Breastfeeding and Complementary Feeding of Children up to 2 Years of Age

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Abstract
Appropriate breastfeeding and complementary feeding practices are fundamental to children’s nutrition, health, and survival during the first 2 years of life. The World Health Organization recommends exclusive breastfeeding until 6 months of age and continued breastfeeding for at least 2 years, along with the timely introduction of adequate amounts of complementary foods of suitable nutritional and microbiological quality. The amounts of energy and micronutrients required from complementary foods have been estimated as the difference between the total physiological requirements of these food components and the amounts transferred to the child in breast milk. Recommendations for the energy density of complementary foods and their frequency of feeding have also been proposed. Intakes of several micronutrients, including iron, zinc, calcium, selected B vitamins and (in some settings) vitamin A, remain problematic because commonly available, low-cost foods contain inadequate amounts of these nutrients to provide the shortfall in breast milk. Alternative strategies to provide these nutrients include adding animal source foods to the diet, providing fortified, processed complementary foods, administering micronutrient supplements, or offering some combination of these approaches. Advantages, disadvantages, and possible risks of these different strategies are discussed.

Introduction
The first 2 years of life represent an especially challenging period for children’s nutrition and health because their relatively high metabolic rates and rapid rates of growth during this period impose proportionately greater nutrient requirements. Moreover, the immaturity of young children’s gastrointestinal tract, neuromuscular coordination, and immunological function limits the types of foods that they are able to consume and exposes them to an elevated
risk of food-borne infections and food allergies. For these reasons, recommendations on optimal child feeding must take into consideration the children’s age-specific physiological requirements for essential nutrients, the appropriate food (or other) sources of these nutrients, and proper methods for preparing and feeding these foods. The World Health Organization (WHO) currently recommends that, “…infants should be exclusively breastfed during the first six months of life. Thereafter they should receive nutritionally adequate and safe complementary foods while breastfeeding continues up to two years of age and beyond’ [1]. The evidence base for these recommendations will be discussed briefly below.

For this review, the definitions of infant feeding practices proposed by the WHO will be applied [2]. In particular, ‘exclusive breastfeeding’ is defined as the consumption of no other food or liquids except breast milk and small amounts of medicines or vitamin-mineral supplements for at least 4 and if possible the first 6 months of life. The term ‘predominant breastfeeding’ is applied when the infant’s major source of nourishment is breast milk, but water and water-based drinks, such as flavored water, teas, and herbal infusions, or fruit juices are also consumed. Complementary feeding refers to the consumption of both breast milk and other foods, usually during the period from 6 to ~24 months of age, until the child ceases to nurse at the breast and is able to consume the same foods as the rest of the family.

The physiological requirements for nutrients do not differ for children in lower income countries and economically more developed ones. Thus, recommendations for infant and young child feeding should be similar in each setting. Nevertheless, proper feeding of infants in resource-poor settings is often more challenging because of limited access to high-quality, nutrient-rich foods, inadequate environmental sanitation, and lack of clean sources of water and proper facilities for food preparation and storage. Thus, recommendations for appropriate breastfeeding practices assume even greater importance for infants raised in these circumstances. Although the appearance of HIV infection in some of these same countries has complicated infant feeding recommendations, standard guidelines still apply for the vast majority of infants worldwide, so these general recommendations will be the focus of the present paper.

A complete discussion of all aspects of breastfeeding and complementary feeding is beyond the scope of this review. Several excellent general texts are available on breastfeeding [3] and complementary feeding [4]. Thus, this presentation will focus on just a few of the most salient issues regarding feeding recommendations, with a primary focus on infants and young children in lower income settings. In particular, information will be presented on: (1) the optimal duration of exclusive breastfeeding, (2) energy and nutrient requirements from complementary foods, and (3) available strategies for satisfying the micronutrient needs of young children during the vulnerable period of complementary feeding.
Appropriate Duration of Exclusive Breastfeeding

Exclusive breastfeeding during the first months of life is associated with reduced rates of diarrhea and other infections [5, 6], and a multicenter study by WHO in Brazil, Pakistan and the Philippines indicated that both exclusive and predominant breastfeeding are associated with reduced infant mortality [7]. The pooled odds ratios of mortality associated with nonbreastfeeding declined progressively with increasing infant age, ranging from 5.8 (95% CI 3.4–9.8) during the first 2 months of life and 4.1 (2.7–6.4) for 2- to 3-month-olds to 1.4 (0.8–2.6) for 9- to 11-month-olds.

