



Delayed Introduction of Solid Foods to Infants: Not So Fast!

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Nearly every pediatrician agrees that “breast is best” for infant feeding throughout the first year of life. Unfortunately, quite a divergence exists between our expectations and the realities of infant feeding in daily practice. The Centers for Disease Control and Prevention (CDC) reported that in 2007, overall, nearly 25% of infants had never been breast-fed, and only 44% were still receiving some breast milk at age 6 months.¹ Data from the Netherlands showed that only 25% of infants are still exclusively breast-fed even at 4 months old.² Almost 40% of all infants have been introduced to some form of solid or complementary food before 4 months old.³

And to make your routine anticipatory guidance even more challenging, in 2012, the AAP has emphasized the recommendation for only exclusive breast-feeding during the first 6 months of life — no longer allowing any latitude for a 4 to 6 months range.¹ The previous AAP policy statement on breast-feeding in 2005 stat-

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Figure 1. A 7-month-old girl being fed cereal mixed with a bit of applesauce.

ed that: exclusive breast-feeding should continue for “approximately 6 months of age,” which many practitioners and textbooks liberally interpreted as a range of 4 to 6 months old.⁴

Even recently, your own wide ranging socioeconomic practice probably has observed very few mothers who exclusively breast-feed for a full 6 months (< 5%). Furthermore, the recommendations for formula-fed infants still allows for the introduction of solid complementary foods after 4 months old.⁵ Why the double standard and the dichotomy?

MATERNAL REASONS FOR EARLY BREAST-FEEDING CESSATION

A survey of 1,177 mothers older than 18 years old showed that 60% discontinued breast-feeding before they desired. Their main concerns were as follows: “1) difficulties with lactation; 2) infant nutrition and weight gain; 3) illness or need to take medicine; and 4) the effort associated with pumping milk.”⁶ Many practicing pediatricians and pediatric residents themselves can also personally testify about the hardships of breast-feeding the 2- to 12-month-old infant

Image courtesy of Stan L. Block, MD, FAAP

while working long days, being on call, or being stressed at work. Finding a time and place to pump, store the milk, and arrange a willing surrogate for feeding can each be daunting, especially as a mother who is single or has other children. Some working mothers (including my three daughters) perceive that after 4 months, the infant seems to demand more calories than the mother can feed or pump alone. (See Table 1).

EXCLUSIVE BREAST-FEEDING FOR 4 MONTHS VERSUS 6 MONTHS

The breast-feeding section and the section on acute otitis media (AOM) guidelines^{1,7} of the AAP have also endorsed a more dogmatic exclusive breastfeeding policy through 6 months old. By contrast, the 2012 *Nelson's Textbook of Pediatrics*,³ 2013 UpToDate.com,⁸ the *Journal of Allergy and Clinical Immunology in Practice*,⁹ and a superb practical handbook from the AAP: the 2012 *Nutrition — What Every Parent Needs to Know*⁵ still allowed for the gradual addition of complementary solid foods by 4 to 6 months of age, albeit the handbook showed some preference for introduction at 6 months of age.

Table 2 (see page 145) shows some of the infant developmental criteria to know when your baby is ready for complementary foods.

REASONS FOR CHANGES TO GUIDELINES

In developed countries such as the US, no difference has been reported in infant mortality rates when comparing breast-feeding versus formula-feeding.³ By contrast, the breast-feeding guidelines estimate that over 900 infant deaths could be averted if 90% of mothers breast-fed exclusively for 6 months.¹ In addition, it is well documented that exclusive breast-feeding for the first 4 months of life confers significant protection against the following: milk intolerance, food allergies, colic, eczema; and

| Boys | Weight | EER (calories) | Approximate amount of milk needed if exclusive (ounces) |
|---------------------------|---------|----------------|---|
| 4 months: 75th percentile | ~7.3 kg | 605 | 30 |
| 4 months: 95th percentile | ~8.2 kg | 686 | 34 |
| 5 months: 75th percentile | ~8 kg | 676 | 33 |
| 5 months: 95th percentile | ~9 kg | 756 | 38 |
| 6 months: 75th percentile | ~8.5 kg | 712 | 36 |
| 6 months: 95th percentile | ~9.5 kg | 804 | 40 |

* Formula is: $(89 \times \text{weight [kg]} - 100) + 56$.
Source: Tschudy MM, Arcara KM¹⁰

infectious problems such as AOM, pneumonia, meningitis, and diarrhea and enteric pathogens.^{1,3}

When comparing exclusive breast-feeding for 4 to 6 months versus exclusive breast-feeding for less than 6 months, rates of the following illnesses have been reduced:^{1,7} gastrointestinal disease (diarrhea); respiratory illness (fourfold reduction in pneumonia); and AOM (77% reduction in recurrent AOM).

