Practical Considerations for Improving Micronutrient Status in the First Two Years of Life

Ibrahim Parvanta and Jacky Knowles

International Micronutrient Malnutrition Prevention and Control Program, Division of Nutrition and Physical Activity, Centers for Disease Control and Prevention, Atlanta, Ga., USA

Introduction

Six- to 24-month-old children are at especially high risk for micronutrient deficiencies due to their rapid rate of growth and their ability to consume only small amounts of food at any one time. Continued breast-feeding during this age provides significant nutritional and health benefits for the children. However, after 6 months of age, breast milk alone will not meet the infant’s needs for some key minerals, such as iron and zinc. Thus, additional dietary sources of these nutrients are needed, and it has been estimated that adequate complementary foods for infants older than 6 months should provide 75–100% of daily zinc and iron requirements [1]. However, even if iron- and zinc-rich foods such as meats were readily available, it would require unrealistically high daily intakes of these foods to achieve the recommended intakes of iron and zinc during the second half year of life [1]. In most developing countries, where complementary foods are mainly based on cereal products of low vitamin and mineral density, iron and zinc intakes are insufficient for optimum development of children less than 24 months old [2, 3].

Public health authorities now agree that infants should be exclusively breast-fed until 6 months of age, followed by the introduction of micronutrient-rich complementary foods [4, 5]. International guidance also clearly specifies that the widespread use of fortified complementary foods and/or universal micronutrient supplementation is essential to prevent micronutrient deficiencies in infants and young children [1, 4, 6].

Innovative strategies to make fortified complementary foods and micronutrient supplements widely available and accessible in non-industrialized
countries are urgently needed. Yet, except for mostly donor-supported vita-
min A capsule distribution, few developing countries have effective programs
to prevent deficiencies of other micronutrients in preschool children. This is
partly due to a lack of understanding among public and private sector decision
makers regarding the detrimental impact of micronutrient deficiencies on the
physical development and mental and learning capacity of populations and,
consequently, on the socioeconomic development of their communities and
nations. Additional constraints to the development of programs to prevent
micronutrient deficiencies in infants and young children, especially related to
fortification of complementary foods, include: a perceived threat to breast-
feeding; concerns about lack of clean water and sanitation needed to safely pre-
pare complementary foods; hesitation about the role of multinational baby food
companies, and the high cost of commercially produced fortified complemen-
tary foods, making them inaccessible to a large proportion of the population.

Recent developments of new micronutrient delivery products such as
Sprinkles [7], Foodlets [8], and Spreads [9], offer new opportunities for sustain-
able elimination or reduction of micronutrient deficiencies in young children
through the principle of in-home fortification of traditional complementary
foods [10].

**Practical Considerations**

Evaluations of iron and folic acid supplementation programs for pregnant
women in developing countries have found that the typical strategy of deliv-
ering supplements through the health system is ineffective on a large scale.
Some key reasons for this include: poor public health sector logistics and
incentives that result in unreliable supplies and distribution of tablets; poor or
nonexistent program communication and community promotion of supple-
ments; inadequate patient counseling and lack of information by health care
providers, and lack of choice of supplements through the health system [11].

Preventive micronutrient supplementation efforts are also hindered in devel-
oping countries because in many societies, micronutrient supplements are syn-
onymous with ‘medications’ and ‘cures’ [11, 12]. In many developing countries,
the classification of micronutrient preparations as pharmaceuticals, with access
to them only by prescription and through medical centers or pharmacies, fur-
ther add to the perception of supplements as curative medical interventions.
Thus, consumers in these countries do not perceive supplements as compo-
nents of, or adjuncts to, good nutrition. Instead, the population is often hesitant
to use the products on a regular basis and for extended periods of time because
of the fear of ‘over medication’ [11, 12]. Furthermore, the limited and high-
priced varieties of fortified complementary foods in developing country markets
also have a connotation as ‘special’ foods with ‘medicinal’ properties which
should be consumed by children when they are ill.
In contrast, in developed countries such as the US, there is widespread availability and use of affordable and competing brands of fortified complementary foods and pediatric micronutrient supplements through the commercial sector. Thus, the average consumer perceives and utilizes fortified complementary foods as the ‘normal’ diet for infants and young children, and can access many varieties of micronutrient supplement preparations in the market without medical prescription.

