Meal and Snack Patterns of Infants and Toddlers

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ABSTRACT

Objective To describe meal and snack patterns of infants and toddlers.

Design A cross-sectional telephone survey in which mothers reported their infants' and toddlers' food and beverage intakes for a 24-hour period.

Subjects Subjects included 3,022 infants and toddlers, ages 4 to 24 months, in the Feeding Infants and Toddlers Study.

Statistical Analyses Performed Means±standard deviations, frequencies, percentages, energy and nutrient analyses, nutrient densities.

Results On average, infants and toddlers were fed seven times per day. The breakfast, lunch, and dinner pattern, plus snacks, emerged at 7 to 8 months and was well established by 9 to 11 months. Breakfasts were higher in nutrient density for iron, folate, and calcium than other meals. The percentage of children reported to be eating snacks increased with age. The afternoon snack was consumed by over 80% of toddlers (12 to 24 months), and snacks provided about 25% of toddlers' daily energy intakes. Typical snack foods for toddlers were milk, water, cookies, crackers, chips, and fruit drinks.

Applications/Conclusions Results of this study provide parents and professionals with specific information about meal and snack patterns, thereby allowing development of targeted messages and/or strategies to improve the dietary patterns of infants and toddlers. Although most foods provided to the Feeding Infants and Toddlers Study infants and toddlers were nutritionally and developmentally appropriate, snack choices could be improved by delaying introduction of and limiting exposures to foods low in nutrients and high in calories.

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The prevalence of snacking and concerns about the quantity and nutritional quality of foods consumed by children and adolescents has increased in recent years (1-8). Concern also has been expressed about deterioration of meal patterns, particularly family dinners (9-11), skipping breakfast and other meals (11-14), and away-from-home eating (6,15-17). Total energy intake from food eaten or obtained away from home by children 2 to 5 years old increased by 100% between 1977 to 1978 and 1994 to 1996 (16). The number of daily snacks eaten by children 2 to 5 years old increased from 1.7 in 1977 to 2.3 in 1996, and the average daily energy intake from snacks also increased by about 100 kcal (1). Foods eaten between meals (eg, snacks) also seem to be lower in nutrient density than foods eaten at meals by preschool children (4). Little is known about the meal and snack patterns of infants and toddlers, although their intakes also may be problematic.

Several recent longitudinal studies suggest that eating patterns of children strongly tracked over periods of 19 months to more than 6 years, for macronutrients (18-20), fruits and vegetables (18,21,22), meats and edible oils (18), and overall food preferences (23). Skinner and colleagues reported that children's food preferences at ages 2 or 4 years old were major predictors of their preferences at 8 years of age (23). Additionally, fruit and vegetable variety in the diets of children at 8 years of age was predicted by food-related experiences before age 2 years (22). Other food-related behaviors may also have their origins before age 2 years old; thus, it is appropriate to investigate the formation of meal and snack patterns in infants and toddlers. The purpose of this study was to describe the meal and snack patterns of the 3,022 infants and toddlers who participated in the Feeding Infants and Toddlers Study (FITS), and to identify transitions in these patterns before 2 years of age.

METHODS

The FITS is a cross-sectional survey with six age categories (4 to 6, 7 to 8, 9 to 11, 12 to 14, 15 to 18, and 19 to 24 months). The recruitment of subjects, the sampling frame, the data collection process, and nutrient analyses procedures have been described (24). Because this article is focused on meal and snack patterns, nutrient intakes excluding dietary supplements were used for analyses.

Mothers (or other primary caregivers) provided, by telephone, a 24-hour dietary recall; they also were asked the time of each eating occasion and whether they considered it a breakfast, lunch, dinner, snack, or other eating occasion. Snacks were then further categorized by researchers as: morning snack (eaten between waking until noon or lunch), afternoon snack (eaten between noon or lunch until 6 PM), and evening snack (eaten after 6 PM or dinner to bedtime). Other eating occasions were those occasions that mothers did not consider either a meal or a snack. Typically these occasions included night feedings and between-meal feedings of breast milk or formula only.