Current recommendations for the duration of exclusive breastfeeding are based on a systematic review of intervention trials and observational studies carried out in both lower income and more affluent countries, which assessed the rates of growth of infants who were breastfed exclusively for 6 months versus those who were partially breastfed or nonbreastfed, as well as their respective rates of infections [8]. Two of the three available controlled intervention trials were conducted in a lower income country, Honduras. In the first of these studies, infants were randomly assigned to one of three feeding regimens: (1) exclusive breastfeeding until 6 months of age, (2) exclusive breastfeeding until 4 months of age at which time high-quality, packaged complementary foods were started and breastfeeding was continued ad libitum, or (3) exclusive breastfeeding until 4 months at which time complementary feeding was initiated as above along with explicit encouragement to maintain breastfeeding frequency [9]. There were no significant differences in the children’s total energy intakes despite the additional energy provided by complementary foods, and there were no differences in their growth velocities from 4 to 6 months. The authors concluded that there was no advantage of introducing complementary foods before 6 months, whereas there may be considerable risks of inadequate nutrient intakes and food-borne infections if the nutritional and hygienic quality of the foods cannot be assured. The second Honduras study yielded similar conclusions, even though all infants enrolled weighed less than 2,500 g at birth [10].

In another large trial conducted in Belarus, more than 17,000 newborns were randomly assigned by clinic to receive an intervention designed to promote appropriate breastfeeding practices. Infants in the intervention group were significantly more likely to be breastfed exclusively at 3 months of age (43.3 vs. 6.4%), and they had a significantly lower occurrence of one or more episodes of diarrhea (9.1 vs. 13.2%) and atopic eczema (3.3 vs. 6.3%) [11]. Based on these intervention trials and other published observational studies, the aforementioned WHO review concluded that, ‘the available evidence demonstrates no apparent risk in recommending, as public health policy, exclusive breastfeeding in both developing and developed country settings’ [8].
Energy and Nutrient Requirements from Complementary Foods

Estimates of the amounts of energy and nutrients required from complementary foods have been derived by subtracting the mean amounts provided by breast milk to children of different ages from their estimated total requirements [4]. These estimates were recently revised [12], using updated information on infant energy requirements obtained from direct measures of energy expenditure and physical growth, including body composition [13]. According to these updated estimates, the average amounts of energy required from complementary foods are approximately 200, 300 and 550 kcal/day for infants 6–8, 9–11, and 12–23 months of age, respectively.

Similar calculations of the amounts of specific nutrients required from complementary foods are complicated by the fact that existing sets of estimates of nutrient requirements are not always consistent. Moreover, in many cases these estimates are simply extrapolated from older age groups or derived from observations of presumably adequate intakes by apparently healthy children rather than from direct measurements of physiological requirements [12]. These issues have been described elsewhere in more detail, along with their implications for estimating the nutrient requirements from complementary foods [12]. Focused research on the nutrient requirements of young children remains a pressing need.

Energy Density and Frequency of Feeding Complementary Foods

To formulate adequate complementary feeding regimens to satisfy young children's total energy requirements, both the frequency of feeding and the energy density of complementary foods must be taken into consideration. When more meals are provided each day, the complementary foods can be prepared with lower energy density and vice versa. Empirical data from several studies indicate that both factors contribute independently to total daily energy intakes, as illustrated in figure 1 [14]. Using these empirical data, the minimum adequate energy density has been estimated for children of several age groups considering different possible levels of feeding frequency (table 1), using assumptions described previously in more detail [4, 12]. It should be noted, however, that most of the available information on young children's food intakes used for these estimates was collected from nonbreastfed children, so additional data are still needed from those who are continuing to nurse at the breast.

It is conceivable, for example, that overzealous feeding (i.e., excessive feeding frequency or energy density of complementary foods) may inadvertently displace breast milk or contribute to undesirably high energy intakes.
Indeed, several recent studies have found that increasing the energy density of complementary foods had a negative impact on breast milk intake, although the effects on total daily energy intakes were inconsistent [15, 16]. In one study, total energy intake was increased when the density of complementary foods was raised from 0.5 to 1.5 kcal/g [15], despite minor reductions in breast milk intake. However, no such effect on total energy intake was

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**Table 1.** Revised estimates of the minimum energy density of complementary foods (kcal/g prepared foods) that is necessary to ensure adequate energy intakes from complementary foods by children of different age groups according to the number of meals served per day

