ALBION®
HUMAN NUTRITION

RESEARCH NOTES

Celebrating 50 Years of Quality Chelated Minerals

A COMPILATION OF VITAL RESEARCH UPDATES ON HUMAN NUTRITION

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Metabolic Syndrome X, a Modern Day Epidemic

A syndrome is a condition defined by a cluster of related symptoms or disorders. Metabolic Syndrome X is an aggregation of abnormalities in carbohydrate and lipoprotein metabolism which has been closely associated with an increased risk of coronary heart disease (CHD). More specifically, Syndrome X refers to a group of health problems that often can stem from insulin resistance, leading to improper handling of dietary carbohydrates and sugars, elevated cholesterol and triglycerides, weight gain, and hypertension. The end point of Metabolic Syndrome X can typically be heart attack and/or stroke. There are a variety of theories behind the reason for the rapid rise in the incidence of insulin resistance. One popular theory revolves around the concept that our modern day lifestyles have changed too quickly for the human body to adapt to these changes, such as a much larger reliance refined carbohydrates, and lower intakes of nutrient rich foods, along with today's more sedentary behavior. High stress and unhealthy lifestyles can also contribute. Additionally, some people have a genetic predisposition to insulin resistance. In insulin resistance, there is a reduction in the number of insulin receptor sites on the cell wall. A healthy person has around 20,000 insulin receptors sites per cell, while people with insulin resistance can have as low as 5000 of these sites per cell. The result of this is that glucose cannot be efficiently transferred by insulin through these receptor sites from the blood stream into the cell to be burned as energy. This causes elevated blood sugar levels. This blood sugar is carried into the liver where it is converted to fat that can be transferred and stored throughout the body, the end result being weight gain. Additionally the conversion of these sugars to triglycerides leads to unhealthy blood lipid levels, which can lead to cardiovascular disease.

Symptoms of the Syndrome

Metabolic Syndrome X can be a very quiet disease. The American Heart Association has estimated that 20-25% of the adult population in the United States suffer from this Syndrome. That would equate to between 58 and 73 million people. This Metabolic Syndrome is usually diagnosed when an individual has at least three of the following symptoms:

- Insulin resistance
- Abdominal fat – in men a 40 inch waist or larger, in women 35 inches or larger
- High blood sugar levels – at least 110mg/dl after fasting
- High serum triglycerides – at least 150mg/dl
- Low serum HDL – less than 40mg/dl
- Pro-thrombotic state (high fibrinogen or plasminogen activator blood levels)
- Blood pressure of 130/85 mm Hg of higher

All aspects of this Syndrome are strongly related to dietary and lifestyle factors; therefore, scientists have considered it reasonable to look for dietary approaches in trying to rectify the Syndrome.

Dietary Studies on Metabolic Syndrome X

In a very recent study by Ka He, MD, ScD, et al. of Northwestern University Feinberg School of Medicine (Circulation, March 27, 2006), the relationship of magnesium intake in young adults to Metabolic Syndrome X is examined. This was a 15 year study, involving 4637 Americans, aged 18-30 years, free of diabetes and metabolic syndrome. During the

course of 15 years of follow-up, there were 608 incidences of Metabolic Syndrome X. Magnesium intake was inversely associated with the incidences of Metabolic Syndrome.

In the published paper, the authors state "Our findings that young adults with higher magnesium intake have lower risk of development of Metabolic Syndrome. Experimental data suggests that magnesium may directly regulate cellular glucose metabolism through its role as a cofactor for a number of relevant enzymes and may influence insulin secretion by interacting with cellular calcium homeostasis. In addition, epidemiological studies and clinical trials indicate that magnesium intake may improve insulin sensitivity."

Low Serum Magnesium Levels And Metabolic Syndrome

Acta Diabetol. 2002; 39(4):209-213.
Guerrero-Romero F; Rodriguez-Moran M.

