Trends in Food and Beverage Consumption Among Infants and Toddlers: 2005–2012

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abstract

BACKGROUND: Nutritional guidance for infants and toddlers is lacking, and the diets of American children in the first 2 years of life are not well characterized.

METHODS: Cross-sectional data from the NHANES were used to describe the diets of 0- to 23-month-olds in the United States. Participants with complete dietary data were eligible for the analysis (N = 2359). Linear regression models were constructed to identify changes from 2005 to 2008 and from 2009 to 2012 in food and beverage consumption, both overall and within sociodemographic groups.

RESULTS: We observed several trends toward meeting early-feeding recommendations, such as a decline in the prevalence of complementary feeding among 0- to 5-month-olds. However, the prevalence of vegetable consumption was consistently lower than desired (~25% of 6- to 11-month-olds and 20% of 12- to 23-month-olds had no reported vegetable consumption on dietary recall days in the 2009–2012 set). Subgroup analyses revealed that some trends were limited to certain populations (eg, a decline in juice consumption was observed among 6- to 11-month-old non-Hispanic whites and non-Hispanic blacks but not among Mexican Americans), and additional trends emerged within groups (eg, the prevalence of breast milk consumption declined among 0- to 5-month-old Mexican Americans).

CONCLUSIONS: Although there have been some improvements in the diets of 0- to 23-month-olds in recent years, there are areas in which this population continues to fall short of current recommendations. This underscores the need for additional policy guidance for providers and education for parents and caretakers on helping infants and toddlers achieve healthy diets.

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WHAT'S KNOWN ON THIS SUBJECT: Early feeding habits have a long-term impact on diet and health. However, the feeding habits of American infants and young toddlers have been understudied, and public health efforts targeting this population have been limited.

WHAT THIS STUDY ADDS: This study describes recent trends in food and beverage consumption among 0- to 23-month-olds in the United States (overall and by race/ethnicity) and highlights areas in which parents and caretakers are in additional need of education on meeting current dietary recommendations.

ARTICLE

A growing body of research suggests early feeding habits influence diet and health later in life. The establishment of food preferences begins during infancy and toddlerhood, and factors such as exposure to breast milk, the timing of introduction to solids, and types of first foods offered are believed to play important roles in laying the foundation for healthy eating habits.[1] Furthermore, evidence from both observational studies and intervention trials suggest that early diet is linked to immune function and weight status during childhood as well as cardiometabolic health into adulthood.[2–6] Despite these potentially far-reaching effects, nutritional guidance for children during the first 2 years of life has been limited.

Currently, the early-feeding recommendations set forth by the American Academy of Pediatrics (AAP) are among the most comprehensive for children ages 0 to 23 months in the United States.[7] For example, the AAP recommendations include the following regarding food and beverage consumption in the first 2 years of life: exclusive breastfeeding for the first 6 months, consumption of appropriate complementary foods after 6 months of age, offering vegetables and/or fruits with every meal and snack, offering water and nonflavored whole milk or 2% milk as beverages for children ages 12 months to 2 years, and delaying juice introduction until 12 months.

Efforts to provide broader nutritional guidance for 0- to 23-month-olds are underway.[8] Specifically, the 2020 Edition of the *Dietary Guidelines for America* will include guidance for children younger than 2 years for the first time since the initial report was issued in 1980. However, additional research characterizing the current feeding habits of infants and toddlers is needed to inform specific guidance for this age group. The current study adds to the literature describing the early feeding habits of American infants and young toddlers[9–18] by examining recent trends in food and beverage consumption among 0- to 23-month-olds using data from the NHANES.

METHODS

We investigated temporal trends in the prevalence of food and beverage consumption among infants and young toddlers in the United States by using NHANES dietary recall data collected between 2005 and 2012. The NHANES' analytic and data-collection methods have been described elsewhere and were approved by the National Center for Health Statistics Research Ethics Review Board.[19,20] In brief, the NHANES is a surveillance program administered by the Centers for Disease Control and Prevention to monitor the health and nutrition of noninstitutionalized Americans of all ages.[19] Information is obtained from a nationally representative sample of the population through a series of questionnaires and physical examinations. What We Eat in America (WWEIA), the dietary intake component of the NHANES, consists of two 24-hour dietary recalls conducted by trained interviewers. For children ages 6 years and younger, dietary recall interviews are completed by adults who are knowledgeable about the children's feeding. Each food and liquid reported in WWEIA is assigned a code from the Food and Nutrient Database for Dietary Studies (FNDDS), which contains detailed descriptions and nutritional information for more than 7000 foods and beverages and is updated biannually to reflect changes in the US food supply.