The number of distinct eating occasions was summed for each child; group means, standard deviations (SD), and medians were calculated for each of the six age categories. The percentage of children participating in each eating occasion was calculated.

Each child's energy and nutrient intakes, percentages of energy from each macronutrient, and nutrient densities at each eating occasion were computed from these data, and group means±SD were calculated for each eating occasion by age. Nutrient density data (ie, milligrams of intake per

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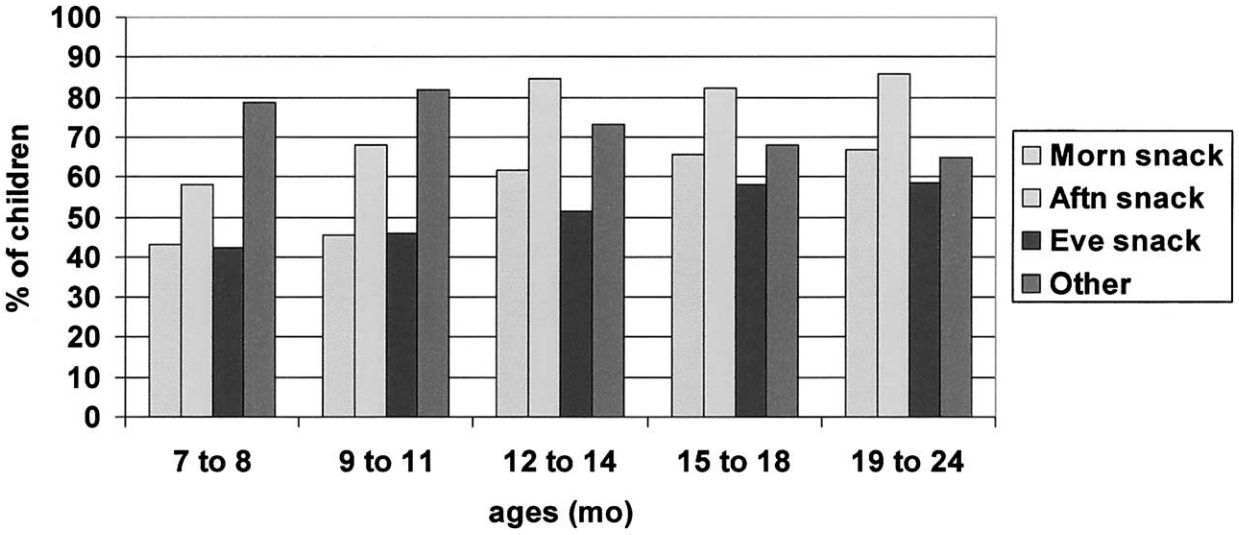

Figure 1. Percentages of infants and toddlers participating in nonmeal eating occasions.

1,000 kcal food energy) allow informal comparisons (eg, not statistical analyses) of dietary quality and identification of transitions in eating patterns among subsamples with different energy intakes, such as children of different ages. We expected that most nutrient densities would decrease with increasing ages of children.

Because of the difficulty in estimating the quantity of breast milk for young infants who consumed breast milk and other nonmilk food and beverages, nutrient intakes for the ages 4 to 6 months were not included in these analyses (25). Although this same issue of estimating the quantity of breast milk also applies to older breastfed infants, two factors justify including older breastfeeding infants in the analysis; (a) the assumed quantity of breast milk consumed for these older infants (600 mL for breastfed infants older than 6 months) accounts for the fact that energy from solid foods replaces energy from breast milk as solids are introduced, and (b) the proportion breastfeeding is substantially lower among infants 7 to 11 months of age, suggesting that the issue related to estimating the quantity of breast milk is less important for these infants.

