





Isfahan University
Of Medical Sciences

ZINC DEFICIENCY / TOXICITY

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October ۲۰۲۲

Zinc

- Zinc is an essential trace element for humans, animals, plants and for microorganisms.
- Zinc is necessary for prenatal and postnatal development.
- It is the second most abundant trace metal in humans after iron and it is the only metal which appears in all enzyme classes.

Zinc functions

- Gene expression
- Enzymatic reactions
- Immune function
- Protein synthesis
- DNA synthesis
- Wound healing
- Growth and development





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Advanced User Guide

Zinc and its importance for human health: An integrative review

Nazanin Roohani et al. J Res Med Sci. 2013 Feb.

[Nazanin Roohani](#)¹, [Richard Hurrell](#), [Roya Kelishadi](#), [Rainer Schulin](#)

How Much Zinc Should a Child Take Daily?

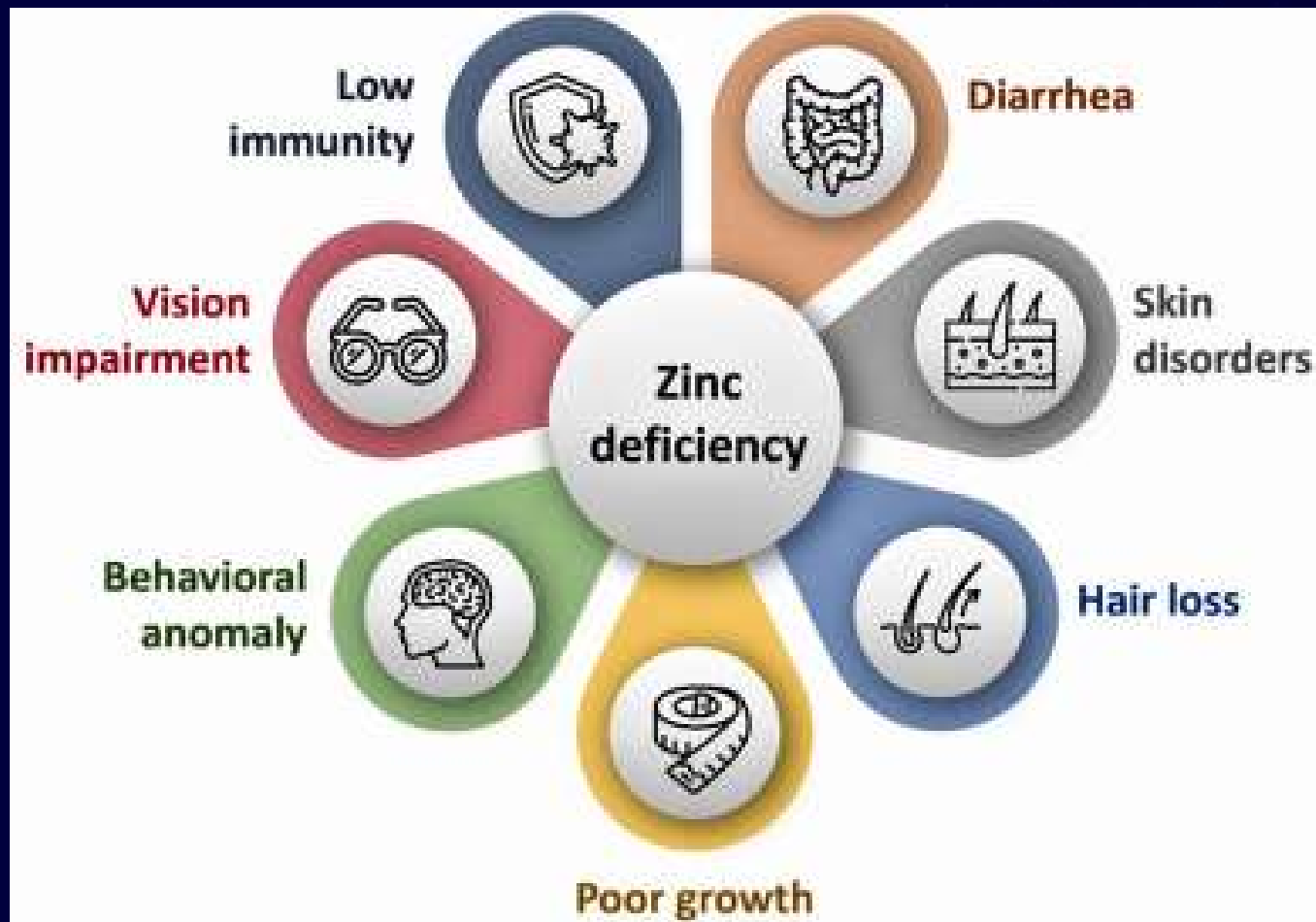
- • to 6 months: 2 mg
- 7 months to 3 years: 3 mg
- 4 years to 8 years: 5 mg
- 9 years to 13 years: 8 mg
- 14 years and up male: 11 mg
- 14 years and up females: 9 mg

