Maternal & Child Nutrition

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Introduction

Consequences of malnutrition in early life and strategies to improve maternal and child diets through targeted fortified products

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This supplement brings together papers focusing on the critical 1000 days of human development from pregnancy until 2 years of age. It is the third in an annual series first published as a Special Supplement of the Food and Nutrition Bulletin in June 2009. Diets of poor nutritional quality during pregnancy, infancy and early childhood lead to nutrient intakes, which do not meet requirements. This, combined with frequent infections during early childhood, results in deficits in growth (stunting), limited psychosocial development, increased risk of mortality, and reduced learning capacity and productivity later in life among those that survive. Programmes need to prevent these deficits by improving maternal and child nutrient intake in addition to preventing and treating infections.

Over the past 3 years, the community of nutrition scientists and researchers, activists and development practitioners committed to an integrated approach to nutrition programming has grown. This community advocates for a greater focus on maternal, infant and young child nutrition (MIYCN), the application of a lifecycle approach to programming and the breaking down of the barriers between expertise and sectors that limit the scale-up of cost-effective programmes that meet the needs of vulnerable populations on a sustained basis. This MIYCN supplement continues to reflect and contribute to this movement by providing the results of leading-edge research to inform technical consensus, programme design, policy and further research. It discusses the consequences of malnutrition in early life and focuses on programme-related research to improve nutrient intake through breastfeeding, promoting consumption of special formulated fortified foods that fill nutrient gaps or enhance the diets of women and children. It also presents research assessing feeding practices and preferences of caregivers in relation to child feeding and formulated products. An operations research project in China is described that illustrates how these activities were brought together in an integrated programme to improve nutrient intake in young children.

Dewey and Begum (2011) set the stage by summarizing the prevalence, causes and consequences of stunting. One-third of children under 5 years of age in developing countries are stunted, with many children in several regions already stunted at birth. Stunting rates increase during the first 24 months of life with little change thereafter until adolescence, when delayed maturation and an extended growth period result in some compensatory growth (Bosch *et al.* 2008). Thus, rates of stunting are lower in adult women than in young girls, but in some areas (South/Southeast Asia and Latin America) maternal stunting rates can exceed 15%. The process of becoming stunted results in higher mortality, increased risk of chronic diseases in adulthood, lower adult height and permanent cognitive impairments. However, there is encouraging evidence that nutritional interventions in pregnancy and early life can reduce stunting and its negative consequences.

Micronutrient deficiencies are common during pregnancy and studies have attempted to determine the optimal formulation of products fortified with nutrients to address maternal deficiencies and subsequently improve pregnancy outcome. The review conducted by Yang and Huffman (2011) identified vitamin- and mineral-fortified products developed specifically for pregnant and lactating women and examined their impacts on maternal nutritional status and growth, birth outcomes and development of their offspring. They report that the use of micronutrient-fortified beverages and supplementary foods during

pregnancy had positive effects on preventing maternal anaemia and iron deficiency. When consumed during pregnancy, those products containing milk and/or essential fatty acids increased mean birthweight, and a few studies have shown that they also improved birth length and reduced rates of preterm delivery.

Huffman *et al*. (2011) report on the importance of essential fats during pregnancy and early childhood. However, intakes among pregnant and lactating women and young children are often less than required. Increasing intake of foods rich in omega-3 fatty acids is needed, though their availability is often lacking in developing countries and costs of foods that are good sources of omega-3s are frequently high. Products for pregnant and lactating women such as milk fortified with omega-3 fatty acids or lipid-based nutrient products have been shown to have positive impacts, but more research is needed. Improving omega-3 intake in young children through enhanced breastfeeding practices and intake of foods with optimal omega-3 content (including animal products, especially fish, and products made with full fat soy or soy oil) will improve children's omega-3 fatty acid status and may improve growth and development.

Soekarjo and Zehner (2011) illustrate that many countries do not have the legal and policy environment necessary to support exclusive and continued breastfeeding. Using examples from Indonesia, they identify legislative requirements for supporting breastfeeding, including improved information, training, monitoring and enforcement systems for the Code of Marketing of Breastmilk Substitutes as well as policy changes to ensure implementation and monitoring of the Baby Friendly Hospital Initiative. These are needed because in spite of existing laws, there are reports of health centre and retail promotion of infant formula, follow-up formula and complementary foods for infants under 6 months, with little or no public sector action to address these Code violations. They suggest that baby-friendly hospital practices be included within accreditation criteria for hospitals.

They also report on the need to establish a registration category for complementary food supplements (CFS) to enhance availability of high-quality, low-cost fortified products to help improve young child feeding. In addition, guidelines for marketing these products for 6–24 month-olds are needed, so as to promote proper use and not interfere with breastfeeding. Complementary foods and supplements need to be distinguished from breast milk substitutes in legislation and policy guidance.

Pelto and Armar-Klemesu (2011) assess the potential of a commercial complementary food, using traditional market research techniques combined with anthropological methodologies. This focused ethnographic study (FES) was conducted among families with children 6–24 months of age living in a range of conditions, from dense urban neighbourhoods to peri-urban areas in Accra, Ghana. More than half of the children were fed Cerelac®, a commercial, fortified, instant porridge that is sold ready to mix with water or milk. Traditional millet porridges (*koko*) were also very common, but generic or branded commercial, non-instant cereals (Weanimix and Tom Brown) were seldom fed to children. Mothers were aware of the nutritional advantages of milk and the value of adding fish powder, ground roasted peanuts, soy flour, and/or oil to traditional *koko*. However, these ingredients were not usually readily available in the urban and peri-urban neighbourhoods. Mothers' beliefs and practices were aimed at furthering the health, well-being and development of children (i.e. nurturance), and the healthiness of the foods they gave their children was of primary importance.

