

Feeding Infants and Toddlers Study: What Foods Are Infants and Toddlers Eating?

MARY KAY FOX, MEd; SUSAN PAC, MS, RD; BARBARA DEVANEY, PhD; LINDA JANKOWSKI, MS

ABSTRACT

Objective To describe the food consumption patterns of US infants and toddlers, 4 to 24 months of age.

Design Descriptive analysis of data collected in the 2002 Feeding Infants and Toddlers study based on telephone interviews and 24-hour dietary recalls.

Subjects A national random sample of 3,022 infants and toddlers age 4 to 24 months.

Statistical Analyses Performed The percentage of infants and toddlers consuming foods from specific food groups was estimated for six age groups, using a single 24-hour recall.

Results Infants as young as 7 months of age showed food patterns that have been observed in older children and adults. From 18% to 33% of infants and toddlers between ages 7 and 24 months consumed no discrete servings of vegetables, and 23% to 33% consumed no fruits. French fries were one of the three most common vegetables consumed by infants 9 to 11 months of age. By 15 to 18 months, french fries were the most common vegetable. Almost half (46%) of 7- to 8-month-olds consumed some type of dessert, sweet, or sweetened beverage, and this percentage increased as age increased. By 19 to 24 months, 62% of toddlers consumed a baked dessert, 20% consumed candy, and 44% consumed a sweetened beverage.

Applications Parents and caregivers should be encouraged to offer a wide variety of vegetables and fruits daily, with emphasis on dark green, leafy, and deep yellow vegetables and colorful fruits. They should offer desserts, sweets, sweetened beverages, and salty snacks only occasionally, offering nutrient-dense, age-appropriate foods as alternatives (eg, fruit, cheese, yogurt, and cereals). Water, milk, and 100% fruit juices should be offered as alternative beverages. Because family food choices influence what foods are offered to children, family-based approaches to developing healthy eating habits may be helpful.

J Am Diet Assoc. 2004;104:S22-S30.

During the first 2 years after birth, infants and toddlers consume an increasingly complex diet, moving from a largely milk-based diet to one that includes a variety of table foods consumed by other family members (1-3).

M. K. Fox is a nutrition consultant, Reading, MA. S. Pac is manager of regulatory affairs, Gerber Products Company, Parsippany, NJ. B. Devaney is senior fellow and L. Jankowski is senior programmer/analyst, Mathematica Policy Research, Inc, Princeton, NJ.

Address correspondence to Mary Kay Fox, MEd, 56 Temple Street, Reading, MA 01867.

E-mail: marykayfox@comcast.net.

Copyright © 2004 by the American Dietetic Association.

0002-8223/04/10401-1009\$30.00/0

doi: 10.1016/j.jada.2003.10.026

Although recommendations exist regarding use of breast milk, formula, and cow's milk (4-6), there are few authoritative guidelines for feeding solid foods to children younger than 2 years of age (3). The US Department of Agriculture's Food Guide Pyramid is designed for children 2 years of age and older (7-8). Existing infant feeding recommendations encourage parents and caregivers to introduce breast milk or complementary foods (foods other than breast milk and formula) as children show signs of developmental readiness and expand their eating skills (6,9).

Food preferences have been shown to predict consumption habits (10), and food preferences develop early in life (11-12). An understanding of food consumption patterns of very young children can help tailor advice and recommendations to guide parents in fostering healthy eating habits in their children. This article uses data from the Feeding Infants and Toddlers study (FITS) to describe the foods and beverages consumed by infants and toddlers between 4 and 24 months of age and to provide insight into this pivotal dietary transition period.

METHODS

The FITS includes a stratified random sample of 3,022 infants and toddlers between 4 and 24 months of age. Parents or primary caregivers of sampled infants and toddlers completed a single 24-hour dietary recall. Recalls were collected between March and July 2002, using the Nutrition Data System for Research (NDS-R; version 4.03, 2001, University of Minnesota Nutrition Coordinating Center, Minneapolis, MN). Although a second 24-hour recall was obtained for a subsample of the population to allow for the estimation of usual nutrient intake distributions (13), the data presented in this article are based only on the single 24-hour recall completed with all study subjects. Data are presented for six age groups of infants and toddlers, from 4 to 6 months through 19 to 24 months. (Although the study was designed to include only infants 4 to 6 months of age and older, 157 infants had not reached 4 months of age by the time they were surveyed. These 3-month-olds are included in the 4 to 6 month category.) Additional details about the FITS sample and data collection protocol are provided elsewhere (13,14).

