The Public Health Importance of Zinc Nutrition, and Strategies for the Control of Zinc Deficiency

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INTRODUCTION

Zinc is an essential nutrient required for the normal structure and function of Zn-containing enzymes, including those involved in gene expression, cell division, apoptosis, and synaptic signalling (IZiNCG 2004). Zinc deficiency, therefore, disrupts multiple biological functions, especially in rapidly replicating tissues, such as the immune system and the gastrointestinal tract, resulting in greater susceptibility to infections and growth restriction of young children. Recent intervention trials in lower-income countries have found that Zn supplementation decreases the rates of diarrhea and lower respiratory infections (Zinc Investigators Group 1999), two major causes of child mortality. Several studies have detected reduced mortality rates among Zn-supplemented children (Sazawal 2001, Baqui 2002, Brooks 2005). Notably, a recent publication on child mortality estimated that >90% coverage with programs to prevent Zn deficiency would reduce child mortality by ~5% globally (Jones 2003). In addition to these effects of Zn on morbidity and mortality from common childhood infections, studies indicate that preventive Zn supplements increase the linear growth and weight gain of stunted or underweight children (Brown 2002).

ASSESSMENT OF ZINC STATUS AND WORLDWIDE PREVALENCE OF ZINC DEFICIENCY

Programs to control Zn deficiency should begin with an assessment of the population's Zn status or risk of Zn deficiency. Several international groups (WHO, UNICEF, IAEA, and IZiNCG) have reached consensus on appropriate population-level indicators of Zn status, namely: 1) serum-Zn concentration in relation to reference data for age, sex, time of day, and fasting status; 2) dietary intake of absorbable Zn in relation to age- and sex-specific requirements; and 3) rates of childhood stunting (low height-for-age) (Hotz in press).

Regrettably, few countries have completed systematic assessments of the Zn status in representative samples of their population. Thus, little information is available on global rates of Zn deficiency. However, WHO compiles anthropometric data on children's growth that indicates that approximately 30% of children worldwide are stunted, thus, suggesting that Zn deficiency is probably widespread. Assessments of dietary Zn intake and serum-Zn concentrations should be incorporated into national nutritional assessment surveys to provide better information on the true prevalence of Zn deficiency.

STRATEGIES FOR THE CONTROL OF ZINC DEFICIENCY

Three major strategies have been proposed for the control of Zn deficiency: supplementation, fortification, and dietary modification.

Zinc Supplementation

Zinc supplementation may be used for treatment of specific diseases or as a preventive strategy. WHO and UNICEF recommend including Zm supplements in the therapeutic regimen for children with diarrhea (20 mg Zn/day for 10-14 days among children $\geq$1 yr of age; half that dose in younger children). Preventive Zn supplementation should be linked to

other health programs, such as periodic growth monitoring or clinic visits for immunizations. Appropriate doses of preventive Zn supplements have been suggested by IZiNCG (2004).

Zinc fortification

Studies show that Zn fortification increases the total amount of absorbed Zn and has little or no adverse effect on absorption of other minerals. However, few results are available on the biochemical and functional impacts of large-scale Zn-fortification programs.

Dietary modification

Possible dietary approaches to increase Zn intake or enhance Zn absorption include promoting greater consumption of animal-source foods, increasing the Zn content of staple foods by selecting Zn-rich cultivars or augmenting the use of Zn fertilizers, and reducing inhibitors of Zn absorption, like phytate, by central or household food processing methods.

CONCLUSIONS

In view of the critical importance of Zn for human health and the likely widespread occurrence of Zn deficiency, public health programs are urgently needed to improve the Zn status of affected populations.

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