ALBION®
HUMAN NUTRITION

RESEARCH NOTES

A COMPILATION OF VITAL RESEARCH UPDATES ON HUMAN NUTRITION

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Zinc: The Multifaceted Trace Mineral!

Zinc is a component of the enzymes involved in most major metabolic pathways, and as such, is essential for human life. Large amounts of zinc are deposited in bone and muscle, but unfortunately, these stores of zinc are not easily available to the rest of the body. The human body's pool of accessible zinc is small and susceptible to rapid turnover . . . deficiency signs appear quickly. Zinc's participation in over 80 enzyme and hormone functions, including many involved in gene expression, could explain its deficiency's immediate effect on cell growth and repair.

Zinc takes part in many metabolic processes, including protein synthesis, wound healing, and growth and maintenance of tissue.

Zinc is essential for development and proper functioning of the reproductive organs and normal functioning of the prostate gland.

Other research on zinc has centered on its role in the human immune system. It has been shown to be an essential element in the maintenance of cell-mediated immune functions. Work done at Wayne State University by Frost, et al., reported that zinc is required enzymatically for the production of B cells and T cells, both of which are involved in immunity. When there is a deficiency of zinc, B and T cell production is impaired with a resulting reduction in immunity. At the latest meeting of the American College of Nutrition, several presentations dealt with findings that suggested an increased role for zinc in patients suffering from HIV.

Frost, P, et al,: The effect of zinc deficiency in the immune response, Zinc Metabolism: Current Aspects in Health and Disease NY: Alan R. Liss, 1977, p. 43.

Zinc Deficiencies: Levels of Manifestation

According to the pioneering researcher, Dr. Ananda Prasad, a zinc deficiency may be classified as severe, moderate, or mild:

Prasad, A.S.: Zinc in Growth and Development and Spectrum of Human Zinc Deficiency. AJCN Vol. 7, No. 5; 377-384 (1984).

1. **Severe Zinc Deficiency Manifestations:** Bullous pustular dermatitis, alopecia, diarrhea, emotional disorder, weight loss, intercurrent infections due to cell-mediated immune dysfunction, hypogonadism in males, neurosensory disorders, and problems with healing of ulcers. This condition can be fatal.

2. **Moderate Zinc Deficiency Manifestations:** Growth retardation and male hypogonadism in adolescence, rough skin, poor appetite, mental lethargy, delayed wound healing, cell-mediated immune dysfunction, and abnormal neurosensory changes.

3. **Mild Zinc Deficiency Manifestations:** Decreased serum testosterone levels and oligospermia in males, decreased lean body mass, hyperammonemia, neurosensory changes, anergy, decreased serum thymulin activity, and decreased IL-2 activity.

Facts on Dietary Zinc

Approximately 70% of dietary zinc in the United States is provided by animal products, especially meat[a] (see Figure 1). Most of the zinc from plant sources is found in cereals. The absorbability of zinc from meat, eggs, and seafood (especially oysters) is fairly good, whereas the zinc from grain products is poorly absorbed[b].

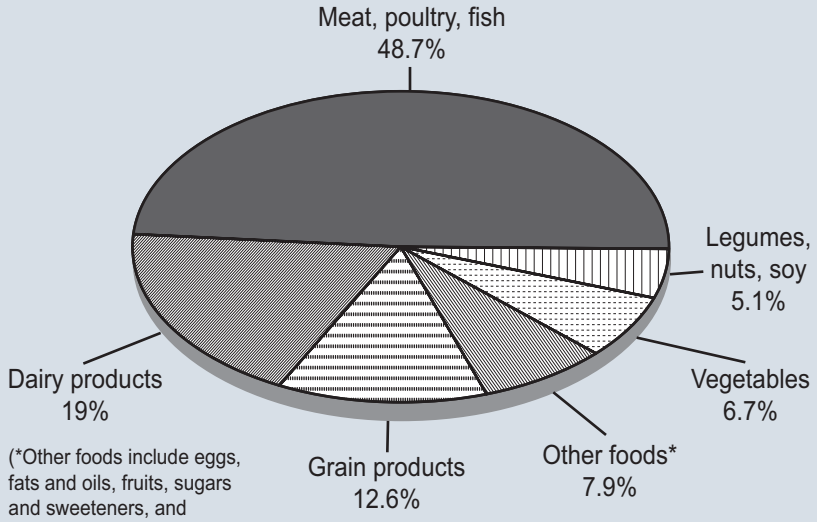
Several factors decrease the absorption of dietary zinc. Dietary fiber, phytates, phosphates, and the simultaneous ingestion of ferrous iron, copper, or cadmium, collectively, or individually, decrease the absorption of zinc. A study by Solomon and Jacobs[c] has shown that ferrous iron inhibits the absorption of zinc salts, but did not interfere with absorption of zinc that was chelated.