Using one- and two-digit food group codes and food descriptions, individual foods and beverages reported in the 24-hour recalls were assigned to major and minor food groups. Fruit juices were not included in these tabulations because a separate article in this supplement explores fruit juice consumption in detail (15). To facilitate the comparison of the FITS data with data for the US population as a whole and/or data for older children, the food group classifications used in the analysis were the same as those used in analyzing data from the most recent Continuing Survey of Food Intakes by Individuals (CSFII) (16-17). Some adjustments were made, however, to permit a more detailed assessment of the consumption

Table 1. Comparison of food groups used in CSFII^a and FITS^b

CSFII major and minor food groups	Differences between FITS and CSFII food groups
Milk and milk products	Because of the largely milk-based diets of young infants, FITS treats milk (breast milk, formula, cow's milk, and other fluid milks) as a separate food group.
Fluid milk	FITS counts yogurt and cheese in the Meat and Other Protein Sources group.
Yogurt	FITS includes milk desserts (eg, ice cream and pudding) in the Sweets and Snacks group to provide a more complete picture of consumption of desserts.
Milk desserts	
Cheese	
Grains and grain products	FITS includes a separate category for infant cereals.
Yeast breads and rolls	For noninfant cereals, FITS includes both cooked and ready-to-eat cereals in a single category.
Ready-to-eat cereals	FITS includes cookies, pastries, and pies in the Sweets and Snacks group to provide a more complete picture of consumption of desserts.
Rice	FITS includes popcorn and corn chips in the Sweets and Snacks group to provide a more complete picture of the consumption of salty snack foods.
Pasta	To provide more detail on foods actually being consumed, FITS breaks mixtures out into subgroups, eg, sandwiches and pizza.
Pancakes, french toast, and quick breads	
Cakes, cookies, pastries, pies	
Crackers, popcorn, pretzels, corn chips	
Mixtures mostly grain	
Vegetables	FITS differentiates vegetables by form: commercial baby food, cooked vegetables, and raw vegetables.
Dark-green vegetables	FITS includes potato chips, which CSFII counts under white potatoes, in the Sweets and Snacks group.
Deep-yellow vegetables	Because of low frequencies for some items, FITS does not count tomatoes, lettuce and lettuce-based mixes, and green beans as separate minor groups. These vegetables are included in the Other Vegetables group.
White potatoes	
Fried potatoes	
Tomatoes	
Lettuce/lettuce-based mixes	
Green beans	
Starchy vegetables	
Other vegetables	
Fruit	FITS differentiates nondried fruits by form: commercial baby food, cooked or canned (in syrup, water/juice, or unknown), and fresh.
Dried	Fruit juice also is included in the FITS fruit group. Information on juice consumption is provided elsewhere (16).
Other	
Citrus	
Apple	
Banana	
Melons	
Berries	
Other	
Meats and beans (protein sources)	FITS differentiates meats by form: baby food meats and nonbaby food meats.
Meat, poultry, and fish	Because of low frequencies, FITS collapses lamb, veal, game, and organ meats into one group.
Beef	FITS also includes cheese and milk in the nonmeat group of protein sources.
Pork	To provide more detail on foods actually being consumed, FITS breaks mixtures out into subgroups, eg, baby food dinners, mixtures with vegetables and/or pasta, and chili and other bean mixtures.
Lamb, veal, game	
Organ meats	
Frankfurters, sausages, and cold cuts	
Poultry	
Fish and shellfish	
Mixtures mainly meat, poultry, fish	
Eggs, legumes, nuts, and seeds	
Eggs	
Legumes	
Nuts and seeds (including peanut butter)	
Sugars and sweets	FITS includes all of these foods in a Sweets and Snacks group.
Sugars	The FITS Sweets and Snacks group also includes milk desserts, cakes, pies, cookies, pastries, and salty snacks.
Candies	
Other sweets	
Beverages	
Fruit drinks and ades	
Carbonated soft drinks	

^aCSFII = Continuing Survey of Food Intakes by Individuals.

^bFITS = Feeding Infants and Toddlers Study.

Table 2. Percentage of infants and toddlers consuming different types of milk

Food group/food	Percentage of infants and toddlers consuming at least once in a day					
	4-6 mo	7-8 mo	9-11 mo	12-14 mo	15-18 mo	19-24 mo
Any milk	100.0	100.0	99.7	98.8	94.6	93.4
Breast milk	39.6	25.7	21.3	13.6	4.2	4.5
Formula	74.1	82.2	75.0	21.2	5.1	1.5
Cow's milk ^a	0.8	2.9	20.3	84.8	88.3	87.7
Soy milk	0.0	0.5	1.7	1.5	3.9	3.8
Types of cow's milk						
Whole	0.5	2.4	15.1	68.8	71.1	58.8
Reduced-fat or nonfat	0.3	0.5	5.3	17.7	20.7	38.1
Unflavored	0.8	2.9	19.5	84.0	87.0	86.5
Flavored	0.0	0.0	0.9	1.8	4.4	5.6

Data from 2002 Feeding Infants and Toddlers Study (Source: reference 14).

^aIncludes goat's milk, which was consumed by 0.2% of 9-11 month old infants.