Two additional cohort studies have suggested a “dose response” level of protection for episodic AOM when breast-feeding has been exclusive for 6 months compared with 4 months.⁷ In one retrospective study, avoiding any formula use during the first 6 months versus the first 3 months of age showed an enhanced but small reduction in risk for episodic AOM (odds ratio for AOM of 2.0 vs. 1.78, respectively). The difference appeared mostly derived from the avoidance of formula (not complementary foods) before 4 months old.

Less substantial possible reductions have been observed in the following for 4 months versus 6 months exclusivity:

- Atopic disease (although data are inconclusive)
- Birth of a preterm infant in a subsequent pregnancy (due to maternal

amenorrhea and anovulation while breast-feeding)

- Leukemia (only a slight difference when comparing extremely rare rates of acute myelogenous leukemia [10% vs. 15%] and acute lymphocytic leukemia (12% vs. 20%))

By contrast, the AAP *Pediatric Nutrition Handbook*⁵ noted no significant benefit from exclusive breastfeeding for 6 months when compared with 4 months for: growth rates, zinc and iron nutrition, allergy or infections. *Uptodate.com*⁸ concludes that: “Evidence for the optimal timing for introducing specific complementary foods is lacking and is largely based on consensus and traditions. Practices vary widely among regions and cultures.”

POTENTIAL PITFALLS OF 6 MONTHS EXCLUSIVITY Practice Realities

In typical pediatric practices, for both bottle-fed and breast-fed babies, we continually fend off the parental and grand-parental misconception that introduction of some small amounts of rice cereal daily as early as 1 to 3 months of age will satisfy the baby more, and will particularly make the baby sleep better at night. Most of this misinformation is

TABLE 2.

Four Physiologic Factors Indicating that Your Baby May Be Ready for Complementary Foods

- An extinguished tongue extrusion reflex (usually by 3 to 4 months old). This indicates that the baby is able to allow a spoon to enter the mouth without resistance.
- Doubling of the birth weight in healthy term infants
- Weight of 13 or more pounds
- Ability to sit up in a high chair.

Source: Adapted from Dietz WH, Stern L⁵

based on the spontaneous resolution of the weeklong growth spurts which occur at age 2, 6, and 12 weeks of life. Many babies will need to eat every 1 to 2 hours intermittently throughout the day during these “growth” weeks. And of course, if a mother eventually (hopefully not inevitably) introduces cereal during these ravenous, seemingly insatiable time frames, the infant’s satiety and night time sleeping “remarkably” improve over the next few days — unwittingly as the growth spurt subsides. Cereal is less calorie-dense than milk. Like many other observations, this is a “temporal” relationship, but not a “causal” relationship, which further perpetuates the mythology of early cereal-feeding.

Also for some infants, you might be concerned that solid food introduction by spoon may have a critical window of time. You have encountered some infants in your practice who have developed total solid-food aversion for months when spooned complementary foods were first introduced after 5 months — an issue you have not seen when solids have been introduced by 4 or 5 months.

Also, many pediatric practices have excitedly considered their anticipatory guidance extremely successful if the mother achieves exclusive breast-feed-

ing during the first 4 months of age. The new lengthier standard of 6 months for breast-feeding exclusivity could become too daunting, too discouraging and too frustrating for many working mothers and even for some practitioners (who are not with the baby all day).

