

Feeding Infants and Toddlers Study

Part 4: Meal, Snack, and Beverage Patterns

Synopsis — Prior to the Gerber Feeding Infants and Toddlers Study (FITS), little was known about the meal, snack, and beverage patterns of infants and toddlers. This article reviews FITS results that describe the meal, snack, and beverage patterns of the 3,022 infants and toddlers, and the transitions in these patterns before 2 years of age.

As would be expected, infants at 4 to 6 months of age relied primarily on breast milk or formula, and infants at 7 to 8 months ate many complementary foods, such as infant cereals and baby foods dinners. Toddler's food choices at various meals and snacks tended to mirror typical patterns of the American diet. Many toddlers did not meet the Five a Day for Better Health program's recommendations for

fruits and vegetables. The percentage of very young children consuming fruit drinks was less than 10% at four to eight months of age, but rose to over 40% at 19 to 24 months; carbonated beverages were consumed by more than 11% of toddlers more than 15 months old. Thus fruit drinks and carbonated beverages are replacing more nutritious beverages in young children's diets.

The finding that some toddlers are consuming carbonated beverage, cookies, candy, and not eating sufficient fruits and vegetables, suggests that several eating patterns currently of great concern in older children and adolescents may originate before 2 years of age. Although preferences for sweet-tasting foods are innate, delaying introduction of and limiting exposures to foods low in nutrients and high in calories may be wise during periods when many food preferences are formed.



Generally, participants in the Gerber Feeding Infant and Toddlers Study (FITS) were fed well. Skipping meals was not a problem in these infants and toddlers, in contrast to reports on older children and adolescents.



The prevalence of high-calorie, low-nutrition snacking¹⁻⁵ and concerns about the quantity and nutritional quality of mealtime foods⁶⁻¹⁰ and beverages¹¹⁻¹⁷ that children and adolescents consume has increased in recent years. Meal patterns have deteriorated, particularly with regard to family dinners,¹⁸⁻²⁰ skipped breakfast and other meals,²⁰⁻²³ and away from home eating.^{3,24-26} Younger children's eating patterns mirror this decline. In children 2 to 5 years old, total energy intake from foods eaten or obtained away from home increased by 100% between 1977-1978 and 1994-1996.²⁵ The number of daily snacks they ate increased from 1.7 in 1977 to 2.3 in 1996 and the average daily energy intake from those snacks increased by about 100 kcal.¹ For preschool children, these between meal snacks also seem to be lower in nutrient density than foods eaten at meals.²⁷

Beverage consumption patterns pose similar concerns, particularly with regard to the increased consumption of beverages high in calories and sugars (e.g., carbonated beverages and sweetened fruit drinks),¹¹⁻¹³ the relationship of these beverages and childhood overweight/obesity,^{14,15} and their displacement of other more nutritionally desirable foods and beverages in the diet.^{11,13,16} In addition to compromised nutritional health, carbonated beverage consumption is related to bone fracture in adolescents²⁸ and dental caries in preschool children.²⁹

Prior to the Gerber Feeding Infants and Toddlers Study (FITS), little was known about the meal, snack,



and beverage patterns of infants and toddlers. This article reviews FITS results that describe the meal, snack, and beverage patterns of 3,022 infants and toddlers, and the transitions in these patterns before 2 years of age. We will also explore whether increased intakes of carbonated beverages and sweetened fruit drinks displace 100% juice and milk in the diet, as suggested with previous studies with older children.^{11-13,16,17} Because food preferences during early childhood are highly predictive of food preferences in later childhood,³⁰ transitions in meal,

snack, and beverage patterns and the development of these patterns prior to two years of age may be important to the establishment of healthy patterns in childhood and adolescence, as well as affecting the current health of infants and toddlers.

Methods

Mothers or other primary caregivers who participated in the FITS provided a 24-hour dietary recall of all the food and beverages that their infant or toddler consumed on the previous day. FITS participants 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 and 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 parents did not consider either a meal or a snack, typically night feedings and between-meal feedings of

Infants at 4 to 6 months of age relied primarily on breast milk or formula, and infants at 7 to 8 months ate many complementary foods, such as infant cereals and baby foods dinners. Toddler food choices at various meals and snacks tended to mirror typical patterns of the American diet.

breast milk or formula only. For the meal and snack pattern findings,³¹ researchers derived the estimated percentage of energy intake from seven categories of food [meats, fruits, vegetables, grains, mixed dishes, sweets and sweetened beverages, and other (e.g., butter, margarine)] for each age group at each eating occasion. Minor categories were created for some categories (e.g., meats: chicken, beef, pork).