Food refining, a low protein diet and high carbohydrate intake, as well as excessive alcohol consumption will also cause a zinc deficiency. Surgical and physical injury, particularly burns, drug treatments, such as corticosteroids or contraceptive pills, liver and kidney disease, diabetes, and even pregnancy will all contribute to an insufficiency of zinc stores in the body[d].

Zinc Intake in the United States

Data from the CSFII 1985-86 show that the mean (daily) dietary intake of zinc in women ages 20-49 years was approximately half of the US RDA. Those data give rise to concerns about zinc deficiency problems for this group. The mean intake for men in the same age category was higher, but still below the US RDA. Elderly people have been found to consume from 7 to 10 mgs. of zinc per day, and are also considered to be at risk for zinc deficiency. It is estimated that 13.5% of the U.S. populace are taking supplements containing zinc[e].

Figure 1. Zinc sources in the United States food supply.



a. *Welsh, SD; Marston, RM: Levels of the US Food Supply, 1982. Food Technol 36; 70-76, 1982.*
b. *Inglett, GE: Ed. Nutritional Bioavailability of Zinc, ACS Symposium Series No. 210, 1983. American Chemical Society Washington, D.C.*
c. *Solomon, NW; Jacob, RS: Studies on Bioavailability of Zinc in Humans: Effect of Heme and Non-Heme Iron on the Absorption of Zinc; AJCN 34, 475-482: 1981.*
d. *Mervyn, L: Minerals and Your Health, George Allen and Unwin Ltd., London, 1980.*
e. *Greger, JL: Potential for Trace Mineral Deficiencies and Toxicities in the Elderly. Current Topics in Nutrition and Disease, Vol. 21, 1989. Alan R. Liss, New York.*

Advantages of Albion's Zinc Chelates

Albion offers three patented forms of zinc amino acid chelate: Zinc Chelazome®, Zinc Histidine, and Zinc Arginine. All three are superior sources of patented zinc amino acid chelates.

Schlomerich, et al., reported that the absorption of zinc histidine was over three times higher than typical dietary zinc complexes. This was also confirmed in studies done at the University of Utah. There, using Albion® technology to make chelates, researches found that Albion's zinc amino acid chelate crossed the intestine at four times the rate of inorganic zinc salt, as demonstrated in Figure 2. In addition, tissue

retention of the amino acid chelated zinc was also higher.

In certain disorders involving zinc deficiency, as seen following penicillamine therapy, in liver diseases, delayed wound healing, and in people with major burns, higher doses of zinc for prolonged periods are frequently indicated. When administering zinc salts, such as zinc sulfate, at therapeutic doses of 45 mg of elemental zinc per dose, gastric erosion has occurred. In fact, gastric distress is a common side effect of zinc salts administered at his dosage. Albion's amino acid chelated zinc has not been implicated in any such untoward activity. In a study by Barabino, et al., zinc amino acid chelate was found to help heal gastric lesions caused by the drug, Reserpine, and the zinc amino acid chelate was felt to have provided a protective effect against ulcer formation.

Barabino, F: Effects of Zinc Glycinate and Zinc Asparate in Healthy Rats and on Reserpine Induced Gastric Lesions.

