

## Commentary

## Improving the Eating Patterns of Infants and Toddlers

JAMIE STANG, PhD, MPH, RD

**E**arly childhood is a critical time for the development of food preferences and eating patterns. The development of eating behaviors is a complex process involving physiological and psychological underpinnings. Factors that influence dietary intakes and nutritional status of young children include food preferences, food availability, parental modeling, praise or reward for food consumption, and peer behaviors (1-4). These factors begin to develop during early infancy, a time when human milk or infant formulas are the only sources of nutrition and feeding is a source of reassurance and parent-child attachment, and continue to develop throughout childhood.

The introduction of complementary foods during late infancy provides an early opportunity for caregivers to expose young children to a wide variety of foods and beverages and to form the basis for lifelong healthful eating habits. However, our understanding of the types of foods and beverages currently being fed to young children and how common feeding practices affect long-term food preferences, eating behaviors, and nutritional status in early childhood is limited. The Feeding Infants and Toddlers Study (FITS) was designed to provide a comprehensive assessment of the food and nutrient intakes of infants and toddlers, as well as to document feeding practices used by caregivers of young children (5). Information from this survey has suggested that there are many opportunities for health care professionals to intervene in an effort to improve feeding practices and nutritional status of young children.

Data from Fox and colleagues (6,7) suggest that infants and toddlers receive the majority of energy and nutrients from relatively few foods. During early childhood, just 10 foods provided 60% of the calories consumed by children in FITS (7). Milk and/or formula provided the majority of energy in the diets of children throughout infancy and early childhood, decreasing from about 56% of energy

during infancy to 24% of energy during the toddler years. Two other beverages, fruit-flavored drinks and juices, provided an additional 11% of energy, making them the second and third most significant sources of energy for toddlers (7). Additional foods comprising the top sources of energy intake among toddlers included cheese, breads, poultry, added fats, cereals, cookies, and processed meats (hot dogs/cold cuts).

FITS suggested that only two fruits and vegetables, bananas and white potatoes, were among the top 25 sources of energy in the diets of young children (7). In fact, 18% to 27% of infants and toddlers consumed no vegetables and 25% to 33% consumed no fruits during a day (6). The variety of fruits consumed by young children was stable throughout early childhood, with bananas, apples, and grapes being the most commonly chosen items. The variety of vegetables consumed by infants and toddlers varied significantly throughout the first 2 years of life. During early infancy, children consumed carrots, sweet potatoes, squash, and green beans in relatively equal amounts, with peas following closely (6). However, by 1 year, white potatoes comprised the majority of vegetables consumed and deep yellow/orange vegetables were no longer consistently consumed by young children (6).

Many of the food items fed to young children were low-nutrient-density choices. Food items high in added fats and sugars, including sweetened beverages, sweetened cereals, butter/margarine, cookies, processed meats, and cakes/pies, provided approximately 19% of the total energy in the diets of toddlers included in FITS (7). By the end of the second year of life, more than 11% of children were consuming carbonated sodas (6). During the afternoon snack, 17% of toddlers consumed cookies, 13% consumed chips, and 11% consumed candy (6). Sweetened fruit drinks were the second most commonly consumed beverage for afternoon snack, with 14% of toddlers drinking this beverage, compared with 15% who consumed whole milk.

The FITS data clearly show that many young children are consuming diets that may place them at risk for inadequate intakes of some vitamins and minerals and excessive intakes of added fats and sugars. Caregivers of some young children seem to be compensating for the lack of variety and poor nutritional quality of foods served by augmenting nutrient intakes with multivitamin/mineral supplements. Briefel and colleagues reported that 31% of toddlers used dietary supplements (8). Nutrient supplements were the most significant source of vitamin E and niacin in the diets of young children; the second highest source of folate, thiamin, riboflavin, iron, and vitamins D

*J. Stang is a project director and continuing education specialist, Leadership Education and Training Program in Maternal and Child Health Nutrition, Division of Epidemiology, University of Minnesota, Minneapolis.*

*Address correspondence to: Jamie Stang, PhD, MPH, RD, University of Minnesota, Division of Epidemiology, 1300 South Second St, Minneapolis, MN 55454-1015. E-mail: stang@eip.umn.edu*

*Copyright © 2006 by the American Dietetic Association.*

*0002-8223/06/10601-1013\$32.00/0*

*doi: 10.1016/j.jada.2005.10.028*

and B-12; and the third highest source of vitamin C (7). These data point out the need to counsel caregivers of young children on how to select and serve a variety of healthful foods to improve nutrient intakes of young children as well as to establish preferences for a wide variety of nutritious foods and beverages.

Nutrition education and counseling for caregivers of young children should include an explanation of how and why children learn to prefer certain foods and beverages over others. Children are born with an innate preference for sweet and salty tastes along with an aversion for sour or bitter flavors (9). Acceptance of food flavors seems to be learned through early feeding experiences. When complementary foods are introduced into the diets of infants, they generally reject these new foods, learning to accept them only after repeated exposures. Data suggest that eight to 10 exposures to a new food may be required before a child develops acceptance of a food (2,10). Caregivers who are unaware of the need for repeated exposures to novel foods may assume the child does not prefer these foods, leading to restriction of novel foods and reduced variety and diversity of food intake. Feeding behaviors that minimize variety and diversity limit important sources of nutrients in the diets of young children and could compromise nutritional status.

---

## Findings from FITS provide guidance for health professionals who provide nutrition education and counseling to expectant and/or new parents and other caregivers of young children.

