NutraMedix

Zinc

Applications

- Immune Support
- Skin Support
- Antioxidant Support
- Gastrointestinal Support

Introduction

NutraMedix Zinc is an essential trace mineral and a co-factor in many biological processes, including catalytic reactions, DNA synthesis, intracellular signaling, and protein transport.[1] It is an integral part of normal immune function, healthy skin, and normal wound healing.* Zinc may provide antioxidant support, help maintain healthy mitochondrial function, and help support epithelial barrier function and gut permeability already within the normal range.*[1,2] The molecular formula for zinc bisglycinate is $C_4H_{12}N_2O_5Zn$.[3]

Zinc supplements are widely available and consist of chelates bound to organic acids, chelates bound to amino acids, and non-chelates bound to inorganic acids. Zinc chelates are generally more bioavailable as they are less likely to interact with food, drugs, or components of the intestinal lumen.*[4] Zinc chelates bound to organic acids include zinc aspartate, zinc methionine, zinc monomethionine, and zinc bisglycinate. Zinc chelates bound to amino acids include zinc acetate, zinc citrate, zinc gluconate, zinc orotate, and zinc picolinate. Zinc non-chelates bound to inorganic acids include zinc sulfate and zinc oxide.[4]

NutraMedix Zinc is in the form of **zinc bisglycinate**, a chelate consisting of two glycines bound to a zinc cation (Zn^{2+}).* Zinc bisglycinate is highly bioavailable, having a low molecular weight which facilitates passage through the cell membrane.*[5,6] In a randomized crossover single-dose trial, zinc bisglycinate was significantly more bioavailable (+43.44%) than zinc gluconate ($p<0.05$).*[5] In a subsequent double-blind placebo-controlled trial, participants were assigned to 60 mg/day for six weeks of either zinc bisglycinate or zinc gluconate. Zinc bisglycinate was again found more bioavailable than zinc gluconate.*[6]

The recommended dietary allowance (RDA) of zinc for ages 19 and older is 8 mg/day for women and 11 mg/day for men.[7] Zinc deficiency, while relatively rare in high-resource nations, can be caused by low zinc intake, high phytate intake, or long-term use of proton pump inhibitors.*[8] It can also can occur in patients undergoing hemodialysis.*[9] Zinc deficiency is estimated to affect 17% of the world's population, due to inadequate nutrition, severe illness, or alcoholism.[10] Signs of zinc deficiency include delayed growth and maturation, impaired cognition, and depressed immunity, among others.[11]

Zinc is most abundant in animal foods, though can be found in plant foods and fortified foods as well. Good sources of zinc include seafood such as oysters, lobster, and crab; meats such as beef, chicken, and pork; nuts such as cashews and almonds; and pumpkin seeds. Oysters are, by far, the richest dietary source of zinc. Fortified sources include breakfast cereals, which are fortified with 25% of the daily value (DV).[12]

Vegetarian and vegan diets can decrease zinc absorption due to the high phytic acid content

of whole grains and legumes. However, there is currently insufficient evidence showing a higher incidence of zinc deficiency in vegetarians, compared to omnivores.[13,14] While zinc from animal foods is more easily absorbed, soaking grains and legumes overnight may help increase the bioavailability of zinc by activating phytase to break down phytic acid.[15,16]

NutraMedix Zinc is free of gluten, soy, and dairy. NutraMedix rigorously follows current good manufacturing practices (cGMP), as do our suppliers, including stringent ID testing, microbial testing, and heavy metal testing. This testing is conducted on both the raw material and after encapsulation.

Immune Support

Zinc may help with healthy immune system support.*[17,18] Normal zinc levels help regulate the natural killer (NK) cells of innate immunity as well as the T and B cells of adaptive immunity, maintaining them already within the normal range.*[19] Zinc deficiency may contribute to immune dysregulation, lower CD4+/CD8+ ratio, decreased lymphocytes, decreased NK cells, and increased monocyte toxicity.*[19] Normal zinc levels are necessary for healthy hematopoiesis, normal cell differentiation, and healthy cell cycle function.*[19] Both deficiency and excess can negatively impact the immune system, and zinc homeostasis is needed for correct functioning of innate and adaptive immunity.[19] One systematic review and meta-analysis found that zinc helped support upper respiratory health (p=0.0004).*[20]

Skin Support

Zinc may help with skin support.* Zinc is prevalent in the epidermis, the majority in the stratum spinosum. Zinc homeostasis is maintained by zinc transporters (ZnTs), Zrt-, Irt-like proteins (ZIPs), and metallothioneins. Zinc leaves the cells through ZnTs and enters the cells through ZIPs.[21] Zinc helps to maintain MHC class II expression already within the normal range in dendritic cells and helps maintain normal mast cell function.*[21] Zinc deficiency can contribute to rough skin, and supplemental zinc may help maintain healthy skin. Additionally, zinc may help support normal wound healing.*[21,22]

Antioxidant Support

Zinc levels within the normal range may help with antioxidant support, while both deficiency and excess can contribute to oxidative stress.* Zinc is unable to participate in redox reactions, as its valence shell is full. Instead, its antioxidant activity is attributed to effects on copper/zinc-superoxide dismutase and the upregulation of metallothionein, among other mechanisms.*[1] Zinc's antioxidant effects may involve proteins such as NF-kappaB, PPARs, and Nrf2.*[11] In a randomized, double-blind, placebo-controlled trial, zinc helped support premenstrual physical health (p=0.03) and mental health (p=0.006) already within the normal range, compared to placebo. Zinc also helped maintain brain-derived neurotrophic factor (BDNF) (p=0.01) and total antioxidant capacity (p<0.001) already within the normal range.*[23]

