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Zinc, and its essentiality for human health

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Abstract
Since its first discovery in an Iranian male in 1961, zinc deficiency in humans is now known to be an important malnutrition problem world-wide. It is more prevalent in areas of high cereal and low animal food consumption. Zinc performs many functions as a part of every cell in the body and so zinc is essential for normal growth development, reproduction and immunity. Zinc is involve maintaining a healthy appetite, assisting in the perception of taste and maintaing capacity for night vision. Zinc involve these functions not just as a metalloenzymes, but also in specific interactions between zinc and various harmones. Human and animal tissues contain about 200 enzymes whose activity depends on the presence of zinc. Zinc is considered as an antioxidant nutrients. Zinc is essential for the maintance of protein structure and for the metabolism of proteins and nucleic acids. The maintenance and replication of genetic material (DNA and RNA) and the use of genetic information to generate specific proteins are dependent on zinc. Zinc is involved cholesterol transport and in maintaining the stability of lipids within the cell membrane.

Keywords: Zinc, DNA and RNA, antioxidant, stomatitis, oral ulceration

Introduction
Zinc essentiality was established in 1869 for plants, in 1934 for experimental animals and in 1961 for humans. A syndrome of anemia, hypogonadism and dwarfism was reported in a 21-year-old Iranian farmer in 1961 who was subsisting on a diet of unrefined flat bread, potatoes, and milk. Shortly after, a similar syndrome was observed in Egyptian adolescents who had similar dietary history to that of the Iranians, mainly subsisting on bread and beans. Administration of supplemental zinc or diets containing adequate animal-protein foods improved growth and corrected the hypogonadism, while anemia responded to oral iron treatment. Subsequent studies showed that the syndrome was primarily the result of low dietary zinc intake in the diet. Since the discovery of zinc deficiency as a human health problem in 1961, interest in the biochemical and clinical aspects of zinc nutrition has increased markedly.

Functions
Zinc performs many functions as a part of every cell in the body and so zinc is essential for normal growth development, reproduction and immunity. Zinc is involve maintaining a healthy appetite, assisting in the perception of taste and maintaing capacity for night vision. Zinc involve these functions not just as a metalloenzymes, but also in specific interactions between zinc and various harmones. Human and animal tissues contain about 200 enzymes whose activity depends on the presence of zinc. Some of these enzymes are alcohol dehydrogenase, alkaline phosphatase, carbonic anhydrase, carboxypeptidase, deoxynucleotidyl transferase, DNA polymerase, etc. Zinc is considered as an antioxidant nutrients. Zinc is essential for the maintance of protein structure and for the metabolism of proteins and nucleic acids. The maintenance and replication of genetic material (DNA and RNA) and the use of genetic information to generate specific proteins are dependent on zinc. Zinc is involved cholesterol transport and in maintaining the stability of lipids within the cell membrane. Zinc dependent enzymes are involved in the synthesis of long chain fatty acids and various prostaglandins.

Zinc deficiency
Zinc deficiency is defined either as insufficient zinc to meet the needs of the body, or as a serum zinc level below the normal range. However, since a decrease in the serum concentration is only detectable after long-term or severe depletion, serum zinc is not a reliable

biomarker for zinc status. Common symptoms include increased rates of diarrhea. Zinc deficiency affects the skin and gastrointestinal tract; brain and central nervous system, immune, skeletal, and reproductive systems. Zinc deficiency in humans is caused by reduced dietary intake, inadequate absorption, increased loss, or increased body system utilization. The most common cause is reduced dietary intake. The highest concentration of dietary zinc is found in oysters, meat, beans, and nuts. Increasing the amount of zinc in the soil and thus in crops and animals is an effective preventive measures. Zinc deficiency may affect up to 2 billion on people worldwide.

Sign and symptoms

Skin, nails and hair

Zinc deficiency may manifest as acne, eczema, xerosis (dry, scaling skin), seborrheic dermatitis, or alopecia (thin and sparse hair). It may also impair or possibly prevent wound healing.

Mouth

Zinc deficiency can manifest as non-specific oral ulceration, stomatitis, or white tongue coating. Rarely it can cause angular cheilitis (Sores at the corners of the mouth).

Vision, smell and taste

Severe zinc deficiency may disturb the sense of smell and taste. Night blindness may be a feature of severe zinc deficiency, although most reports of night blindness and abnormal dark adaptation in humans with zinc deficiency have occurred in combination with other nutritional deficiencies (e.g. vitamin A).

Immune system

Impaired immune function in people with zinc deficiency can lead to the development of respiratory, gastrointestinal, or other infections, e.g., pneumonia. The levels of inflammatory cytokines (e.g., IL-1β, IL-2, IL-6, and TNF-α) in blood plasma are affected by zinc deficiency and zinc supplementation produces a dose-dependent response in the level of these cytokines. During inflammation, there is an increased cellular demand for zinc and impaired zinc homeostasis from zinc deficiency is associated with chronic inflammation.

Diarrhea

Zinc deficiency contributes to an increased incidence and severity of diarrhea.