Low serum magnesium levels are related to diabetes mellitus (DM) and high blood pressure (HBP), but as far as we know, there are no previous reports that analyzed the serum magnesium concentration in individuals with metabolic syndrome (MS). The researchers performed a cross-sectional population-based study to compare 192 individuals with MS and 384 disorder-free control subjects, matched by age and gender. Magnesium supplementation treatment and conditions likely to provoke hypomagnesemia, including previous diagnosis of diabetes mellitus (DM) and/or high blood pressure (HBP), were exclusion criteria. In this regard, only incident cases of DM and HBP were included. MS was defined by the presence at least of two of the following features: hyperglycemia (> or =7.0 mmol/l); HBP (> or =160/90 mmHg); dyslipidemia (fasting triglycerides > or =1.7 mmol/l and/or HDL-cholesterol <1.0 mmol/l); and obesity (body mass index > or =30 kg/m(2) and/or waist-to-hip ratio > or =0.85 in women or > or =0.9 in men). Low serum magnesium levels were identified in 126 (65.6%) and 19 (4.9%) individuals with and without MS, p<0.00001. The mean serum magnesium level among subjects with MS was 1.8+/-0.3 mg/dl, and among control subjects 2.2+/-0.2 mg/dl, p<0.00001. There was a strong independent relationship between low serum magnesium levels and MS (odds ratio (OR)=6.8, CI(95%) 4.2-10.9). Among the components of MS, dyslipidemia (OR 2.8, CI(95%) 1.3-2.9) and HBP (OR 1.9, CI(95%) 1.4-2.8) were strongly related to low serum magnesium levels. This study reveals a strong relationship between decreased serum magnesium and MS.

Magnesium Intake, C-reactive Protein, And The Prevalence Of Metabolic Syndrome In Middle Aged And Older Us Women

Diabetes Care. 2005; 28(6):1438-44.
Song Y, et al.

The aim of this study was to examine whether and to what extent magnesium intake is related to systemic inflammation and the metabolic syndrome. The researchers performed a cross-sectional analysis on data from 11,686 women > or =45 years of age participating in the Women's Health Study who were initially free of cardiovascular disease and cancer and had no use of postmenopausal hormones. In age- and BMI-adjusted analyses, magnesium intake was inversely associated with plasma C-reactive protein (CRP) concentrations; CRP concentrations were 12% lower in the highest intake quintile than in the lowest (P for trend <0.0001). This association was not appreciably altered by further adjustment for other potential confounding variables including dietary factors; the mean CRP concentrations for ascending quintiles of magnesium intake were 1.50, 1.39, 1.35, 1.34, and 1.31 mg/l (P for trend = 0.0003). This inverse association was stronger for women with a BMI > or =25 kg/m(2) (P < 0.0001 for interaction) and those who were current or past smokers (P = 0.0009 for interaction). After adjustment for confounding lifestyle and dietary factors, women in the highest quintile of magnesium intake had 27% lower risk of the metabolic syndrome (defined according to the National Cholesterol Education Program criteria) compared with those in the lowest quintile of intake (odds ratio 0.73 [95% CI 0.60-0.88], P for trend = 0.0008). The results suggest that magnesium intake is inversely associated with systemic inflammation and the prevalence of the metabolic syndrome in middle-aged and older women.

Role Of Zinc In Insulin Resistance

Arq Bras Endocrinol

Metabol. 2004; 48(2): 234-9.
Marreiro DN, et al.

This review reports the etiological aspects of insulin resistance as well as the participation of zinc in this process. Zinc participates in the metabolic pathways involving protein synthesis, and the metabolism of carbohydrate, lipid and nucleic acid. This element has been associated with the interaction between hormones and their receptors and to the improvement in the post-receptor stimulus. In vitro studies show that insulin may form a complex with zinc improving the solubility of this hormone in the pancreatic beta cells and also increasing the binding ability of insulin to its receptor. Regarding obesity and insulin resistance, alterations in zinc concentration and distribution in tissues, as well as improvement in sensitivity to insulin after supplementation with this element, have been detected. Thus, the metabolic role of zinc in the insulin resistance syndrome should be further investigated having in mind that this element may contribute to the control of the usual metabolic alterations present in obese patients.

Intracellular Magnesium And Insulin Resistance

Magnes Res. 2004; 17(2):126-136.
Takaya J; Higashino H; Kbayashi Y.