Zinc deficiency

It may have several symptoms as:

- **unexplained weight loss**
- **wounds that won't heal**
- **lack of alertness**
- **decreased sense of smell and taste**
- **diarrhea**
- **loss of appetite**
- **open sores on the skin**

Zinc deficiency



Foods rich in zinc

- **Meat, poultry and fish**
- **Legumes: chickpeas, lentils, black beans, kidney beans, etc.**
- **Nuts and seeds: pumpkin seeds, cashews, hemp seeds, etc.**
- **Dairy products: milk, yogurt, and cheese**
- **Eggs**
- **Whole grains: oats, quinoa, brown rice, etc.**
- **Certain vegetables: mushrooms, peas and beet greens**



Bioavailability

- **The diet may not necessarily be low in zinc, but its bio-availability plays a major role in its absorption. Phytic acid is the main known inhibitor of zinc.**
- **Phytic acid may have positive health effects as protection against oxidative damage and insulin resistance. However, it impairs the body's absorption of iron, zinc, and calcium.**

How to reduce phytates in foods?

- **Soaking**: Cereals and legumes are often soaked in water overnight to reduce their phytate content.
- **Sprouting**: The sprouting of seeds, grains, and legumes causes phytate breakdown.
- **Fermentation**: Organic acids, formed during fermentation, promote phytate breakdown. Lactic acid fermentation is the preferred method, such as in the making of sourdough.

Zinc supplements

Zinc supplements are available in various forms as:

- **zinc sulfate,**
- **acetate,**
- **gluconate.**

The absorption rates of zinc from supplements vary:

- **zinc citrate and zinc gluconate absorbed at about 61%**
- **zinc oxide at 50%.**

Recommended upper levels of zinc intake

Infants	
0-6 months	4 mg/day
7-12 months	5 mg/day
1-3 yr	7 mg/day
4-8 yr	12 mg/day
Children and adolescents	
9-13 yr	25 mg/day
14-18 yr	35 mg/day

Risk factors for zinc deficiency



Vegetarian or vegan diet



Pregnant or lactating women



Elderly (>75 years)



Intake of proton pump inhibitors

Risk factors for zinc intoxication



Zinc supplementation or treatment of a disease, e.g. Wilson's disease



Inhalation of zinc dust or fume

Adverse effects of high zinc intake

- **Nausea and vomiting**
- **loss of appetite**
- **abdominal cramps**
- **diarrhea**
- **headaches**
- **low copper status**
- **altered iron function**
- **reduced immune function**
- **....**

Chronic adverse effects

Long-term intake of high doses of zinc supplements can have adverse effects as:

- **interfering with copper absorption**
- **compromised immune function,**
- **lower levels of HDL- cholesterol**
- **neurologic symptoms**
- **sensory ataxia (loss of coordination)**
- **myelopathy (spinal cord issues)**
- **Interfering with magnesium absorption**
- **anemia**
- **....**

Effects of zinc toxicity

Nervous system

Neuronal death, aggregation of A β and Tau protein
Alzheimer disease, Parkinson disease

