

NEWS UPDATES



2018

Magnesium and Cardiovascular Health

This study reported the impact of magnesium (Mg) supplementation on arterial stiffness in a group of overweight men and women. The study was a double-blind placebo controlled intervention over twenty-four weeks. Arterial carotid-to-femoral pulse wave velocity (PWV) was used to assess arterial stiffness and performed at baseline, at twelve and twenty-four weeks. Blood Mg was assessed and the treatment group were given 350 mg of Mg per day over the study period. Serum Mg levels were within normal range for both groups and rose following therapy. The PWV decreased indicating a reduction in arterial stiffness in the treatment group. The study confirms the beneficial effects of Mg supplementation on cardiovascular health. *Joris, PH, et al. Long-term magnesium supplementation improves arterial stiffness in overweight and obese adults: results of a randomized double-blind, placebo-controlled intervention trial. 103,5, 2016.*

Comment: It is interesting in that even though serum Mg levels were within the normal range for both groups in the study, Mg supplementation yielded significant benefit in reducing arterial stiffness and improved vascular function. This would suggest a few possibilities. First, due to the response to therapy there may be a subclinical need for increased Mg in many individuals and not just those who are overweight. Secondly, serum Mg is not a good indicator of Mg status or need in the general population since serum levels of many minerals are maintained at the expense of tissue or cellular concentrations. Almost half (48%) of the US population consumed less than the required amount of magnesium from food in 2005-2006. Third, Mg assessment should not be based upon measuring Mg alone, but in conjunction with other minerals and nutrients known to impact Mg status. There are many factors that can contribute arterial stiffness, but it is safe to say that most of the causes are in some way related to mineral imbalance that can be assessed easily and with cost effectiveness using HTMA as a screening tool.

[The Nutritional Relationships of Magnesium](#)

Zinc Induced Neurological Symptoms

A case study reported a female 61 years of age presenting with gait instability, numbness and tingling in the hands and feet. The patient had renal disease and was undergoing dialysis. One year before the present symptoms developed, the patient developed dysguesia and was prescribed 220 milligrams of zinc sulfate twice per day. After three months when symptoms did not abate the zinc intake was doubled to over 400 milligrams per day. Ultimately, it was found that the patient was suffering from myelopathy with posterior column disease related to copper deficiency. Blood tests revealed low ceruloplasmin and copper, and an elevated serum zinc. After eliminating zinc intake and providing copper, the neurological symptoms abated. *Saly, DL. Et al. An Element of Unsteadiness. Clinical Problem-Solving. Solomon, CG, Ed. NEJM 377,14, 2017.*

Comment: This is an example of the interrelationship between minerals. Even though zinc and copper do work together, an excess intake of one can contribute to a deficiency of another and should always be taken into consideration and monitored.

Tattoos: A Source of Heavy Metals

It is known that contaminants are present in tattoo inks, ranging from polycyclic aromatic hydrocarbons, preservatives, bacteria and metals. Titanium and iron oxides are present as shading additives to carbon black. Metals are present as shading and colorant additives, or as contaminants and include barium, aluminum, copper, antimony, arsenic, cadmium, cobalt, lead, mercury and nickel. *Laux, P., et al. A medical-toxicological view of tattooing. Lancet, 387, 2016.*

Comment: Often HTMA studies reveal the presence of heavy and other metals and the source is difficult to determine. This study found that some metals such as copper, titanium, chromium, nickel, lead and aluminum can be present in high concentrations in tattoo inks. Often these metals and chemicals can be found in lymph nodes long after the ink has been applied.

High Fat Diets and Improved Mortality

Finally the issue of fats in the diet is settled. In the past, the recommendations for the reduction in fat intake to less than ten percent was based upon false science and some observational studies with few facts to support those recommendations. Now studies of more than one-hundred thousand individuals in eighteen countries over a period of seven years has shown that higher carbohydrate intake is associated with a higher risk for overall mortality. However, higher intake of fats, including saturated, monounsaturated and polyunsaturated fats were associated with a lower overall mortality risk. Comments of the study state: "Data from this large, diverse international cohort does not support current dietary guidelines that recommend restricting total and saturated fats. The findings suggest that people who eat a high carbohydrate diet might benefit from substituting fats for some of their carbohydrates."(1)