<table>
<thead>
<tr>
<th>Number of meals/day</th>
<th>Age group</th>
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<tbody>
<tr>
<td></td>
<td>6–8 months</td>
</tr>
<tr>
<td>2</td>
<td>0.71</td>
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<tr>
<td>3</td>
<td>0.48</td>
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<td>4</td>
<td>0.36</td>
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<td>5</td>
<td>0.29</td>
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Analysis assumes average level of breast milk intake and total energy requirements as estimated by FAO, 2004 [34]. Assumed functional gastric capacity (30 g/kg reference body weight) is 249 g/meal at 6–8 months, 285 g/meal at 9–11 months, and 345 g/meal at 12–23 months [see 3, 11 for more details].

**Fig. 1.** Effects of dietary energy density and frequency of feeding on total daily energy intakes by young children recovering from severe malnutrition [reprinted from 14 with permission from the *American Journal of Clinical Nutrition*].
noted in another study when energy density was boosted by from 0.20 to 0.55 kcal/g by adding oil to a cereal-legume mixture [16]. The different outcomes of these two studies may be due to the distinct ranges of energy density that were used or the fact that the latter study provided each diet for 1 day only, so it is possible that the children had not yet reached a constant level of intake. Additional studies with a greater number of permutations of energy density and feeding frequency are currently in progress to address these issues.

**Problem Micronutrients and Strategies to Provide Adequate Micronutrients**

As indicated above, the nutrient requirements from complementary foods can be estimated as the difference between the total theoretical nutrient requirements and the amounts of these nutrients transferred in breast milk. Despite the difficulties imposed by the lack of harmonization of current estimates of young children's nutrient requirements, as published by different international groups of experts, we have attempted to identify specific ‘problem nutrients’ by comparing the observed nutrient intakes from complementary foods in different low-income settings with the range of currently estimated requirements [12, 17]. We defined ‘problem nutrients’ as those for which there is the greatest discrepancy between their content in complementary foods and the estimated requirements for young children. These analyses indicate that iron, zinc, calcium, selected B vitamins and occasionally vitamin A are often present in limited amounts in home-available complementary foods relative to the requirements for these nutrients. Other investigators have arrived at similar conclusions, using somewhat different approaches to estimate current dietary intakes [18].

Available strategies to supply these problem nutrients include promotion of greater consumption of animal source foods or other nutrient-rich food sources of these nutrients, provision of fortified complementary foods, or delivery of additional nutrients through home-based fortification or micronutrient supplementation. An analytic approach for identifying local foods that can be used to fulfill the nutrient shortfalls has been described recently [19]. This method utilizes information on dietary intake and local food prices to model potential nutrient intakes at particular costs, using linear programming.

Incorporating animal source foods, such as animal flesh and organs, eggs, fish, and dairy products, is often the only way to supply the aforementioned problem nutrients through local foods. However, these foods may be available in very limited amounts in the poorest countries [17], and their relatively high cost frequently makes them inaccessible to poorer households. Moreover, religious proscriptions or cultural taboos may further restrict their use in some societies. On the other hand, a recent study in the US demonstrated the
feasibility of including meat in the feeding regimens of young infants [20], and another study carried out in slum communities in Peru found that, following an intensive educational campaign, poor households were able to increase children’s consumption of animal source foods. Moreover, the linear growth of children in the intervention communities in Peru was significantly greater than in the control areas, reducing rates of stunting by two thirds at 12 months [21]. Thus, it may be possible to increase children’s consumption of these foods in some settings, by using appropriately targeted educational interventions.

Distribution of processed, fortified complementary foods, either through public sector programs or commercial channels, offers an alternative food-based approach to supply problem nutrients [22]. Although such foods can successfully cover current nutrient shortfalls of the home diet, the rapid changes in young children’s nutrient requirements during the period of complementary feeding make it difficult to design a single product that meets the nutrient needs of all children in this age range without imposing the risk of excessive intakes by some children [23]. Moreover, the impact of these foods on children’s growth has been inconsistent, possibly related to the timing, amount, and composition of these foods, as well as the underlying nutritional status of the study populations [24–26]. Despite the inconsistent growth responses observed in these earlier studies, several recent studies have found positive effects on iron status and/or developmental milestones among children who received these products [27–29].

