ALBION®
HUMAN NUTRITION

RESEARCH NOTES

A COMPILATION OF VITAL RESEARCH UPDATES ON HUMAN NUTRITION

June, 1997 Volume 6, No. 2

A Healthy Start?

Joe awakes to the buzz of his alarm. It is 6:00 AM and time to power his way through another productive day. Joe attacks life with enthusiasm. He leaves nothing to chance. He wants his body to function on "all cylinders". He works out on a regular basis, both aerobically and anaerobically. To get his day off to the right start, Joe has a healthy breakfast of his favorite high fiber cereal with low fat milk, a side of fresh papaya, a little high fiber toast, and a glass of fresh squeezed orange juice. Joe's days are hectic, so to be sure that he is properly fueled; Joe takes his daily multivitamin/mineral supplement along with some antioxidants that contain high amounts of "good-for-you polyphenols" from green tea concentrate and the like. The multivitamin/mineral is formulated to deliver close to the daily requirements of all the essentials. It requires three tablets daily to do so, and Joe takes them all at once. It is easier than carrying them around all day. The minerals in the product consist of various citrates, gluconates, sulfates, carbonates, a polynicotinate, and even an alpha-ketoglutarate. Some pretty high tech stuff!! Nothing but the best will do for Joe.

It appears that Joe has done all the right things. However, on a closer review, we find that his stomach has become a combat zone. On one side, he has a large amount of fiber from the cereal, papaya, toast, and the pulp of the orange juice. On the other, he has the minerals ingested with his multivitamin/mineral supplement. None of the mineral forms in Joe's multiple supplements are nutritionally functional mineral chelates. All of the forms of minerals in his supplement are subject to ionization in the gastrointestinal system. Once these types of minerals ionize the fiber that was consumed during breakfast latches onto them to form complexes that are nonabsorbable and effectively decreasing the bioavailability of the minerals from Joe's multiple supplements. But wait!! Some of the ionized minerals have evaded the fiber, and they are trying to head for their absorption sites and the carrier proteins that await them at the mucosa of the small intestine. Now these ionized minerals start to fight amongst themselves for absorption sites – a form of intra-intestinal mineral revolution! Calcium and zinc fighting against iron. Iron fighting back against zinc. Calcium and iron against manganese. Calcium now goes back against zinc. The dietary phosphates present from the cereal, toast, and milk try to block the absorption of all the minerals in Joe's multiple supplements. The polyphenols in the antioxidant are attacked by the harsh ionized minerals, rendering them inactive. Tannins in the green tea attack the ionized minerals and form even more nonabsorbable mineral complexes.

When the smoke settles from this intestinal warfare, Joe's body finds that it still is in need of minerals. Although well intended, Joe's nutritional breakfast regimen has self-destructed. He didn't remember the importance of the form of the minerals in his multiple supplements. He took a supplement that had minerals that were not nutritionally functional mineral chelates. His supplement contained mineral forms that ionize in the gut, which result in decreased absorption through the formation of nonabsorbable complexes with dietary fiber, tannins, and phosphates. In addition, many ionized minerals compete for the same absorption sites and carrier proteins, and thus, effectively decrease each other's absorption.

Intestinal Nutrient Interaction/ Significant Findings

(Coutinued on page 2)

(Coutinued from cover page)

