

Zinc Nutrition on Human Health

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ABSTRACT

Micronutrients play a major role in human health. Intake of micronutrients in adequate amount is necessary for a healthy living. Except Vitamin D all the other micronutrients like Zinc, Iron, iodine are to be supplied from external sources as the body cannot produce these by itself. Zinc is important for our immune system and to fight off the diseases. Zinc has critical effect in homeostasis, in immune function, in oxidative stress, in apoptosis, and in aging, and significant disorders of great public health interest are associated with zinc deficiency. Deficiency of Zinc may complicate many of the chronic diseases which includes neurological disorder, ageing, Wilson's disease and autoimmune diseases. Present paper discusses role of zinc for our health and consequences of the deficiency of Zinc.

Keyword : Micronutrients, immune system, Zinc

I. INTRODUCTION

Micronutrients are a large set of nutrients that our bodies require in extremely small amounts, almost in micrograms or nanograms. These micronutrients aid in the growth and development of our bodies. Vitamins and minerals such as iron and zinc are examples of common micronutrients required by human bodies. The small intestine absorbs these micronutrients. The reactivity, restricted solubility, or lack of stability of micronutrients causes their absorption in the small intestine. Our bodies cannot generate micronutrients, with the exception of Vitamin D, and they must be obtained from our diet. Even though these micronutrients are only required in modest amounts, their absence can affect our immune system. Zinc is one such micronutrient that is required to maintain our bodies healthy.

Zinc is found in the human body in amounts of 2–3 g, with the majority of it attached to proteins. Zinc is contained in every cell of our body. Zinc aids our immune system in combating viruses and germs that infiltrate the human body. Zinc is also necessary for the production of protein and genetic material in body cells. Zinc is required

in adult males at 11 mg and females at 8 mg per day.

Zinc's importance in human health was initially discovered in an Iranian peasant suffering from anaemia and dwarfism in 1961(1,2), who ate flat bread, potatoes, and milk as part of his diet. His growth improved after he was given a zinc supplement and a diet rich in animal protein. The human body cannot create or store zinc on its own, despite it being an important nutrient. As a result, it must be supplemented through the diet. A huge number of Indians consume less zinc than what is needed for healthy immune function. Natural and adaptive immune responses are both slowed by zinc deficiency. Oxidative stress, enhanced inflammatory processes, and life-threatening circumstances, as well as premature cell death at the cellular and sub-cellular levels, are all signs of zinc deficiency.

Zinc can be found in a wide range of foods, including red meat, seafood such as crab and lobster, cereals, beans, nuts, dairy products, and whole grains. However, if the amount of zinc consumed exceeds the recommended level, it might cause stomach cramps, nausea, vomiting, lack of appetite, and headache. Zinc aids in the formation and development of white blood cells, which are important components of our immune system. White blood cells come in a variety of shapes and sizes, and some of them produce antibodies, trap and destroy viruses, and help the immune system recover after an infection.

In this paper, we will briefly examine the functions of zinc, its dietary sources, and the consequences of zinc shortage.

Functions of Zinc:

On a cellular level, zinc's functions can be split into three groups.

1. Catalytical: Zinc is required by around 100 distinct types of enzymes to catalyse the important chemical reactions that occur inside the body. Zinc-dependent enzymes can be found in every type of enzyme.

2. Structural: Zinc plays a significant function in protein and cell membrane structure.

The loss of zinc from cellular membranes increases their sensitivity to oxidative damage and reduces their functionality.

3.Regulatory: Zinc proteins operate as transcription factors to regulate gene expression. Zinc plays a vital role in cell signalling, and it has been shown to influence hormone release and nerve transmission impulsion.