Typical foods eaten at each eating occasion were calculated as follows. First, foods eaten at each eating occasion were categorized (ie, meats, fruits, vegetables, grains, mixed dishes, sweets and sweetened beverages, and other, which included foods such as margarine and butter). Percentages of children consuming foods from the major categories at each eating occasion were calculated. Next, minor categories were created in each major category (eg, meats: beef, chicken, pork). For some categories more specificity (eg, a second minor category) was necessary to accurately describe foods eaten.

RESULTS

Eating Patterns

Regardless of age group, the median number of daily eating occasions was seven, and the total number of meals and snacks consumed ranged from 3 to 15. Breakfast, lunch, and dinner were eaten by over 89% of the children, excluding the youngest infants. The percentages of each age group who reported eating each snacks or the other eating occasion are shown in Figure 1. The percentages of children reported to be eating snacks increased with age. Over 80% of toddlers (12 to 24 months) ate afternoon snacks, whereas two-thirds of toddlers consumed a morning snack and slightly more than half consumed an evening snack.

The percentages of daily food energy provided by break-

Table 1. Percentages of total energy from each eating occasion by age category for infants and toddlers[a]

Eating occasion[b]	4-6 mo n=862	7-8 mo n=483	9-11 mo n=679	12-14 mo n=374	15-18 mo n=308	19-24 mo n=316
	← mean %[c] →					
Breakfast	13	18	18	19	19	20
Lunch	11	15	17	20	20	21
Dinner	12	16	17	21	24	24
Snacks	15	20	20	25	25	26
Other	49	32	28	16	12	9

[a]n=3,022 children.

[b]Eating occasions as reported by mothers or other primary caregivers; other eating occasions were defined as those not categorized as a meal or snack, such as feedings with only breast milk or infant formula.

[c]Mean percentages weighted for oversampling, nonresponse, and underrepresentation of certain ethnic or racial groups.

Table 2. Macronutrient distributions at meals and snacks by age category

	7-8 mo	9-11 mo	12-14 mo	15-18 mo	19-24 mo
	← % of energy →				
Breakfast					
Protein	8	10	14	14	14
Fat	28	27	30	31	32
Carbohydrate	64	65	58	57	56
Lunch					
Protein	10	12	16	17	16
Fat	28	29	34	34	35
Carbohydrate	64	61	51	50	49
Dinner					
Protein	11	14	18	19	19
Fat	27	28	35	33	35
Carbohydrate	63	59	49	49	47
Morning snack					
Protein	8	8	12	11	10
Fat	42	36	33	29	26
Carbohydrate	51	58	58	62	67
Afternoon snack					
Protein	9	9	12	12	10
Fat	37	34	32	28	28
Carbohydrate	57	58	59	63	65
Evening snack					
Protein	8	10	14	13	13
Fat	40	41	37	34	31
Carbohydrate	52	51	52	55	58

n=3,022 infants and toddlers.

fast, lunch, dinner, snacks, and the other eating occasion are presented in Table 1. The percentages of energy from meals and snacks increased with age and that from the other eating occasion decreased. Among infants, the other eating occasion category provided the highest percentages of energy; among toddlers, snacks (all daily periods combined) provided slightly higher percentages of energy than any single meal occasion. For toddlers, snacks provided about 25% of their daily energy intake. Breakfast provided less than 20% of daily energy for both infants and toddlers.

Nutrient Contributions of Meals and Snacks

Macronutrient data suggest that major changes in dietary intake occurred between 9 to 11 and 12 to 14 months (Table 2). Percentages of energy from protein tended to increase at both meals and snacks, although fat percentages increased at meals and decreased at snacks, and carbohydrate percentages decreased at meals and increased at snacks. Among toddlers, breakfasts tended to be slightly lower in fat and higher in carbohydrate than other meals, and evening snacks were higher in fat and protein and lower in carbohydrate than morning snacks.

Nutrient densities for selected nutrients (iron, calcium, vitamin A, folate) show a variety of patterns (Figure 2). Iron density decreased with age for all meals, although iron density at breakfast was higher than at other meals. Calcium densities were similar among the five age groups; breakfasts showed the highest calcium density.

