HippEvo
Hippocrates Evolution

Magnesium: *magnesium as oxide, hydroxide, gluconate, glycinate, sulfate, chloride, aspartate, malate, laurate, succinate, fumarate, ascorbate or citrate*

Common Indications:

- Cardiovascular Disease, including Congestive Heart Failure
- Diabetes and insulin resistance/impaired glucose tolerance
- Hypertension
- Muscle Cramps/Pain
- Sleep disturbances
- Mood disorders, including premenstrual syndrome
- Obesity
- Asthma

General Comments:
Magnesium is involved in hundreds of chemical reactions in our physiology and is responsible for proper nerve transmission, membrane stabilization, the most significant mineral in the detoxification process, and more. Only a small 1% of all magnesium is found in the blood so measuring levels using standard blood tests are not reliable. RBC testing for magnesium levels is felt to be more reliable but is still criticized for its lack of true reliability. Our use of caffeine, alcohol and other diuretics increases replacement needs but is often met with a poor diet that lacks it.

The FDA recognizes that most Americans don't get near the appropriate amount in out diets and the best foods for supplying magnesium include seeds, beans, fish and vegetables. The least absorbable form of magnesium is oxide and yet this remains the most easily and readily used form in many suboptimal supplements.

Benefits & Mechanism of Action:

Cardiovascular Disease, including Congestive Heart Failure

Magnesium influences many aspects of cardiovascular health. It decreases platelet stickiness, helps thin the blood, blocks calcium uptake, and relaxes blood vessels.[1,2,3,4] Adequate magnesium intake reduces the risk of cardiovascular disease and increases the rate of survival following a heart attack. It is now known that many heart attacks occur in people with healthy hearts. Magnesium deficiency increases calcium/magnesium ratio, which can cause a cardiac muscle spasm resulting in a heart

attack, and frequently, death. If intravenous magnesium is given during the early stages of a heart attack, it results in approximately a 70 percent decrease in deaths within one month following the event. Magnesium is also a cofactor for oxidative phosphorylation in the production of ATP. It is essential for the production and transfer of energy for protein and lipid synthesis, contractility of muscle, and nerve transmission.

Diabetes and insulin resistance/impaired glucose tolerance

Low levels of magnesium and low intake of magnesium are associated with an increased risk of developing insulin resistance and type 2 diabetes.[5,6,7] Magnesium was found to reduce the risk of secondary complications like atherosclerosis and neuropathies in Type 1 diabetes.[8,9,10] One study of Type 1 diabetics found a HbA_{1c} decrease of 1.7% with higher levels of magnesium.[11]

Studies have also found a link between low magnesium levels and risk of developing Type 2 diabetes.[12,13] Magnesium has also shown efficacy in improving diabetic control, reducing fasting glucose, and increasing insulin levels.[14,15]

Hypertension

Studies show that serum magnesium levels have an inverse relationship with blood pressure levels, especially in older adults.[16] Supplementation of magnesium intake of 500 mg/d to 1000 mg/d may reduce blood pressure as much as 5.6/2.8 mm Hg. However, the effect is usually only moderate, and thus magnesium should not be viewed as a primary treatment for hypertension. A 2010 comprehensive analytical review of 44 human studies in 43 publications of oral magnesium (Mg) therapy for hypertension reported that Mg supplements may enhance the blood- pressure lowering effect of anti-hypertensive medications in Stage 1 hypertensive individuals.[16,17]

Muscle Cramps/Pain

Low levels of magnesium are reported to increase inflammation and pain associated with the musculoskeletal system.[18,19,20,21] Magnesium supplementation is reported to decrease C-reactive protein (CRP) levels which are associated with inflammatory processes.[22]

Sleep disturbances

Magnesium has been reported to improve sleep patterns and sleep related neurohormonal function.[23]

Mood disorders, including premenstrual syndrome

Although data is inconclusive, magnesium supplementation is reported in human studies to be effective in decreasing symptoms of depression, and that magnesium depletion and/or disturbances in magnesium metabolism may be related to depression and/or mood disorders.[24,25]

When given as an oral supplement, magnesium showed promising results for reducing fluid retention and mood swings associated with premenstrual syndrome.[26,27,28,29,30] Clinically significant effects are achieved over a period of time, typically in 2 to 3 cycles. Magnesium, in this instance, should be considered preventative and consistency is key.

