TRACE ELEMENTS

NEWS UPDATES

OCTOBER – NOVEMBER 2013

Chromium and Diabetes Study

Chromium is known to be related to the normal function of insulin and is a constituent of cellular insulin receptors. A lack of chromium is related to insulin resistance. This study evaluated the effect of chromium supplementation on fasting plasma glucose, glycated hemoglobin (HbA1c), and lipid levels in type 2 diabetic patients who were also on insulin therapy. Patients were randomized and supplemented with 100 micrograms of chromium daily over a period of two weeks. The chromium dosage was then increased to 200 micrograms daily for the next six weeks. Fasting plasma glucose, HbA1c and serum lipids were measured after each phase and compared to baseline. Fasting plasma glucose showed a significant decrease after the first phase of chromium supplementation and tended to diminish even further during the second phase of supplementation. HbA1c also significantly decreased during both phases. *Effect of Chromium-Enriched Yeast on Fasting Plasma Glucose, Glycated Haemoglobin and Serum Lipid Levels in Patients with Type 2 Diabetes Mellitus Treated with Insluin. Jaroslav Racek, et al. Biol.Trace Elem. Res.155,1, 2013.*

Comment: It has long been known that chromium deficiency is present in patients with diabetes and that supplementation aids in the improvement of insulin resistance and other complications associated with the progression of type 2 diabetes. The status of the body's chromium reserve is difficult to determine, however, hair tissue mineral concentrations can readily provide the tissue status of chromium. Additionally, is can also reflect chromium's relationship to other nutritional factors that may also contribute to the development and progression of type 2 diabetes. Unfortunately, even though the worldwide epidemic of diabetes is increasing, assessing and providing necessary nutritional support for treating and preventing the long-term complications caused by this disease is severely lacking.

Arsenic and Cardiovascular Disease Study

This study discusses the impact of long-term arsenic exposure and the incidence of cardiovascular disease. The study included over 3,500 Native American Indian men and women aged 45 to 74 years living in Arizona, Oklahoma, North and South Dakota. Arsenic was measured in urine at baseline and used as a biomarker of long-term arsenic exposure. Over 1,100 individuals developed fatal and nonfatal cardiovascular disease. The study concluded that long-term exposure to low to moderate arsenic levels was associated with the incidence of cardiovascular disease and mortality. *Association Between Exposure to Low to Moderate Arsenic Levels and Incident Cardiovascular Disease: A prospective Cohort Study. Moon, KA, et al. Ann. Intern. Med. Sept, 2013*

Comment: Sources of arsenic other than from industry can also be found in the environment. It can be found naturally occurring in water, and is present in foods, herbs, seafoods, seaweed, rodenticides, and insecticides as well and in weed control products. Hair tissue mineral analysis (HTMA) can be used to monitor arsenic exposure and has been correlated with intake as well as arsenic accumulation in internal organs with long-term intake.

Hair Mineral Patterns, Reproduction and Environmental Endocrine Disruptors

It is known that chemicals from the environment can impact fertility. It is also believed that heavy metals such as mercury as well as the status of some nutrient minerals can impact fertility and reproduction in humans. A report by Dickerson, et al, studied the hair mineral concentrations in women with fertility problems who underwent in vitro fertilization treatment and investigated treatment outcomes. Mercury, zinc and selenium were analyzed. Hair mercury revealed a negative correlation with oocyte yield and follicle number following ovarian stimulation. The hair zinc and selenium correlated positively with oocyte yield after ovarian stimulation. Their data found that mercury had a deleterious impact while zinc and selenium showed a positive impact in the ovarian response to gonadotropin therapy for in vitro fertilization. The researchers found that minerals such as zinc and selenium may be important for reproductive outcomes and are reflective of long-term environmental exposure and dietary status. Their study concluded that HTMA offers a method of investigating the impact of long term exposure to endocrine disruptors and nutritional status on reproductive outcomes. **E***ndocrine Disruptor and Nutritional Effects of Heavy Metals in Ovarian Hyperstimullation. Dickerson, EH, et al. J. Assist Reprod. Genet. 12, 2011.*

Comment: Nutritional status is very important in reproductive health and may involve many factors beyond those mentioned in this one article. For example not only are zinc and selenium important but also the metabolic type, thyroid status, hormonal status as well as other nutritional and heavy metals, such as manganese, copper and zinc relationship, iron, magnesium, lead and cadmium. The status of these factors can also be related to complications during pregnancy, such as; eclampsia, gestational diabetes and even postpartum depression. HTMA is a valuable tool for investigating and addressing the nutritional status in those women with reproductive problems and also during and following pregnancy.