Addition of micronutrients to current feeding regimens, either through home-based fortification or direct child supplementation, offers a lower-cost strategy than providing a processed, nutritionally complete complementary food. Home-based fortification involves the addition of a prepackaged micronutrient supplement to the child’s food once daily at the time of serving. One such formulation, ‘Sprinkles’, which contains iron as microencapsulated ferrous fumarate (to avoid adverse organoleptic effects of iron on the food), and vitamins A and D, folic acid, ascorbic acid, and zinc, has been shown to reduce rates anemia among consumers, although evidence of its positive impact on other indicators of micronutrient status and growth is still lacking [30].

Micronutrient supplements may be supplied as liquid formulations; chewable, crushable, or dispersible tablets [31], or fat-based food pastes [32]. A complete review of these products and related issues is beyond the scope of the present publication. Nevertheless, each of these formulations has been found to yield positive impacts on selected indicators of micronutrient status, depending on the specific formulation, the preexisting nutritional status of the target population and the presence of conditions that may interfere with nutrient absorption or utilization, but there is only limited evidence of any positive effects of these products on child growth. A recent study compared the effects of Sprinkles, ‘Nutritabs’ (crushable multiple micronutrient tablets), and ‘Nutributter’ (a micronutrient-enriched peanut butter mixture) in Ghanaian children [33]. Each type of the supplements was well accepted,
and there were no differences in adherence to treatment by intervention group. After 6 months of study, children in the three supplementation groups had greater concentrations of serum ferritin and lower concentrations of transferrin receptors than those in the nonintervention group. Children who received Nutributter had greater final weight-for-age and length-for-age Z scores compared with the other two intervention groups and the control group. Thus, all three products enhanced iron status, but only Nutributter increased the infants’ growth. Additional research is still required to define optimal dosing regimens of multiple micronutrient formulations added to complementary foods, interactions among nutrients in the various preparations, and any possible adverse effects on child growth and other health outcomes in particular settings.

**Conclusions**

Important advances in knowledge have been achieved in recent years with regard to the multiple advantages of exclusive breastfeeding during the early months of life, the optimal timing of introduction of complementary foods, and the appropriate energy density, feeding frequency and micronutrient composition of these foods. However, adequate understanding of the effects of different complementary feeding regimens on breast milk intakes and the ultimate duration of breastfeeding is still lacking. Likewise, more information is needed on the ideal micronutrient composition of fortified complementary foods and the impact of alternative micronutrient delivery systems on young children’s nutritional status, physical growth, and neurobehavioral development.

**References**

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Discussion

Dr. Haschke: With regard to energy density, where you showed that it is of importance in terms of changing the amount of breast milk which is consumed. Can we now move to a recommendation or is it too early? How can it be started at 6 months, at which energy density, and then how can the energy density be increased? Secondly, with regard to your studies in Peru and Guatemala, you said that the amount of cereals consumed was very low; it was higher in the intervention studies than in the two studies. But isn't that also an effect of just being observational and not intervention. Did these infants grow normally or did they show growth faltering?

Dr. Brown: Munirul Islam, a who is based at the ICDDR, the International Center for Diarrheal Disease Research in Bangladesh, is the person who actually carried out the pilot study. He has just finished a follow-on study which has a number of different permutations of feeding frequency, (3, 4 or 5 servings/day) and energy density (0.5 to 1.5 kcal/g). I don't think we have enough information yet to make formal recommendations. I just showed this information to alert us that we can go too far by promoting either overly dense complementary food or feeding more frequently than desirable, which might have adverse effects on breast milk intake. In terms of the age specificity question, there is no information that I am aware of. In the Bangladesh study the children were 8–12 months of age, but they weren't stratified so as to have a sufficient sample to look at whether there are differences in the different age groups. The second question with regard to what would happen if these children actually received food either through a government program or some sort of subsidy. Would they consume more of these cereal-based fortified foods? Undoubtedly, yes, because that is what we saw. We could double the level of energy intake from cereal-based complementary food by providing these foods free to each household. We provided a plastic sac, 250 g dry weight, once a week, which translates to just a little over 30 g dry weight/day. Based on earlier studies we did, we assumed that children would actually consume about 20 g/day; in fact they actually consumed about 23 g/day. So either they can't consume more or the food is being used for other purposes. I can't tell you exactly why, but we couldn't boost the intake beyond that, even though we were giving more than what was actually consumed. I am sure that it is very culture specific,
depending on what the usual feeding practices are. In Peru, for example, mothers are giving milk in addition to breast milk, so that is another source of energy. Other milks are probably the largest non-breast milk source of energy. They often start complementary foods with soups and may pick out certain items from the soup and make a dish specifically for the child. So, even when we give fortified complementary foods to the households, the mothers are still feeding all these other things.

