ALBION®
HUMAN NUTRITION

RESEARCH NOTES

A COMPILATION OF VITAL RESEARCH UPDATES ON HUMAN NUTRITION

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Albion® Is Your Mineral Research Assistant

Albion® has published "Minerals in the News" every month since May, 2003. The e-Letter is devoted to the latest in mineral research. Each month the e-Letter contains about 5 to 6 summaries or abstracts of recently published research on minerals. "Minerals in the News" is sent out to individuals throughout the nutrition industry at no charge. Table 1 is a summary of the research findings found in the last two years of "Minerals in the News" for the listed minerals. Each finding listed comes from a separate study concerning that mineral. The amount of research devoted to magnesium and zinc has increased over the last two years, and the findings show the great importance of both of these minerals to the maintenance and enhancement of health. In reviewing these findings, the critical importance that all minerals have to the maintenance of health comes through quite dramatically. Each mineral can impact a variety of biochemical and physiological systems. Magnesium and zinc appear to have the widest ranges of impact, and there is much interplay among the minerals in several systems. Although the summaries of mineral research in "Minerals in the News" do not represent all of the research reported on the minerals over the last few years, they do reflect what is going on in the field of mineral nutrition.

There are some minerals which are not mentioned in Table 1, such as potassium, molybdenum, manganese, and chromium. All of these are necessary for various bodily needs, which is why they are noted as nutritional requirements. There absence from Table 1 is just a reflection of the relative amount of research that we came across in our searches. In reviewing the findings in the studies that we have reported on over the last two years, one can see common areas or biological systems (hematological, neurological, immune, and so on) in which there is interplay of more than one mineral. In some cases a mineral that one would not associate with the proper function of a particular system is in fact, a key factor. Here are some of these biological systems and the minerals that have demonstrated impact over the last two years. These are things to keep in mind when formulating effective, state of the art dietary supplements and functional foods.

Hematological Impact

Studies reviewed by "Minerals in the News" (2007-2008) have uncovered research that indicates that magnesium, zinc, copper, and iron (of course) have roles in the maintenance of the body's hematological status. Iron has been repeatedly shown to be one of the most commonly deficient of all minerals, and its role in the production of hemoglobin and red cells has been demonstrated again and again, however, more research has shown the problem of iron handling in chronic diseases, such as cancer and inflammatory diseases that lead to severe anemia that are more difficult to treat. More recently, magnesium intake has been shown to be an indicator of the potential for iron deficiency anemia, and the supplementation of magnesium has been associated with an increase in erythrocyte and hemoglobin levels. Pointing to one possible mechanism through which magnesium can improve athletic performance. Zinc is very often thought about only in terms of the immune system, but it has been shown to be needed for the production of EPO (erythropoietin), and its deficiency results in a decrease in red cell production. Zinc can have a negative impact on iron status, and recent research has shown that the higher the zinc:iron intestinal lumen ratio (when using non-chelated forms), the greater the inhibition of iron absorption. Copper deficiency is an often overlooked cause of anemia and neutropenia, and is implicated in bone marrow failure and hematological abnormalities. Copper deficiency can cause a shortened life span of red cells which is one way that it can cause anemia.

Metabolics

The metabolic system and metabolic disorders cover a wide array of health concerns. Many of these are issues that fall under what is referred to today as Metabolic Syndrome X. This syndrome is composed of interrelated problems such as hypertension, diabetes, heart disease, and different forms of lipidemias (elevated triglycerides and cholesterol). Many minerals are involved here, including calcium, magnesium, zinc, and to a lesser degree, copper and selenium. Chromium is involved in Type -2 diabetes, but it was not covered in the 'Minerals in the News' over the last 24 months. In regard to