Magnesium and Heart Disease

Over seven-thousand individuals without any known cardiovascular disease participated in a study to determine if urinary magnesium excretion and plasma magnesium were associated with ischemic heart disease risk. Urinary magnesium excretion was measured in two baseline twenty-four hour urine collections. The mean urinary magnesium excretion in males was 4.25 +- 1.65 mmol/24 hours and 3.54 +- 1.4 mmol/24 hours for women. A median follow-up at ten years found 462 fatal and non-fatal ischemic heart disease events occurred. It was found that the lowest range of urinary magnesium excretion was associated with increased heart disease risk compared to higher excretion rates. There was no association found between plasma magnesium and heart disease. The study concluded that low urinary magnesium excretion was independently associated with higher ischemic heart disease incidence and suggests increasing dietary magnesium intake in those with the lowest urinary magnesium excretion could reduce the risk of ischemic heart disease. *Urinary and Plasma Magnesium and Risk of Ischemic Heart Disease. Joosten, MM, et al. The Am.J.Clin.Nutr. 97,6, 2013.*

Comment: Adequate magnesium intake would result in higher urinary magnesium excretion thus indicating a higher dietary intake compared to low urinary excretion. Therefore, it is logical that those with low urinary magnesium excretion had low dietary intake and have a higher risk of developing heart disease over time. Magnesium is an important intracellular mineral and is essential for many functions in the body and is especially important for normal cardiovascular function. Past studies have relied upon plasma magnesium levels to determine an association between heart disease and magnesium deficiency and most have been unable to show any relationship. The reason for this is that circulating magnesium levels are maintained within a narrow homeostatic range and additional magnesium reserves can be called upon as needed from storage areas, such as the muscle and bone. For this reason, circulating magnesium does not adequately indicate dietary intake or status. In addition, even though urinary magnesium excretion can somewhat provide information concerning dietary intake of magnesium, it cannot provide an indication of tissue status or the important interrelationships that magnesium shares with other minerals. Hair tissue mineral patterns however, can provide a reflection of dietary intake as well as the relationship of magnesium with calcium, sodium, potassium, etc. It has been reported that almost half the U.S. population consumed less than the required magnesium intake from the years 2005 and 2006. This dietary trend has subsequently lead to an increase in calcium intake relative to magnesium intake over the years from a ratio of less than three to one to greater than three to one, leading to a relative decrease in magnesium absorption from the diet and even reduced body reserves. When excess calcium develops in the tissues a relative magnesium deficit develops leading to chronic, calcium-activated inflammatory conditions throughout the body.

Stress and Hair Mineral Concentrations

The following discusses the hypothesis of stress and the impact upon mineral levels in the body based upon HTMA studies. Specifically, this study determined the hair tissue levels of calcium, copper, iron, magnesium, phosphorus and zinc levels in the hair of elementary school girls between the ages of five and ten years. Hair cortisone levels were also analyzed. Estimates of stress were obtained through the Coddington Life Events Scales for children. The questionnaire measures the frequency and timing of positive and negative life events relevant for the age group during the last year. The study found that higher levels of hair cortisone were associated with reduced hair levels of calcium, magnesium, zinc and calcium/phosphorus. The authors state, "This study demonstrates an independent association between chronic stress measures and hair mineral levels in young girls, indicating the importance of physiological stress-mineral pathways independently from individual or behavioral factors." *Cross-Sectional Relationship Between Chronic Stress and Mineral Concentrations in Hair of Elementary School Girls. Vanaelst, B, et el. Biol.Trace Elem. Res. 153, 2013.*

Comment: Stress is known to affect not only physiological and psychological status but nutritional status as well. Changes in nutritional status in turn can lead to behavioral and biological changes leading to chronic activation of the stress response. Hair tissue mineral analysis (HTMA) can reflect the impact of long-term stress on nutritional status and thereby provide a specific approach to nutritional therapy.

Dietary Habits and Hair Mineral Patterns

Chojnacka, and colleagues investigated the diet of over one-hundred individuals while at the same time performing hair mineral analysis on the group. Evaluation of the data found that in those consuming highly processed foods there were statistically higher hair levels of sodium and phosphorus. Other findings from the study suggests that hair mineral content reflects the exposure or accumulation from the diet. *The Effect of Dietary Habits on Mineral Composition of Human Scalp Hair. Chojnmacka, K, et al. Environ. Toxicol.Pharmacol. 30,2, 2010.*