Table 3. Percentage of infants and toddlers consuming different types of grain products

Food group/food	Percentage of infants and toddlers consuming at least once in a day					
	4-6 mo	7-8 mo	9-11 mo	12-14 mo	15-18 mo	19-24 mo
Any grain or grain product	65.8	91.5	97.5	97.8	98.6	99.2
Infant cereals	64.8	81.2	63.8	23.9	9.2	3.1
Noninfant cereals ^a	0.6	18.3	44.3	58.9	60.5	51.9
Not presweetened	0.5	17.0	37.0	44.5	40.6	31.9
Presweetened ^b	0.0	1.8	9.0	17.7	26.4	22.7
Breads and rolls ^c	0.6	9.9	24.5	47.3	52.7	53.1
Crackers, pretzels, rice cakes	3.0	16.2	33.4	45.2	46.4	44.7
Cereal or granola bars	0.0	1.1	3.4	9.8	10.0	9.7
Pancakes, waffles, french toast	0.1	0.8	7.5	15.1	16.1	15.4
Rice and pasta ^d	2.3	4.5	18.2	26.2	39.0	35.9
Other	0.2	0.1	2.7	2.8	2.5	4.5
Grains in mixed dishes	0.4	5.3	24.1	48.3	52.0	55.1
Sandwiches	0.0	1.1	8.6	21.5	25.8	25.8
Burrito, taco, enchilada, nachos	0.0	0.0	1.0	4.5	2.8	2.1
Macaroni and cheese	0.2	1.6	4.9	14.6	15.0	15.0
Pizza	0.1	0.7	2.2	6.8	9.0	9.4
Pot pie/hot pocket	0.0	0.9	0.5	2.0	1.0	1.8
Spaghetti, ravioli, lasagna	0.1	1.8	9.9	15.3	12.1	8.8

Data from 2002 Feeding Infants and Toddlers Study (Source: reference 14).

^aIncludes both ready-to-eat and cooked cereals.

^bDefined as cereals with more than 21.2 g sugar per 100 g.

^cDoes not include bread in sandwiches. Sandwiches are included in mixed dishes.

^dDoes not include rice or pasta in mixed dishes.

of specific types of foods and beverages and/or to reflect more accurately the relative roles of these items in the diets of infants and toddlers. The CSFII food groups and the FITS food groups are compared in Table 1. (These food groups accounted for the vast majority of foods and beverages consumed by sampled infants and children. Reported items that were not considered in this analysis include added fats, water, and other noncaloric beverages [eg, unsweetened coffee or tea]. Added fats will be examined in a future article.)

Tables presented in the following sections show the percentage of infants and toddlers in each age group who consumed specific foods or food groups at least once in a day. All reported foods and beverages were included in

these tabulations, regardless of the amount consumed. Future analyses will examine the sizes of portions consumed, including contributions of mixed dishes.

RESULTS

Breast Milk, Formula, and Cow's Milk

Virtually all infants and toddlers younger than 15 months consumed some form of milk in a day (Table 2). Forty percent of 4- to 6-month-old infants consumed at least some breast milk. This percentage dropped precipitously between 4 to 6 months and 7 to 8 months and continued to decline through 15 to 24 months, when only 4% to 5% of toddlers consumed any breast milk. [Breast-

Table 4. Percentage of infants and toddlers consuming different types of vegetables

Food group/food	Percentage of infants and toddlers consuming at least once in a day					
	4-6 mo	7-8 mo	9-11 mo	12-14 mo	15-18 mo	19-24 mo
Any vegetable	39.9	66.5	72.6	76.5	79.2	81.6
Baby food vegetables	35.7	54.5	34.4	12.7	3.0	1.6
Cooked vegetables	5.2	17.4	45.9	66.3	72.9	75.6
Raw vegetables	0.5	1.6	5.5	7.9	14.3	18.6
Types of vegetables^a						
Dark green vegetables ^b	0.1	2.9	4.2	5.0	10.4	7.8
Deep yellow vegetables ^c	26.5	39.3	29.0	24.0	13.6	13.4
White potatoes	3.6	12.4	24.1	33.2	42.0	40.6
French fries and other fried potatoes	0.7	2.9	8.6	12.9	19.8	25.5
Other starchy vegetables ^d	6.5	10.9	16.9	17.3	20.8	24.2
Other vegetables	11.2	25.9	35.1	39.1	45.6	43.3

Data from 2002 Feeding Infants and Toddlers Study (Source: reference 14).

^aTotals include commercial baby food, cooked vegetables, and raw vegetables.

^bReported dark green vegetables include broccoli, spinach and other greens, and romaine lettuce.

^cReported deep yellow vegetables include carrots, pumpkin, sweet potatoes, and winter squash.

^dReported starchy vegetables include corn, green peas, immature lima beans, black-eyed peas (not dried), cassava, and rutabaga.

feeding rates, duration, and patterns are discussed in detail elsewhere (18)].

Infant formula was the most common source of milk in infants' diets through ages 9 to 11 months (Table 2). Roughly 75% to 80% of infants between 4 and 11 months of age consumed some infant formula in a day. The use of infant formula declined sharply between 9 to 11 months and 12 to 14 months. The difference was made up by cow's milk, which began to appear in an appreciable proportion of infants' diets between 9 and 11 months and increased dramatically thereafter. Eighty-five percent or more of toddlers 12 months or older consumed cow's milk. Most of the cow's milk fed to infants and toddlers was whole milk; however, a substantial proportion of toddlers consumed reduced-fat or nonfat milk, and small percentages of toddlers consumed flavored milk.

Grains and Grain Products

By 4 to 6 months of age, 66% of infants consumed infant cereals and small percentages consumed other types of grain products (Table 3). Infant cereals continued to be the predominant grain-based food in infants' diets through 9 to 11 months, but by 7 to 8 months, appreciable numbers of infants were consuming other grain-based foods such as noninfant, ready-to-eat cereals; crackers, pretzels, or rice cakes; and breads or rolls.