developing Type -2 diabetes, the mechanism through which insulin resistance develops is a real critical issue. In the study findings listed in Table 1, calcium, magnesium, and zinc deficiencies have been implicated in the development of insulin resistance. Exact mechanism for this is still a subject of research. Magnesium and zinc have been involved in more research in this area than calcium, and seem to be of greater impact. Of course chromium is another involved in insulin resistance, but research on it is not in Table 1. Magnesium has been shown to have a positive effect on the level of serum lipids in diabetics, and the supplementation of magnesium has a positive effect on the metabolic profile of diabetics. Both copper and zinc deficiencies have been seen to be pro-atherosclerotic. In a way totally unrelated to the other minerals, selenium has a positive impact on diabetes accelerated atherosclerosis. It is not involved in the changes in lipids, as seen with magnesium, copper, or zinc. Selenium inhibits certain high glucose/high insulin activation of protein kinases that are involved in forming the adhesion molecules which lead to atherosclerotic lesions.

Certain types of hypertension have been separately related to either magnesium or zinc deficiency. In addition, certain forms of hypertension have been shown to deplete zinc, as well.

Immune System

The immune system is comprised of a wide variety of components, such as various white blood cells, immuno-globulins, certain glands, the digestive system, skin, and a wide variety of enzymatic reactions and prostaglandin cascades. It is so wide ranging that there is a role for every mineral somewhere in this mix. The minerals which had the most frequent study findings involved with immune system function in Table 1 were magnesium, zinc, selenium, and copper. Iron, of course, is critical to the immune function, as well. People who are iron deficient or have iron deficiency anemia are prone to infection. The findings show that some of the minerals have big impacts as anti-inflammatories via their enzymatic roles in fighting oxidative stress. This has certainly been demonstrated in the study findings for zinc, copper, and selenium. Excess inflammatory response to oxidative stress has been shown to be the result of magnesium deficiency, and its supplementation has been shown to decrease systemic markers of inflammation seen in intestinal inflammation and heart failure. Magnesium's effect on proper prostaglandin metabolism is also a key to its anti inflammatory activity shown in its supplementation benefits to asthmatics and PMS sufferers. Zinc has been shown to help fight against a wide variety of infectious disorders, including various respiratory infections and pneumonia. Copper's improvement in Cu/Zn SOD activity has been shown to be of benefit to arthritics conditions, as well. Copper, zinc, and selenium have been demonstrated to have hepato-protective benefits. Boron and selenium studies show certain protective effects on the prostate gland, possibly helping prevent prostate cancers. Calcium has been indicated to have a positive impact on the incidence of colon cancer. The mechanisms for these effects for selenium, boron, and calcium are most probably an immune function, although it could possibly be via some new effect.

Neurological System

The neurological system, especially in the area of things such as brain development and cognitive function require some key minerals. Findings in Table 1 for iron show this mineral to have a wide range of CNS effect. Iron deficiency is shown to cause a decrease in cognitive function, alter behavior, and has been associated with different forms of depression. Iron is required for motor development, and not all of the negative effects on CNS development due to iron deficiency during pregnancy and infancy can be overcome later in life. Higher hemoglobin levels have been related to better CNS function. This is one of the main reasons that it has been found to be better to supplement iron during pregnancy than to take any chances. Copper also plays a role in the development of the CNS, and a key role in brain health, possibly through its impact on synaptic plasticity and axonal extension. The role of zinc in the CNS is in need of more research, but studies have shown that it pays a role in the prevention of anxiety in children and adolescents, and it has been shown to prevent the spatial and object recognition memory impairments to the fetus caused by ethanol exposure during early pregnancy.

Summary

There are other more separate or individual findings concerning the impacts of the mineral research summarized over the last two years of "Minerals in the News", which can be found in Table 1, such as the need for certain minerals to prevent cardiac abnormalities and certain myopathies. As we continue to publish "Minerals in the News", many more health findings concerning the need for minerals will come to be known.

When it comes to minerals, Albion is always there. Providing mineral information, uses, and the finest in mineral supplementation. For the world's best source of mineral amino acid chelates (TRAACS™), Albion is all one needs to know.