Cardiovascular system

Elevated blood pressure, impairment of ECC

Respiratory system

Injury of epithelial airway barrier
Metal fume fever

Renal system

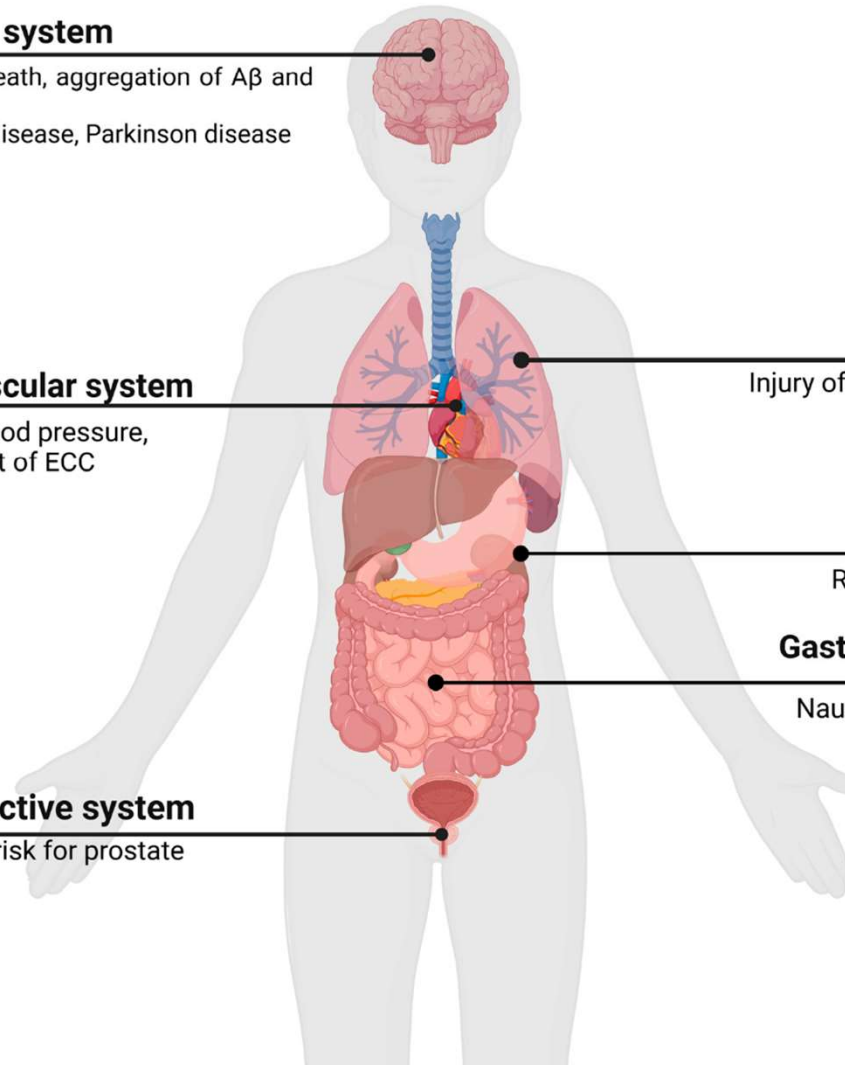
Reduced renal blood flow

Gastrointestinal system

Nausea, abdominal cramps, altered microbiome

Reproductive system

Increased risk for prostate cancer



Review Paper

A Systematic Review and Meta-analysis on the Prevalence of Zinc Deficiency in Iranian Population



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Citation Eslami MJ, Khoshhali M, Kelishadi R. A Systematic Review and Meta-analysis on the Prevalence of Zinc Deficiency in Iranian Population. *Journal of Pediatrics Review*. 2023; 11(3):209-220. <http://dx.doi.org/10.32598/jpr.11.3.451.1>

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Key message

Because high dose zinc supplements can lead to dangerous side effects, it is important to stick to recommendations and only take supplements when necessary.





Thank you