

MAGNESIUM MADNESS

by Andrea Plazman, MS, RD, CDN

“Magnesium was first shown to be an essential dietary component in 1932 and though magnesium deficiency is rare, recently moderate or marginal deficiency has been proposed as a risk factor for chronic diseases such as osteoporosis, cardiovascular disease and diabetes,” says Dr. Fleet, Associate Professor, Purdue University.

Total body magnesium content is approximately 25 grams with even distribution between the skeleton (50-60%) and soft tissues (40-50%). About one-third of the skeletal magnesium is on the surface of bone. It is this fraction that may serve as a reservoir for maintaining a normal extracellular magnesium concentration regardless of recent magnesium dietary intake. Intracellular free magnesium is only 1 to 5 percent of total cellular magnesium and may be an important metabolic regulator,” says Dr. Fleet.

Together with calcium, magnesium is involved in muscle contraction and blood clotting as well as adding integrity to bones and teeth.

CARDIOVASCULAR DISEASE

Many studies indicate that magnesium deficiency affects lipoprotein metabolism, particularly elevating triglyceride level and decreasing high-density lipoprotein (HDL) levels. Magnesium deficiency can induce cardiovascular lipid deposition and lesions in animals fed atherogenic diets.

Epidemiological evidence suggests that magnesium may play an important role in regulating blood pressure. In the Honolulu study by Joffres et al (1987), magnesium was the dietary variable that had the strongest association with blood pressure.

Stampfl et al (1996) found that the extracellular magnesium can modulate the intracellular free calcium concentration of the myocardial cells by its influence on calcium elimination. Magnesium dilates the blood vessels of the heart, arms and legs, thus relieving the burden on the heart muscle as well as maintaining an even, stable heart beat.

CENTRAL NERVOUS SYSTEM

When magnesium levels are too low, the nervous system becomes easily irritated and stress hormones are released. Magnesium

reduces the release of the stress hormones, which in turn leads to improved oxygen circulation by relaxation of the blood vessels.

BONE HEALTH

Bone formation and the completion of the bone remodeling cycle are accomplished by osteoblasts. Osteocytes help to maintain the bone matrix. Osteoporosis occurs when bone formation and bone resorption are out of balance.

Magnesium plays a major role in bone and mineral homeostasis and can also directly affect bone cell function as well as influence hydroxyapatite crystal formation and growth. “Both the parathyroid hormone (PTH) and vitamin D regulate calcium tightly and magnesium loosely. In general, they have opposite actions in the body with magnesium termed nature’s ‘calcium channel blocker.’

In humans, PTH is not secreted to low calcium levels unless blood magnesium is normal, this is why low magnesium levels can lead to low calcium blood levels,” says Dr. Sojka, in a study by Sojka et al (1995). It was found that magnesium therapy appears to have prevented fractures and significantly increased bone density.



There is a definite need for both calcium and magnesium fortified foods as part of the management and prevention of osteoporosis, to maintain healthy heart and muscle functions as well as better sports performance.

This observation suggests that magnesium deficiency may be related to osteoporosis.

DIABETES

Recently Kao et al (1999) assessed the risk for type II diabetes associated with low serum magnesium levels and low magnesium intake in a six-year prospective study of 12, 128 non-diabetic middle-aged adults. Paolisso et al (1997) suggests that magnesium supplements can improve glucose tolerance and insulin response in the non-insulin diabetic.

MAGNESIUM REQUIREMENTS

"Magnesium homeostasis is maintained by controlling the efficiency of intestinal absorption and losses through the urine," says Dr. Fleet. The serum magnesium concentration may not reflect intracellular magnesium availability; nevertheless, serum magnesium is the most available measure of magnesium status. Many factors regulate magnesium absorption. Generally, as the level of calcium intake goes down, the level of magnesium absorption goes up. High intakes of calcium, protein, vitamin D and alcohol increase the magnesium requirement. Caffeine, phosphorus, sugar, sodium, diuretics and alcohol increase the loss of magnesium through the urine. Though obvious magnesium depletion is rare, suboptimal levels are seen frequently since most people are not consuming enough dietary magnesium. Foods with high magnesium content include nuts, tofu, green leafy vegetables, seeds, bananas, whole grains, legumes and avocados. Refined foods have the lowest magnesium content.

BIOAVAILABILITY OF MAGNESIUM

Normally, the more soluble a calcium or magnesium salt is, the more effective the minerals are. In a study by Lindberg et al (1990), magnesium oxide and magnesium citrate were compared, showing that magnesium citrate is more bioavailable. Magnesium citrate contains

11.9 percent magnesium as compared to magnesium lactate (9.5 percent) and magnesium gluconate (5.5 percent). In some applications where solubility is of great importance Gadot Biochemical Industries has developed two new products called GADOCAL+ and GADOMAG+, for calcium and magnesium fortification respectively. These products are readily soluble in aqueous solutions and enjoy the unique bioavailability inherent in citrate based mineral forms.

FUNCTIONAL FOODS

The estimated functional foods market in the United States is over US\$200 billion dollars, depending on the definition given to functional foods. When formulating functional foods, not only is bioavailability an important issue, but solubility and taste are also important considerations. "Magnesium citrate has a neutral flavour and has little effect on the taste of the end product," says Mr. Koder, V.P. Business Development, Gadot Biochemical Industries Ltd.

A study conducted by Marier et al indicates that 75 percent of 37,000 United States citizens tested show a magnesium deficiency, with 55 percent having 75 percent or less of the RDA and 30 percent having 50 percent less than the RDA. This deficiency is due mainly to the typical US diet containing foods high in fat, sugar and white-flour and not consuming or minimally consuming foods containing magnesium such as whole grains, legumes and nuts.

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Magnesium citrate can be added to a wide range of products including cereals, infant formulas, sports drinks, energy bars, dietary supplements and beverages. Magnesium has been passed over in favour of calcium in the mineral fortification market. Supplying the adequate intake from a highly bioavailable source like magnesium citrate has at least similar importance. ♦

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