Appetite

Zinc deficiency may lead to loss of appetite. The use of zinc in the treatment of anorexia has been advocated since 1979 by Bakan. At least 15 clinical trials have shown that zinc improved weight gain in anorexia. A 1994 trial showed that zinc doubled the rate of body mass increase in the treatment of anorexia nervosa. Deficiency of other nutrients such as tyrosine, tryptophan and thiamine could contribute to this phenomenon of "malnutrition-induced malnutrition".

Cognitive function and hedonic tone

Cognitive functions, such as learning and hedonic tone, are impaired with zinc deficiency. Moderate and more severe zinc deficiencies are associated with behavioral abnormalities, such as irritability, lethargy, and depression (e.g., involving anhedonia). Zinc supplementation produces a rapid and dramatic improvement in hedonic tone (i.e., general level of happiness or pleasure) under these circumstances. Zinc supplementation has been reported to improve symptoms of ADHD and depression.

Psychological disorders

Low plasma zinc levels have been alleged to be associated with many psychological disorders. Schizophrenics linked to decreased brain zinc levels. Evidence suggests that zinc deficiency could play a role in depression. Zinc supplementation may be an effective treatment in major depression.

Growth

Zinc deficiency in children can cause delayed growth and has been claimed to be the cause of stunted growth in one third of the world's population.

During pregnancy

Zinc deficiency during pregnancy can negatively affect both the mother and fetus. Animal studies indicate that maternal zinc deficiency can upset both the sequencing and efficiency of the birth process. An increased incidence of difficult and prolonged labor, hemorrhage, uterine dystocia and placental abruption has been documented in zinc deficient animals. These effects may be mediated by the defective functioning of estrogen via the estrogen receptor, which contains a zinc finger protein. A review of pregnancy outcomes in women with acrodermatitis enteropathica, reported that out of every seven pregnancies, there was one abortion and two malfunctions, suggesting the human fetus is also susceptible to the teratogenic effects of severe zinc deficiency. However, a review on zinc supplementation trials during pregnancy did not report a significant effect of zinc supplementation on neonatal survival.

Zinc deficiency can interfere with many metabolic processes when it occurs during infancy and childhood, a time of rapid growth and development when nutritional needs are high. Low maternal zinc status has been associated with less attention during the neonatal period and worse motor functioning. In some studies, supplementation has been associated with motor development in very low birth weight infants and more vigorous and functional activity in infants and toddlers.

Testosterone production

Zinc is required to produce testosterone. Thus, zinc deficiency can lead to reduced circulating testosterone, which could lead to sexual immaturity (Ananda Parsad, *et al*) hypogonadism, and delayed puberty.

Sources of Zinc

Animal foods are the best sources of zinc compared to plant foods, like vegetables, because zinc bioavailability (The fraction of zinc that’s retained and used by the body) is high in foods like animal meat and seafood. This is due to the absence of compounds that inhibit zinc absorption in animal foods and the presence of sulfur-containing amino acids that improve zinc absorption, like cysteine and methionine. Although there are plant-based zinc foods, they’re less bioavailable because of their high content of phytic acid (or phytates), which inhibits zinc absorption. Reports suggest that people who don’t eat meat or animal products, like people on

a vegetarian or vegan diet, need up to 50 percent more zinc in their diets to absorb what the body needs. However, the inhibitory effects of phytic acid on the absorption of zinc can be minimized with methods like soaking, heating, sprouting, fermenting and leavening. Research also shows that the absorption of zinc can be improved by using yeast-based breads and sourdough breads, sprouts, and pre soaked legumes.

The best way to achieve optimal zinc levels is to consume two to three servings of these zinc foods per day: Pumpkin Seeds, Hemp Seeds, Grass-Fed Beef, Chickpeas (Garbanzo Beans), Lentils, Cocoa Powder, Cashews, Kefir or Yogurt, Ricotta Cheese, Mushrooms, Spinach, Avocado, Chicken, Almonds.

References

1. Cousins RJ, Zinc In, Filer LJ, Ziegler. Present Knowledge in Nutrition. 7th ed. Washington DC International Life Science Institute Nutrition Foundation, 1996, 293-306.
2. King JC, Cousins RJ Zinc In, Shils ME, Shike M, Ross AC, *et al*. Modern Nutrition in Health and Disease. 10th ed. Baltimore: Lippincott Williams and Wilkins, 2006, 271-85.
3. Prasad AS, Miale A, Jr Farid Z, Sandstead HH, Schulert AR. Zinc metabolism in patients with the syndrome of iron deficiency anemia, hepatosplenomegaly, dwarfism, and hypognadism. J Lab Clin Med. 1963; 61:537-49.
4. Roohani N, Hurrel R, Kelishadi R. Zinc and its importance for human health: An integrative review. Journal of Research in Medical Sciences, 2013; 18(2):144-157.
5. Ruggeri C, CHHC. Top 10 foods high in zinc. Dr. Axe Food is medicines, 2019.
6. Sandstead HH, Prasad AS, Schulert AR, Farid Z, Miale A, Jr Bassilly S. Human zinc deficiency, endocrine manifestations and response to treatment. Am J Clin Nutr. 1967; 20:422-42.
7. Shrilakshmi B. Nutrition Science. 4th revised edition, New age international (P) limited publisher, 2012, 237. https://en.m.wikipedia.org