Convenience was also a major concern for caregivers. Cerelac® was considered the most convenient because packets could be obtained from neighbourhood kiosks quickly and easily with a small cash outlay. Because it is instant, it requires no cooking, which was another major component of convenience. Millet porridge was also considered very convenient because it could be purchased ready-made from a *koko* seller. Caregivers had to balance these two important concerns (nurturance, as reflected in the healthiness of the food and convenience) with cost. Mothers often fed low-cost, traditional porridges because of cost concerns, but when they did so, they felt they were not giving their children the best foods for their health. Thus, finding a lower cost alternative

to Cerelac®, that is instant and fortified at higher levels (so as to meet more of the child's needs through fewer servings per day) would be important for caregivers. Alternatively, a CFS that could be used to fortify the traditional porridge would also provide an important choice for caregivers.

The FES tool used by Pelto and Armar-Klemesu (2011) and has now also been adapted and used to assess the potential for marketing complementary foods and supplements in South Africa, Philippines and Afghanistan.

A different type of formative data collection was conducted by Tripp *et al*. (2011) in Niger, where they assessed the acceptability of a multiple micronutrient powder (Sprinkles®) and lipid-based nutrient supplement (Nutributter®) among rural and urban families. Focus group discussions were held among mothers, fathers and grandmothers of children 6–23 months of age, and 80 mothers who participated in a home study were interviewed about their views on these two products. Nutributter® was the preferred product, although both Sprinkles® and Nutributter® were well accepted by children 6–23 months of age. Caregivers reported a willingness to pay for both products, agreeing to pay higher amounts for Nutributter®. Although most mothers had intended to mix the Nutributter® into the child's food (*boule*), more mothers ended up giving the Nutributter® directly because their children preferred to eat it that way, there was less waste when the child did not finish the *boule*, and it was easier for mothers since the child could feed him/her self.

As new CFS are developed locally, there is a need to interpret international guidelines on nutrient requirements to determine actual amounts of nutrients to include in products. The iron absorption rate from sodium iron ethylenediaminetetraacetate (NaFeEDTA) is about two to three times greater than that from either ferrous fumarate or ferrous sulfate in diets high in phytate, which are common in developing countries. NaFeEDTA is also highly effective and has few organoleptic problems. However, EDTA should not be consumed in excessive levels and Food and Agriculture Organization/World Health Organization have established an acceptable daily intake (ADI) for EDTA. The paper by Yang, Siekmann and Schofield (2011) explores one way of determining how much NaFeEDTA should be included in a product so as not to exceed the ADI for EDTA.

Because the ADI for EDTA is given per kilogram body weight, the actual amount of NaFeEDTA to include in a CFS serving children of different ages needs to be decided upon. Yang, Siekmann and Schofield explore this issue by using the distribution of weights of children based on different prevalences of malnutrition. The clarification of how such levels can be determined is important so that others can understand the reasoning behind levels of nutrients in products.

Calculations were conducted using the reference of 6–8-month-old infants, because they would be at highest risk of consuming levels of EDTA above the ADI because of their lower weights than older children. If 2 mg NaFeEDTA were to be given to 6–8-month-old infants, the percentage exceeding the ADI for EDTA would be <10% for populations with <30% of children who are underweight. However, if 2.5 mg iron were given in NaFeEDTA form to all 6–8-month-old infants, 30–64% of infants would be above the ADI for EDTA. Such quantification of the risks of different doses of nutrients is useful for setting policies and developing standards for products.

A public–private partnership that brings together many of the issues discussed in the preceding papers was implemented in Shan'xi province, in the north of China (Sun *et al*. 2011). A CFS (*Ying Yang Bao*-YYB) made from full-fat soy powder and fortified with multiple micronutrients (including NAFeEDTA) was produced and marketed by a private sector company. Social marketing materials were developed by the China Center for Disease Control (CDC) and the Capital Pediatrics Institute who worked with health centres to train staff on the importance of continued breastfeeding and use of YYB to improve child nutrition. Because there had been no category for a CFS needed to market the product, China CDC worked with the National Standardization Administration to develop and get approval for a CFS standard, the first ever. This standard is shown in their paper, and can serve as an example as other countries develop regulations for local products. In the end-line survey, more than half (60%) of caregivers knew about YYB and of

those, 23% had ever purchased it (13.5% of all caregivers). More than 95% of the target children consumed the product at least three times per week. The risk of anaemia was greatly reduced among those children compared with those in families that did not purchase the product. The prevalence of early initiation of breastfeeding, minimal dietary diversity, minimal acceptable diet and consumption of iron-rich food improved significantly following the intervention. However, the authors emphasize that investments in demand creation need significant time and effort, and marketing needs to be harmonized with Behaviour Change Communication.

Dewey and Mayers (2011) illustrate the negative impact of infections on child growth. Of major concern are diarrhoeal and respiratory infections, as well as subclinical infections, especially environmental enteropathy. They conclude that interventions that combine improved nutrition with prevention and control of infections are likely to be most effective for enhancing child growth and development. Promotion of breastfeeding has the dual benefit of reducing infection and improving nutrition. Use of instant or ready-to-use fortified complementary foods or supplements (such as lipid-based nutrient supplements) can reduce the risk of infection because they can be easily prepared prior to serving, reducing the likelihood of contamination when refrigeration is not available. Feeding during and after illness can help to sustain adequate nutrient intake and promote catch-up growth. Programmes that combine nutrition objectives with the other components required for prevention and control of infections (e.g. water quality, sanitation, malaria control) are also needed.

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Conflict of interest

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