



Improving Population Health through Adequate Trace Element Intake

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DESCRIPTION

Zinc is an essential trace element required for numerous biochemical and physiological processes. It plays a central role in immune defense, wound healing, growth, reproduction and neurological development. Despite being needed in small quantities, deficiencies can have widespread effects on health, particularly in vulnerable populations such as infants, children, pregnant women and the elderly. Zinc deficiency is recognized as a significant public health issue, especially in low- and middle-income countries where diets are heavily cereal-based and intake of animal-source foods is limited.

Addressing zinc deficiency is not only a matter of individual health but also of societal importance, as impaired growth, infections and developmental delays linked to inadequate intake contribute to disease burden and economic losses.

Biological role of zinc

Zinc functions as a cofactor for more than 300 enzymes that regulate metabolic pathways, protein and DNA synthesis and cell division. It is integral to both innate and adaptive immunity, influencing the activity of T cells, natural killer cells and the production of antibodies. Zinc also affects skin integrity, appetite regulation and sensory functions such as taste and smell.

Unlike some micronutrients, zinc is not stored in large amounts in the body. Daily intake through diet is essential to maintain adequate levels. Absorption occurs mainly in the small intestine, with bioavailability influenced by dietary composition—animal proteins enhance absorption, while phytates in cereals and legumes reduce it.

Risk factors for zinc deficiency

Populations that depend on staple foods such as maize, wheat, or rice, without adequate inclusion of meat, dairy, or seafood, face a higher risk due to low bioavailability of zinc in plant-based diets. Vegetarians and vegans, while able to meet requirements

with careful planning, may need higher intakes to compensate for lower absorption. Certain life stages increase the need for zinc. Rapid growth in infancy and adolescence, as well as pregnancy and lactation, substantially raise requirements. Without supplementation or dietary adjustment, deficiencies are likely to occur.

Chronic diarrhea, intestinal diseases and infections contribute to zinc loss. Children with recurrent diarrheal episodes are particularly vulnerable, creating a vicious cycle of infection and malnutrition. Limited access to diverse diets and reliance on inexpensive staples increase the prevalence of zinc deficiency in economically disadvantaged communities.

Zinc deficiency across the life course

Deficiency in early life contributes to impaired linear growth, increased susceptibility to respiratory and gastrointestinal infections and developmental delays. Zinc supplementation has been shown to reduce the duration and severity of diarrhea and improve growth outcomes in deficient populations. Adolescents undergo rapid physical growth, requiring higher zinc intake. Inadequate supply during this phase may impair sexual maturation, immunity and academic performance.

Zinc plays a vital role in maternal health, fetal development and breast milk composition. Deficiency during pregnancy is associated with complications such as prolonged labor, low birth weight and increased risk of infections for both mother and child. While adults may not face the same growth demands, zinc deficiency can compromise immune responses, wound healing and reproductive health. Men with inadequate zinc intake may experience reduced fertility, while women may face risks to bone health and immunity.

Older adults are at heightened risk due to reduced dietary intake, absorption inefficiencies and comorbidities. Zinc deficiency in this group can contribute to impaired taste perception, appetite loss, delayed wound healing and higher infection rates.

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Zinc deficiency remains a significant challenge for public health, with consequences spanning from impaired child growth to compromised immunity and reproductive health in adults. Addressing this issue requires coordinated efforts across health systems, agriculture and community programs. Dietary diversification, supplementation, fortification and integration into health services can together reduce the burden of zinc deficiency.

By approaching zinc deficiency prevention across the life course, from infancy through old age, societies can improve growth, development, disease resistance and quality of life. Such strategies not only enhance individual health outcomes but also contribute to stronger and more resilient communities.