After 9 to 11 months, the percentage of infants consuming infant cereals began to decline and there was a marked increase in the percentage consuming other grain products and grain-based mixed dishes, such as spaghetti and sandwiches. Noninfant cereals were among the grain products most commonly consumed by toddlers over the age of 12 months. Most toddlers consumed nonpresweetened cereals. However, depending on the age group, between 18% and 26% of toddlers age 12 months or older consumed presweetened cereals (defined as cereals with more than 21.2 g of sugar per 100 g) in a day.

Vegetables

Table 4 presents the percentages of infants and toddlers who consumed vegetables in a day. Estimates reflect vegetables consumed as distinct food items, and do not in-

Table 5. Top five vegetables consumed by infants and toddlers

Top vegetables by age group ^a	Percentage consuming at least once in a day
4-6 months	
Baby food carrots	9.6
Baby food sweet potatoes	9.1
Baby food squash	8.1
Baby food green beans	7.2
Baby food peas	5.0
7-8 months	
Baby food carrots	14.2
Baby food sweet potatoes	12.9
Baby food squash	12.9
Baby food green beans	11.2
Baby food mixed/garden vegetables	10.1
9-11 months	
Cooked green beans	9.7
Mashed/whipped potatoes	9.0
French fries/other fried potatoes	8.6
Baby food mixed/garden vegetables	8.4
Cooked carrots	8.0
12-14 months	
Cooked green beans	18.2
French fries/other fried potatoes	12.9
Cooked carrots	11.5
Mashed/whipped potatoes	10.3
Cooked peas	8.4
15-18 months	
French fries/other fried potatoes	19.8
Cooked green beans	16.7
Cooked peas	13.9
Cooked tomatoes/tomato sauce	13.7
Mashed/whipped potatoes	12.4
19-24 months	
French fries/other fried potatoes	25.5
Cooked green beans	16.8
Cooked corn	15.2
Cooked peas	11.4
Cooked tomatoes/tomato sauce	9.4

^aBaby food vegetables include single vegetables (majority of vegetables reported) as well as mixtures with the named vegetable as the predominant vegetable, eg, broccoli and cauliflower or broccoli and carrots.

Table 6. Percentage of infants and toddlers consuming different types of fruit

Food group/food	Percentage of infants and toddlers consuming at least once in a day					
	4-6 mo	7-8 mo	9-11 mo	12-14 mo	15-18 mo	19-24 mo
Any fruit	41.9	75.5	75.8	77.2	71.8	67.3
Baby food fruit	39.1	67.9	44.8	16.2	4.2	1.8
Nonbaby food fruit	5.3	14.3	44.2	67.1	69.4	66.8
Types of nonbaby food fruit						
Canned fruit	1.4	5.8	21.6	31.9	25.1	20.2
Packed in syrup	0.7	0.7	8.1	14.9	12.7	8.1
Packed in juice or water	0.7	4.5	13.5	18.5	11.3	11.4
Unknown pack	0.0	0.7	1.5	1.2	3.1	1.2
Fresh fruit	4.4	9.5	29.5	52.1	55.0	54.6
Dried fruit	0.0	0.4	2.1	3.5	7.1	9.4
Types of fruit^a						
Apples	18.6	33.1	31.6	27.5	19.8	22.4
Bananas	16.0	30.6	34.5	37.8	32.4	30.0
Berries	0.1	0.6	5.3	6.6	11.3	7.7
Citrus fruits	0.2	0.4	1.6	4.9	7.3	5.1
Melons	0.6	1.0	4.4	7.3	7.2	9.6

Data from 2002 Feeding Infants and Toddlers Study (Source: reference 14).

^aTotals include all baby food and nonbaby food fruits.

clude vegetables contained in mixed dishes, such as pizza, spaghetti, or stews. The percentage of infants who consumed vegetables as a distinct food item increased with age, from 40% of infants ages 4 to 6 months to 82% of toddlers ages 19 to 24 months.

The percentage of older infants and toddlers who were not consuming vegetables as distinct food items was striking. Among 9- to 11-month-olds, 27% consumed no separate servings of vegetables in a day; among toddlers 12 months or older, between 18% and 23% did not do so. Mixed dishes contributed some vegetables, but relatively few children consumed vegetable-rich mixed dishes.

Commercial baby foods were the leading source of vegetables for infants up to 7 to 8 months old. By 9 to 11 months, cooked vegetables were more commonly consumed than baby food vegetables. Raw vegetables were consumed infrequently, particularly among infants and toddlers less than 15 months of age.

The consumption of dark green, leafy vegetables was low. Fewer than 10% of infants and toddlers in all age groups consumed dark green, leafy vegetables in a day; the sole exception was 15- to 19-month-old infants (10.4%). Deep yellow vegetables were consumed more frequently. More than a quarter of infants 4- to 6-month-olds and 39% of 7- to 8-month-olds consumed deep yellow vegetables. After 8 months of age, the percentage of infants consuming deep yellow vegetables began to decline; by 15 to 18 months it had decreased to 14%.