For the beverages findings,³² the data were categorized into six groups: total milks, 100% juices, fruit drinks, carbonated beverages, water, and “other” drinks (Table 1). Total milks included breast milk, all kinds of infant formula, cow’s milk with varying fat content, soy milk, and goat’s milk. Although these milks may differ in nutrient composition and bioavailability, they are more similar to one another than to any of the remaining beverage categories, which also differ in nutrient content within each category. To explore the notion that some beverages may displace others in the diets of toddlers, two linear regression models were developed. Analyses were limited to data from 15- to 24-month-old toddlers because the numbers of children consuming carbonated beverages at younger ages were too small for analyses with only 24-hour data (Table 2, page 21). Intake patterns and transitions in intake of milks are described in greater detail in the FITS supplement to the Journal of the American Dietetic Association.^{33,34}

Results

Generally, participants 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.^{4,21-23}

Eating Patterns

Regardless of age group, the median number of daily eating occasions for FITS participants 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. 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 afternoon snack period seemed to be slightly more popular than morning or evening times, confirming patterns at 2 to 8 years reported elsewhere.³⁵ By 12 to 24 months, foods such as fruit drinks, candy, chips, and cookies were typical snack foods, along with milk, water, and crackers. The percentages of children reported to be eating snacks increased with age. While between meal snacks are appropriate for infants and toddlers because their small stomachs do not allow them to consume enough food to go for extended periods without eating, snacks should make important contributions to the nutritional quality of the diet.

**Table 1:
FITS Beverage Categories**

Beverage	Definition
Milks	Breast milk, all kinds of infant formula, cow’s milk with varying fat content, soy milk, and goat’s milk.
100% juice	Infant and adult fruit and vegetable juices that were 100% juice, including juices fortified with calcium and/or other nutrients, which is consistent with food-labeling regulations.
Fruit drinks	Beverages with less than 100% juice, many of which had added sugars (e.g., lemonade, punch), and some of which were fortified with one or more nutrients. Included many sweetened beverages that have low amounts of real juice, but also included some beverages with higher percentages of juice (e.g., cranberry) that would be too tart for consumption without added sweeteners.
Carbonated beverages	Carbonated mineral waters and “diet” and “regular” products that may or may not have contained sugars and caffeine.
Water	Noncarbonated bottled water and tap water, both consumed plain or used to dilute other beverages. Excluded water used to prepare infant formula or reconstitute juices and fruit drinks.
Other	Tea, cocoa and other dry milk mixtures, and electrolyte replacement beverages for infants.

Among infants, breast milk and infant formula were the most common beverages in the milks category, and whole cow's milk was the predominant choice among toddlers. By 19 to 24 months of age, however, over one-third of the sample consumed some form of reduced-fat milk, which is contrary to AAP recommendations.



Foods Eaten at Meals and Snacks

As would be expected, infants at 4 to 6 months of age relied primarily on breast milk or formula, and infants at 7 to 8 months ate many complementary foods, such as infant cereals and baby foods. Most toddlers transitioned from infant formula to whole milk at about 1 year of age and to table foods at about the same age.

Toddler food choices at various meals and snacks tended to mirror typical patterns of the American diet. About half of the children ages 9 to 24 months consumed a fruit or fruit juice at breakfast and/or lunch; bananas were the most popular fruit at breakfast. While roughly two-thirds of toddlers ate a vegetable at dinner, only a few vegetables were eaten by at least 10% of toddlers (e.g., green beans, French fries, corn). In a longitudinal study, children appeared to eat a greater variety of vegetables as infants than they did as toddlers.³⁶ Chicken and cheese were eaten by FITS toddlers at both lunch and dinner; some foods, such as cookies, candy, and French fries, were eaten by more than 10% of FITS toddlers, similar to patterns found in other studies with infants³⁷ and older children.^{2,3,26,38}

Many toddlers did not meet the Five a Day for Better Health³⁹ program's recommendations 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. Children's low fruit and vegetable intakes are also evident in other studies.^{21,30,35,36,40,41}



Beverages

Some form of milk beverage was consumed by almost all children at each age, although total amounts of milk beverages decreased with increasing age, as did the total energy provided by milks. The types of milks consumed also changed with increasing age. Among infants, breast milk and infant formula were the most common beverages in the milks category, and whole cow's milk was the predominant choice among toddlers. By 19 to 24 months of age, however, over one-third of

the sample consumed some form of reduced-fat milk, which is contrary to the American Academy of Pediatrics (AAP) recommendation to use whole milk from 12 to 24 months of age.⁴²

Most parents and caregivers of infants appear to be following the AAP recommendation that juices not be introduced before 6 months of age.⁴³ However, 21% of infants age 4 to 6 months in the study drank 100% juice; by 19 to 24 months, 60% of infants drank 100% juice. Apple juice was the most frequently consumed by all age groups, approximately double that of orange juice, which was ranked second. The average amounts consumed more than doubled from 4.1 ounces at four to six months of age to 9.5 ounces at 19 to 24 months. About 10% of toddlers 15 to 24 months had over 14 ounces of juice. Studies on the relationship between young children's juice intake and growth have been mixed,^{17,44,45} although a longitudinal study showed no relationship between growth and intake of 100% juice.¹⁷

The percentage of very young children consuming fruit drinks was less than 10% at four to eight months of age, but rose to over 40% at 19 to 24 months. Fruit drinks and 100% juices were consumed in similar amounts, and increased with age in similar percent-

The most significant changes to macronutrient dietary intake occurred between 9 to 11 and 12 to 14 months. These changes probably reflect the discontinuation of formula or breast milk at about 1 year, concurrent with use of cow's milk as well as table foods.