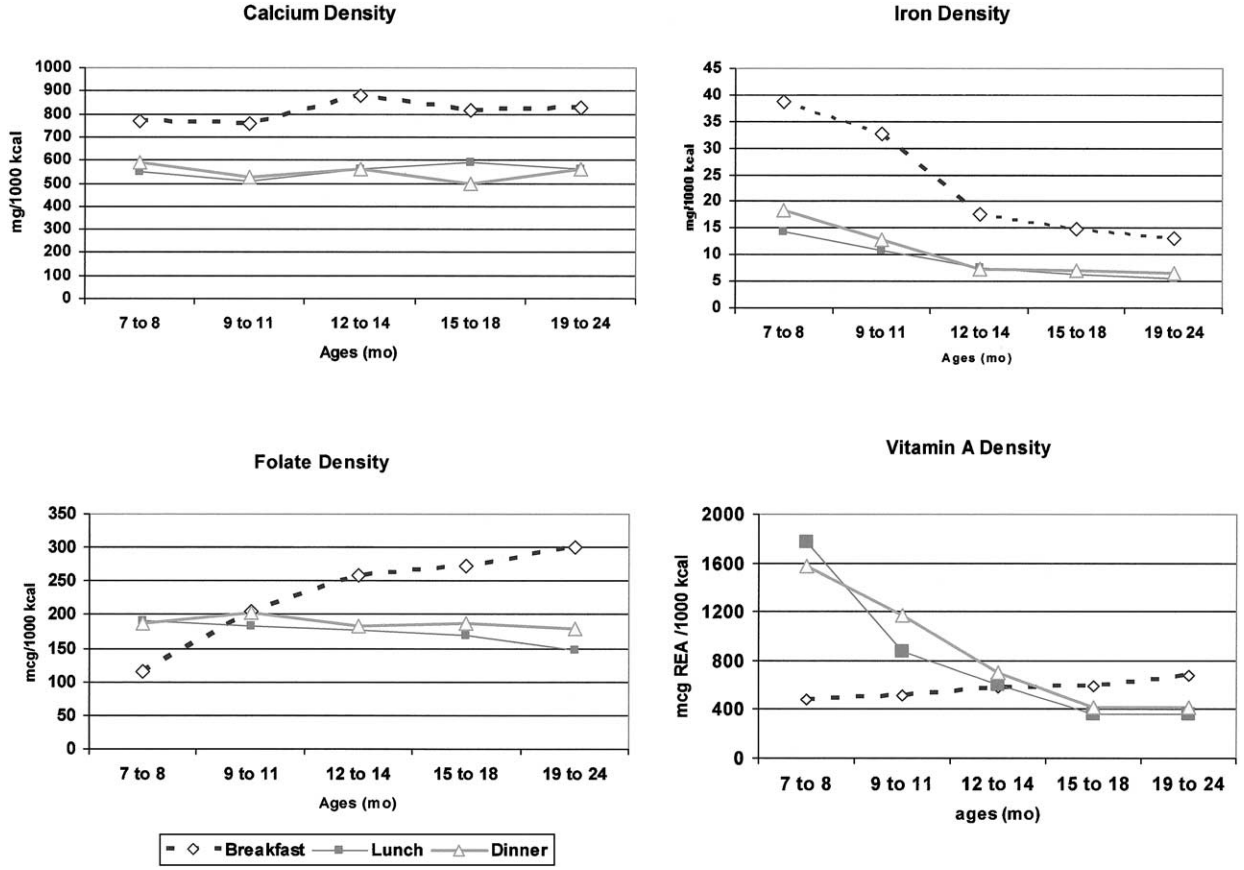

Figure 2. Nutrient densities of meals.