*Dr. Haschke:* And their growth?

*Dr. Brown:* These children remained stunted; the final prevalence of stunting was 18%. These were children who were initially selected for being at risk of stunting. Their initial Z score at 6 months of age was less than \(-0.5\); so it was a selected group. But we did not see any impact of the zinc intervention. I can't say whether or not porridge had an impact because all the groups were given porridge, although it was fortified in different ways in the different groups.

*Dr. Giovannini:* I perfectly agree that the problem of nutritional tradition is very important for complementary food but I have some concerns about the use of chicken livers. We are involved in a nutritional study in Cambodia, and I don't think it is good practice to suggest liver in child nutrition, especially in this country where hygienic conditions are bad. Moreover, in Western countries the use of liver is no longer allowed following the BSE outbreak, and chicken, as we know, is full of salmonella and bacteria.

*Dr. Brown:* Those are very important considerations. In Peru, chicken liver is surprisingly commonly fed to young children. At least in the communities where I worked in Peru, it is generally viewed as a good thing to feed the children. We found in earlier studies that the use of chicken liver, and controlling for other components in the diet, was associated with increased growth of the children. So at least from a nutritional perspective it seems like a good thing to do. From a microbiologic perspective there is much less concern because it is always boiled in soup, so I don't think we have a problem here. My major concern would be more from a toxicological perspective, and unfortunately I have no information to present. In Peru there is a very well-developed poultry industry, so the chickens are generally raised in closed conditions, at least along the coast of Peru, and marketed through formal markets. But this doesn't really answer your question. I don't know that anybody has done a formal study on possible heavy metal contamination of chicken liver, and this would be worth knowing. It is something that is being used locally and is appreciated by mothers as a valuable component to diet. The only reason it is not used more widely is because not everybody can afford it.

*Dr. Fisberg:* Sometimes it is very easy to obtain zinc and iron levels over the upper limits, especially in fortified food. In spite of that how do they behave in clinical data? How do they behave when reaching low zinc plasma levels or low anemia or lowering anemia?

*Dr. Brown:* This is a very important question. I should reemphasize that these results that I presented are all simulations; we have no evidence of any true adverse effect of delivering nutrients at levels greater than the upper level. So we are simply bound by what the current published recommended intakes are. As I said we rely mostly on the dietary reference intakes (DRI) for the upper level that I referred to. There are several caveats; for most minerals the US DRI don't take bioavailability into consideration. I think we could probably go much higher, safely. But I can't ignore the DRI, so we do the analysis using the existing recommendations. The second issue is that in many cases the upper levels are simply extrapolated from adults, there is no empirical information from children to establish the upper levels correctly. The third thing, at least in the case of zinc which I have looked at much more closely, the upper level is just too low for children. Over months we have continuously supplemented children at levels 50% greater than the upper limit without any evidence of adverse effects. We are presently trying to put the literature together to try to make the case that, at
least for zinc, the upper level for young children is probably set too low, Dr. Krebs, would you like to comment on that?

**Dr. Krebs:** There is a general agreement that the upper limit is too low for young children. In fact the procedure that was to be used to establish these limits was not actually followed to completion for the young children. Once they had come up with this proposed level, they did not go back to compare the actual and common intakes, and had they done that they would have seen that there are many children with much higher intakes with no apparent problems.

**Dr. Brown:** Let me just mention that we have looked at the US data published by the US Department of Agriculture, a continuing survey of food intake by individuals. We found that in the US more than 90% of infants consume more than the upper level for zinc although that percent decreases with age. But even among older children, 30–40% are still consuming usual zinc intakes greater than the upper level.

**Dr. Solomons:** I would like to return to the Shrimpton slide. How can we use it to frame the entire discussion for the week? That is to say, is the notion that all regions of the world actually assume the zero, because in fact after they get to 15 months they run parallel to that. So does this period represent some sort of adaptation or is it desirable that all the world be on the NCHS curve channels forever? I would also ask, is it complementary feeding alone or are other environmental-related issues important to correct the abnormality that Dr. Shrimpton showed on the slide?