Joe's story is a common one that has an ever growing list of documentation found in research studies listed in scientific publications. Minerals that ionize in the stomach are prone to a variety of absorption interferences. Tannins, fibers, and phytates, polyphenols, and other minerals are all known to block or decrease the fractional absorption of minerals that are not in the optimal chelated form. In a recent study[1], athletes were divided into two groups (with or without zinc salt supplementation) and respective subgroups (with or without cereal diet). They were tested for serum levels of zinc, iron, copper, phosphorus, and potassium for an eight week period. It was found that the athletes who were simultaneously taking cereal products with zinc slats showed decreases in their zinc levels. A similar finding was seen in a recent Danish study[2]. In this case, eight healthy subjects were put on a high fiber, high phytate diet, and were given diets enhanced with non-chelated forms of copper, zinc, and magnesium. The researchers found that the fractional absorption of these minerals from the fiber rich diet was not enough to overcome intestinal and urinary losses of these elements. All the subjects were found to be in negative mineral balance for the supplemental minerals. Natural sources of fiber, such as cereals and fruits, generally have a depressing effect on absorption of minerals such as calcium, iron, zinc, and copper[3]. Imagine taking mineral supplements and still going into a negative balance for the very minerals that are being supplemented.

Non-chelated mineral forms ionize in the stomach and are absorbed, for the most part, in the duodenal area. In fact, research has shown that these positively charged minerals irons migrate to specific sites on the mucosal surface of the duodenum, and attach to carrier proteins that allow for their absorption. There is documentation that shows that these ionized minerals compete with one another for these sites and carrier proteins, effectively inhibiting the absorption of one another, as seen in Figure 1.

In an interesting study by Argiratos and Samman[4], the effects of calcium carbonate or calcium citrate on the absorption of zinc (as sulfate) were evaluated. The subjects in this study received either 4.5 mg elemental zinc with 600 mg elemental calcium as carbonate, or zinc with 600 mg elemental calcium as citrate on three different occasions under metabolic ward conditions. Blood samples were drawn at 30 minute intervals for four hours after the dosing. The area under the plasma zinc curve (AUC) showed that when the zinc was taken alone, its AUC was 356% higher than that for the zinc taken with calcium carbonate, and 507% higher than for the zinc taken with calcium citrate (see Table 1).

Figure 1
Mineral Interrelationships in Animal Metabolism

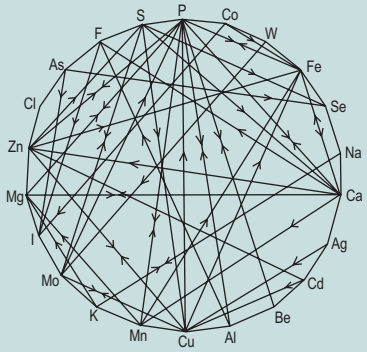

Table 1
Ca Carbonate and Ca Citrate on Zinc Absorption

Supplementation	Plasma Zinc (AUC)*	Zn Relative Absorption
Zn Sulfate alone	1561.7 +/- 240	100%
Zn Sulfate + Ca as Carbonate	438.4 +/- 129	28%
Zn Sulfate + Ca as Citrate	308.0 +/- 110.5	19.7%

* AUC measured in mumol Zn/min/100g albumin

The researchers concluded that the decrease in zinc absorption with the different forms of calcium was suggestive of an antagonistic competition between the minerals, and that elemental calcium was the inhibiting factor.

Additionally, Solomins and Jacobs (AJCN 34:475-487, 1981) have shown that when inorganic zinc is ingested (as sulfate) its absorption is decreased by the presence of inorganic iron in the lumen.

Further evidence of the propensity of inorganic minerals to block the absorption of one another was given in a recent study reported in the American Journal of Clinical Nutrition[5]. In this research, the influence of calcium supplements on the absorption of dietary non-heme iron and of iron supplements was evaluated in 61 normal volunteers. In their study, they found that all three inorganic calcium supplements (carbonate, citrate, and phosphate) decreased the absorption of the iron supplement (ferrous sulfate), when taken with food. Calcium as citrate and calcium as phosphate were found to reduce the absorption of the supplemental iron by 49% and 62%, respectively, when taken alone with the iron supplement. All three non-chelated calcium supplements decreased the absorption of the volunteers' dietary non-heme iron, as well.