A viewpoint by David Ludwig, stated that in the 1970's the US government and professional nutrition organizations recommendations that individuals eat a low-fat, high-carbohydrate diet turned out to be the largest public health experiment in history. He sites that during the 40 years of promoting this to the population at large by professionals and government policies, obesity and diabetes has seen a several fold increase. (2)

(1) *Soloway, B. High-Fat Diets Were Associated with Lower 7-Year Mortality. NEJM Journal Watch Sept. 7, 2017*

(2) *Ludwig, D. Lowering the Bar on the Low-Fat Diet. JAMA 316,20, 2016.*

[Cholesterol – Fat – Protein 1991](#)

Magnesium and Gestational Diabetes

A double blind placebo controlled study was performed on seventy women to assess the impact of magnesium supplementation on metabolic status and pregnancy outcomes in pregnant women with gestational diabetes. Women in the magnesium supplement group had significant improvements in insulin levels and inflammatory markers compared to the placebo group. Also, the magnesium supplement group had a lower incidence of newborn hyperbilirubinemia (8.8% vs. 29.4%) and hospitalization rate (5.9% vs. 26.5%). *Zatollah, A., et al. Magnesium supplementation affects metabolic status and pregnancy outcomes in gestational diabetes: a randomized, double-blind, placebo-controlled trial. Am.J.Clin.Nut.102,1 2015.*

Comment: We have performed thousands of HTMA studies from women prior to conception, during pregnancy and following delivery. Magnesium levels typically fall during the last two trimesters in expectant mothers. HTMA studies have shown an increased need for most women during pregnancy and virtually all those who have developed gestational diabetes. However other significant mineral imbalances are also found, such as a marked elevation in the normal calcium/magnesium ratio. This pattern is associated with hyper-insulinism and inflammation due to increased tissue calcium accumulation. Elevated copper levels may also be a contributor to inflammation and hyper-insulinism. A marked elevation of copper and very low zinc/copper ratio suggest an elevation of estrogen and other hormones that also contribute to inflammation, oxidative stress and high insulin levels during pregnancy.

Since calcium, estrogen and insulin act synergistically this triad contributes to reduced insulin sensitivity due to contributing to the development of chromium and zinc deficiency. Extreme development of the above described imbalances are also seen in pregnant women who have developed toxemia and post-partum depression. It is logical from this study and others that specific, targeted nutritional support would significantly impact and reduce complications during pregnancy as well as newborn outcomes.

Further, an editorial in the American Journal of Clinical Nutrition reported a study in which high serum calcium levels were associated with an increased risk for development of type 2 diabetes. They state that higher serum calcium has been associated with altered glucose metabolism affecting beta cell function or insulin sensitivity. The possible mechanism is that higher tissue or intracellular concentration of calcium may reduce insulin sensitivity in fat cells due to decreased glucose transporters and insulin receptor activity. *Chatterjee, R. et al. Serum calcium and its complex association with incident type two diabetes. Am.J.Clin. Nutr. 104, 2016.* This further supports our finding from HTMA studies of high tissue calcium in adult onset diabetic patients. Also, it is well known that calcium will enhance the glycemic response.

[Diabetes, A Failed Approach 2013](#)
[Glycemic Response and Calcium 1988](#)

Nutritional Deficiencies and Heavy Metal Accumulation

Hair mineral analysis and blood mineral analysis were performed on a group of malnourished children and compared to a group of normal children. Elements tested included, lead, calcium, iron and zinc. Results showed twice the level of lead in the malnourished group compared to the control group and half the levels of calcium, iron and zinc. *Talpur, S., et al. Interaction of Lead, with Calcium, Iron and Zinc in Biological Samples of Malnourished Children. Biol. Trace Elem. Res. Aug. 2017.*

Comment: It is well known that malnutrition, nutritional deficiencies and imbalances allow increased susceptibility to heavy metal retention from many sources. This is especially the case in growing children. HTMA offers the ability to evaluate the relationship between nutritional minerals that play a role in protecting from the absorption and retention of heavy metals of not only lead, but mercury, cadmium and others that are ever present in the environment.

Increased Risk of Aneurysm Associated with Fluoroquinolone Use. Zn/Cu Imbalance?