Table 3. Most frequently eaten foods at each eating occasion by age category

Eating occasion	4-6 mo	7-8 mo	9-11 mo	12-14 mo	15-18 mo	19-24 mo
	← *Percent of children consuming each food* →					
Breakfast[a]	Formula (62)[b] Infant cereal (55) Breast milk (19) Water (14) Apple juice (10)	Infant cereal (73) Formula (51) Water (25) BF banana mix (12)[e] BF apple mix (11)	Infant cereal (53) Formula (38) Water (26) RTE cereal (18)	Whole milk (45) RTE cereal (25)[c] Water (23) Banana (19) Infant cereal (18) Bread, etc. (16) Pancakes, etc. (15)[g] Eggs (14) Butter, etc. (12) Low-fat milk (11) Syrup (11)	Whole milk (47) Bread, etc. (24)[d] RTE cereal (23) Water (22) Butter, etc. (19)[f] Syrup, etc. (19) Eggs (19) RTE sweet cereal (16) Pancakes, etc. (15) Banana (15) Low-fat milk (12) Hot cereal (11)	Whole milk (40) Water (23) Eggs (21) RTE cereal (19) Butter, etc. (19) Low-fat milk (17) Bread etc. (16) RTE sweet cereal (16) Banana (14) Syrup, etc. (14) Orange juice (13) Pancakes, etc. (13) Hot cereal (11)
Lunch[h]	Formula (56) Infant cereal (26) Breast milk (19) Water (18) BF apple mix (10)	Formula (41) BF dinner (24) Water (24) BF apple mix (14) Infant cereal (13)	Water (34) Formula (27) BF dinner (21) Bread, etc. (11) Apple juice (10)	Water (38) Whole milk (23) Bread, etc. (18) Sandwich (17)[i] Cheese (16) Chicken (15) Crackers, etc. (10) Apple juice (10)	Water (33) Whole milk (30) Bread, etc. (26) Chicken (24) Sandwich (22) Cheese (18) Pasta/rice (15) French fries (11)	Water (32) Chicken (25) Bread, etc. (24) Whole milk (24) Sandwich (20) Cheese (16) Hotdog/sausage (14) Fruit drink (14) French fries (13) Pasta/rice (11) Low-fat milk (11)
Dinner[j]	Formula (54) Infant cereal (40) Breast milk (17) Water (17) BF dinner (11)	Formula (38) BF dinner (29) Infant cereal (25) Water (23)	Water (34) Formula (24) BF dinner (24) Chicken (14) Pasta/rice (12) Infant cereal (12)	Water (36) Whole milk (30) Chicken (22) Pasta/rice (19) Bread, etc. (18) Cheese (14) Beef (13) Green beans (12)	Water (33) Pasta/rice (31) Chicken (29) Whole milk (27) Bread, etc. (16) Cheese (14) Beef (14) Butter, etc. (14) Green beans (11) Fruit drink (10)	Water (30) Chicken (29) Pasta/rice (27) Whole milk (23) Bread, etc. (22) Cheese (17) Butter, etc. (15) Beef (13) Corn (12) Fruit drink (12) Low-fat milk (12) Green beans (12)
Morning snack[k]	Formula (56) Breast milk (30) Infant cereal (16) Water (11)	Formula (60) Water (18) Breast milk (16)	Formula (39) Water (29) Breast milk (16) Crackers, etc. (15) Apple juice (14) RTE cereal (12)	Water (34) Whole milk (27) Crackers, etc. (16) Cookies (13) RTE cereal (12)	Water (35) Whole milk (26) Crackers, etc. (25) Cookies (17) Fruit drink (12)	Water (32) Crackers, etc. (17) Whole milk (17) Cookies (15) Fruit drink (12)
Afternoon snack[l]	Formula (55) Breast milk (22) Water (19) Infant cereal (11)	Formula (52) Water (24) Baby cookies (15) Breast milk (11) Crackers, etc. (10) RTE cereal (10)	Water (34) Formula (32) Crackers, etc. (20) RTE cereal (14) Baby cookies (11) Cookies (11) Breast milk (11)	Water (35) Crackers, etc. (30) Whole milk (26) Cookies (16)	Water (35) Cookies (28) Whole milk (26) Crackers, etc. (26) Chips (12) Fruit drink (11) Candy (10)	Water (36) Crackers, etc. (26) Cookies (17) Whole milk (15) Fruit drink (14) Chips (13) Candy (11) Cheese (11)
Evening snack[m]	Formula (59) Breast milk (32) Infant cereal (19) Water (12)	Formula (56) Water (18) Breast milk (16) Infant cereal (12)	Formula (43) Water (19) Breast milk (14) Crackers, etc. (12)	Whole milk (39) Water (20) Crackers, etc. (12)	Whole milk (35) Water (26) Cookies (19) Ice cream, etc. (12) Low-fat milk (11)	Water (31) Whole milk (27) Low-fat milk (15) Cookies (14) Crackers, etc. (12) Soda (10)