The Women, Infants and Children’s Supplemental Nutrition Program (WIC) has been implemented in the United States since the 1970s and is designed to provide nutrition screening and counseling services, as well as nutritious foods, to low-income children <5 years old and pregnant women [13]. It is quite likely that one important reason for the success of this 30-year-old national maternal and child nutrition program is that beneficiaries purchase specific authorized foods from the commercial market using special program coupons or credit mechanisms. Enabling WIC Program participants to access the nutrient-rich foods through the existing market eliminated the need for the government to create an independent and costly logistics network to deliver food products to program participants through government clinics. Anecdotal information also suggest that the promotion of specific types of micronutrient fortified foods helped to encourage the private sector to increase the number of commercially fortified products that meet WIC Program requirements, including lower priced generic ones (fig. 1). Thus, over time, WIC Program recipients have had more fortified food options to choose from and, perhaps even more importantly, the remainder of the US population not receiving WIC Program services have also benefited from the availability of competitively priced fortified foods on the grocery store shelves.

Examples of effective market-based public health intervention programs in developing countries include local production and commercial distribution of oral rehydration solutions, and more recently, retail level distribution of safe water storage vessels and chlorine-based disinfectant solutions [14, 15]. It is highly likely that lessons from these programs could be adapted to improve the distribution and coverage of micronutrient supplements, in-home fortificants, and centrally produced fortified complementary foods in developing countries. Furthermore, with continued success and expansion of safe-water programs [14, 15], it might be possible to combine this effective disease prevention measure with efficacious fortified water strategies to prevent iron and perhaps other micronutrient deficiencies, as have been reported in Brazil [16, 17].

Considerations for Future Program Development

It would be safe to say that, although treatment of micronutrient deficiencies requires intervention by the health sector, the sustainable widespread prevention of these deficiencies cannot be achieved through interventions
delivered by public health agencies alone. The long term improvement of micronutrient status of young children requires that appropriate, low-cost, fortified complementary foods and micronutrient supplements are available through the commercial market and other community-based delivery

![Graph showing the increase in the number of breakfast cereal products and percent of store vs. national brand breakfast cereals authorized by the Women, Infants and Children Supplemental Nutrition Program (WIC) in the state of Maine, USA, 1985–2002.](image)

**Fig. 1.** The increase, over time, in the number of breakfast cereal products (a) and percent of store vs. national brand breakfast cereals (b) authorized by the Women, Infants and Children Supplemental Nutrition Program (WIC) in the state of Maine, USA, 1985–2002. Source: Personal communication from Mr. Ron Bansmer, Director, Maine WIC Program.
channels, and that their production and use become the norm among industry and consumers. It is important for the health sector to acknowledge the essential role of private industry in the production, marketing and distribution of high-quality micronutrient-rich foods and supplements for various consumer segments in society. This supportive role of the health sector is essential to ensure public acceptance of the products. By ‘sharing the burden’ of micronutrient deficiency interventions with the private sector, public health agencies could channel limited resources to target the most vulnerable populations with limited access to markets, and to better monitor the process and impact of micronutrient intervention programs.

It is also essential to recognize that, if a particular strategy is not applicable to one part of the world or may not reach the most vulnerable or most remote populations within countries, the implementation of that strategy may still benefit populations in other parts of the world or of a nation; i.e. no single intervention will cover all populations or is 100% effective. For example, children under 24 months old in both rural and urban areas of developing countries are often iron deficient. With adequate marketing and promotion, it may be possible to distribute appropriately priced fortified complementary foods, in-home fortificants, and/or micronutrient supplements through the market sector in urban and peri-urban communities using various pricing schemes, while the most underprivileged could be served through improved government or nonprofit sector distribution networks.