There are other classic examples of dietary interactions between non-chelated minerals that have resulted in similar significant decreases in relative absorption. In fact, according to Couzy, F., et al. (Prog Feed NutrSci, Vol 17, Jan-Mar, 1993), the interactions between minerals can be profound and have significant implications for human health. The authors state that there are direct competitive absorption interferences among essential minerals of metabolic significance. Considering the ready availability of dietary supplementation (either through food enrichment or use of supplements), such interactions are commonplace.

One additional mineral dietary interaction of not involves the tannins in various teas, herbs, and fruits. Their numerous hydroxyl radicals give them a strong affinity for minerals such as iron, zinc, and copper. This property makes them strong inhibitors for the intestinal absorption of these minerals. The higher the tannin content of a dietary component, the greater its tendency to inhibit non-chelated mineral absorption. Green tea concentrates have been found to be high in antioxidant activity, but they are also high in tannins.

Evidence of Mineral Amino Acid Chelates/Exempt from Common Dietary Interactions

A. In a recent study conducted by Oscar Pineda[6], the effect of known inhibitors of non-heme or inorganic (ionizing) iron forms on the absorption of Ferrochel (Albion's patented iron amino acid chelate) was put to the test. In this study, cookies containing Albion's Ferrochel® were prepared that were high in fiber, tannin, and phenols. The cookies were then used in the treatment of anemic school aged children, and the results were compared to that seen with children who had received the Ferrochel alone in syrup form. The resulting data showed that whether the Ferrochel was administered with the cookies that were high in iron absorption inhibitors or without, the favorable impact on the iron status of the children was the same. Pineda concluded that the usual dietary inhibitors of iron absorption did not interfere with the absorption of the iron in patented Ferrochel. These findings go along with other research findings[7] that heme iron (the chelated form found in meat, poultry, and fish) is much less affected by other dietary constituents than non-heme or inorganic iron forms.

B. Inorganic iron and copper salts are well known antagonists to one another's absorption. When taken in conjunction with iron, copper has been seen to compete for the carrier protein transferrin, and thus decrease the amount of transferrin available to bind with and absorb iron. Iron can have the same effect on copper's absorption via a same competition for transferrin. In a study by Dr. H. DeWayne Ashmead, et al.,[8] Involving 30 healthy human volunteers, the effect of the co-administration of Albion's chelated iron (Ferrochel) and chelated copper

(Coutinued on page 4)

(Coutinued from page 3)

on one another's absorption was evaluated. The researchers divided the volunteers into three supplement regimens (iron alone, copper alone, iron + copper), and tracked their hemoglobin, serum iron, and copper, as well as urinary iron and copper. There was no significant difference found between the three groups. There was no evidence of intestinal absorption changes when the Albion® chelated iron was taken with its chelated copper.

C. Similar findings were observed by Solomons, N.W. and Jacobs, R. (AJCN 34: 475-487, 1981) on the co-ingestion of zinc and iron. They observed that the absorption of inorganic zinc was decreased by the presence of inorganic iron in the gastrointestinal lumen. However, if either zinc or iron was present in the organic (chelated) form, such competition did not occur.

D. Calcium and phosphorus in cows' milk are known to inhibit the absorption of iron. In a study done in Brazil[9], milk was fortified with Albion's iron amino acid chelate (Ferrochel) and given to 269 anemic children for 12 months. The improvement in the group, as evidenced by a high rate of elimination of anemia, was dramatic. The researchers determined the overall absorption rate of the iron (from Ferrochel) to be in excess of 40%.

The Bottom Line

To avoid pitfalls of intestinal mineral dietary interactions, there is one obvious choice. Use nutritionally functional mineral amino acid chelates. Albion Laboratories holds over 50 patents in the field of mineral chelate nutrition. Research has shown that only this form of mineral is much less prone to suffer from the negative effects of other dietary ingredients. Albion's amino acid chelates don't hinder the absorption of one another like other mineral forms. A multimineral containing Albion's chelated minerals makes sense. A multimineral containing the other mineral forms is senseless.

