The Challenges of Promoting Optimal Infant Growth

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Safe and adequate complementary feeding of breastfed infants is well recognized as a critical factor in preventing child malnutrition. In disadvantaged populations, growth faltering is most evident in the first year of life, and is often accompanied by micronutrient deficiencies and high rates of infection. After two years of age, it is very difficult to reverse the growth stunting that has occurred earlier. Thus, it is essential to identify interventions that are effective in promoting optimal growth and development in early life.

Several recent documents have prompted greater attention to complementary feeding (1–3), and there is intense interest among policy makers in implementing effective programs. Unfortunately, there have been very few well-designed intervention trials to evaluate the efficacy and effectiveness of various strategies for improving complementary feeding. As a result, the scientific base for advising policy makers is much thinner than desirable. The few studies available indicate that it is certainly possible to improve feeding practices, but the impact on growth and other functional outcomes has been mixed. For example, among 10 efficacy trials in which an enhanced or fortified complementary food was provided free of charge to infants of various ages, only three demonstrated an increase in linear growth (3). There are many possible reasons for the lack of impact in the other trials, such as targeting the intervention too early (e.g., before 6 mo) or too late (e.g., after 12 mo); methodological limitations such as small sample size, short duration of the intervention, or attrition bias; and constraints on growth response due to infections, prenatal “programming” or other factors.

In this context, the intervention study conducted by Bhandari et al. (4) in an urban slum in India makes an especially important contribution. The researchers used a strong experimental design: a randomized controlled trial that evaluated the effects of providing a micronutrient-fortified complementary food (with nutritional counseling) or nutritional counseling alone. The fortified food provided a reasonable increase in micronutrient density. Moreover, in both intervention and control groups, nutritional counseling provided a modest increase in energy density of complementary foods, rather than on micronutrient density. Use of the fortified food, and careful frequent assessments of growth and morbidity. In the food supplementation group, packets of the fortified food were delivered to the home twice a week and the mother was instructed to mix the instant powder with boiled water.

The researchers report a modest increase in weight gain (250 g over 8 mo) in the food supplementation group, but no significant effect on length gain, and no growth impact of nutritional counseling alone. The weight gain difference in the food supplementation group was almost entirely attributable to differences between 6 and 9 mo, with no significant difference among groups in the earlier (4 to 6 mo) or later (9 to 12 mo) age intervals. Compared to expected growth rates of breastfed infants at these ages (5), weight and length gain of these Indian infants was normal between 4 and 6 mo, but fell below normal subsequently. The overall average “deficit” in weight gain between 4 and 12 mo was about 800 g in the control group. Thus, the fortified food resulted in making up about a third of this deficit.

The effects of food supplementation on breastfeeding, as well as some of the morbidity outcomes, were disconcerting. In the food supplementation group, breastfeeding frequency was significantly lower at 6 and 9 mo (by 1–2 feeds per day), and fewer infants were still being breastfed at 12 mo in comparison with the visitation group (84 vs 97%). Despite the advice to use boiled water, the prevalence rate of dysentery was twice as high in the food supplementation group and the prevalence of fever was increased by 44%. The authors speculate that the relatively small effect on weight gain, and the lack of impact on length gain, could be partially due to the adverse effects of this intervention on breastfeeding and morbidity.

What are the lessons to be learned from this study? The authors conclude that the infants’ energy intake from complementary foods may still have been lower than desirable, even in the food supplementation group, and suggest that there are barriers related to the amount of food offered by caregivers that need to be overcome. While this may be part of the explanation, there are other potential constraints on intake and growth that may be at least as important. First, restrictions on infant appetite due to micronutrient deficiencies or illness may play a major role. It is well known that zinc deficiency depresses appetite, and the same may be true for other nutrient deficiencies. Although the fortified food provided a reasonable amount of zinc compared to estimated needs at this age (1), its bioavailability is uncertain. In the nutrition counseling group, the emphasis appears to have been on feeding frequency, portion size and energy density of complementary foods, rather than on micronutrient density. Moreover, in both interven-
tion groups it is likely that many infants were of low birth weight and thus may have had low hepatic stores of zinc at birth (6), which increases the vulnerability to zinc deficiency. Other micronutrients may also have been in short supply: based on the median reported intake of the fortified food (940 kJ/d) and assumed values for breast milk content (1,7), the infants in the food supplementation group received adequate amounts of vitamin A, riboflavin and calcium, but insufficient vitamin B-6, phosphorus and iron to meet their needs. Deficiencies of any of these three nutrients could be linked to poor appetite. Suppression of appetite during illness, particularly for solid foods (though not for breast milk), is also well documented (8). In infant feeding studies it is useful to observe complementary food intake over a 12-h period, to determine whether the infants are consuming all of the food offered, or are leaving a substantial portion of food unconsumed. In the latter situation, it may be that the caregiver is offering plenty of food, but the child's appetite is impaired. The educational and programmatic implications are very different if this is a common scenario.

Second, the growth response to the fortified food may have been constrained by prenatal “programming” or intergenerational effects of maternal stunting. According to the baseline data, 25% of the infants were already stunted at 4 mo of age, a large proportion of which was presumably due to intrauterine growth retardation (IUGR). Infants who experience IUGR usually never completely catch-up in size to their normal birth weight peers (9), even when raised under optimal conditions. The lack of growth response to the intervention at 9–12 mo of age in the Indian infants is consistent with other reports documenting growth faltering at that age in disadvantaged populations, even when they are provided with adequate complementary foods (10). Thus, researchers and planners must be realistic about the magnitude of any improvement in growth expected from postnatal interventions alone. It is likely that a combination of prenatal and postnatal approaches is the most effective strategy.

The study by Bhandari et al. also provides information relevant to the appropriate age for introduction of complementary foods, which has recently received considerable attention (11). Evidence from two randomized intervention studies in Honduras indicates no growth advantage of introducing complementary foods at 4 mo, compared to exclusive breastfeeding for 6 mo (12,13), but there have been no other randomized trials in other parts of the world. Although the Indian study was not designed to directly address this question (which would require a control group who was exclusively breastfed for six months), the data are nonetheless informative because the “visitation” group received very little energy from nonbreast milk sources prior to six months (a median of only 192 kJ/d at 6 mo). Despite the fact that the food supplementation group received far more energy from complementary foods (1111 kJ/d at 6 mo), their average weight and length gains from 4 to 6 mo were identical to those of the visitation group (0.97 kg and 4.1 cm). These results, plus the observation that the growth rates of these infants at 4–6 mo were at or above expected values for breastfed infants (5), suggest that near-exclusive breastfeeding for six months is compatible with normal growth even in a population in which maternal malnutrition is prevalent.

In conclusion, the results of the intervention trial reported by Bhandari et al. illustrate the need to better understand the etiology of infant growth faltering. In particular, researchers and program planners need to pay special attention to the potential impact of complementary food interventions on rates of breastfeeding and the prevalence of illness, and not assume that merely increasing complementary food intake will have the desired impact. This is one situation in which “more” is not necessarily “better,” because of the tradeoff between intake of complementary foods and intake of breast milk. Planners sometimes justify providing more than needed, to allow for individual variability and the possibility of catch-up growth, but in so doing they must recognize that there are risks associated with “overshooting.” Comprehensive approaches that address the full range of prenatal and postnatal influences on growth are needed to reduce the rates of stunting in malnourished populations.

LITERATURE CITED