Dietary sources of Zinc:

Shellfish, beef and other red meats are rich sources of zinc. Nuts and legumes are relatively good plant sources. The Zinc content of some relatively Zinc-rich foods is listed in milligrams (mg) in the Table given below:

Table :Sources of Zinc in food

Category of foods	Zinc contents in mg/100 calories
Fats and various non-nutritive foods	None to 0.2
Fish, fruits, cakes	0.1 to 0.5
Poultry, pork, dairy products and whole grains cereals	0.4 to 1.2
Lamb, beef, leafy grains, root vegetables, shell fish and organ meats	> 1.2

Role of Zinc in Human Health

1.Zinc and Immune System

Zinc's importance in the body's reaction to infection is well understood. Zinc is a component of thymic hormone, which regulates and facilitates lymphocyte development. Zinc also aids in the formation of immune system cells by assisting in cell division and DNA replication.

2.Zinc and Common Cold

According to a 1992 study, zinc gluconate lozenges given at the first indication of a cold lessen the duration and severity of the illness. Zinc, an antiviral and astringent, is released into the saliva, which helps to relieve cough, nasal drainage, and congestion.

3.Zinc and Brain Activity

Zinc is found in the mossy fibre system of the brain's hippocampus's vesicles. These fibres help to improve memory and thinking skills. Women who were zinc deficient performed worse on routine memory tests, according to University of Texas researchers. Following an accident or surgery, zinc is diverted to the mending tissues, making it less available for other vital functions.

4.Zinc for Healing and Protecting Skin

Zinc is necessary for skin health. Diaper rash, itchiness, and chapped lips and skin have all been treated with topical zinc formulations (zinc oxide). Acne, cold sores, and burns have all been treated using zinc sulphate in a water-based solution. Remember that zinc sulphate is a salt that, at high or moderate quantities, can be highly

caustic to raw tissue. Zinc promotes cell division, healing, and healthy connective tissue production on the inside. It promotes the passage of Vitamin A from the liver to the skin, assisting in the protection and repair of bodily tissue..

4.Zinc and Pre-Menstrual Syndrome

Premenstrual syndrome may potentially benefit from zinc supplementation (PMS). PMS affects 50% of all women who menstruate. There is mounting evidence that PMS is caused by a progesterone shortage. Many hormones, including progesterone, are regulated by trace levels of zinc. During PMS, a reduction in zinc levels could lead to a decrease in progesterone and endorphin releases. Our bodies create endorphins, which are natural painkillers. While further research is needed, it appears that zinc may help some people with PMS symptoms.

5.Pregnancy and Infertility

- Because of zinc's role in generating cells, it is essential for
- *Zinc's involvement in cell formation makes it necessary for the growing foetus, where cells are rapidly dividing.
- * Getting enough zinc in a pregnant mother's diet helps to minimise the risk of miscarriage.
- *Adequate zinc in a pregnant woman's diet has been demonstrated to minimise the risk of premature birth and associated problems, as well as enhance newborn survival.

* It's thought that zinc deficiency during pregnancy is linked to learning issues.

*There has been research into the possibilities of treating male infertility using zinc treatment to boost sperm count and motility.

6.Zinc for Brain Functions

*Zinc interacts with other molecules to deliver messages to the sensory brain centre, which improves memory and cognition.

* Patients with a head injury are more likely to suffer headaches in the weeks following the injury.

*Zinc supplements are thought to aid cognitive performance in patients with head injuries who have low zinc levels.

*Zinc stimulates the parts of the brain that receive and process information.

*Zinc stimulates the region of the brain that receives and transmits data from taste and smell sensors.

*Zinc deficiency has been connected to anorexia.

*Anorexia is connected to a zinc deficiency that responds favourably to zinc replacement therapy.

*Mood disorder sufferers frequently have zinc insufficiency.

*Zinc sulphate appears to be useful in lowering fatigue, mood fluctuations, and changes in appetite when taken as a supplement.

*Zinc interacts with other chemicals to send messages to

7.Zinc for skin Care

Zinc compounds are important in skin care, for example:

* In the treatment of cold sore symptoms

* As a sun block to protect skin from the sun's harmful rays

* Effective treatment of acne

* To soothe nappy rashes and itching

* As a bactericide in high-quality cosmetics

* As an anti-inflammatory agent to relieve sunburns and blisters

• As bactericides in high quality cosmetics and toiletries.

• To help heal leg ulcers through addition to the diet.