ESTIMATED ENERGY REQUIREMENTS

Some authors have advocated that all infants should abide by the “one quart-rule,” that is, a maximum of only 32 ounces of milk per day is required during the first 6 months of life.³ However, this may be an inadequate amount for the larger infant, whether breast-fed or formula-fed. For example, to see if this is reasonable, you must first calculate the estimated energy requirements (EER) or calorie needs of the above-average size growing infant to determine how many ounces of breast milk or formula are needed to sustain them when milk is the only source of calories. EER of an infant 4 to 6 months is calculated as shown in Table 1 (see page 144).¹⁰

As you can see from Table 1 (see page 144), many larger infants between 4 and 6 months old will probably exceed the “one quart” rule, which may explain in part why many parents seem to ignore this physician advice. On the other hand, it would also explain why the “one quart” rule for milk intake likely would then be appropriate for an infant whose feeding is supplemented with sufficient baby cereal once or twice daily after 4 months old. Daily use of solid foods after 4 or 5 months old could also enable the working mother who is breast-feeding more flexibility for feedings and to go longer intervals between either pumping or feeding if needed (think 8 to 12 hour work shifts).

IRON DEFICIENCY ANEMIA/ZINC DEFICIENCY/VITAMIN D

Infants who are exclusively breast-fed for less than 3 months are reported

to have somewhat higher intelligence scores and teacher’s ratings.¹ But iron deficiency is observed in 9% of all children 12 to 36 months old; clinical anemia occurs in 3% of all children.³ Despite the high rate of absorption of the limited amount of iron in breast milk, by age 6 months the amount of stored (both from in utero and ingested) iron and zinc in breast milk is often insufficient by itself to support normal infant growth. Although one study reported no clinical iron deficiency anemia at 12 to 24 months in 6 months exclusively BF infants,¹¹ the AAP concludes that iron drop supplementation may be needed before 6 months in some breast-fed infants, yet it is not possible to identify which ones.¹

In a placebo randomized controlled trial of 77 healthy Canadian infants, 3% of the infants breast-fed exclusively for 6 months developed iron deficiency anemia if they had not been iron supplemented. Some experts have observed that infants who are iron deficient have “impaired intellectual and motor functions that can occur early in iron deficiency before anemia develops. There is evidence that these changes might not be completely reversible after treatment with iron, increasing the importance of prevention.”³

An additional recent study of iron status in infants deserves cautious consideration. Serum ferritin is the most sensitive laboratory value for the detection of early iron deficiency anemia.³ A randomized controlled trial of 119 healthy, term, breast-fed infants in Iceland compared a group of infants fed complementary food at age 4 months with a group of infants exclusively breast-fed for 6 months.¹² At 6 months, the complementary food (8% of average daily iron requirement) was found to not affect growth rate but it did have a small and a positive effect on iron status (serum ferritin: 70 vs 43 mcg/L, $P = .013$). No statistical difference in cases of overt iron deficiency anemia at



Figure 2. Percent of daily value of iron per jar (clockwise from left): 4%, 6%, 4%. Percentage of daily value of zinc (clockwise): 15%, 35%, 15%.

age 6 months was observed (10% in the exclusively breast-fed group vs. 4% in the group of infants fed complementary foods, $P = .44$). The infants were not followed beyond 6 months.

Zinc deficiency has not been a common issue with healthy breast-fed infants, even though unsupplemented zinc stores are depleted by 6 months. Clinically, zinc deficiency is associated with acrodermatitis enteropathica, diarrhea, and failure to thrive.

Breast-feeding does not provide adequate vitamin D in many infants for a multitude of reasons, thus the AAP recommends that vitamin D (400 IU) supplementation of all breast-fed infants should begin after hospital discharge until breast-feeding is discontinued.¹

SOURCES OF IRON AND ZINC

Figures 2 through 5 show that the amount of iron and zinc from commercially prepared infant fruits, vegetables, and meat products is quite sparse; notice that peas contain as much iron as the baby meats do. Thus the only major source of these two elements appears to be fortified infant cereals. Because these cereals also provide a substantial source of vitamin B and other vitamins, infants should probably be continued on these particular cereals (and not sugary cereals, etc) until at least 9 months old or table food meats are initiated. A reasonable al-



Figure 3. Percent of daily values of iron per jar (clockwise from top left): 6%, 2%, 2%, 2%. No product contains zinc.



Figure 4. Percent of daily values of iron per jar (clockwise from top left): 0%, 2%, 0%, 0%. No product contains zinc.