Bioavailability of Zinc from Zinc Histidine Complex:

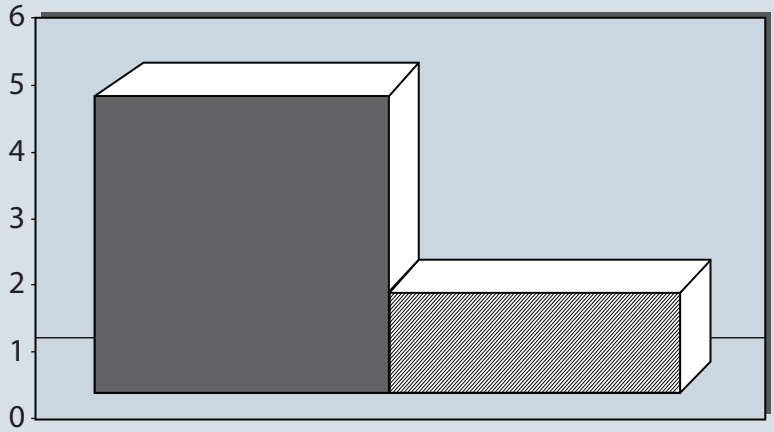
A Comparison with Zinc Sulfate in Healthy Men

The data obtained from experiments involving zinc supplementation clearly demonstrated that zinc from zinc histidine was better absorbed than zinc sulfate. In the first experiment, each healthy volunteer received 20 mg of zinc. The ingestion of 20 mg of zinc, as zinc histidine, increased serum zinc concentrations 25 % more than with the ingestion of zinc sulfate.

In one experiment in this series of studies, different doses of zinc histidine (15 mg of zinc three times a day) and zinc sulfate (45 mg of zinc three times a day) were compared. The 15 mg dose of zinc from zinc histidine was found to give the same rise in serum zinc as the 45 mg dose of zinc from zinc sulfate. The authors stated that they believed that the zinc from zinc histidine had an absorption rate in excess of 50%. It was also the author' opinion that it may be possible to use zinc histidine to avoid such side effects as gastric erosion which have been reported in courses of therapy using 200 mg of zinc sulfate (45 mg of zinc three times a day) for longer periods of time.

Scholmerich, J., et al., Am J Clin Nutr 1987; 45: 1480-86.

Figure 2. Transport of zinc from the mucosa to the serosa.



Fang, SM, Burton, SA, Peterson, RV: Bioavailability of Zinc: Effect of Amino Acid Chelation. Chelated Mineral Nutrition in Plants, Animals, and Man, p. 137-152; Thomas 1982.

A Final Word on Chelated Zinc

British researcher, Dr. Len Mervyn has summarized the advantages of true amino acid chelates:

- They are better absorbed (230% better than zinc sulfate and 390% better than zinc oxide)
- They have greater body retention
- They exhibit better utilization
- They offer greater protection from interfering dietary factors
- They have significantly reduced side effects

When looking for the ultimate in zinc, the choice is clear: Albion's family of patented amino acid chelated zinc products:

- They are safer!
- They have higher bioavailability!
- They have greater tissue retention!
- They are more gentle on the system!

Influences of Dietary Picolinic Acid on Mineral Metabolism in the Rat

Low molecular weight zinc binding ligands that promote zinc absorption similar to amino acids are interesting but controversial. Picolinic acid, a minor metabolite of tryptophan, has been said to increase zinc availability in rats. However, other research has shown that picolinic acid increased turnover of metals within the body. The following study investigated the interaction of picolinic acid on dietary zinc and its effects on metabolic balances of copper, magnesium, and calcium.

Animals were fed the same diet with the exception on zinc and picolinic acid content (25, 60, 120, ppm zinc/ 0, 20, 40, 60 mmol, respectively, of picolinic acid per kg diet). Balance collection of urine and feces were made over a four-day period. Animals fed 25 ppm zinc were in negative zinc and copper balances throughout the experiment. Fecal zinc, but not urinary zinc, was elevated with increasing zinc supply. Urinary zinc, copper, and magnesium increased with increasing intakes of dietary picolinic acid, regardless of zinc intake.

The researches concluded that picolinic acid complexes with metal ions, resulting in rapid excretion, making them unavailable for metabolism or tissue incorporation.

Seal, CJ: Ann Nurt Metab 32; 186-191, 1988.

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