Micronutrient Deficiencies and Effect of Supplements on Correcting Them

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The etiology of micronutrient deficiencies in infancy is well described. The deficiencies are caused by one of the following four scenarios: (a) low initial stores of micronutrients from micronutrient deficiency during gestation, premature birth or low birthweight; (b) rapid postnatal growth; (c) ingestion of foods with low concentration of micronutrients, and (d) gastrointestinal pathology resulting in the malabsorption of nutrients, including micronutrients. Understanding the cause of the deficiencies is essential in planning interventions to either prevent or treat them. This summary will focus on the dietary causes of micronutrient deficiencies and recent strategies to correct them.

Dietary Origins of Micronutrient Deficiencies

With the exception of vitamin D, human breast milk will provide all of the nutrients needed for the otherwise healthy infant during the first 6 months of life. However, after 6 months of age, breast milk is not sufficient on its own. There is a need for additional sources of nutrients, especially iron and energy. To meet the energy needs of the infant between 6 and 24 months, there is a need for a source of calories from complementary foods. Similarly there is a need for micronutrients in addition to those found in breast milk and unfortified complementary foods.

Public Health Approaches to the Prevention of Micronutrient Deficiencies

There are three types of fortification: general staple food (commodity) fortification, targeted fortification and ‘home’ or point-of-use fortification. Staple food fortification is the process of adding micronutrients to commodity type foods such as flour, vegetable oil or salt. The
major advantage of staple food fortification is that it is inexpensive and the commodity used is a common food eaten by the majority of the population. However, the level of fortification is quite low in fortified staple foods, and infants and young children do not consume enough of fortified foods to meet their needs.

Targeted fortification is a proven successful strategy for groups at the highest risk of micronutrient deficiencies. With targeted fortification, the vehicle is specifically a food eaten only by the ‘at risk’ population. For example only infants eat infant cereals and infant formulas, thus for these two foods, the level of fortification is tailored to the specific micronutrient needs of young infants and children. Although targeted fortification is, at least in theory, an efficient method to ensure the micronutrient adequacy of the diet, it assumes that infants are eating commercially fortified foods. In most households in developing countries, however, infants do not eat commercially prepared baby foods, but rather eat complementary foods prepared from local commodities and cooked in the home. Thus, this public health approach is not successful in most developing countries.

The concept of ‘home fortification’ was introduced and developed by researchers at the Hospital for Sick Children in Toronto, Canada. Home fortification is a strategy to improve the nutritional quality of home-prepared foods with micronutrient powders containing mineral and vitamin fortificants. For circumstances where the macronutrient and energy density of food provided to children is adequate, but the foods are lacking in micronutrients, micronutrient powder can be added to the food just before it is eaten. A systematic review and meta-analysis of home fortification of complementary foods was recently completed by Dewey and colleagues. Treatment trials indicate that micronutrient powders are as effective as iron drops, are better accepted and have fewer side effects.

Conclusions

Of the three modes of fortification, general staple food, targeted and home fortification, only the latter two are effective for use in infants and young children. Research studies in developing countries, including Ghana, India, and Bangladesh, have proven the efficacy and effectiveness of home fortification as a means to fortify food in the home and to effectively treat and prevent micronutrient deficiencies. As a result of these advances, home fortification with micronutrient powders has recently been incorporated as a component of established World Health Organization/UNICEF-recommended feeding strategies.