Albion is placing this mineral intake guide here for your easy reference. When you think about minerals, we hope that you think Albion. In sharing this guide, we hope to make it easier for you to decide how much of any given mineral to use in putting together your dietary formulation, beverage or yogurt product. Albion makes the most nutritionally desirable mineral forms.

Minerals: Recommended Intake Levels

The following chart shows the recommended minimum daily intake levels and the recommended "not to exceed" daily maximums (tolerable upper intake levels) for minerals – as recommended for healthy adults by the Food and Nutrition Board of the National Academy's Institute of Medicine.

When there is more than one line for a mineral, the first line is for everyone, ages 14 and older, unless a second or third line specifies an age group.

It's not necessary for your multi-vitamin-mineral to contain 100% of every nutrient. Even then, however, the recommended daily intake for calcium would not fit into a single pill (or if it did, the pill would be huge).

NK = means "not known"
Mg = milligrams
Mcg = micrograms (1,000 mcg = 1 mg)

Table 2

Mineral	Women		Men	
	minimum	**maximum**	**minimum**	**maximum**
Boron	NK	20 mg	NK	20 mg
Boron (ages 14-18)		17 mg		17 mg
Calcium	1,000 mg	2,5000 mg	1,000 mg	2,500 mg
Calcium (ages 14-18)	1,300 mg		1,300 mg	
Calcium (ages 51+)	1,200 mg		1,200 mg	
Chromium	25 mcg	NK	35 mcg	NK
Chromium (ages 51+)	20 mcg		30 mcg	
Copper	900 mcg	10,000 mcg	900 mcg	10,000 mcg
Fluoride	3 mg	10 mg	4 mg	10 mg
Iodine	150 mcg	1,000 mcg	150 mcg	1,000 mcg
Iron	18 mg	45 mg	8 mg	45 mg
Iron (ages 14-18)	15 mg		11 mg	
Iron (ages 50+)	8 mg			
Magnesium	310 mg	350 mg	350 mg	400 mg
Magnesium (ages 14-18)	360 mg		410 mg	
Magnesium (ages 31+)	320 mg		420 mg	
Manganese	1.8 mg	11 mg	2.3 mg	11 mg
Manganese (ages 14-18)	1.6 mg	9 mg	2.2 mg	9 mg
Molybdenum	45 mcg	2,000 mcg	45 mcg	2,000 mcg
Molybdenum (ages 14-18)	43 mcg	1,700 mcg	43 mcg	1,700 mcg
Nickel	NK	1.0 mg	NK	1.0 mg
Phosphorus	700 mg	4,000 mg	700 mg	4,000 mg
Phosphorus (ages 14-18)	1,250 mg		1,250 mg	
Selenium	55 mcg	400 mcg	55 mcg	400 mcg
Vanadium	NK	1.8 mg	NK	1.8 mg
Zinc	8 mg	40 mg	11 mg	40 mg

Table I

Mineral	Study Findings
Calcium	• Deficiency found in muscle fatigue • Overall low intake in women • Supplementation can reduce cancer risks in post menopausal women • Blacks may have higher retention on ingested calcium • Intake of 470/mg/day meets bone growth needs of 1-4 year olds • Supplementation has positive impact on colon cancer incidence • Supplementation has positive effect on lipids during weight loss • Deficiency may contribute to insulin insensitivity
Magnesium	• Deficiency is associated with disease components of Metabolic Syndrome • Deficiency incidence is widespread • Has neuroprotective effects • Administration Modulates cadmium toxicity • Deficiency a factor in the increase in serum lipids of diabetes • Level of intake an indicator of anemia • Low in muscle fatigue • Palliates skin allergy • Absorption mechanism • Anti stress effects • Deficiency causes small intestine inflammation • Supplementation fights gallstone disease in men • Role as chronic cell regulator • Decreases inflammatory markers (c-reactive protein) in heart failure • Deficiency contributes to metabolic syndrome, hypertension, and eclampsia • Supplementation improves athletic performance through increasing erythrocyte and hemoglobin levels • Little correlation between ionized and total magnesium • Intake lowers systemic markers of inflammation • Deficiency leads to excess inflammatory response to oxidative stress