Retail level delivery of micronutrient-rich products will likely also lead to more regular use of such products. For example, the high compliance with pre-pregnancy and early prenatal folic acid supplementation program in China is in part attributed to the sale of the supplements to program beneficiaries. The sale of the supplements provides monetary incentives for those responsible for ensuring high coverage of the program, and improves compliance by overcoming the population’s perception that a freely distributed product is not beneficial or is of poor quality (Li Zhu, Beijing University, personal commun.).

Finally, appropriate partnerships between the public, private, and civic sectors are essential for implementation of sustainable public health interventions, including prevention of micronutrient deficiencies. For example, the tremendous achievement in increasing the proportion of households in the world using iodized salt from less than 20 to almost 70% during the 1990s [18], was only realized once public health authorities acknowledged that the salt industry ‘held the key’ to success, and together with Kiwanis International, a civic organization, initiated an active engagement with salt producers. In 2000, the partnership led to the salt industry publicly acknowledging its role in salt iodization and a collaborative international coalition of public, private, and civic organizations was formed to support national efforts for sustained elimination of iodine deficiency [19]. Another example of public and private sector partnership to improve public health can be found in the development of an effective water
pultrusion system which was the result of collaboration between the US Centers for Disease Control and Prevention (CDC) and the Proctor and Gamble Health Sciences Institute. This collaboration has further led Proctor and Gamble Health Sciences Institute, the CDC, the International Council of Nurses, and other organizations to establish an International Network to Promote Safe Household Water Treatment and Storage in developing countries [20].

**Conclusion**

Successful and sustainable prevention of micronutrient deficiencies will require public, private, and civic sector commitment to collaborate, based on the resources and expertise of each group. No single sector, intervention method, or product can reach all of the target populations. Multiple intervention strategies are needed which involve multiple sectors of society, multiple forms of fortified foods, multiple types of micronutrient supplements, and especially, a combination of market- and community-based access points, as well as government sector distribution networks, to make nutrient-rich foods and supplements accessible and acceptable by consumers in developing countries.

**References**

Discussion

Dr. Semba: You talked about one last potential solution being the introduction of fortified complementary foods after 6 months, and I would like to give you two scenarios. For example, in Indonesia the most common complementary food is rice, rice porridge, and in Malawi it is corn porridge, and both of these are locally produced and not centrally distributed. So how would you fortify these?

Mr. Parvanta: In some countries centrally produced fortified foods may not be the option. In those situations, there are other strategies that could be used. These include in-home fortification, using micronutrient Sprinkles which will be discussed later by Dr. Zlotkin, and micronutrient supplementation. However, fortification of complementary foods is possible in some parts of the world. Thus, we at the CDC, are collaborating with UNICEF to support complementary food fortification efforts in South and Central America and Eastern Europe and the former Soviet Union regions because centrally produced complementary foods are used by relatively large population segments. The main point is that where it is possible, production and utilization of fortified complementary foods must be promoted.

Dr. Bhutta: I agree with a lot of what you have said. As a member of the WHO expert panel on breast-feeding I would like to clarify a few things. One, there was extensive discussion within the group on micronutrient supplementation, not just after 6 months but even within the first 6 months. I believe within the recommendations there are recommendations for high-risk groups such as small-for-date infants, and there was clear recognition even though it may not appear for reasons of parsimony in that paragraph that you alluded to. The challenge therefore is how this can be done in developing countries where commercial or centrally processed complementary foods only represent at best about a third of the entire repertoire of complementary foods in households. There is a mix of strategies that needs to be adopted which at one end really needs to look at what the market will provide in terms of complementary foods, and at the other end looks at alternative strategies such as fortification of staples. Just to conclude, I strongly endorse moving forward by bringing the industry into this entire debate. Pakistan, where I come from, has had a central food fortification program with regard to vitamin A for over 40 years in terms of vegetable oil fortification. Yet in four decades it has not been possible to expand it to include additional micronutrients or additional vehicles, and this is partly because at the public health level the importance of this for children in general has not been recognized.
Mr. Parvanta: Thank you for this point. Let me just add that developing countries vary, just as developed countries vary. Thus, we should consider opportunities by country, or perhaps by region. In those countries where fortification of complementary foods is a potential option, their governments and relevant industries should be encouraged and supported to make such fortification happen. We should note that in countries where food fortification programs are in place, often the food producers are not informed of their important contributions to public health. For example, a few months ago at a meeting of flour millers, a miller from El Salvador pointed out that their industry had not been informed if fortification of flour with iron and folic acid had had any impact on the health of the population of El Salvador. Thus, the public health sector should make a special effort to inform food industry partners about the impact of fortification programs and acknowledge their contribution accordingly.

