF MILK

In general, milk is not a rich source of magnesium, but many cultures throughout the ages have depended upon dairy foods as the foundation of balanced, healthy diets that conferred strength and vitality. Weston Price, for example, investigated residents of the Swiss Alps as well as the African Maasai whose sturdy, disease-resistant individuals had little or no tooth decay. But can we replicate those diets with the same health-giving properties if we depend upon today's industrialized food model?

The mineral composition of milk depends upon many factors, including the breed of animal, stage of lactation, frequency of milking, environmental conditions, type of pasture, soil makeup and amount of soil contamination. Grass tetany, for instance, is a serious and potentially fatal condition in cattle characterized by extremely low levels of serum magnesium. Also called "grass staggers" or "wheat pasture poisoning," it is the result of animals grazing on fast-growing young grass in spring or fall on soil that is severely magnesium deficient, as can happen when the pastures have been fertilized with high nitrogen and potassium fertilizers. In acute poisoning, the animal can be saved by injections of magnesium sulfate; yet subclinical magnesium deficiency in the herd may go undetected.

By contrast, pastures that offer a great deal of plant diversity to grazing animals also offer diversity to the soil ecology as well as nutrient diversity to the ruminant. In a Swiss study that examined thirty plant species of alpine pastures, researchers found that "the botanical composition of an alpine pasture has a significant influence on the nutritive value of the forage.... Compared with grass species, legumes and herbs showed a lower content of cell walls but a higher content of crude protein, as well as four times the content of calcium and twice the content of magnesium." The Swiss visited by Dr. Price grazed their cattle on alpine slopes populated by numerous plant species and watered by the mineral-rich glacial run-off—water the villagers also used in drinking and cooking.

Numerous stresses can take their nutritional toll on the dairy animal and therefore on the quality of her milk. Crowding, confinement, filth and unnatural fodder come to mind instantly as obvious offenders, but too frequent milking—more than once a day—can result in dilution of nutrients in the milk. The daily output is greater, but the nutrients are fewer by volume.

"The mineral content of milk and popular meats has fallen significantly in the past 60 years, according to a new analysis of government records of the chemical composition of everyday food," begins an article in the Guardian about researcher David Thomas's comparison of food tables from 1940 and 2002. The research was done for the consumer watchdog group in the UK, the Food Commission, and published in their quarterly journal, *The Food Magazine*. Mineral declines in dairy products showed that milk lost 60 percent of its iron, 2 percent of its calcium, and 21 percent of its magnesium. Compared to 1940, currently "[m]ost cheeses showed a fall in magnesium and calcium levels. According to the analysis, cheddar provides 9 percent less calcium today, 38 percent less magnesium and 47 percent less iron, while parmesan shows the steepest drop in nutrients, with magnesium levels down by 70 percent."

Ignoring the declining magnesium content in foods such as dairy products may have confounded some analyses of disease etiology in large populations. Anti-animal-fat proponents tend to blame the rampant incidence of heart disease among the Finns on their high intakes of dairy products. However, according to Dr. Mildred Seelig, of New York University Medical Center, “In Finland, which has a very high death rate from IHD (ischemic heart disease), there is a clear relationship with heart disease and the amount of magnesium in the soil. In eastern and northern Finland, where the soil content is about a third of that found in southwestern Finland, the mortality from ischemic heart disease is twice as high as is that in the southwest. Ho and Khun surveyed factors that might be contributory both to the rising incidence of cardiovascular disease in Europe, and the falling levels of magnesium both in the soil and in the food supply. They commented that in Finland, which has the highest cardiovascular death rate in Europe, the dietary supply of magnesium has decreased by 1963 to a third of the intake common in 1911.”

Modern, urban Finns of course consume pasteurized dairy products, which not only have reduced magnesium levels to begin with thanks to modern farming practices, but also have less soluble calcium as a result of the denaturing of the enzyme phosphatase during pasteurization. Calcium that is not soluble precipitates out to soft tissue, such as the vascular system, and can contribute to a cascade of ominous events linked to heart disease.

We might surmise from these observations, then, that dairy products must be produced with reverence not only to the beast herself, but also to the soil that feeds the pasture that feeds her. When all nutrients are in balance with one another we can expect the food to have the power to truly nourish us.

Countless stressors in life today increase the body’s demands for magnesium—by our challenged endocrine systems, by environmental poisons that must be neutralized, by excess refined carbohydrates in our diets, to name a few. The balance of nutrients provided in the foods in the groups that Dr. Price visited was also in felicitous balance with those peoples’ physical, emotional, and social ecologies. We can only strive, both as consumers and producers of food, to achieve that equilibrium in the ecologies we inhabit.