Other Support

Gastrointestinal Support

Zinc may support gastrointestinal health.*[24] Zinc and gastrointestinal epithelial cells have a reciprocal relationship; zinc is needed for a healthy epithelium, and a healthy epithelium is needed for the absorption of dietary or supplemental zinc.* Zinc may help support healthy gastrointestinal epithelial barrier function at tight junctions and may help maintain healthy gastrointestinal permeability already within the normal range.* It may also help maintain a healthy lactulose/mannitol ratio already within the normal range (p<0.03).*[25]

Safety and Cautions

Zinc is generally well tolerated. Side effects are more common at higher doses. Common side effects may include gastrointestinal symptoms such as cramps, nausea, vomiting, and diarrhea, the latter two of which are dose-dependent.[26] In higher doses of zinc (150 mg/day or more), copper deficiency may result.[26] Zinc bisglycinate at 60 mg/day for six weeks showed no change in erythrocyte superoxide dismutase, a marker of copper deficiency.[6] Zinc overdose has resulted in interstitial nephritis and acute renal tubular necrosis.[27] Studies are mixed as to high-dose zinc (>100 mg/day) and the risk of prostate cancer, though a meta-analysis did not find this relationship to be statistically significant.[28,29]

Zinc may interfere with the therapeutic effects of integrase inhibitors and cisplatin.[26] Zinc may decrease the levels and clinical effects of atazanavir, ritonavir, cephalexin, quinolone antibiotics, tetracycline antibiotics, and penicillamine.[26] Zinc may chelate these medications, decreasing absorption, and should be taken at least two hours before or four to six hours after these medications.[26]

Safety is not documented in breastfeeding or pregnant women, or in children under age 3, due to insufficient safety research.

*This statement has not been evaluated by the Food and Drug Administration. This product is not intended to treat, cure, or prevent any diseases.

References

[1]Lee, S.R. (2018). *Oxidative Medicine and Cellular Longevity*, *2018*, 9156285.
[2]Michielan, A., & D'Incà, R. (2015). *Mediators of Inflammation*, *2015*, 628157.
[3]PubChem. (2021). Zinc bis(glycinate) monohydrate. Retrieved 2 September 2021, from https://pubchem.ncbi.nlm.nih.gov/compound/Zinc-bis_glycinate_-monohydrate#section=InChI-Key
[4]Stargrove, M., Treasure, J., et al. (2007). *Herb, Nutrient, and Drug Interactions* (pp. 556-582). Mosby|Elsevier.
[5]Gandia, P., Bour, D., et al. (2007). *Internationale Zeitschrift fur Vitamin- und Ernahrungsforschung. Journal International de Vitaminologie et de Nutrition*, *77*(4), 243-248.
[6]DiSilvestro, R.A., Koch, E., et al. (2015). *Biological Trace Element Research*, *168*(1), 11-14.
[7]Institute of Medicine (U.S.). (2002). *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*. National Academies Press.
[8]Skrovanek, S., DiGuilio, K., et al. (2014). *World Journal of Gastrointestinal Pathophysiology*, *5*(4), 496-513.
[9]Berger, M.M., Shenkin, A., et al. (2004). *The American Journal of Clinical Nutrition*, *80*(2), 410-416.
[10]Wessells, K.R., & Brown, K.H. (2012). *PloS One*, *7*(11), e50568.
[11]Prasad, A.S., & Bao, B. (2019). *Antioxidants*, *8*(6), 164.
[12]ODS. (2022). Office of Dietary Supplements - Zinc. Retrieved 31 January 2022, from https://ods.od.nih.gov/factsheets/Zinc-HealthProfessional/
[13]Hunt J.R. (2002). *Nutrition Reviews*, *60*(5 Pt 1), 127-134.
[14]Foster, M., & Samman, S. (2015). *Advances in Food and Nutrition Research*, *74*, 93-131.
[15]Brown, D.D. (2018). *Journal of Dance Medicine & Science*, *22*(1), 44-53.
[16]Gupta, R.K., Gangoliya, S.S., et al. (2015). *Journal of Food Science and Technology*, *52*(2), 676-684.
[17]Rerksuppaphol, S., & Rerksuppaphol, L. (2013). *Paediatrics and International Child Health*, *33*(3), 145-150.
[18]Rerksuppaphol, L., & Rerksuppaphol, S. (2020). *Journal of Tropical Pediatrics*, *66*(4), 419-427.
[19]Wessels, I., Maywald, M., et al. (2017). *Nutrients*, *9*(12), 1286.
[20]Abioye, A.I., Bromage, S., et al. (2021). *BMJ Global Health*, *6*(1), e003176.
[21]Ogawa, Y., Kinoshita, M., et al. (2018). Zinc and Skin Disorders. *Nutrients*, *10*(2), 199.
[22]Sharquie, K.E., Najim, R.A., et al. (2006). *International Journal of Dermatology*, *45*(7), 857-861.
[23]Jafari, F., Amani, R., et al. (2020). *Biological Trace Element Research*, *194*(1), 89-95.
[24]Rerksuppaphol, L., & Rerksuppaphol, S. (2020). *Paediatrics and International Child Health*, *40*(2), 105-110.
[25]Ryan, K.N., Stephenson, K.B., et al. (2014). *Clinical Gastroenterology and Hepatology*, *12*(9), 1507-13.e1.
[26]Natural Medicines. (2021). Zinc [monograph]. http://naturalmedicines.therapeuticresearch.com
[27]Barceloux D.G. (1999). *Journal of Toxicology. Clinical Toxicology*, *37*(2), 279-292.
[28]Leitzmann, M.F., Stampfer, M.J., et al. (2003). *Journal of the National Cancer Institute*, *95*(13), 1004-1007.
[29]Mahmoud, A.M., Al-Alem, U., et al. (2016). *PloS One*, *11*(11), e0165956.