What Should Joe Do?

As we have seen, the problems with Joe's attempt at a healthy start were easily predictable, given the existing body of nutritional research regarding the many mineral-mineral and mineral-dietary interactions. When reviewing a mineral supplement formulation or taking daily supplements, how many of us overlook the problems that Joe had? Mineral forms that are not true, nutritionally function mineral amino acid chelates are subject to ionization in the gastrointestinal system, and thus suffer from intestinal absorption interferences due to other ionized minerals, phytates, tannins, and other mineral scavengers including certain medications. So, what could you or Joe do to remedy this situation? Take each individual mineral at a separate time and make sure no to ingest any of them too near to the time that you consume cereals, vegetables, fruits, grains, teas, medications, etc.? This solution is obviously impractical. It is also unnecessary!

The best answer is to take your mineral supplements in the form of nutritionally functional mineral amino acid chelates. This form of mineral is not prone to ionization in the gastrointestinal system the way other mineral forms are. The ionized form of the mineral is most subject to the absorption hindering interactions, as observed in countless studies, in addition to the studies referenced earlier in this newsletter. Albion Laboratories has the patents on the production of totally reacted, nutritionally functional mineral amino acid chelates. By definition, a nutritionally functional mineral amino acid chelate must meet the chemical definition of a chelate and also, it must:

- Have a molecular weight of less than 800 daltons
- Have an easily metabolized ligand
- Have electrical neutrality (not charged)
- Have adequate stability constant

All four of these additional qualifications for a mineral chelate to be considered nutritionally functional have important practical implications.

The two highlighted above are keys to the mineral nutrition dilemmas that are faced on a daily basis by Joe and the rest of us. Research indicates that it is the ionized mineral (electrically charged form) that is subject to the various intestinal dietary interactions that lead to mineral malabsorption. Albion makes nutritionally functional mineral amino acid chelates. The stability constants and electrical status of an Albion chelate have been thoroughly reviewed, and verify their nutritional functionality. Albion's mineral amino acid chelates are not charges, and they do not ionize in the gastrointestinal lumen. Taking minerals in this elite form should eliminate the problems that often defeat the good intentions of people on nutritional supplement programs, like Joe.

1. Schardt, F.Z., "Effects of doses of cereal foods and zinc on different blood parameters in performing athletes," Ernahrungswuiss 3 (33) 207-216, 1994.

2. Knudsen, E., Sandstrom, B., Solgaard, R., "Zinc, copper, and magnesium absorption from a fiber-rich diet," J Trace Elem Med Biol 2 (10) 68-76, June, 1996.

3. Torr, M., Rodriguez, A.R., Sauro-Calixio, F., Crit Rev Food Sci Nutr 1 (1): 1022, 1991.

4. Argiratos, V., Samman, S., Eur J Clin Nutr 3 (48): 198-204, March, 1994.

5. Pizarro, F., Olivares, M., Hertramph, E., Walter, T., "Factors which modify the nutritional status of iron: tannin content of herbal teas," Arch Latinoam Nutr 4 (44): 277-280, Dec 1994.

6. Pineda, O., "The use of cookies fortified with Iron Amino Acid Chelate for the treatment of iron deficiency anemia in school children." Publication pending.

7. Zeigler and Filer, Present knowledge in nutrition, ILSI Press, Washington, D.C., 7th Edition, p. 278-279, 1996.

8. Ashmead, H., et al., "A lack of competition in the absorption of Albion Iron and Copper Amino Acid Chelates," Unpublished.

9. Torres, A., Study from the Department of Health in the city of Angatuba, state of Sao Paulo, Brazil, 1993.

Albion Human Nutrition

100 Maple Park Blvd., Suite 110
St. Clair Shores, Michigan 48081 USA
[P] 586•774•9055 | [TF] 800•222•0733
[F] 586•774•8838
[e] info@AlbionMinerals.com