ages. Apple-based fruit drinks were the most popular, and, as with 100% juices, there was little variety. Carbonated beverages were consumed by more than 11% of toddlers more than 15 months old in the FITS. Patterns previously reported in older children, such as substitution of fruit drinks or carbonated beverages for milk³⁸ first appeared in the 15 to 18 month subgroup at lunch, dinner and morning snacks, and afternoon snacks. Thus fruit drinks and carbonated beverages are replacing more nutritious beverages in young children's diets. Some carbonated beverages provide caffeine, which is undesirable in the diets of young children, especially when consumed on a regular basis.⁴⁶

Nutrient Intakes

Initially, breast milk and/or formula were the sole sources of energy and nutrients for babies. However, by 19 to 24 months of age, milks contributed about one-third of the daily protein and vitamin A, more than half of the calcium and vitamin D, and less than one-fourth of the day's energy intake. These changes show the importance of milks for infants and toddlers, as well as the increasing contribution of table foods to the diet.

As eating patterns changed, so did the percentages of energy from meals, snacks and other eating occasions. For example, among infants, the other eating occasion category provided the highest percentages of energy, which stands to reason given the frequency of breast and formula feeding throughout the day for young infants. 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. All in all, the percentages of energy from meals and snacks increased with age and that from other eating occasions decreased. With snacks providing 20% of total energy at 7 to 8 months and 26% at 19 to 24 months, it is crucial that snacks be planned to provide nutrients as well as energy.

The most significant changes to macronutrient dietary intake occurred between 9 to 11 and 12 to 14 months, as shown in Figure 1 (page 20). During this period, we

saw an increase in percentages of energy from protein at both meals and snacks. At the same time, significant percentages of energy from carbohydrates were replaced by fats at meals, but the reverse was true for snacks, as percentages of energy from fat decreased and carbohydrates increased. These changes probably reflect the discontinuation of formula or breast milk at about 1 year, concurrent with use of cow's milk as well as table foods. 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) showed a variety of patterns. Iron density decreased with age for all meals, although iron density at breakfast was higher than at other meals. The higher iron density at breakfast was probably related to consumption of iron-fortified infant cereals and iron-fortified ready-to-eat cereals. Calcium densities were similar among the five age groups; breakfast showed the highest calcium density. Vitamin A density decreased with increasing age except at breakfast. Folate density tripled with age at breakfast as orange juice intake increased, but was similar among age categories at other meals.

Beverages, including breast milk and formula, provided 84% of total energy (kcal) for infants 4 to 6 months of age, 43% at 12 to 14 months, and 36% at 19 to 24 months. These changes are appropriate as infants and toddlers transition from a totally fluid diet to one that includes primarily solid foods. Beverages also provided at least one-third of the daily intakes of calcium, vitamins A, C, and D, protein, and zinc. These percentages show the importance of wisely chosen beverages, such as milk and 100% juices for older infants and toddlers.

Regression models developed to explore the notion that some beverages displaced others in the diet are shown in Table 2 (page 21). In model 1, variables positively related to the calcium density in diets of toddlers ages 15 to 24 months were milk consumption and mother's age. Intakes of 100% juice, fruit drinks, and carbonated beverages were negatively related to

continued on page 20

Putting Research Into Practice

with Herschel R. Lessin MD, FAAP



After more than 20 years in private practice, I can safely say that I have reassured tens of thousands of parents that their young children will not starve nor develop scurvy due to the way that they eat. This is not to say, however, that parents always make good choices in the way that they feed their infants and toddlers. The early use of ill-advised feeding practices can not only contribute to poor childhood nutrition, but can also set a child up for a lifetime of poor eating choices that increase the risk of obesity, hypertension and cardiovascular disease.



The FITS study demonstrates that such unhealthy habits can be developed quite early in infancy. Therefore, I believe that it is critical for pediatricians to advise parents about good feeding habits for toddlers from the very first well child visit. You will most likely get peculiar looks from parents when you talk to them about avoiding fast food restaurants and unhealthy snacks at the two-week checkup. After all, who in their right mind would do this? The fact of the matter is that it is

better not to start the fast food habit than to try to quit. Once poor snacking and eating habits are established, it is extremely difficult to change them.

Pediatricians should start having such conversations at birth and continue them throughout the first two years and beyond. I begin by joking with parents not to take their new infant to drive-thru restaurants, and to avoid making a French fry their first solid food. This concept can then be expanded to introduce the idea that good eating habits are established early. I reinforce this like a broken record at every well child visit. As the infant becomes a toddler, there should be less joking.

Bad snacking habits need to be emphasized. Too often, when a child refuses to eat a meal, the parent will offer a snack before the next meal. This will often be a food of questionable nutritional value. If a child refuses to eat, that is his choice. You cannot force him to eat. You can, however, make it clear that not eating has a consequence: hunger. If the kitchen is closed between meals and you mean what you say and do not give in to whining, children quickly learn to eat at mealtime.

Parents will often give snacks that they think are healthy, but pose hazards. The most common of these is giving grapes as a snack to toddlers. While grapes are certainly a healthy snack, they have a big problem associated with eating them. If a toddler should aspirate them, grapes tend to swell up and occlude the airway, thus causing a substantially increased risk of choking and asphyxiation.

