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The role of trace minerals in osteoporosis.

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Abstract

Osteoporosis is a multifactorial disease with dimensions of genetics, endocrine function, exercise and nutritional considerations. Of particular considerations are calcium (Ca) status, Vitamin D, fluoride, magnesium and other trace elements. Several trace elements, particularly copper (Cu), manganese (Mn) and zinc (Zn), are essential in bone metabolism as cofactors for specific enzymes. Our investigations regarding the role of Cu, Mn and Zn in bone metabolism include data from studies with animals on Cu- and Mn-deficient diets. We have also demonstrated cellular deficiencies using bone powder implants, as well as fundamental changes in organic matrix constituents. In clinical studies we have demonstrated the efficacy of Ca, Cu, Mn and Zn supplementation on spinal bone mineral density in postmenopausal women. Each of these studies demonstrated the necessity of trace elements for optimal bone matrix development and bone density sustenance.

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Is there a potential therapeutic value of copper and zinc for osteoporosis?

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Abstract

Osteoporosis is almost universal in very old age, and is a major cause of morbidity and mortality in the elderly of both sexes. Bone is lost at a rate of 0.2-0.5 %/year in both men and women after the age of 40-45 years. The causes of age-related changes in bone mass are multifactorial and include genetic predisposition, nutritional factors, endocrine changes, habitual exercise levels and body weight. Bone loss is accelerated to 2-5 % year immediately before and for up to 10 years post-menopause (Heaney, 1986). In women hormone-replacement therapy is effective in reducing the rate of bone loss caused by this peri-menopausal decrease in hormone levels (Smith & Studd, 1993); however, in men and older women (>10 years post-menopause) nutrition plays a key role in the rate of bone loss. One factor contributing to bone loss in the elderly may be a

subclinical Zn and/or Cu deficiency, due to a reduced dietary intake of micronutrients and reduced absorption (Thomson & Keelan, 1986). Zn and Cu are essential cofactors for enzymes involved in the synthesis of various bone matrix constituents. Paradoxically, Ca supplementation may accentuate the problem of reduced Zn and Cu levels by impairing the absorption of simultaneously-ingested Zn and the retention of Cu (Snedeker et al. 1982; Grekas et al. 1988). The present paper will review the current literature on the potential benefits of Cu and Zn supplementation in reducing bone loss, and present new information on the effect of Ca supplementation on Zn and Cu status in post-menopausal women with osteoporosis.

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Spinal bone loss in postmenopausal women supplemented with calcium and trace minerals.

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Abstract

The effects of calcium supplementation (as calcium citrate malate, 1000 mg elemental Ca/d) with and without the addition of zinc (15.0 mg/d), manganese (5.0 mg/d) and copper (2.5 mg/d) on spinal bone loss (L2-L4 vertebrae) was evaluated in healthy older postmenopausal women (n = 59, mean age 66 y) in a 2-y, double-blind, placebo-controlled trial. Changes (mean +/- SEM) in bone density were -3.53 +/- 1.24% (placebo), -1.89 +/- 1.40% (trace minerals only), -1.25 +/- 1.46% (calcium only) and 1.48 +/- 1.40% (calcium plus trace minerals). Bone loss relative to base-line value was significant (P = 0.0061) in the placebo group but not in the groups receiving trace minerals alone, calcium alone, or calcium plus trace minerals. The only significant group difference occurred between the placebo group and the group receiving calcium plus trace minerals (P = 0.0099). These data suggest that bone loss in calcium-supplemented, older postmenopausal women can be further arrested by concomitant increases in trace mineral intake.

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