Dr. Bloem: I have two comments for you. It is very interesting when you say we have to give people more choices, but poverty means that there is a lack of choice. It is almost like poor people denying that they have no choices, but giving them more choices is almost a contradiction. The other issue you talked about is industry, and I think it is a little bit dangerous to talk about industry because industry is quite different in different places. In China of course you see an incredibly increased food industry, but because of globalization the food industry is no longer working in isolation.

For example a big industry in Indonesia was bought by Heinz, and that happens in many places, supermarkets are growing, all these global companies are actually influencing many different countries, and you have small countries like Bangladesh where there is hardly any industry and where in fact people still eat what they produce to a certain extent. So it is more complicated than just saying let’s involve industries. We have to be more specific when we talk about industry.

Mr. Parvanta: Obviously, the situation varies from country to country, and one has to address each situation accordingly. For example, in India about 20–25% of wheat flour consumed is milled by large scale mills while the remaining 75–80% of flour is by the small milling sector. Given India’s large population, the public health benefits of fortifying industrially produced flour would affect tens of millions of people in that country. So, why not move ahead with such efforts?

Dr. Vasquez-Garibay: You were talking about infants and mentioned the rapid growth rate and low gastric capacity as a limitation for receiving a high nutrient density diet. I didn’t understand what you were trying to say with that because perhaps that high density diet might mean adipose proliferation and obesity, that is the problem now in Mexico. The second point is that the most vulnerable people in Mexico, something like 26 million people, cannot afford to buy fortified foods.

Mr. Parvanta: Let me take the second issue first. Yes, there are people in every country that cannot purchase fortified commercial foods. However, there are also large segments of the population who can purchase such foods and would benefit accordingly. Furthermore, there is a range of incomes among the poor, and they make purchasing choices. For example, I pointed out in my presentation the poor purchase cigarettes which are relatively expensive. Thus, they choose how to spend their limited resources. We, public health and the food industry, need to inform and encourage them to choose to purchase healthier fortified foods instead. With regard to the point about low gastric capacity, fortification of complementary foods would provide a richer diet with regard to micronutrient content without increasing the caloric content of infants’ diets.

Dr. Tolboom: You shared some very stimulating ideas with us and you showed an interesting slide on the recommendation of exclusive breast-feeding. You are quite happy with that but I am still quite worried. I recall an earlier Nestlé Nutrition Workshop. Series [1], in which we looked at the time of introduction of complementary
foods. If you look at Malawi or Zambia you see that children get complementary foods at the age of 2 or 3 months. So I think that the breast-feeding expert committee’s use of terms such as ‘you should’, ‘exclusive’, ‘continue for 6 months’ etc. do not adequately address what actually happens in the field. With your clear intuition for client perspective, I would like you to elaborate a little bit on that.

Mr. Parvanta: I feel exactly as you do that the reality of infant feeding practices in most populations is far different than the expert guidelines on type and length of breast-feeding. By our just focusing public health programs to implement the breast-feeding guidelines and ignoring actual consumer practices, we severely jeopardize infant health and development. While good breast-feeding practices should be promoted, there is an urgent need to improve the vitamin and mineral content of complementary foods, no matter how early such foods are offered to infants. For example, in the late 1960’s a very small proportion of infants in the United States were breastfed. To improve nutritional status of infants, starting in the early 1970’s, use of fortified breast milk substitutes were encouraged by health and nutrition programs, while breast-feeding was also promoted. Over time, breast-feeding rates have improved, but non-breast-fed infants have also been protected from micronutrient deficiencies because of widespread availability of fortified formulas and other baby foods.

Reference