The consumption of potatoes, other starchy vegetables (such as corn and green peas), and other types of vegetables (such as green beans, tomatoes, and tomato sauce) became increasingly common with increasing age. Table 5 shows the top five vegetables consumed by infants and toddlers. The shift over time from deep yellow vegetables to potatoes, starchy vegetables, and other types of vegetables is apparent. By 9 to 11 months, french fries and other fried potatoes were the third most commonly consumed vegetable. By 12 to 14 months, french fries were the second most commonly consumed vegetable, and by

15 to 18 months, they were the most commonly consumed vegetable. More than a quarter of 19- to 24-month-olds consumed french fries or other fried potatoes in a day.

Fruits

Table 6 presents data on the percentage of children consuming various types of fruit (excluding fruit juices) as individual food items. At 4 to 6 months old, 42% of infants consumed some type of fruit in a day. By 7 to 8 months of age, more than three-quarters of all infants were consuming fruit. This percentage remained relatively constant through 15 to 18 months of age, and then began to decline. Substantial numbers of infants and toddlers older than 6 months (about 25% of infants between 7 and 18 months of age and 33% of 19- to 24-month-olds) consumed no discrete servings of fruit in a day.

Commercial baby foods were the leading source of fruits in infants' diets through 7 to 8 months of age. By 9 to 11 months, the percentages consuming baby food fruits and other fruits were roughly equivalent. Fresh fruit was the most commonly consumed type of fruit other than baby food fruit, followed by canned fruit. By 19 to 24 months, the percentage consuming fresh fruit was more than twice that of canned fruit (55% vs 20%). In general, toddlers consumed fruits that were canned in juice or water more often than fruits that were canned in syrup, but the differences were small.

Beginning at age 9 to 11 months, bananas were the most commonly consumed fruit. Berries, citrus fruits, and melons were much less common. Table 7 shows the five most commonly consumed fruits in each age group. The difference in frequencies of fresh fruits and canned is apparent, as is the low frequency of citrus fruits, melons, and berries.

Meats and Other Protein Sources

Fewer than 15% of infants under the age of 7 months consumed meats and other foods high in protein (eg, eggs,

Table 7. Top five fruits consumed by infants and toddlers

Top fruits by age group ^a	Percentage consuming at least once in a day
4-6 months	
Baby food applesauce	17.5
Baby food bananas	13.0
Baby food pears	7.5
Baby food peaches	7.4
Fresh banana	0.3
7-8 months	
Baby food applesauce	29.0
Baby food bananas	25.2
Baby food pears	18.2
Baby food peaches	13.1
Fresh banana	6.6
9-11 months	
Fresh banana	19.0
Baby food applesauce	17.7
Baby food bananas	16.8
Baby food pears	12.4
Canned applesauce	11.1
12-14 months	
Fresh banana	33.0
Canned applesauce	15.2
Fresh grapes	9.0
Fresh apple	8.8
Canned peaches	7.2
Canned fruit cocktail	7.2
15-18 months	
Fresh banana	30.5
Fresh grapes	13.2
Fresh apple	11.2
Fresh strawberries	10.6
Canned peaches	8.9
19-24 months	
Fresh banana	29.6
Fresh apple	15.0
Fresh grapes	11.2
Raisins	9.0
Fresh strawberries	7.6

Data from 2002 Feeding Infants and Toddlers Study (Source: reference 14).
^aBaby food fruits include single fruits (majority of fruits reported) as well as mixtures with the named fruit as the predominant fruit, eg, pears and raspberries or prunes with pears. Baby food fruits with tapioca and other baby food dessert fruits were counted as desserts.

cheese, peanut butter, legumes; does not include meats consumed in sandwiches and other grain-based mixtures; Table 8). When these foods did begin to appear in the diet, they were most commonly consumed in commercial baby food dinners. Fewer than 5% of infants of any age consumed plain baby food meats. By 9 to 11 months, the percentage of children consuming non-baby food meats, poultry, and fish equaled that of commercial baby food dinners. After this age, few children consumed baby food dinners, but substantially more children consumed non-baby food meats and other nonmeat protein sources.

Poultry was the most common type of meat consumed, followed by beef and hot dogs, sausages, and cold cuts. By 12 months of age, hot dogs, sausages, and cold cuts were the second most commonly consumed type of meat.

Among infants 12 months and older, cheese was the most commonly consumed nonmeat protein source, followed by eggs, yogurt, peanut butter, and other nuts and seeds. Peanut butter was consumed as an individual food item by only a small percentage of children less than 1 year of age.

Desserts, Sweets, Sweetened Beverages, and Salty Snacks

About 10% of infants 4 to 6 months of age consumed desserts, sweets, or sweetened beverages in a day (Table 9). The percentages of infants and toddlers consuming these foods increased sharply after age 6 months. Almost half (46%) of the infants 7 to 8 months old consumed one or more foods from this group in a day. By 19 to 24 months, nearly all children (91%) consumed at least one food from this group in a day.