Rarely, parents can make some very odd and sometimes dangerous feeding choices. I have seen many infants fed herbal teas in the hopes of calming them down or treating

abdominal pain. While most of these are probably harmless, I tell parents that no one knows exactly what is in these teas. If they actually work, then there is some sort of active ingredient, which we can't identify, have no idea how it works, and really have no clue about side effects and risks. Just because it's a "natural" plant does not make it safe. Being a vegetarian is also a popular diet alternative and can be acceptable for toddlers if done in moderation. A strict vegan diet without any animal products whatsoever (e.g. dairy, eggs, fish) can cause vitamin B₁₂ and folate deficiency and well as protein malnutrition. Children on vegetarian diets should take B vitamin supplements and special attention must be paid to protein intake.

The last habit that should be discouraged is replacing the family dinner table with the family couch. Eating meals at the television is increasingly common. It encourages the eating of junk food in large quantities with all of the attendant nutritional problems. It is also associated with a sedentary lifestyle that we know predisposes one to cardiovascular disease. Just as toddlers should not be allowed to carry a bottle or cup around the house, eating should occur at the table, not the TV. ●

Dr. Herschel Lessin is the medical director for The Children's Medical Group, a 23 member pediatric practice with six offices in New York's Mid-Hudson Valley. He writes a newspaper column twice a month, broadcasts parenting advice on radio ten times monthly, and is Child Health Editor for Healthology.com, a health information website.



Snack occasions should be planned to complement the energy and nutrients provided by meals. For example, milk, water, and crackers were often consumed as snacks by FITS toddlers, but fruit drinks, cookies, candy, and chips were also common. Thus the nutritional quality of some snacks could be improved.

continued from page 18

calcium density, indicating that intakes of these beverages decreased calcium density in the diet. In model 2, variables positively related to density of vitamin C were intakes of 100% juice and fruit drinks; negatively related variables were the child's age and milk intake. These results indicate that milk may be displaced in toddlers' diets by 100% juice, fruit drinks, and carbonated beverages. The decreasing milk intake and increasing intake of fruit drinks and carbonated beverages with increasing age may be cause for concern, particularly given that infants and toddlers are developing food preferences and food patterns that are likely to carry over to preschool and early school age years.^{30,35}

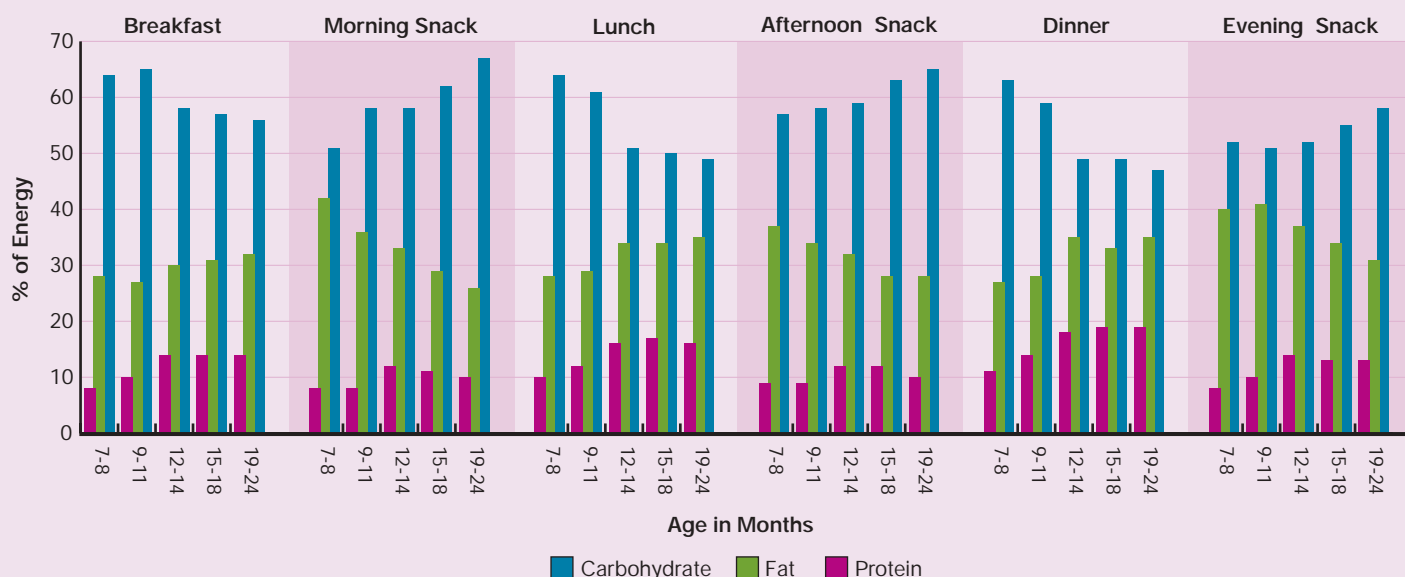
Food intakes were consistent with and provided explanations for transitions in nutrient intakes. Increased protein and decreased carbohydrate and fat occurred when infants transitioned from infant formula to whole milk at about 1 year of age. Transitions from baby food to table food showed decreased vitamin A and folate densities when meals at 9 to 11 months were compared with those at 12 to 24 months.