Mineral	Study Findings
Magnesium	• Deficiency contributes to lens opacifiction • Supplementation has positive affect on pediatric asthma • Supplementation has positive affect on metabolic profile of diabetics • Supplementation reduces symptoms of PMS • Deficiency contributes to insulin resistance • May be associated with BMI • High acid load can cause magnesium deficiency
Iron	• Fights anemia of cancer • Deficiency causes anemia • Deficiency high in China • Deficiency caused by H. pylori • Heme iron uptake • Iron handling and anemia of chronic disease • Iron Deficiency due to gastric bypass • Ferrous bisglycinate more effective due to better compliance • Resulting from less side effects • Iron absorption inhibited by tea and enhanced by Vitamin C • Deficiency causes decreased Cognitive Function • Daily intake improves anemia status, while weekly intake only maintains status • Ferrous Bisglycinate low dose cookie (3.8mg) 3X a week overcomes anemia • Iron deficiency linked to depression • Iron absorption in intestines is upregulated in iron deficiency • Irion deficiency causes increase in zip metal transporters • Iron needed for cognitive function • Iron affects behavior • Deficiency of iron in infants decreases motor development • Deficiency can cause ovary infertility • Better to supplement iron in pregnancy than take chances

Mineral	Study Findings
Zinc	• Deficiency associated with cardiomyopathy (IDCMP) • Oxidative stress fighter • Deficiency is a far greater health problem than previously recognized • Deficiency associated with heart abnormalities • Deficiency associated with type 2 diabetes • High incidence of deficiency in China • Anti inflammatory benefits • Extends health span (genomic effect) • Enhances antioxidant effect • Anti-aging effect on immune system • Decreases respiratory tract infection • Deficiency is higher than believed and is associated with many real clinical problems • Use prevents some alcohol effects on the fetal neurological system • Supplementation helps fight pneumonia in elderly • Health impact on 300 enzyme systems • Deficiency is pro-atherosclerotic • Supplementation suppresses disease activity of ulcerative colitis • Loss can be both cause and effect of high blood pressure • Deficiency impairs EPO production leading to a decrease in red cell production • Supplementation has positive impact on oxidative stress of exercise • Has hepato-protective properties • Supplementation seen to decrease incidence of infection and decrease oxidative stress • Inhibits iron absorption, the degree of which depends on the Zinc/Iron ratio in lumen • Impacts cognitive function • Can negatively impact iron status • Supplementation improves immune response in elderly • Deficiency often seen in exclusively breast fed causing skin lesions

Mineral	Study Findings
Copper	• Deficiency causes hematological abnormalities • Modulates cadmium toxicity • Role in liver health • Improves certain immune functions • Important to brain health • Deficiency can be cause of bone marrow failure • Deficiency associated with atherosclerosis • Deficiency is overlooked cause of anemia and neutropenia • Deficiency can cause altered cardiac function due to elevated NO Synthases • Intake decreases homocysteine and increases gluthathione • Deficiency contributes to altered cardiac function • Supplementation with copper glycinate increases red cell SOD • Has a role in CNS development • May be associated with BMI
Selenium	• Absorption capacity • Effect on immune system • Positive impact on atherosclerosis seen in diabetics via decreased lesion formation • Fights against liver damage • Helps prevent gastric cancer • Improves lymphocytic function • Positive impact on antioxidant activity and glucose homeostasis • Deficiency contributes to myopathy • Intake of selenium glycinate reduces plasma PSA
Boron	• Has estrogenic effects • Supplementation may inhibit certain prostate cancer cells • Deprivation affects cysteine metabolism in a way that negatively affects bone
Phosphorus	• Too much causes decrease in bone formation and increase bone resorption
Cadmium	• Cadmium displaces copper from metalloproteins