Before 9 months of age, the most commonly consumed desserts were commercial baby food desserts and cookies specifically marketed toward infants (eg, arrowroot cookies, animal crackers/cookies, and teething biscuits). Beginning at 9 months, children consumed a number of other desserts, candy, and sweetened beverages (fruit-flavored drinks and carbonated sodas). The percentages of children consuming these foods increased steadily as age increased. In a day, more than 60% of toddlers between 19 and 24 months consumed some type of cake, cookie, pie, or pastry; 20% consumed candy; and 44% consumed sweetened beverages. The consumption of sweetened beverages is explored in detail in another article in this supplement (18).

DISCUSSION

Much of the published research on food consumption patterns of infants and toddlers has focused on breastfeeding, the use of cow's milk, and/or the timing of the introduction of solid foods (19-21). The 1994 to 1996, 1998 CSFII included infants and toddlers; however, published tables report data only for broad age ranges (<1 year, 1 year, and 2 years) and exclude breastfed infants and toddlers (16-17). The FITS data provide a more comprehensive picture of food consumption habits of infants and toddlers. These data offer insights that practitioners can use in providing nutrition guidance for parents and caregivers of infants and toddlers. They also provide an evidence-based foundation for developing detailed food consumption guidelines for this age group.

The FITS data show two potential concerns related to milk consumption. The use of cow's milk before 1 year of age is a concern, as is the consumption of reduced-fat or nonfat milk before 2 years of age. The American Academy of Pediatrics recommends that cow's milk be avoided before 1 year of age (5). The consumption of cow's milk before this age increases the potential for iron deficiency and contributes to an undesirably high renal solute load (6). There is strong concurrence among experts that fat should not be restricted in diets of children under the age of 2 years (22-24), and several studies have shown that such restrictions can lead to inadequate consumption of food energy and essential nutrients (3,22-23).

The FITS data show that infant cereals are widely used up to 11 months of age. Consumption of iron-fortified infant cereals is one of several strategies recommended by the Centers for Disease Control and Prevention (CDC) to prevent iron deficiency in toddlers (25). The consump-

Table 8. Percentage of infants and toddlers consuming meat or other protein sources

Food group/food	Percentage of infants and toddlers consuming at least once in a day					
	4-6 mo	7-8 mo	9-11 mo	12-14 mo	15-18 mo	19-24 mo
Any meat or protein source	14.2	54.9	79.2	91.3	92.7	97.2
Baby food meat	1.7	4.0	3.1	1.1	0.0	0.0
Nonbaby food meat	1.5	8.4	33.7	60.3	76.3	83.7
Other protein sources	2.7	9.7	36.1	59.2	66.8	68.9
Dried beans and peas, vegetarian meat substitutes	0.6	1.3	3.3	7.0	6.6	9.9
Eggs	0.7	2.9	7.3	17.0	25.0	25.2
Peanut butter, nuts, and seeds	0.0	0.5	1.9	8.8	11.6	10.4
Cheese	0.4	2.1	18.5	34.0	39.1	41.1
Yogurt	1.2	4.1	15.7	14.9	20.2	15.3
Protein sources in mixed dishes	11.0	43.3	46.2	30.1	25.5	20.5
Baby food dinners	9.5	39.8	33.5	10.2	2.4	1.3
Beans and rice, chili, other bean mixtures	0.0	0.0	0.9	1.2	2.1	2.0
Mixtures with vegetables and/or rice/pasta	0.9	1.2	4.7	8.2	9.0	7.8
Soup ^a	0.9	3.4	10.1	12.5	13.8	11.5
Types of meat^b						
Beef	0.9	2.6	7.7	16.1	16.3	19.3
Chicken or turkey	2.0	7.3	22.4	33.0	46.9	47.3
Fish and shellfish	0.0	0.5	1.9	5.5	8.7	7.1
Hotdogs, sausages, and cold cuts	0.0	2.1	7.1	16.4	20.1	27.0
Pork/ham	0.3	1.7	4.0	9.7	11.2	13.9
Other	0.0	0.6	2.5	2.8	2.1	3.9

Data from 2002 Feeding Infants and Toddlers Study (Source: reference 14).

^aThe amount of protein actually provided by soups varies. Soups could not be sorted reliably into different food groups because all soups were assigned the same two-digit food code and many food descriptions lacked detail about major soup ingredients.

^bIncludes baby food and nonbaby food sources.

Table 9. Percentage of infants and toddlers consuming desserts, sweets, sweetened beverages, and salty snacks

Food group/food	Percentage of infants and toddlers consuming at least once in a day					
	4-6 mo	7-8 mo	9-11 mo	12-14 mo	15-18 mo	19-24 mo
Any type of dessert, sweet, sweetened beverage	10.4	45.8	61.1	78.8	88.8	90.5
Desserts and candy	8.4	40.3	53.8	65.4	73.0	75.1
Baby food desserts	4.2	17.7	17.0	6.0	2.3	0.0
Cakes, pies, cookies, and pastries	4.3	27.0	40.9	50.5	60.2	61.6
Baby cookies, teething biscuits, and animal crackers	2.8	17.2	18.0	16.2	13.0	10.6
Other cookies	0.7	8.0	19.2	28.0	40.8	36.6
Cake	0.2	0.6	2.5	3.9	3.5	4.4
Pies and pastries	0.0	0.1	0.8	1.9	2.6	3.0
Sweet rolls, doughnuts, muffins	0.3	0.8	3.4	4.8	8.8	11.6
Ice cream, frozen yogurt, pudding	0.7	3.2	6.7	10.5	16.5	16.3
Other desserts	0.4	1.3	3.5	5.6	5.5	10.7
Candy	0.0	1.1	3.2	10.2	15.2	20.0
Other sweets	1.7	3.6	7.4	20.9	30.7	28.0
Milk flavorings	0.0	0.0	0.1	1.2	2.9	4.6
Sugar, syrups, preserves	1.7	3.6	7.3	20.7	28.3	23.4
Sweetened beverages	0.6	7.5	11.2	28.2	36.7	44.3
Carbonated sodas	0.0	1.1	1.4	4.1	10.1	11.4
Fruit-flavored drinks	0.6	6.6	9.2	23.0	29.6	37.5
Other	0.0	0.6	1.0	3.1	4.0	2.9
Salty snacks^a	0.0	2.0	5.8	15.6	21.2	26.6