Obesity

Magnesium is vital for the health of nervous and muscular tissues throughout the body. It is required for the metabolism of carbohydrates, proteins and fats, as well as activity related to calcium, phosphorus, and vitamin C. Magnesium is also needed to help make thyroid hormones. Low magnesium levels are commonly found in overweight and obese individuals. Decreased magnesium levels in patients with obesity cause an increased risk for metabolic syndrome, insulin resistance and type 2 diabetes.[31,32,33,34]

Asthma

Magnesium inhibits calcium from entering muscle cells, leading to decreased contraction. This is important in asthma as a mechanism to reduce bronchospasm.[35,36] It also affects pulmonary vascular muscle contractility, neurohumoral mediator release, and mast cell granulation.[37] Multiple studies have shown significant symptom improvement and decreases in the number of attacks when magnesium is added to current therapy.[38,39,40] These suggest that magnesium may be a useful adjunct therapy to improve asthma control.

DOSE:

DRI*

- Women: 300mg daily
- Men: 350mg daily

ODA**

- 400 – 800mg daily

* The Dietary Reference Intakes (DRI) are the most recent set of dietary recommendations established by the Food and Nutrition Board of the Institute of Medicine, 1997-2001. They replace previous RDAs, and may be the basis for eventually updating the RDIs.

**The Optimum Daily Allowance (ODA) represents a reference level beyond the RDI, and is often many times higher than the RDI to prevent diseases such as aging or cancer. These numbers are based on clinical use.

Symptoms of Deficiency:

Although clinical deficiency is rare in the U.S., marginal deficiency appears to be widespread with various studies reporting that approximately 75 percent of Americans ingest less than the RDA. Magnesium deficiency is associated with increased incidence of atherosclerosis,

hypertension, stroke, and heart attacks. Low levels of magnesium can cause stiffness in the vasculature, which elevates blood pressure and a contraction or spasm in the heart muscle, which can result in sudden death.

Deficiency symptoms include:

- Muscle cramps
- Weakness
- Insomnia
- Loss of appetite
- GI disorders
- Kidney stones[41]
- Osteoporosis
- Nervousness
- Restlessness
- Irritability
- Fear
- Anxiety
- Confusion
- Depression
- Fatigue
- High blood pressure

Conditions that leave a patient with an increased need for magnesium include:

- Alcoholism
- Asthma
- Cardiovascular Disease
- Congestive Heart Failure o Diabetes Mellitus
- Fatigue
- Hypertension
- Kidney Stones
- Migraines
- Obesity
- Muscle Cramps

Cautions & Side Effects:

Kidney excretion of excess magnesium prevents magnesium toxicity. Excess intake of inorganic magnesium salts cause diarrhea. Individuals with kidney disease and/or heart block (without a pacemaker) should consult with their physician before using a magnesium dietary supplement.

Symptoms that may indicate acute toxicity include:

- Diarrhea
- Gastric irritation
- Light-headedness

- Headache
- Nausea
- Flushing and warmth

Medication interactions

Medications that can increase the amount of magnesium include:

- Potassium-sparing diuretics
- Dasatinib

Medications with increased effects while taking magnesium include:

- Calcium channel blockers
- Neuromuscular blockers

Medications that can decrease the amount of magnesium include:

- Aminoglycosides
- Amphotericin B
- Cholestyramine
- Corticosteroids
- Estrogen (ERT) and Hormone (HRT) replacement therapy
- Foscarnet
- Lanoxin
- Loop and thiazide diuretics
- Neomycin
- Oral contraceptives
- Penicillamine
- Pentamidine
- Proton pump inhibitors (PPIs), including Lansoprazole (Prevacid), Omeprazole (Prilosec)[42]
- Tetracycline Antibiotics

Medications with decreased effects while taking magnesium include:

- Fluoroquinolones
- Levothyroxine

Patients with the following disease states or conditions should not use magnesium:

- Kidney disease

Food Sources:

The magnesium content in foods varies widely, as does the soil content of magnesium. Good food sources include nuts, legumes, cereal grains, fish and dark green leafy vegetables. Dietary magnesium is absorbed in the small intestines.

Nutrient interactions:

Calcium

Magnesium and calcium work very closely in the body. If there is a magnesium deficiency, there is a higher risk of calcium deficiency.[36,43,44] Also, because of the roles each plays in parathyroid hormone and vitamin D production, hypermagnesemia may cause calcium levels to decline.[36,43]

Potassium

Low magnesium levels lead to increased potassium efflux from cells and increased renal secretion, leading to hypokalemia.[36,43]

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