

NSNZ: Muriel Bell Memorial Lecture

Strategies for preventing micronutrient deficiencies in developing countries

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Until recently, strategies for preventing micronutrient deficiencies have focussed on single micronutrients, principally iodine, iron, and vitamin A. The importance of concurrent micronutrient deficiencies in developing countries (DCs) is now recognized, their existence prompted by the often disappointing responses with single micronutrient supplementation programs. Latent deficiencies of other micronutrients can suppress the effect of a single micronutrient, when it is not the first limiting nutrient. The etiology of these multiple micronutrient deficiencies is multifactorial. Inadequate intakes and/or poor bioavailability, induced by predominately plant-based diets and low intakes of animal source foods, are major factors, although non-nutritional factors such as parasitic infections, genetic hemoglobinopathies, malaria, and infectious diseases, play a role. Co-existing micronutrient deficiencies result in impairments in growth, immune, and cognitive function, poor reproductive outcome, and increased morbidity and mortality. Clearly major health benefits could be achieved by choosing appropriate and cost-effective strategies that successfully alleviate concurrent micronutrient deficiencies in developing countries.

Approaches include supplementation to those 'at risk', and food-based strategies involving fortification and dietary diversification/modification with minimal risk of antagonistic micronutrient interactions. Of these, multi-micronutrient fortification of centrally processed staple foods or condiments is now feasible, but inappropriate in subsistence settings. Instead, for the latter, more sustainable approaches involve biofortification of plant-based staples, and promotion of small-livestock production, aquaculture, and consumption of animal source foods. In addition, household dietary strategies involving changes in food preparation and processing can be used to alter the content of micronutrient absorption modifiers in plant-based diets. Practical methods involve consumption of absorption enhancers, and use of germination, fermentation, and soaking to reduce the phytate content of cereal flours by enzyme-induced hydrolysis of phytate and/or passive diffusion of water soluble phytate.

We have applied these dietary strategies among subsistence households in rural Malawi, and evaluated their impact on the dietary adequacy of weanlings and young children through knowledge and practices and interactive 24-h recalls, using a quasi-experimental design. In both groups, intervention diets were of higher dietary quality than controls, supplying significantly more animal source foods, especially soft-boned fish, but less phytic acid. Median intakes of energy, protein, calcium, available zinc, available iron (only for weanlings) were greater, and phytate:zinc molar ratios were lower in intervention compared to controls. In the children, intervention enhanced Z-scores for mid-upper-arm circumference and arm muscle area, but had no impact on weight or height gain. After controlling for baseline variables, mean hemoglobin was higher post-intervention, whereas incidence of anemia and common infections was lower in intervention compared to controls. To enhance effectiveness and sustainability, all micronutrient strategies should be integrated with ongoing national food, nutrition, and health education programs, and implemented using education and social-marketing techniques.