Synthetic broad-spectrum antibiotics known as fluoroquinolones are prescribed as a first line antibacterial for acquired infections, especially in hospital settings. They include ciprofloxacin, levofloxacin, gatifloxacin, moxifloxacin, ofloxacin, norfloxacin and have been prescribed to over twenty million Americans. Some of the known side effects that have been reported with their use include tendonopathy, tendon rupture as well as peripheral neuropathy. Recently a study reported the increased risk of aortic aneurysm with their use. The mechanism is thought to involve an increase in the stimulation of matrix metalloproteinase activity causing a breakdown of collagen and the structural components of the extracellular matrix. Excess metalloproteinase can also result in poor wound healing. *Mueller, PS. General Medicine, Journal Watch. 38,9, 2018.*

Comment: Since metalloproteinase is a zinc-containing metalloenzyme the mechanism could be related to a zinc/copper imbalance. Aortic aneurysm has been associated with copper deficiency. Other signs of copper deficiency include poor wound healing, as well as neuropathy, neurological disturbance, infections, arthritis, orthopedic disturbance, hypercholesterolemia, anemia, cerebrovascular and cardiovascular disease. It would be prudent to assess the tissue zinc and copper status of those individuals who are prescribed fluoroquinolones and who are experiencing the symptoms mentioned above.

The Microbiome Disturbance and Medications, Other Than Antibiotics

It is well known that antibiotics can alter the normal intestinal flora or microbiome of the gut. However, recently it has been reported that other common medications can do the same. Researchers screened 1000 drugs and 40 common intestinal bacterial strains. They found that twenty-four percent of the drugs inhibited at least one intestinal bacterial strain. The widely prescribed drugs included metformin, as well as antipsychotics and other psychoactive drugs as well as proton pump inhibitors, hormones and antineoplastics. Komaroff, AL. *Nonantibiotic Drugs Alter the Gut Microbiome Profoundly. Journal Watch. 38,9, 2018.*

Comment: Individuals taking the above medications should be evaluated for intestinal issues. A loss of normal intestinal flora can lead to many common gut issues.

Hair Calcium/Magnesium Ratio and Coronary Artery Calcification

This study investigated the relationship between tissue calcium and magnesium using hair sample testing and subclinical coronary artery calcification, using coronary calcium scores (CCS). The population included over 200 individuals aged 40 years and above. They found an association with CCS and the tissue calcium-to-magnesium relationship. Coronary calcification scores were strongly associated with a higher calcium-to-magnesium ratio in the hair than lower calcium-to-magnesium ratios found. Park, B, et.al. *High Calcium-Magnesium Ratio in Hair is Associated with Coronary Artery Calcification in Middle Aged and Elderly Individuals. Biol.Trace Elem.Res. 179,1, 2017.*

Comment: An excess tissue calcium-to-magnesium relationship can lead to many problems not only related to coronary artery calcification, but other soft tissue calcium deposition sites. An elevated ratio is also associated with blood sugar and insulin dysregulation, arthritis, osteoporosis, hypertension and stress-related conditions. The many enzyme activities that require magnesium could also become disturbed.

Low Hair Magnesium and Ventricular Wall Thickness

The relationships between low magnesium intake and cardiovascular disease are well known. As discussed above, a disturbance in the relationship between calcium and magnesium is associated with coronary calcification. This study found a relationship between hair magnesium status and echocardiographic parameters in chronic hemodialysis patients. They found that hair magnesium levels were significantly lower in patients with high-left ventricular mass index compared to those having a low mass index. Low hair magnesium correlated with posterior left ventricular thickness, interventricular septum thickness, left ventricular wall thickness as well as relative wall thickness. The authors concluded that hair magnesium concentrations is a biomarker for ventricular hypertrophy in hemodialysis patients. Ochi, A. et al. *Hair magnesium, but not serum magnesium, is associated with left ventricular wall thickness in hemodialysis patients. Circ. J. 77,12, 2013.*

Comment: Inadequate magnesium status has been associated with many health conditions for decades, particularly heart disease. However, apparently since serum magnesium has been used as the test of choice, but rarely reflects true magnesium status, the use of magnesium therapy for the large population affected is grossly ignored and underutilized. Since it is also well known that serum magnesium tests do not reflect total body magnesium status, hair tissue mineral analysis (HTMA) can be accepted as a more adequate screening tool for total body magnesium as well as magnesium's relationship with other mineral concentrations.