8.Zinc for Eyesight

Zinc is found in high concentrations in the retina of the eye. Evidence exists linking zinc deficiency with the deteriorating vision that comes with ageing.

9. Immunity -Boosting Effects ofZinc

Zinc is involved in the activation and inactivation of several enzymes and co-enzymes that are important for cellular activities like DNA synthesis, RNA transcription, and energy metabolism. Zinc deficiency could alter B-cell growth, lower immunoglobulin production, increase infection rates, and, most importantly, increase death rates, according to the study. Zinc deficiency and its harmful effects are more common in infants and the elderly. Zinc consumption, according to several studies, is likely to lower the severity of COVID-19 infection due to its antiviral qualities; it also aids in the treatment of respiratory tract infections.

Effects of Zinc deficiency:

Zinc deficiency has a wide range of symptoms, making it difficult to diagnose. Many of the symptoms of zinc shortage might also be caused by a lack of other dietary supplements or by medical conditions. However Zinc deficiency can lead to a variety of health issues. *Common cold

* Diarrhoea

* Weak immune system

* Increased risk of age-related macular degeneration

*Weight loss

*Ulcer in skin

*Sexual dysfunctionig

* Worsening asthma symptoms are some of the common effects of zinc deficiency.

Symptoms of deficiency of Zinc :

Applications of Zinc in health and chronic diseases

*Retardation of growth

* lack of appetite

*Loss of weight

*Loss of smell and taste

*Fatigue

* Retarded bones are some of the frequent signs of Zinc deficiency.

Chicken, lamb, cattle, rabbit meat, oysters, scallops, blackfish, and animal liver are all good sources of zinc in food. Zinc can be found in mushrooms, daylily blooms, edible fungus, rape, cabbage, black sesame, black rice, dates, hazelnuts, ebony, and other vegetables, food crops, and fruit.

Clinical role of Zinc :

1. Zinc is important home remedy for acne and pimple.
2. Zinc is helpful in the healing of chronic infections and in restoring the body's ability to heal properly.
3. Zinc helps to control the quantity of testosterone in the body, which is a major contributor to acne. Zinc is also involved in the production of collagen. This also helps to maintain healthy skin by regulating the amount of skin oils.
4. In men, zinc plays an important role in the prostate gland, preventing early damage that can lead to cancer.
5. Zinc is a component of hydroxyapatite, a salt that strengthens and hardens the bone matrix. As a result, adding zinc to your diet may help you avoid bone loss .
6. Wilson's disease is a copper buildup ailment that runs in families. The amount of copper excreted in the bile from the liver is reduced. This causes copper to accumulate in the liver due to a failure of normal copper excretion in the stool. Excess copper accumulation eventually damages not only the liver, but also the brain and other organs. Oral zinc effectively reduces copper uptake by competing with copper for comparable binding sites. Zinc may also operate via inducing intestinal cell metallothionein. Once triggered, metallothionein T has a high affinity for copper binding and inhibits copper from entering the bloodstream through the skin.

II. CONCLUSION :

Zinc is a critical micronutrient for growth, immunological function, and infection resistance. Children in many low-income nations are at an elevated risk of infection and death due to zinc deficiency. Although mild to moderate zinc shortage is widespread in underdeveloped countries, the public health significance of this level of zinc deficiency is unclear.

Zinc deficiency raises the likelihood and severity of a range of infections, limits physical growth, and has an impact on various pregnancy outcomes. Zinc influences the immune system in a variety of ways, from skin barriers to gene regulation in cells.

Zinc supplementation has been demonstrated to have a considerable impact on the acute lower respiratory infections in preventive trials. Pneumonia, the common cold, and respiratory infections are all treated with zinc. Zinc supplementation may lower the risk of clinical

malaria attacks in children. Sufficient zinc is necessary for immune system function, and HIV patients are especially vulnerable to zinc deficiencies. In HIV patients, lower serum Zinc levels have been linked to advanced disease and greater death. Zinc supplementation is frequently used to aid wound healing. Zinc has a number of activities that may help patients with debridement and wound healing.

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