Practical Applications

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. 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.^{1,19,38} For example, milk, water, and crackers were often consumed as snacks by FITS toddlers, but fruit drinks, cookies, candy, and chips were also common. (See Table 3, page 22.) Thus the nutritional quality of some snacks could be improved.

Because children's intakes did not meet the Five a Day for Better Health program's recommendations, parents should be encouraged to offer developmentally appropriate fruits and vegetables as frequent snack choices. This is particularly important given that by age 3, many children develop a dislike for certain foods, most notably vegetables.^{30,47,48} The reluctance of

Figure 1:
Macronutrient Distributions at Meals and Snacks by Age Category



n = 3,022 infants and toddlers

Adapted from: Skinner JD, Ziegler P, Pac S, Devaney B: Meal and snack patterns of infants and toddlers. *J Am Diet Assoc* 104: S65-70, 2004.

Reproduced with permission by the Journal of the American Dietetic Association © American Dietetic Association.

Milk may also be displaced in toddlers' diets by fruit drinks and carbonated beverages. Pediatricians can recommend that parents offer children nutritious beverages, such as milk, 100% juice, and water, and limit their intake of less nutritious beverages, such as carbonated beverages, tea, and juice drinks.



preschool children to eat, or even taste, vegetables is reflected in their very low intakes of these important foods.^{40,49} Children indeed eat what they like.⁵⁰⁻⁵⁴ Therefore, parents and other caregivers who provide opportunities for children to learn to like a variety of nutritious foods through repeated exposures early in childhood⁵⁵⁻⁵⁷ help their children establish healthy eating patterns that could serve them well throughout their lifetimes.

Most parents and caregivers of infants appear to be following the AAP recommendation that juices not be introduced before 6 months of age.⁴³ However, high intakes by a few infants and toddlers suggest that some of the FITS parents did not heed that advice. Although 100% juices provided concentrated energy (kcal) and sugars to the diet, they also make significant contributions to daily vitamin C intake. The low contributions of dietary folate by 100% juices reflect the popularity of apple juice, which is low in folate compared with orange juice. The AAP considers 100% fruit juice to be a serving of fruit, but recommends that daily juice intake be limited to four to six ounces for children 1 to 6 years of age. Pediatricians can help parents and

other caregivers recognize the health advantages of serving a variety of 100% juices, including the array of nutrients that consuming a good variety provides to infants and toddlers.

The AAP does not consider fruit drinks to be nutritionally equivalent to 100% juice, nor do they consider fruit drinks a serving of fruit.⁴³ However, the AAP does not make any recommendations about limiting amounts of fruit drinks or carbonated beverages in the diets of infants and toddlers. Perhaps such guidance is needed. Importantly, fruit drinks vary considerably in nutritional quality. In general, fruit drinks with higher percentages of real juice are more nutritious than those with lower percentages of juice. Parents and caregivers may be in need of dietary advice about selecting fruit drinks that are beneficial to the diet. The best advice is to choose 100% juice.

Milks, including breast milk and formula as well as other milks, remained the major beverage in children's diets prior to age 2 years. These were also the major source of many nutrients, which is appropriate because it would be difficult for children to meet daily needs for calcium and vitamin D without some type of milk

Table 2:
Influences of Toddlers' Beverages on Nutrient Densities for Calcium and Vitamin C^b

Variable	Parameter estimate+SE	t-Value	P value
Model 1: Dependent variable: Calcium density (mg/1,000 kcal/d) F=44.61, P<.0001, R ² =.36			
Mother's age, y	3.37 ± 1.55	2.17	.03*
Wt/age, percentile ^c	0.40 ± 0.32	1.27	.21
Age, wk	-1.47 ± 0.86	-1.72	.09
Milk, oz	14.26 ± 1.01	14.09	.0001***
100% juice, oz	-6.60 ± 1.62	-4.09	.0001***
Fruit drink, oz	-8.92 ± 1.40	-6.37	.0001***
Carbonated beverage, oz	-9.03 ± 3.75	-2.41	.02*
Model 2: Dependent variable: Vitamin C density (mg/1,000 kcal/d) F=23.94, P<.0001, R ² =.23			
Mother's age, y	0.57 ± 0.30	1.90	.06
Wt/age, percentile ^b	-0.11 ± 0.06	-1.72	.09
Age, wk	-0.43 ± 0.17	-2.59	.01**
Milk, oz	-0.59 ± 0.20	-3.01	.003**
100% juice, oz	3.58 ± 0.20	11.46	.0001***
Fruit drink, oz	1.60 ± 0.27	5.91	.0001***
Carbonated beverage, oz	-1.21 ± 0.72	-1.66	.10



^a Toddlers 15 to 24 months, only; n=561

^b From a 24-hour recall provided by mothers or other primary caregiver

^c From Center for Disease Control percentiles

* ≤ .05

** ≤ .01

*** ≤ .0001

Skinner JD, Ziegler P, Ponza M: Transitions in infants' and toddlers' beverage patterns. *J Am Diet Assoc* 104: S45-50, 2004. Reproduced with permission by the Journal of the American Dietetic Association © American Dietetic Association.