[a]Unweighted numbers of children consuming breakfast were 4-6 mo, n=592; 7-8 mo, n=436; 9-11 mo, n=650; 12-14 mo, n=374; 15-18 mo, n=303; 19-24 mo, n=305.
[b]Percentage of children consuming this food at this eating occasion.
[c]RTE=ready-to-eat.
[d]Bread, etc.=bread, rolls, biscuits, bagels, tortillas.
[e]BF=baby food.
[f]Butter, etc.=butter, oil, margarine, other fats.
[g]Pancakes, etc.=pancakes, waffles, french toast.
[h]Unweighted numbers of children consuming lunch were 4-6 mo, n=526; 7-8 mo, n=425; 9-11 mo, n=624; 12-14 mo, n=358; 15-18 mo, n=284; 19-24 mo, n=305.
[i]Sandwich includes all kinds (eg, peanut butter, cheese, hamburger)
[j]Unweighted numbers of children consuming dinner were 4-6 mo, n=597; 7-8 mo, n=445; 9-11 mo, n=636; 12-14 mo, n=365; 15-18 mo, n=298; 19-24 mo, n=304.
[k]Unweighted numbers of children consuming morning snacks were 4-6 mo, n=261; 7-8 mo, n=215; 9-11 mo, n=313; 12-14 mo, n=234; 15-18 mo, n=198; 19-24 mo, n=217.
[l]Unweighted numbers of children consuming afternoon snacks were 4-6 mo, n=317; 7-8 mo, n=281; 9-11 mo, n=462; 12-14 mo, n=312; 15-18 mo, n=253; 19-24 mo, n=269.
[m]Unweighted numbers of children consuming evening snacks were 4-6 mo, n=254; 7-8 mo, n=213; 9-11 mo, n=306; 12-14 mo, n=188; 15-18 mo, n=175; 19-24 mo, n=188.

Vitamin A density decreased with increasing age except at breakfast. Folate density tripled with age at breakfast, but was similar among age categories at other meals.

Foods Eaten at Meals and Snacks

Foods consumed by at least 10% of children by eating occasion and by age are shown in Table 3. Infants at 4 to 6 months relied primarily on breast milk or formula, although infants at 7 to 8 months also ate many complementary foods. Most toddlers transitioned from infant formula to whole milk at about 1 year of age. About half of the children ages 9 to 24 months ate a fruit or fruit juice at breakfast and/or lunch (data not shown); bananas were the most popular fruit at breakfast. Chicken and cheese were eaten by toddlers at both lunch and dinner. Although about two-thirds of toddlers ate a vegetable at dinner, only a few vegetables were eaten by at least 10% of toddlers (eg, green beans, french fries, corn). By 12 to 24 months, foods such as fruit drinks, candy, chips, and cookies were typical snack foods, along with milk, water, and crackers.

Many toddlers did not meet the Five a Day for Better Health (26) program's recommendation for fruits and vegetables. From 40% to 50% of toddlers did not have a fruit for breakfast; about 50% lacked fruit at lunch, and about 60% at dinner. Fruit was uncommon at morning, afternoon, and evening snacks. Similarly, more than 50% of toddlers did not have any vegetables for lunch, and more than 30% had no vegetable for dinner; vegetables were rarely included for breakfast or snack occasions (<5% of food records).