**Dr. Brown:** For the first question let me refer to what was recently published by the WHO as a new international reference database for assessing growth. This growth chart was put together using what they called prescriptive selection of children, that is children were enrolled in the study because they were adhering to recommended infant feeding practices. They were predominantly breastfed at least until 4 months of age and continued breastfeeding until 12 months of age. They were all selected from communities in which their environmental circumstances, should not have limited their growth, and they were selected to represent all of the world's population, so 6 geographically distinct countries were included. These statistics are published on the internet. Although some of the distributions of the new WHO growth standards differ from those for the earlier CDC WHO reference data, the median values of the new standards are generally similar to those of the prior CDC/WHO data. So at least among individuals who were adhering to the recommended feeding practices, this is the expected growth pattern. Now could you do better in terms of certain functional outcomes by adhering to some other growth pattern? I don't know the answer to that. I think the other aspect that you are probably implying is the issue of to what extent does intrauterine nutrition, or perhaps genetic factors, also program postnatal growth. I imagine that it is something that we will get to later in this conference.

**Dr. Solomons:** So wherever we put the new zero line projected by the WHO, I assume it is your notion that the world as a whole, by region, should mimic it.

**Dr. Brown:** My notion is that if children adhere to recommended feeding practices and don't have the environmental circumstances that we think of as being adverse, i.e. contaminated environment, infections, they will follow that zero line.

**Dr. Simell:** Two questions related to the simulation models which were highly interesting. The first one concerns the assumption that the distribution is normal in the consumption of these nutrients. Do you have any evidence that this is true, especially when we are talking about energy intake for instance? The second question is related to how you handle the child who is expected to be a passive recipient of a nutrient, but factors like satiety and differences in intake affect this. Have you taken this into consideration here? The child is not just a passive recipient of nutrients, the satiety feeling is an important factor in the amount of nutrients consumed.

**Dr. Brown:** I could talk for another hour just on how the simulations were done. The issue of distribution of intakes depends on the nutrients. In many cases these are
nonsymmetrical distributions, and to do the simulations, transformation is needed to try to adjust for that, and we’ve taken that into account. It is actually even more complicated because what you would like to model is the usual intake of a nutrient and the usual intake of the food that you are trying to fortify, and these are two independent distributions. It simply cannot be done. What we have done is to look at the distribution intakes on given days rather than usual intakes. Then those graphs are superimposed and we find that for most nutrients the 2.5 percentile of usual intake crosses about the 10 to 15th percentile of intake on a given day. I always used the 10th percentile for my cutoffs in establishing inadequate intake relative to the estimated average requirement and excessive intake relative to the upper limit. This work can certainly be refined; this was something we did fairly quickly because we wanted to be able to talk about these points in this setting. The critical take away message here is that it is very difficult to decide what the right level to fortify these foods is, and it may well be age-specific and it may well be country-specific. It is a difficult problem to solve.

The second question: children determine what they are eating and we are very much aware of that. In the studies that I described with regard to energy density, the protocol is one that we worked on over years and it has certain aspects which I think are very important. One, we always try to mask the diets so that if you look at them physically, smell them, even taste them, for the most part they can’t be distinguished. We add flavoring and ingredients to all of them so that they are masked, and we try to make them as similar to adult test panels without adding anything that we think might independently affect consumption. The second is that we have a very rigorous feeding protocol in which a nursing aide does the feeding. She would get a coded bowl for the child with an amount of food that was far in excess of what the child could possibly eat. The instructions were to fill the spoon, put the fluid in the child’s mouth, let the child swallow that, and when the child has swallowed, repeat the process and offer it again until the child shows some indication of not wanting anymore. At that point they wait 60 s and then start again: they offer another spoon, and continue the feeding until the child refuses again, then they wait another 60 s, try a third time, and after that third attempt and third refusal, the meal is considered completed. So all these studies are done using this very standardized feeding protocol to try to control for all those child-specific factors. There are some fascinating things that we have never published in terms of the duration of meals. The children seem to have a certain duration regarding how long they want to eat. When you change the energy density of the food the children eat more rapidly. They swallow the food and are ready for a new spoon faster, but the total duration of a meal doesn’t change. So what changes with lowering density is eating velocity, not how long the meal lasts. We also found that if we control for a nursing aide that explains a small but significant part of the variability; some aides feed more rapidly or more than others. So there are a lot of factors that need to be controlled in doing these kinds of studies.

*Dr. Leone:* You showed the evolution of weight for age Z scores and length for age. Do you have data about the evolution of the body mass index in the complementary feeding groups?

*Dr. Brown:* We have some data, but I don’t have the information with me.