

Controlled Trial of Zinc Supplementation During Recovery From Malnutrition: Effects on Growth and Immune Function

Deficiencies of such trace minerals as zinc, iron, copper, and magnesium are often associated with protein-calorie malnutrition (PCM). To evaluate the role of zinc supplementation on growth and immune function in malnourished infants during recovery from PCM, 32 marasmic infants were randomly assigned to receive either 2 mg/kg/day elemental zinc supplement or a placebo without zinc. The marasmic condition was defined by birth weight $> 1,500$ g, weight for age $< 80\%$ WHO standard, and history of primary malnutrition without an underlying disease associated with malnutrition. All infants received a milk-based formula which provided 150 to 200 kcal/kg, 4.5 to 5.0 g protein/kg, and 3.0 to 3.5 mg zinc/day. Weight and length were measured daily; arm circumference and triceps skinfold, biweekly.

Plasma zinc and copper determinations and complete blood counts were performed at days 0, 30, 60, and 90 of the study. Function of the immune system was assessed on days 0 and 90 of zinc supplementation by cutaneous delayed hypersensitivity reaction, T-cell blastic proliferation, immunoglobulin concentrations, the number of febrile days, and the type/number of intercurrent infections. Plasma zinc and copper levels were measured serially and maintained within normal limits. They were similar in both the supplemented and placebo groups.

At 60 days, the overall gain in weight for length as a percent of standard was 9% in the supplemented group and 3% in the placebo group ($p < 0.05$). Zinc-supplemented infants had significantly fewer infectious illnesses, such as pyoderma, when

compared with the placebo group ($p < 0.05$). A significant negative correlation between the plasma zinc level and the number of febrile days in the placebo group was noted during the 1- to 2-month interval ($r = 0.66$, $p < 0.05$). Following 90 days of zinc supplementation, the percentage of anergic infants had increased more than in the placebo group ($p < 0.05$). Serum IgA concentrations were greater in the zinc-supplemented group.

Castillo-Duran C, Heresi G, Fisberg M, et al. *Am J Clin Nutr* 1987;45:602.

Editor's comment—The authors describe marginal zinc deficiency that could not be identified by plasma zinc levels, but only by salutary clinical and immunological responses to zinc supplementation.

Zinc supplementation in these marasmic infants improved weight gain without differences in food intake and reduced the incidence of infectious morbidity. If a clinician cannot rely on standard measures to determine zinc status, ie, plasma levels, it becomes difficult to determine when supplementation is indicated and the amount required to elicit a positive response. However, mineral supplementation is recommended during recovery of malnutrition for a number of reasons. First, catch-up growth during recovery of malnutrition increases the need for zinc and other trace minerals. Additionally, diets based on cow's milk provide insufficient amounts of zinc for optimal recovery from malnutrition. Finally, marginal deficiencies of these minerals may also interfere with clinical recovery. Therefore, zinc supplementation is recommended during recovery from malnutrition since we have no other valid indication of adequate zinc levels that can permit the diagnosis of zinc deficiency in human beings. As reported in this paper, a supplement of 2 mg/kg/day is effective.