FOOD SOURCES OF MAGNESIUM

In milligrams per 100 grams

Kelp	760	Pecan	142	Beets	25
Wheat bran	490	Walnut	131	Broccoli	24
Wheat germ	336	Rye	115	Cauliflower	24
Almonds	270	Tofu curdled by Mg nigiri	111	Carrot	23
Cashews	267	Coconut meat, dried	90	Celery	22
Blackstrap molasses	258	Collard greens	57	Beef	21
Nutritional yeast	231	Shrimp	51	Asparagus	20
Buckwheat	229	Corn, sweet	48	Chicken	19
Brazil nuts	225	Avocado	45	Green pepper	18
Dulse	220	Cheddar cheese	45	Winter squash	17
Filberts	184	Parsley	41	Cantaloupe	16
Peanuts	175	Prunes	40	Eggplant	16
Millet	162	Sunflower seeds	38	Tomato	14
Wheat whole grain	160	Sweet potato	31	Milk	13

MAGNESIUM SUPPLEMENTATION CAN BE TRICKY

Even when it seems obvious that magnesium supplementation is called for to alleviate typical deficiency symptoms such as anxiety or heart palpitations, finding the best means to raise intracellular levels can be difficult. Most often, oral supplements will cause laxative effects at levels too low to restore magnesium supplies to the cells, where it is needed. Marina, whose husband Alex was recovering from heart surgery, had to be persistent. “I noticed in the hospital that he was given intravenous magnesium during intensive care, but the doctors never mentioned it later on, when Alex was overcome with panic attacks, bouts of low energy, hypertension and arrhythmia. We were offered drugs for all of these conditions, but we both wanted to avoid the medications if at all possible, although we couldn’t at first. A couple of alternative doctors had mentioned magnesium along with other supplements that could help, but with no particular emphasis on the magnesium, so it was by trial and error that we discovered just how effective the magnesium could be. But first we had to find the best way for Alex to take it.

“Capsules of magnesium citrate and magnesium taurate both caused diarrhea at only a quarter of the recommended dose. I learned that chronic magnesium deficiency can unfortunately leave you with a much reduced capacity for intestinal absorption, and it was likely that Alex had been deficient for a long time. This was hard for me to accept at first, since he had been eating a superb diet for many years—full of mineral-rich bone broths, soups with seaweeds and nettles, and no sugar or caffeine. But his history included decades of intense stress and obvious signs of adrenal exhaustion.

“I next tried liquid ionic magnesium, which included trace minerals as found in the Great Salt Lake in Utah. I felt that magnesium in isolation might not be the best way to try to absorb it. Starting with just a few drops in his soup, Alex was able to take more magnesium over time in this fashion, although we still had to be very careful not to exceed a certain amount or the diarrhea would return. Nevertheless, we were starting to see positive results. First came better sleep. Alex had been waking every ninety minutes during the night—he’d get up to pee, come back to bed and struggle to fall asleep only to wake again in ninety minutes to repeat the process. He was certain his prostate was failing, but after about a month with the ionic magnesium, he was able to sleep uninterrupted for three-, then four-, then six-hour spans. We realized his prostate was fine, but his traumatized adrenals had been regularly firing an adrenaline rush to jolt him awake. When they began to be pacified his sleep finally became restful; he now usually only wakes once during the night and can easily return to sleep. And, dare I say, he sleeps better these days than he has for years. Also, with a good night’s sleep his daytime energy level is much improved.

“Alex still had bouts of arrhythmia which had been very frightening at times, and although his hypertension was improving with energy work and flower essences, we knew there was a nutritional component that needed to be addressed. A friend happened to suggest using homeopathic magnesium to help with absorption—she herself was starting to use magnesium supplements and was also experiencing the common problem of loose stools when this solution dawned on her. The concept was brilliant—we needed a way to gently get the cells to accept the magnesium, and so we began using the tissue salts *Magnesia phosphorica* in the 6X potency. After the very first dose Alex had improvement with his stool and was able to keep up the same dosage of the ionic magnesium. It was as though a key had opened a lock, and the magnesium was now entering the cells where it could do its good.

“One day Alex casually mentioned that he hadn’t had a single moment of arrhythmia in a week. This was stunning news, since he had had at least slight arrhythmia daily for months. Everyone told us this was extremely common after heart surgery and we thought we’d have to accept this fact. Encouraged by his progress, I next purchased some magnesium ‘oil’ in order to have yet another means to deliver the magnesium without involving the intestinal tract at all.

“Our current protocol includes a once-daily use of the magnesium oil. I add ionic magnesium drops to our drinking and cooking water, as well as to every pot of soup, pan of sautéed vegetables, tray of stuffed peppers. I call this ‘microdosing’ and it is in addition to using sea vegetables and plenty of bone broths. Along with the *Magnesia phosphorica*, Alex takes the tissue salt *Kali phosphorica* (potassium phosphate) which is indicated for all conditions of nervous debility; the two together make a very good heart tonic. At bedtime, Alex has a single dose of magnesium citrate with a food complex vitamin C powder. This is a relaxing evening ritual and now causes no intestinal upset.

“The only medication Alex still takes is a beta-blocker for hypertension—a small dose that we hope to be able to quit soon. If you supplement with magnesium and have hypertension you will need to pay close attention to your blood

pressure. You will have to reduce your medication accordingly or your blood pressure could get too low too fast! You must do this slowly, though, to give the vascular tissue time to recondition itself and regain elasticity—as it will. “Finally, Alex himself wanted me to add that the magnesium therapy allowed him to shift the intensity of his focus from his physical condition to his spiritual life, and sparked new creativity. He has begun to write and will be publishing the first in a series of his memoirs early next year. Truly, who would have thought so much healing could be initiated by finally replenishing this neglected mineral?”

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