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### Role of Zinc in Bone Metabolism and Preventive Effect on Bone Disorder

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#### Abstract:

Zinc is essential for the growth of the human and animals. Bone growth retardation is a common finding in various conditions associated with zinc deficiency, suggesting a physiologic role of zinc in the growth and mineralization of bone tissues. Bone zinc content is decreased by development with aging, skeletal unloading, and postmenopausal conditions. Zinc deficiency may play a pathophysiologic role in the deterioration of bone metabolism. Zinc has been demonstrated to have a stimulatory effect on osteoblastic bone formation and mineralization; the metal directly activates aminoacyl-tRNA synthetase, a rate-limiting enzyme at translational process of protein synthesis, in osteoblastic cells, and it stimulates cellular protein synthesis. Zinc has been shown to stimulate gene expression of the transcription factor Runx2 that is related to differentiation into osteoblastic cells. Moreover, zinc inhibits osteoclastic bone resorption due to inhibiting osteoclast-like cell formation from bone marrow cells and stimulating apoptotic cell death of mature osteoclasts. Zinc has a suppressive effect on the receptor activator of nuclear factor(NF)- $\kappa$ B ligand(RANKL)-induced osteoclastogenesis, indicating that the metal inhibits RANKL signaling in pre-osteoclasts. Zinc may act on the process of bone resorbing factors-induced protein kinase C activation, which is involved in  $\text{Ca}^{2+}$  signaling in osteoclastic cells. Zinc plays a role in the preservation of bone mass.  $\beta$ -Alanyl-L-histidinato zinc(AHZ) is a zinc compound, in which zinc is chelated to  $\beta$ -alanyl-L-histidine. The stimulatory effect of AHZ on bone formation was more intensive than that of zinc sulfate. Also, zinc acexamate has a potent- anabolic effect on bone metabolism. The effect of AHZ or zinc acexamate on bone formation is equal

in comparison with the effect of various bone-regulating hormones and other factors. The oral administration of AHZ or zinc acexamate has a fine restorative effect on bone loss with various pathophysiologic conditions(including aging, skeletal unloading, aluminium bone toxicity, calcium- and vitamin D-deficiency, adjuvant arthritis, estrogen deficiency, diabetes, and fracture healing). Zinc compounds may be designed as new drugs in the therapy of osteoporosis.

**Key words:** zinc, bone formation, bone resorption, osteoporosis

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