ALBION®
HUMAN NUTRITION

RESEARCH NOTES

A COMPILATION OF VITAL RESEARCH UPDATES ON HUMAN NUTRITION

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Magnesium: Many Potential Benefits

It had been commonly held that magnesium was involved in 300 enzymes as a cofactor, which is a significant number. Newer enzymatic databases are listing over 600 enzymes in which magnesium serves as a cofactor, and an additional 200 in which it may act as an activator (Nucleic Acid Res 28/40, 200/2012). Magnesium is involved in nearly every major metabolic and biochemical process within the cell. The human body contains about 24 grams of magnesium, and 99% of this is stored in bone, muscle, and other soft tissue. Every organ has a critical need for magnesium in order to effectively perform their functions. The serum reflects only 1% of the body magnesium content, but is of critical electrolytic need. Serum magnesium levels can be in the normal range, even when one is in a severely deficient state. This has caused the clinical impact of magnesium deficiency to be undervalued (Physiological Reviews Jan 2015,V.95 no.1, 1-46). It is of particular importance in the physiology of the brain, heart, and skeletal muscle. However, it also plays major roles in the lung, liver, immune system, bone, as well as the pancreas. Studies have suggested that magnesium levels could influence the onset and development of type 2 diabetes mellitus, and that magnesium supplementation may be a way to achieve better glycemic control (Diabetic Med 23:1050-1-56, 2006).

Magnesium Intake

The broad ranging and vital influences seen for magnesium in the human body make it that much more important, to make sure that one maintains adequate dietary intake of this macro-mineral. In Table 1, the Recommended Dietary Allowances for magnesium are listed according to the NIH Office of Dietary Supplements.

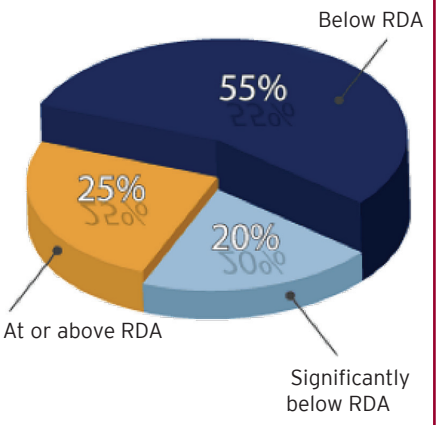
The most recent dietary surveys of the US populace have consistently shown that intake of magnesium is lower than the recommended amounts. A review of the data from the National Health and Nutrition Examination Survey (NHANES) from 2005-2006 shows that the majority

Table 1: Recommended Dietary Allowances (RDAs) for Magnesium				
Age	Male	Female	Pregnancy	Lactation
Birth to 6 months	30 mg*	30 mg*		
7-12 months	75 mg*	75 mg*		
1-3 years	80 mg	80 mg		
4-8 years	130 mg	130 mg		
9-13 years	240 mg	240 mg		
14-18 years	410 mg	360 mg	400 mg	360 mg
19-30 years	400 mg	310 mg	350 mg	310 mg
31-50 years	420 mg	320 mg	360 mg	320 mg
51+ years	420 mg	320 mg		

*Adequate Intake (AI)

U.S. Intake of Magnesium

Percent of U.S. population meeting recommeded Daily Allowance (RDA)



of Americans of all ages fail to take in the needed amount of magnesium. About 75 % of the population has magnesium deficient diets. Magnesium deficiency can lead to a chronic state of inflammation, which has been indicated as one of the factors behind the ever- increasing incidence of Metabolic Syndrome in the United States and many other developed countries.

Magnesium Physiology and Organ System Impact

The multifaceted systems in which magnesium is required, is seemingly immeasurable. A system of major importance that relies heavily on magnesium is that of cell proliferation. In this system, magnesium has been shown to have direct influence on cell cycling, protein synthesis, and growth factor response. Protein synthesis is highly dependent on intracellular magnesium concentrations. Increasing the magnesium content amplifies protein synthesis (Proc Natl Acad Sci USA 76:3917-3921, 1979). This impact is likely what is behind the findings that magnesium is associated with muscle growth and strength. Maintaining good magnesium levels has been shown as an important influence on sports performance and energy. Protein synthesis and energy generation (ATP recycling) are two of magnesium's major contributions toward enhancing muscular exercise power and endurance.

By now, it is unmissable that magnesium is involved in the workings of virtually all facets of the human body. Published clinical studies have found that magnesium deficiency is associated with a broad range of diseases. Because of this, magnesium supplementation can be considered as, at least in part, as potential treatment in the disorders associated with magnesium deficiency. In the review by Joeren H.F. de Baaji, et al (Phys Reveiew1/2015 Vol.95 no.1, 11-46) there is a section discussing all the major diseases in which magnesium can play a role in organ specific areas, which are summarized in Table 2.

Magnesium and the Heart

The disorders of the heart and vasculature in which magnesium supplementation may be considered in a treatment regimen are several, as noted in Table 2. The mechanisms by which magnesium asserts its effect in these diseases are quite varied. Magnesium has been seen to have major positive influence on cardiac arrhythmias. In a recent article [Vierling W, et al. Dtsch Med Wochenschr 2013; 138 (22):1165-1171], are extensive recommendations concerning magnesium deficiency and magnesium therapy for cardiac arrhythmias. In the article, the group of experts in this area summarily state: Magnesium is an activator of many enzymes and ion pumps (Na-K-ATPase, Calcium-ATPase) responsible for the membrane potential of cardiac muscle, the correct distribution of the cations, and the excitability of the physiological cell. Magnesium deficiency can cause considerable problems with the electrical processes of the cardiac cell. This plays a role in the anti-arrhythmic effect of magnesium. While the enzyme dependent effects of magnesium are limited, there are other physiological effects,

which can be increased by upping the serum magnesium beyond the normal range, achieving a pharmacodynamics response.