The finding that some toddlers are consuming carbonated beverages, cookies, candy, and not eating sufficient fruits and vegetables, suggests that several eating patterns currently of great concern in older children and adolescents may originate before 2 years of age.

**Table 3:
Most Frequently Eaten Foods at Each Eating Occasion by Age Category**

Eating Occasion	4-6 months	7-8 months	9-11 months	12-14 months	15-18 months	19-24 months
	<i>Percent of children consuming each food</i>					
Breakfast	Formula (62) ^a Infant cereal (55) Breast milk (19) Water (14) Apple juice (10)	Infant cereal (73) Formula (51) Water (25) BF banana mix (12) ^d BF apple mix (11)	Infant cereal (53) Formula (38) Water (26) RTE cereal (18)	Whole Milk (45) RTE cereal (25) ^b Water (23) Banana (19) Infant cereal (18) Bread, etc (16) Pancakes, etc (15) ^f Eggs (14) Butter, etc (12) Low-fat milk (11) Syrup (11)	Whole milk (47) Bread, etc (24) ^c RTE cereal (23) Water (22) Butter, etc (19) ^e 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	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) ^g 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	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	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	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	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 Percentage of children consuming this food at this eating occasion

^b RTE = ready-to-eat

^c Bread, etc. = bread, rolls, biscuits, bagels, tortillas

^d BF = baby food

^e Butter, etc. = butter, oil, margarine, other fats

^f Pancakes, etc. = pancakes, waffles, French toast

^g Sandwich: includes all kinds (e.g., peanut butter, cheese, hamburger)

Adapted from: Skinner JD, Ziegler P, Pac S, Devaney B: Meal and snack patterns of infants and toddlers. *J Am Diet Assoc* 104: S65-70, 2004.



in the diet.⁵⁸ The findings that 100% juice appeared to displace milk in the diet and also that milk displaced juice (Table 2, page 21) emphasizes the importance of dietary balance. Both milk and 100% juice are nutritious beverages, which is why parents might not believe that restrictions are necessary.⁴³ Usually they are not, but excessive amounts of any food or beverage must be avoided.

Milk may also be displaced in toddlers' diets by fruit drinks and carbonated beverages. In studies with older children, milk intake decreased as fruit drinks and carbonated beverages increased.⁴³ The decreasing milk intake and increasing intakes of fruit drinks and carbonated beverages with increasing age in this study may be cause for concern. Infants and toddlers are developing food preferences and food patterns that are likely to carry over to preschool and early school age years.^{30,35} Pediatricians can recommend that parents offer children nutritious beverages, such as milk, 100% juice, and water, and limit their intake of less nutritious beverages, such as carbonated beverages, tea, and juice drinks.

FITS is the first study to document water intake in infants and toddlers. Water is an appropriate choice for quenching thirst and does not contribute to excessive energy intake. Breastfed and formula-fed infants usually do not need additional water. Caution must be

used so that water does not displace energy and nutrients in the diet. However, infants are particularly susceptible to dehydration because of their large surface area per unit of body weight, their higher percentage of body water, and their inability to communicate thirst.⁵⁹ Thus, in unusually hot weather, infants may need some additional water.



Conclusion

The finding that some toddlers are consuming carbonated beverages, cookies, candy, and not eating sufficient fruits and vegetables, suggests that several eating patterns currently of great concern in older children and adolescents may originate before 2 years of age. Although preferences for sweet-tasting foods are innate, delaying introduction of and limiting exposures to foods low in nutrients and high in calories may be wise during periods when many food 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 eating and meal patterns. ●

Dr. Jean Skinner is Professor Emeritus of Nutrition at the University of Tennessee, Knoxville, Tennessee and a registered dietitian. The applied nutrition courses she taught graduate students focused on the socio-cultural aspects of nutrition, research and survey methods, and nutrition education. Dr. Skinner's research interests include infants, children and adolescents and their nutritional problems and concerns, including determinants of nutrition-related behavior and how to change behaviors through nutrition education.