Data from 2002 Feeding Infants and Toddlers Study (Source: reference 14).

^aIncludes potato chips, popcorn, cheese curls/puffs, tortilla chips, corn chips, and other types of chips and salty snacks.

tion of presweetened noninfant cereals is a potential concern. Although many of these cereals are comparable with unsweetened cereals in vitamin and mineral content, their use may contribute to a preference for sweetened foods.

The low vegetable and fruit consumption by infants and toddlers is a major concern. Daily consumption of a wide variety of vegetables and fruits is a cornerstone of a healthy diet (7,8,24). The FITS data show that substantial proportions of infants and toddlers consumed no vegetables or fruits as distinct food items in a day and that the vegetables most commonly consumed tended to be those lower in micronutrients and higher in energy. Similar patterns of vegetable and fruit consumption were recently reported for school-age children (26-28). The low percentages of infants and children consuming summer fruits such as melons and berries may have been influenced by seasonal variation. The FITS data were collected from March through July 2002.

The CDC recommends the consumption of plain meats after 6 months of age to prevent iron deficiency (25). Easily chewed red meats such as baby food meat and pureed home-prepared meat have been recommended as a source of highly bioavailable heme iron (6). The FITS data indicate that relatively few infants under the age of 9 months are being fed plain meats of any kind. Commercial baby food dinners, which include meat, poultry, or nonmeat protein sources, are far more commonly consumed. Chicken and turkey are the most popular type of meat, followed by hot dogs, sausages, and cold cuts. The latter are lower in iron, zinc, and other nutrients and are generally higher in fat and sodium than other meats.

The majority of infants and toddlers over 8 months old consumed at least one type of dessert, sweet, or sweetened beverage in a day. By 19 to 24 months, 91% of toddlers consumed one or more of these foods in a day, and 27% consumed a salty snack. Many of these foods are high in calories and low in micronutrients. In light of the increasing prevalence of childhood obesity in the United States (29), these consumption patterns deserve careful consideration.

We surmise that infants and toddlers are being fed the same foods that other members of the family are eating, because many of the food consumption patterns observed in the FITS data are consistent with patterns observed among older children and the entire US population (26-28,30). What is surprising is that some of these patterns begin to emerge as early as 9 to 11 months of age. Given that some food preferences seem to be established early in life (11) and that they may predict later eating habits (12), efforts to foster the development of healthy eating habits should begin very early in life. The FITS provides a foundation for building a more complete understanding of the food consumption patterns of this age group. Moreover, given the influence of family eating habits (31), particularly for older infants and toddlers, guidance will need to take a family-based approach.

APPLICATIONS

- Dietary guidance provided to parents and caregivers should stress the importance of meeting the special nutritional needs of infants and toddlers and the potential impacts of early food preferences and eating habits over the long term. Because family food choices influence what foods are offered to children, family-based

approaches to developing healthy eating habits may be helpful.

- The FITS data suggest that dietetics professionals consider the following points when providing guidance for parents and caregivers:

Once infants begin consuming solid foods, the goal is gradually to include a variety of vegetables and fruits on a daily basis. Emphasis should be placed on dark green, leafy, and deep yellow vegetables and on colorful fruits.

Parents should limit the frequency with which they offer desserts, sweets, sweetened beverages, and salty snacks. Nutrient-dense, age-appropriate foods including fruit, cheese, yogurt, and cereal are good alternative snacks. Water, milk, and 100% fruit juices should be offered as alternative beverages.

Cow's milk should not be fed to infants under 1 year of age, and reduced-fat and nonfat milk should not be fed to children under 2 years of age.

At about 6 months of age, infants should be offered plain, pureed meats instead of or in addition to commercial baby food dinners. Children in older age groups should be offered other meats that they can chew easily.