The mechanisms of action through which magnesium can prevent or treat cardiac rhythm are:

- Maintaining the heart muscle electrolyte balance
- Calcium Antagonism
- Increasing the cardiac muscle excitation threshold
- Mitigation of the release of neurotransmitters and mediators (e.g. noradrenaline, adrenaline).

Other Clinical Findings

Albion's Magnesium Bisglycinate has been the subject of a number of clinical studies. Some of the studies covered organ specific diseases from the list in

Table 2. They include lung (asthma and cystic fibrosis) and muscle (leg cramps of pregnancy) specific disorders. Below are the summaries of these two lung studies and one muscle study.

C. Gontijo-Amaral, et al. European Journal of Clinical Nutrition (2007) 61, 54-60.

This study was a double-blind randomized parallel placebo controlled design, investigating the long term effect of oral magnesium supplementation on clinical symptoms, bronchial reactivity, lung function and allergen-induced skin responses in children and adolescents with moderate persistent asthma. The study included 37 patients, ages 7-19 years and lasted 2 months. They were randomly placed into two groups: placebo group and magnesium group. The magnesium (Albion's Magnesium Bisglycinate Chelate) group received 300 mg of elemental magnesium in capsule form per day. Both groups received inhaled fluticasone (250 mcg twice a day) and salbutamol, as needed. After two months, the researchers found that the magnesium group had fewer asthma exacerbations and used less salbutamol than the placebo group. The Magnesium Bisglycinate Chelate supplementation helped reduced bronchial reactivity, diminish the allergen-induced skin responses, and to provide better symptom control in pediatric patients with moderate persistent asthma treated with inhaled fluticasone.

Table 2. Overview of organ specific diseases in which magnesium may play a role.

Brain	Migraine/Depression/ Epilepsy/Stroke/Brain Injury/Parkingson's Disease Neurological Pathologies (including alzheimer's, Bipolar, Addiction, Schozophrenia/ Stress
Lung	Asthma/Cystic Fibrosis/COPD
Heart & Vasculature	Coronary artery Disease/ Myocardial Infarction/ Arrythmia/Preeclampsia/ Hypertension/Vascular Calcification
Muscle	Asthma/Cystic Fibrosis/COPD
Pancreas	Diabetes Mellitus
Liver *(Magnesium's role has been poorly studied here)*	Cirrhosis/Non Alcoholic Fatty Liver Disease
Immune System	T-Cell Immunodeficiency (magnesium has role in t-lymphocyte development and proliferation)
Bone	Osteoporosis

C. Gontijo-Amaral, et al. Am J Clin Nutr (published ahead of print 5/30, 2012 as doi:10.3945/ajcn.112.034207)

This study was done to assess the importance of magnesium supplementation in cystic fibrotic (CF) patients. Earlier studies had reported low magnesium in cystic fibrotics. Study design was that of a double-blind, randomized, placebo-controlled crossover. The study included 44 CF patients, ages 7-19 years, randomly assigned to receive magnesium (300mg of elemental Mg per day) or placebo for 8 weeks, with a 4-week washout between trials. The magnesium was Albion's Magnesium Bisglycinate Chelate Taste Free, administered in powder sachets. The magnesium supplementation showed dramatic increases in urinary magnesium, which demonstrated a need for magnesium supplementation in this disease. Only after the magnesium supplementation was there a significant improvement in minimal inspiratory pressure and maximal expiratory pressure. Supplementation with Magnesium Bisglycinate Chelate helped improve the Shwachman-Kulczycki score (a measure of the severity of cystic fibrosis) and the respiratory muscle strength in pediatric patients with CF.

Supakatisant, C. and Phupong, V.Maternal and Child Nutrition, 2012 DOI:10.111/j.1740-8709.2012

This study was a double-blinded, randomized placebo controlled design. It included 86 healthy pregnant women (80 women completed the study) suffering with leg cramps, at least twice per week. The study lasted 4 weeks. One group received Magnesium Bisglycinate Chelate (Albion, 300mg elemental magnesium per day, as tablets), and the other received placebo. There was a 50% higher reduction in leg cramp frequency and intensity in the magnesium-supplemented group, with no differences in gastric side effects (nausea or diarrhea). Oral magnesium may be a good treatment option for women suffering from pregnancy-induced leg cramps.

Concluding Remarks

The roles that magnesium play are diverse and of critical importance. Marginal to moderate magnesium deficiency, which often goes undetected, can result in a chronic low-grade inflammation. This chronic inflammatory stress can contribute to chronic diseases, such as atherosclerosis, hypertension, asthma, osteoporosis, diabetes mellitus (type 2), types of obesity, as well as cancer. Given the status of magnesium intake in the US and elsewhere, the supplementation of magnesium should be given serious consideration. Albion's Magnesium Bisglycinate Chelate has been shown to be an effective form of magnesium, as seen in the studies mentioned. When formulating or taking a magnesium supplement, it would be a good idea to employ a clinically proven effective form of magnesium –Albion's Magnesium Bisglycinate Chelate!

Magnesium Bisglycinate Chelate is also available in a patented Taste Free form.

Albion's other 2:1 amino acid: metal magnesium forms are: Magnesium Lysyl Glycinate Chelate and Magnesium Glycyl Glutamine Chelate.

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