References

- 1 Jahns L, Siega-Riz AM, Popkin BM: The increasing prevalence of snacking among US children from 1977 to 1996. *J Pediatr* 138:493-8, 2001.
- 2 Ezell JM, Skinner JD, Penfield MP: Appalachian adolescents' snack patterns: morning, afternoon, and evening snacks. *J Am Diet Assoc* 85:1450-4, 1985.
- 3 Wilder MB, Pampalone SZ, Pelletier RL, Zive MM, Elder JP, Sallis JF: Fat and sugar levels are high in snacks purchased from student stores in middle schools. *J Am Diet Assoc* 100:319-22, 2000.
- 4 Siega-Riz AM, Carson T, Popkin B: Three squares or mostly snacks: what do teens really eat? *J Adolesc Health* 22:29-36, 1998.
- 5 Kanarek R: Psychological effects of snacks and altered meal frequency. *Br J Nutr* 77:S105-120, 1997.
- 6 Gatenby SJ: Eating frequency: methodology and dietary aspects. *Br J Nutr* 77:S7-20, 1997.
- 7 Picciano MF, Smiciklas-Wright H, Birch LL, Mitchell DC, Murray-Kolb L, McConahy KL: Nutritional guidance is needed during dietary transition in early childhood. *Pediatrics* 106:109-14, 2000.
- 8 Kennedy E, Goldberg J: What are American children eating? Implications for public policy. *Nutr Rev* 53:111-26, 1995.
- 9 Munoz KA, Krebs-Smith SM, Ballard-Barbash R, Cleveland LE: Food intakes of US children and adolescents compared with guidelines. *Pediatrics* 100:323-9, 1997.
- 10 Bardy LM, Lindquist CH, Herd SL, Goran MI: Comparison of children's dietary intake patterns with US dietary guidelines. *Br J Nutr* 84:361-7, 2000.
- 11 Harnack L, Stang J, Story M: Soft drink consumption among US children and adolescents: nutritional consequences. *J Am Diet Assoc* 99:436-41, 1999.