Figure 5. Percentage of daily values of iron per serving: 45% each; percentage of daily values of zinc: 20% each.

ternative approach is for the family to puree cooked meats etc for infant consumption rather than purchase prepared infant meat products. Providing fruits (vitamin C source) simultaneously with the meats or fortified cereals will also enhance the absorption of iron. But, you may want to avoid fruit juices altogether.

INTRODUCTION OF ALLERGENIC FOODS

In a generational cohort study of over 7,000 children from the Netherlands, in-

vestigators reported that early introduction (4 to 5 months old) of more allergenic foods (cow's milk, eggs, peanuts, tree nuts, soy and gluten) was not associated with an increased likelihood of wheezing and eczema at either 2, 3, or 4 years of life.² Almost no children in the study had attended daycare during the first year of life, and only 24% were exclusively breast-fed by 4 months. The authors concluded that their data did not support the delayed introduction of allergenic solid foods until after 6 months. In addition, in

an older cohort, introduction of fish between 6 and 12 months (but not after 12 months old) was associated with a significantly lower prevalence of wheezing as well. However, you should advise parents to initiate introduction of these possibly allergenic foods only after other complementary foods are well established, and only when the child is at home, in case a very rare severe or anaphylactic reaction should occur (as I witnessed in my grandson).⁹

INTRODUCTION OF COMPLEMENTARY FOODS

Introduce a single ingredient food item one at a time, usually every 3 to 5 days, to ensure no reactions or intolerance. Food variety also helps the infant develop an important diversity in taste preferences. Delayed introduction of more allergenic foods until 12 months does not prevent atopic disease. Daily iron-fortified cereals are preferred due to their enriched concentration of protein and minerals. Interestingly, the concentrations of iron and zinc in commercially pureed single ingredient meat and other preparations are minimal compared with fortified cereals (see Figures 2, 3, 4, and 5, page 146).

Customarily, rice cereal has been the first food for the first weeks, but new data on detectable inorganic arsenic concentrations in infant rice cereal (including in one organic brand) makes me wary.¹³ Thus I now recommend oatmeal cereal routinely, as oatmeal and wheat tend to have lower detectable arsenic concentrations than rice. *Consumer Reports* recently reported low-grade inorganic arsenic contamination of the rice supply chain, including four different infant rice cereals (0.8 to 2.7 mcg of arsenic/serving).¹³ The lower limit of the most protective standard in the US for ingestion of inorganic arsenic is 5 mcg/liter consumed.

Furthermore, in a comparative study of 3,633 participants 6 years or older who had consumed no fish in the last 24 hours, urine levels of arsenic were 44% higher af-

ter ingesting one rice product; 70% higher after two rice products; and 20% higher after a serving of apple or grape juice.

One suggested approach to initial complementary feedings at 4 to 6 months is as follows:

Month 1: Oatmeal cereal. A few teaspoons of pureed applesauce or pears may be necessary to “jump start” the feeding process in reluctant infants.

Month 1.5 to 2: Meat dinners like turkey/noodle or chicken/rice. The single ingredient meats are barely palatable (taste them yourself) and only provide minimal iron or zinc.

Month 2 to 3: Vegetables. Introduced one at a time, four or more single ingredients as routine staples.

Month 3 to 4: Fruits. Introduced one at a time, four or more single ingredients as routine staples. Fruits are started last to avoid developing a “sweet tooth” and a subsequent reluctance to eat vegetables and meats.

First year: Liquids. Feed only breast milk, formula, or occasional water. I prefer infants receive no juice at all, but if they are used, the AAP suggests parents use no more than 4 oz of pure fruit juices daily, and start only after 6 months old.^{1,5} I also suggest parents do not use “infant feeders” and that they do not add solid foods to bottles.

CONCLUSION

Practitioners will need to inform families of the pros and cons with delayed complementary feedings until 6 months old in exclusively breast-fed infants. Vitamin D supplementation should be provided to all breast-fed infants. Perhaps, initiating iron drop supplementation (2 mg/kg single dose) at 4 to 6 months of age to all 6 months exclusively breast-fed infants should be considered.¹⁴

The ideal goal of withholding complementary solids until 6 months may work for many steadfast mothers. But many mothers will also find the recommendation too burdensome. Regardless

of her decision — breast or formula, and starting supplemental foods at 4 months or 6 months — establishing a nonjudgmental, compassionate working relationship with the mother and her infant is still the primary goal of your pediatric practice. ■

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