Children prefer energy-dense foods over similar foods that are lower in fat and/or sugar (11-13). This preference seems to occur during early childhood, possibly as a biological mechanism to ensure adequate caloric intake during times of rapid growth. Caregivers who expose young children to higher-fat rather than lower-fat food items miss an important opportunity to establish healthful eating habits. Nutrition education for parents and caregivers of young children should emphasize the availability and acceptability of lower-fat and lower-sugar foods and beverages. Food items that are commonly available in more nutrient-dense forms include reduced-sugar, pre-sweetened breakfast cereals, baked snack chips, reduced-fat cheeses, and *trans*-fat-free baked crackers.

Nutrition education and counseling related to selecting nutritious foods and beverages and how this affects food preference development of young children should start during routine prenatal care. Maternal dietary exposures have been shown to affect infants' acceptance of novel foods. Flavors such as garlic, vanilla, and carrot can be transmitted to amniotic fluid and human milk, providing early flavor experiences during perinatal and neonatal development (14-17). Infants exposed to flavors in utero or via human milk have been shown to be more receptive to eating foods with the same flavors and to show fewer negative reactions to these foods on introduction (17). Infants have also been shown to consume greater quan-

ties of the foods to which they had been exposed to during prenatal or neonatal development. Expectant parents may be provided with anticipatory guidance related to early flavor exposure in an effort to provide the foundations for enhanced acceptance of novel foods and the establishment of healthful feeding practices during infancy.

Findings from FITS provide guidance for health professionals who provide nutrition education and counseling to expectant and/or new parents and other caregivers of young children. Key points to consider include:

- Encourage women to consume a variety of foods, including fruits, vegetables, and whole grains, during pregnancy, not only to provide adequate nutrients for fetal development, but also to maximize fetal exposure to flavors of a variety and diversity of nutritious foods and beverages.
- Promote breastfeeding to foster early infancy exposure to a variety of food flavors.
- Teach parents and caregivers of young children how to recognize the developmental milestones that signal the appropriate time to introduce complementary foods into the diets of infants and the appropriate order of complementary food introduction.
- Emphasize the importance of repeated exposures to novel foods and the need for variety and diversity in the diets of infants and toddlers.
- Encourage caregivers to purchase and serve lower-fat and lower-sugar food selections to promote preferences for more nutrient-dense foods and beverages.

## References

1. Carruth BR, Skinner J, Houck K, Moran J, Coletta F, Ott D. The phenomenon of "picky eater": A behavioral marker in eating patterns of toddlers. *J Am Coll Nutr.* 1998;17:180-186.
2. Sullivan SA, Birch LL. Infant dietary experience and acceptance of solid foods. *Pediatrics.* 1994;93:271-277.
3. Birch LL. Effects of peer models' food choices and eating behaviors on preschoolers' food preferences. *Child Dev.* 1980;51:489-496.
4. Birch LL, Johnson SL, Fisher JA. Children's eating: The development of food-acceptance patterns. *Young Child.* 1995;50:71-78.
5. Devaney B, Kalb L, Briefel R, Zavitsky-Novak T, Clusen N, Ziegler P. Feeding Infants and Toddlers Study: Overview of the study design. *J Am Diet Assoc.* 2004;104(suppl 1):S8-S13.
6. Fox MK, Pac S, Devaney B, Jankowski L. Feeding Infants and Toddlers Study: What foods are infants and toddlers eating? *J Am Diet Assoc.* 2004;104(suppl 1):S22-S30.
7. Fox MK, Reidy K, Novak T, Ziegler P. Sources of energy and nutrients in the diets of infants and toddlers. *J Am Diet Assoc.* 2006;106(suppl 1):S28-S42.
8. Briefel R, Hanson C, Fox MK, Novak T, Ziegler P. Feeding Infants and Toddlers Study: Do vitamin and mineral supplements contribute to nutrient adequacy or excess among US infants and toddlers? *J Am Diet Assoc.* 2006;106(suppl 1):S52-S65.

9. Cowart B. Development of taste perception in humans: Sensitivity and preference throughout the lifespan. *Psychol Bull.* 1981;90:43-73.
10. Birch LL, Gunder L, Grimm-Thomas K, Laing DG. Infants' consumption of a new food enhances acceptance of similar foods. *Appetite.* 1998;30:283-295.
11. Kern D, McPhee L, Fisher J, Johnson S, Birch LL. Children's lunch intake: Effects of midmorning snacks varying in energy density and fat content. *Appetite.* 1993;20:83-94.
12. Birch LL, Fisher JA. Appetite and eating behaviors in children. *Pediatr Clin North Am.* 1995;42:931-953.
13. Birch LL, Fisher JO. Development of eating behaviors among children and adolescents. *Pediatrics.* 1998;101:539-549.
14. Mennella JA, Beauchamp GK. The effects of repeated exposure to garlic-flavored milk on the nursling's behavior. *Pediatr Res.* 1993;34:805-808.
15. Mennella JA, Beauchamp GK. The infant's responses to flavored milk. *Infant Behav Devel.* 1994;17:819.
16. Mennella JA, Beauchamp GK. The early development of human flavor preferences. In: *Why We Eat What We Eat.* Capaldi ED, ed. Washington, DC: American Psychological Association; 1996:83-112.
17. Mennella JA, Jagnow CP, Beauchamp GK. Prenatal and postnatal flavor learning by human infants. *Pediatrics.* 2001;107:88-93.