- 12 Johnson RK, Frary C: Choose beverages and foods to moderate your intake of sugars: The 2000 Dietary Guidelines for Americans—what's all the fuss about? *J Nutr* 131:2766S-71, 2001.
- 13 Ballew C, Kuester S, Gillespie C: Beverage choices affect adequacy of children's nutrient intakes. *Arch Pediatr Adolesc Med* 154:1148-52, 2000.
- 14 Troiano RP, Briefel RR, Carroll MD, Bialostosky K: Energy and fat intakes of children and adolescents in the United States: Data from the National Health and Nutrition Examination Surveys. *Am J Clin Nutr* 72:1343S-53, 2000.
- 15 Ludwig DS, Peterson KE, Gortmaker SL: Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet* 357:505-8, 2001.
- 16 Rampersaud GC, Bailey LB, Kauwell GPA: National survey beverage consumption data for children and adolescents indicate the need to encourage a shift toward more nutritive beverages. *J Am Diet Assoc* 103:97-100, 2003.
- 17 Skinner JD, Carruth BR: A longitudinal study of children's juice intake and growth: the juice controversy revisited. *J Am Diet Assoc* 101:432-7, 2001.
- 18 Neumark-Sztainer D, Hannan PJ, Story M, Croll J, Perry C: Family meal patterns: associations with sociodemographic characteristics and improved dietary intake among adolescents. *J Am Diet Assoc* 103:317-22, 2003.
- 19 Gillman WM, Rifas-Shiman SL, Frazier AL, Rockett HRH, Camargo CA, Field AE, Berkey CS, Colditz GA: Family dinner and diet quality among older children and adolescents. *Arch Fam Med* 9:235-40, 2000.
- 20 Skinner JD, Salvetti NN, Ezell JM, Penfield MP, Costello CA: Appalachian adolescents' eating patterns and nutrient intakes. *J Am Diet Assoc* 85:1093-9, 1985.
- 21 Hackett AF, Gibbon M, Stratton G, Hamill L: Dietary intake of 9-10-year-old and 11-12-year old children in Liverpool. *Public Health Nutr* 5:449-55, 2002.
- 22 Nicklas TA, Weihs B, Webber LS, Berenson GS: Breakfast consumption affects adequacy of total daily intake in children. *J Am Diet Assoc* 93:886-91, 1993.
- 23 Cueto S: Breakfast and dietary balance: the enKid Study. Breakfast and performance. *Public Health Nutr* 4:1429-31, 2001.
- 24 Nielsen SJ, Siega-Riz AM, Popkin BM: Trends in energy intake in US between 1977 and 1996: similar shifts seen across age groups. *Obes Res* 10:370-8, 2002.
- 25 Guthrie JF, Lin BH, Frazao E: Role of food prepared away from home in the American diet 1977-78 versus 1994-1996: changes and consequences. *J Nutr Educ Behav* 34:140-50, 2002.
- 26 Nicklas TA, Baranowski T, Cullen KW, Berenson G: Eating patterns, dietary quality and obesity. *J Am Coll Nutr* 20:599-608, 2001.
- 27 Bremner B, Langenhoven ML, Swanepoel ASP, Steyn M: The snacking habits of white preschool children. *S Afr Med J* 78:472-5, 1990.
- 28 Wyshak G: Teenaged girls, carbonated beverage consumption and bone fractures. *Arch Pediatr Adolesc Med* 154:610-3, 2000.
- 29 Watt RG, Dykes J, Sheiham A: Preschool children's consumption of drinks: implications for dental health. *Community Dent Health* 17:8-13, 2000.
- 30 Skinner JD, Carruth BR, Bounds W, Ziegler PJ: Children's food preferences: a longitudinal analysis. *J Am Diet Assoc* 102:1638-47, 2002.
- 31 Skinner JD, Ziegler P, Pac S, Devaney B: Meal and snack patterns of infants and toddlers. *J Am Diet Assoc* 104:S65-70, 2004.
- 32 Skinner JD, Ziegler P, Ponza M: Transitions in infants' and toddlers' beverage patterns. *J Am Diet Assoc* 104:S45-50, 2004.
- 33 Briefel RR, Reidy K, Karwe V, Devaney B: Feeding Infants and Toddlers Study: improvements needed in meeting infant feeding recommendations. *J Am Diet Assoc* 104:S31-7, 2004.
- 34 Briefel RR, Reidy K, Karwe V, Jankowski L, Hendricks K: Toddlers' transitions to table foods: impact on nutrient intakes and food patterns. *J Am Diet Assoc* 104:S38-44, 2004.
- 35 Skinner JD, Carruth BR, Bounds W, Ziegler P, Reidy K: Do food-related experiences in the first 2 years of life predict dietary variety in school-aged children? *J Nutr Educ Behav* 34:310-5, 2002.
- 36 Skinner JD, Carruth BR, Houck K, Coletta F, Cotter R, Ott D, McLeod M: Longitudinal study of nutrient and food intakes of infants aged 2 to 24 months. *J Am Diet Assoc* 97:496-504, 1997.
- 37 Neving W, Carruth BR, Skinner JD: How do socioeconomic status and age influence infant food patterns? *J Am Diet Assoc* 97:418-20, 1997.
- 38 Skinner JD, Bounds W, Carruth BR, Ziegler P: Children's meal and snack patterns: from ages 2 to 8 years. *J Am Diet Assoc* (in press).
- 39 Havas S, Heimendinger J, Reynolds K, Baranowski T, Nicklas TA, Bishop D, Buller D, Sorenson G, Bersford SAA, Cowan A, Damron D: 5 A Day for Better Health: a new research initiative. *J Am Diet Assoc* 94:32-6, 1994.
- 40 Skinner JD, Carruth BR, Houck KS, et al: Longitudinal study of nutrient and food intakes of white preschool children aged 24 to 60 months. *J Am Diet Assoc* 99:1514-21, 1999.
- 41 Resnicow K, Smith M, Baranowski T, Baranowski J, Vaughan R, Davis M: 2-year tracking of children's fruit and vegetable intake. *J Am Diet Assoc* 98:785-9, 1998.
- 42 American Academy of Pediatrics, Committee on Nutrition: The use of whole cow's milk in infancy (policy statement). *AAP News* 8:8-22, 1992.
- 43 American Academy of Pediatrics, Committee on Nutrition: The use and misuse of fruit juice in pediatrics. *Pediatrics* 107:1210-3, 2001.
- 44 Dennison BA, Rockwell HL, Baker SL: Excess fruit juice consumption by preschool-aged children is associated with short stature and obesity. *Pediatrics* 99:15-22, 1997.
- 45 Kloben-Tarver AS: Fruit juice consumption not related to growth among preschool-aged children enrolled in the WIC program. *J Am Diet Assoc* 101:996, 2001.
- 46 Arbeit ML, Nicklas TA, Frank GC, Webber LS, et al: Caffeine intakes of children from a biracial population: The Bogalusa Heart Study. *J Am Diet Assoc* 88:466, 1988.
- 47 Beyer NR, Morris PM: Food attitudes and snacking patterns of young children. *J Nutr Educ* 6:131-3, 1974.
- 48 Phillips B, Kolasa K: Vegetable preferences of preschoolers in day care. *J Nutr Educ* 12:192-5, 1980.
- 49 Stanek K, Abbot D, Cramer S: Diet quality and the eating environment of preschool children. *J Am Diet Assoc* 90:1582-4, 1990.
- 50 Birch LL: Development of food preferences. *Annu Rev Nutr* 19:41-62, 1999.
- 51 Birch LL: Psychological influences on the childhood diet. *J Nutr* 128:407S-10S, 1998.
- 52 Domel SB, Thompson WO, Davis HC, Baranowski T, Leonard SB, Baranowski J: Psychosocial predictors of fruit and vegetable consumption among elementary school children. *Health Educ Res* 11:299-308, 1996.
- 53 Resnicow K, Davis-Hern M, Smith M, Baranowski T, Lin LS, Baranowski J, Doyle C, Wang DT: Social-cognitive predictors of fruit and vegetable intake in children. *Health Psychol* 16:272-6, 1997.
- 54 Drewnowski A: Taste preferences and food intake. *Annu Rev Nutr* 17:237-53, 1997.
- 55 Pliner P: The effects of mere exposure on liking for edible substances. *Appetite* 3:283-90, 1982.
- 56 Birch LL, Marlin DW: I don't like it; I never tried it: effects of exposure on two-year-old children's food preferences. *Appetite* 3:353-60, 1982.
- 57 Nicklas TA, Baranowski T, Baranowski JC, Cullen K, Rittenberry L, Olvera N: Family and child-care provider influences on preschool children's fruit, juice, and vegetable consumption. *Nutr Reviews* 59:224-35, 2001.
- 58 Black RE, Williams SM, Jones IE, Goulding A: Children who avoid drinking cow milk have low dietary calcium intakes and poor bone health. *Am J Clin Nutr* 76:675-80, 2002.
- 59 National Research Council: Recommended Dietary Allowances, 10th edition. National Academy Press, Washington DC, 1989.