References

1. Ryan C, Dwyer J, Ziegler P, Yang E, Moore L, Song WO. What should infants eat and what do infants really eat? *Nutr Today*. 2002;37:50-56.
2. Herrick RA, Dwyer JT, Ziegler P, Moore L, Park Y, Yang E, Song WO, Martinez AD. Food sources of nutrients and adequacy of nutrient intakes in infants. *Nutr Today*. (In press.)
3. Picciano MF, Smickilas-Wright H, Birch LL, Mitchell DC, Murray-Kolb L, McConahy KL. Nutritional guidance in needed during dietary transition in early childhood. *Pediatrics*. 2000;106:109-114.
4. American Academy of Pediatrics, Committee on Nutrition. Breastfeeding and the use of human milk. *Pediatrics*. 1997;100:1035-1039.
5. American Academy of Pediatrics, Committee on Nutrition. The use of whole cow's milk in infancy [policy statement]. *AAP News*. 1992;8:8-22.
6. Foman S. Feeding normal infants: Rationale for recommendations. *J Am Diet Assoc*. 2001;101:1002-1005.
7. The Food Guide Pyramid. Washington, DC: US Dept of Agriculture, Center for Nutrition Policy and Promotion; 1996. Home and Garden Bulletin No. 252.
8. Tips for Using the Food Guide Pyramid for Young Children 2 to 6 Years Old. Washington, DC: US Dept of Agriculture, Center for Nutrition Policy and Promotion; 1999. Program Aid 1647.
9. American Academy of Pediatrics, Committee on Nutrition. Supplemental foods for infants. In: Kleinman R, ed. *Pediatric Nutrition Handbook*. 4th ed. Elk Grove Village, IL: American Academy of Pediatrics; 1998:43-54.
10. Skinner J, Carruth BR, Bounds W, Ziegler P. Children's food preferences: A longitudinal analysis. *J Am Diet Assoc*. 2002;102:1638-1647.
11. Birch LL. Development of food acceptance patterns in the first year of life. *Proc Nutr Soc*. 1998;57:617-624.
12. Glinsmann W. Dietary guidelines for infants. In: Ebejer M, ed. *Current Practices in Infant Feeding*. Fremont, MI: Gerber Products Company; 1999.

13. Devaney B, Ziegler P, Pac S, Karwe V, Barr SI. Nutrient intakes of infants and toddlers. *J Am Diet Assoc.* 2004;104(suppl 1):S14-S21.
14. 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.
15. Skinner JD, Ziegler P, Ponza M. Transitions in infants' and toddlers' beverage patterns. *J Am Diet Assoc.* 2004;104(suppl 1):S45-S50.
16. US Department of Agriculture, Agricultural Research Service. Food and Nutrient Intakes by Region, 1994-1996. Table set 14. 1999. Available at: <http://www.barc.usda.gov/bhnrc/foodsurvey/homt.htm>. Accessed December 2003.
17. US Department of Agriculture, Agricultural Research Service. Food and Nutrient Intakes of Children 1994-96, 1998. Table set 17. 1999. Available at: <http://www.barc.usda.gov/bhnrc/foodsurvey/homt.htm>. Accessed December 2003.
18. Briefel RR, Reidy K, Karwe V, Devaney B. Feeding Infants and Toddlers Study: Improvements needed in meeting infant feeding recommendations. *J Am Diet Assoc.* 2004;104(suppl 1):S31-S37.
19. Martinez GA, Dodd DA, Samartgedes JA. Milk feeding patterns in the United States during the first 12 months of life. *Pediatrics.* 1981;68:863-868.
20. Skinner JD, Carruth BR, Houck K, Moran J 3rd, Coletta F, Cotter R, Ott D, McLeod M. Transitions in infant feeding practices during the first year of life. *J Am Coll Nutr.* 1997;16:209-215.
21. Ryan AS, Wenjun Z, Acosta A. Breastfeeding continues to increase into the new millennium. *Pediatrics.* 2002;110:1103-1109.
22. American Academy of Pediatrics, Committee on Nutrition. Statement on cholesterol. *Pediatrics.* 1992;90:469.
23. American Academy of Pediatrics, Committee on Nutrition. Cholesterol in childhood. *Pediatrics.* 1998;101:141-147.
24. US Department of Agriculture, US Department of Health and Human Services. Nutrition and Your Health: Dietary Guidelines for Americans. 4th ed. Washington, DC: US Government Printing Office; 2000.
25. Centers for Disease Control. Recommendations to prevent and control iron deficiency in the United States. *MMWR.* 1998;47:1-36.
26. Krebs-Smith SM, Cook A, Subar AF, Cleveland L, Friday J, Kahle LL. Fruit and vegetable intakes of children and adolescents in the United States. *Arch Pediatr Adolesc Med.* 1996;150:81-86.
27. Krebs-Smith SM, Heimendinger J, Patterson BH, Subar AF, Kessler R, Pivonka E. Psychosocial factors associated with fruit and vegetable consumption. *Am J Health Promot.* 1995;10:98-104.
28. Munoz KA, Krebs-Smith SM, Ballard-Barbash R, Cleveland L. Food intakes of US children and adolescents compared with recommendation. *Pediatrics.* 1997;100:323-329.
29. US Department of Health and Human Services. Healthy People 2010: Understanding and Improving Health. 2nd ed. Washington, DC: US Government Printing Office; November 2000.
30. Kant AK, Schatzkin A, Block G, Xiegler RG, Nestle M. Food group intake patterns and associated nutrient profiles of the US population. *J Am Diet Assoc.* 1991;91:1532-1537.
31. Picciano MF, McBean LD, Stallings VA. How to grow a healthy child: A conference report. *Nutr Today.* 1999;34:6-14.