Magnesium, the second most abundant intracellular divalent cation, is a cofactor of many enzymes involved in glucose metabolism. Magnesium has an important role in insulin action, and insulin stimulates magnesium uptake in insulin-sensitive tissues. Impaired biological responses to insulin is referred to as insulin resistance. This review was designed to reach a better understanding of the mechanism involved in the correlation between magnesium and insulin resistance. Intracellular magnesium concentration is low in type 2 diabetes mellitus and in hypertensive patients. In patients with type 2 diabetes an inverse association exists between the plasma magnesium and insulin resistance due to intracellular changes. The suppressed intracellular magnesium concentration may result in defective tyrosine kinase activity and modify insulin sensitivity by influencing receptor activity after binding or by influencing intracellular signaling and processing. Intracellular magnesium deficiency may affect the development of insulin resistance and alter the glucose entry into the cell. Magnesium is required for both proper glucose utilization and insulin signaling. Metabolic alterations in cellular magnesium, which may play the role of a second messenger for insulin action, contribute to insulin resistance.

A Scientific Review: The Role Of Chromium In Insulin Resistance

Diabetes Educ. 2004; Suppl:2-14.
No author stated.

Chromium is an essential mineral that appears to have a beneficial role in the regulation of insulin action and its effects on carbohydrate, protein and lipid metabolism. Chromium is an important factor for enhancing insulin activity. Studies show that people with type-2 diabetes have lower blood levels of chromium than those without the disease. Insulin resistance is the common denominator in a cluster of cardiovascular disease risk factors. One out of every five Americans has metabolic syndrome. It affects 40% of people in their 60s and 70s. Insulin resistance, with or without the presence of metabolic syndrome, significantly increases the risk of cardiovascular disease. Insulin resistance is present in two serious health problems in women; polycystic ovarian syndrome (PCOS) and gestational diabetes. Several studies have now demonstrated that chromium supplements enhance the metabolic action of insulin and lower some of the risk factors for cardiovascular disease, particularly in overweight individuals. Chromium picolinate, specifically, has been shown to reduce insulin resistance and to help reduce the risk of cardiovascular disease and type-2 diabetes. Dietary chromium is poorly absorbed, chromium levels decrease with age. Supplements containing 200-1,000 mcg chromium as chromium picolinate a day have been found to improve blood glucose control. Chromium picolinate is the most efficacious form of chromium supplementation. Numerous animal studies and human clinical trials have demonstrated that chromium picolinate supplements are safe.

According to Milagros G Huerta, MD, in the May 2005 issue of Diabetes Care, magnesium deficiency in obese children is associated with the development of insulin resistance, a deficiency that they found to be the result of decreased dietary intake of magnesium. Dr. Huerta goes onto state that magnesium is associated with insulin resistance and increased risk for type-2 diabetes in adults. Magnesium is a very important cofactor for enzymes involved in carbohydrate metabolism.

Recommendations

It is quite apparent from the clinical research to date that there is definitely a micronutrient component to the epidemic of Metabolic Syndrome X. There have been several micronutrients that have been linked one way or another to this devastating syndrome. Calcium, magnesium, zinc, chromium, and even potassium have all been looked at. However, as more research is done, certain minerals are coming to the top of the list for possible adjuncts in the treatment of Metabolic Syndrome X. Magnesium with its multitude of roles in the realm of carbohydrate metabolism, as well as its ability to help decrease serum lipids is of prime importance. More people are suffering from at least marginal magnesium status than for any other mineral in the USA. Zinc has been shown to hold one of the keys to fighting insulin insensitivity. It has also been shown that the diabetic has a much more difficult time absorbing and utilizing zinc. Doses of zinc in a diabetic need to be higher at the start of any zinc supplementation program due to this.

A certain form of Chromium has been referred to as the glucose tolerance factor for many years, and it has been shown to assist in fighting insulin resistance, as well.

Magnesium • Zinc • Chromium

These are the keys to fighting Metabolic Syndrome from the micronutrient side.

Summary

Albion Advanced Nutrition is looking to work with researchers to help design and fund studies to further our understanding of Metabolic Syndrome X.

Look to Albion Advanced Nutrition for the best in mineral supplementation:

- Highest bioavailability
- Greater tolerability
- Safety
- Less dietary interferences
- Greater physiological benefit

Magnesium ingredients from Albion: Magnechel®, Magnesium Chelazome®, Magnesium Glycyl Glutamine, DiMagnesium Malate, and Buffered Magnesium Amino Acid Chelate

Zinc ingredients from Albion: Zinc Chelazome®, Zinc Histidine Amino Acid Chelate, Zinc Arginine Amino Acid Chelate, Zinc Amino Acid Chelate Taste-Free

Albion also provides Chromium Chelavite®

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