DISCUSSION

Generally, infants and toddlers in the FITS were fed well. Skipping meals was not a problem in these infants and toddlers, in contrast to reports on older children and adolescents (2,5,12-14). Among the FITS children, the transition from multiple daily feedings to the traditional American pattern of three meals plus snacks per day began at 7 to 8 months and apparently was well established by 9 to 11 months. The afternoon snack period seemed to be slightly more popular than morning or evening times, confirming patterns in 2 to 8 year olds reported elsewhere (27). Frequent eating occasions throughout the day are appropriate for infants, toddlers, and young children because of their small stomachs and high levels of activity. However it is important that snack occasions be planned to complement the energy and nutrients provided by meals (1,10,27). Milk, water, and crackers were often consumed as snacks by the FITS toddlers, but fruit drinks, cookies, candy, and chips also were common; thus the nutritional quality of some snacks could be improved. Because children's intakes did not meet Five a Day for Better Health program's recommendations, parents should be encouraged to offer developmentally appropriate fruits and vegetables as frequent snack choices.

Food intakes were consistent with and provided explanations for transitions in nutrient intakes. Increased protein and decreased carbohydrate and fat occurred when infants transitioned from infant formula to whole milk at about 1 year of age. Transitions from baby food to table food showed decreased vitamin A and folate densities when meals at 9 to 11 months were compared with those at 12 to 24 months. Patterns previously reported in older children, such as substitution of fruit drinks or carbonated beverages for milk (27), first appeared in the 15 to 18 month subgroup at lunch, dinner, morning snacks, and afternoon snacks. Although carbonated beverages were not consumed by more than 10% of infants or toddlers at any single eating occasion, another article in this supplement (28) documented that carbonated beverages were consumed by more than 11% of toddlers more than 15 months old in the FITS. Some foods, such as cookies, candy, and french fries, were eaten by more than 10% of the FITS children, similar to patterns in older children (3-6,17,27). Children's low fruit and vegetable intakes are also evident in other studies (12,21-23). These findings suggest that several eating patterns currently of great concern in older children and adolescents may have originated before 2 years of age. Although preferences for sweet-tasting foods are innate, early and repeated exposures to specific foods have been shown to enhance their acceptability to children (29,30). The stability of early food preferences shown in a longitudinal study (23) also suggests that delaying introduction of and exposures to foods low in nutrients and high in calories may be wise during periods when many preferences are formed. Parents and caregivers must assume responsibility for offering appropriate foods to infants and toddlers. Because infants and toddlers often want to taste what the rest of the family is eating, these recommendations may involve some alterations in family patterns.

One of the problems associated with research about meals and snacks is that inconsistent definitions prevent valid comparisons among studies (7). The FITS mothers were asked to designate each eating occasion as breakfast, lunch, dinner, or a snack; then, snacks were further categorized by researchers using the time of the eating occasion. However, allowing respondents to identify eating occasions as meals or snacks may result in inconsistent categorization within a data set (7). For example, one respondent may categorize an eating occasion as a meal although another respondent may categorize the same combination of foods as a snack. In other studies, researchers have established specific criteria, such as time of day and certain meal components, and then categorized eating occasions accordingly (11). Thus, caution should be used when interpreting data from different studies about meal and snack patterns (7).

APPLICATIONS

- Parents and caregivers should provide toddlers with nutritious foods (eg, milk, developmentally appropriate fruits and vegetables) as snacks rather than high-sugar, high-calorie foods such as cookies and candy.
- Parents should be encouraged to delay the introduction of and limit exposures to foods low in nutrients and high in calories so that toddlers do not learn to prefer these foods over more nutritious choices.
- Dietetics professionals can help parents and caregivers by providing suggestions about appropriate and easy-to-serve foods, homemade or commercial, for toddlers' meals and snacks.

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