We linked data from WWEIA to the version of the FNDDS corresponding to the survey cycle (ie, 2005–2006 WWEIA data were linked to FNDDS 3, 2007–2008 WWEIA data were linked to FNDDS 4.1, and so on) to categorize food and beverage items consumed by participants <2 years old.[21–24] To facilitate cross-study comparisons, we used previous research to identify age-appropriate food and beverage categories for this population.[11,18,25] Consistent with this literature, food mixtures (eg, pizza, sandwiches) were considered a single food item instead of broken down into their component parts. Consumption was defined as any reported intake, regardless of amount, on at least 1 recall day unless otherwise noted.

All analyses were performed in Statistical Analysis System version 9.4 (SAS Institute, Inc, Cary, NC) using survey procedures to produce nationally representative estimates and account for the NHANES' complex sampling design. Children who had not yet reached their second birthday by the time of the dietary data collection and had 2 dietary recall interviews completed on their behalf were eligible for the study (N = 2359). We pooled data over 2 survey cycles to obtain an adequate sample size for subgroup analyses.[26] Therefore, a combined dietary sample weight was calculated to properly estimate SEs. Rao-Scott χ^2 tests[27] (for categorical variables) and t tests (for continuous variables) were performed to identify changes over time in the distribution of demographic and anthropometric characteristics of 0- to 23-month-olds in the United States. Multivariable linear regression models were constructed to estimate the prevalence of food and beverage consumption from 2005 to 2008 and from 2009 to 2012 and identify changes over time within the following age groups: 0 to 5 months, 6 to 11 months, and 12 to 23 months. In subgroup analyses, we examined trends within the 3 largest racial/ethnic groups (Mexican Americans, non-Hispanic whites, and non-Hispanic blacks) and among children participating in

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TABLE 1 Demographic and Anthropometric Characteristics of 0- to 23-month-olds in the US: NHANES, 2005–2012

	NHANES 2005–2008			NHANES 2009–2012		
	Sample Size	Weighted %	SE	Sample Size	Weighted %	SE
Total	1285			1074		
Sex						
Male	682	50.4	1.5	522	51.2	2.1
Female	603	49.6	1.5	552	48.8	2.1
Age, mo						
0–5	365	22.2	1.4	323	27.4	1.6
6–11	419	28.1	1.2	332	26.5	1.7
12–23	501	49.7	1.4	419	46.1	1.5
Race/ethnicity						
Mexican American	481	17.2	1.8	318	19.8	3.0
Other Hispanic	101	5.6	1.1	130	7.9	1.4
Non-Hispanic white	417	57.6	3.0	323	51.7	3.8
Non-Hispanic black	222	13.1	1.9	205	12.8	1.6
Other non-Hispanic race(s)	64	6.5	1.0	98	7.7	1.0
Maternal age at birth, y						
19 y or younger	153	8.8	1.0	94	6.9	1.0
20–24	356	25.3	1.7	274	21.3	1.6
25–29	345	28.8	1.8	296	30.8	1.9
30–34	261	23.2	1.5	267	27.0	1.4
35 or older	170	13.9	1.5	142	13.9	1.2
Annual household income						
Less than $19 999	365	20.2	1.4	273	20.0	1.9
$20 000–$34 999	306	19.0	1.6	244	19.2	1.5
$35 000–$54 999	203	18.2	1.7	148	15.7	1.2
$55 000–$74 999	137	15.4	1.4	89	12.2	1.6
$75 000 or more	199	27.1	2.3	225	33.0	2.1
Average income-to-poverty ratio	1212	2.4	0.1	997	2.3	0.1
WIC status[a]						
WIC participant	751	42.2	2.3	646	46.8	2.5
Income-eligible, nonparticipant[b]	174	12.0	1.3	126	11.4	1.5
Nonparticipant	339	45.8	2.3	275	41.8	2.5
Weight-for-length percentile[c]*						
<fifth	34	2.3	0.5	13	0.9	0.3
fifth–85th	1068	85.4	1.1	897	85.0	1.3
>85th	169	12.3	1.0	157	14.0	1.3

[a] WIC.

[b] Income eligibility is defined as annual income ≤185% of the federal poverty level.

[c] Ref 31.

* $P < .05$ for Rao-Scott χ^2 test of equality of distributions across years.

TABLE 2 Adjusted Prevalence (SE) of Food and Beverage Consumption Among 0- to 5-month-olds in the United States: NHANES, 2005–2012

	2005–2008		2009–2012	
Breast milk	39.9	(4.0)	35.7	(3.4)
Formula[a]	81.0	(2.8)	76.6	(3.0)
Infant cereals	37.0	(3.3)	25.9	(3.1)*
Fruit	19.1	(1.6)	13.6	(2.5)
100% fruit juice	12.8	(1.6)	6.6	(1.8)*
Vegetables	16.2	(2.6)	11.5	(2.2)
Meat or other protein source	3.0	(0.9)	2.1	(0.7)
Snacks, desserts, or sweetened beverages	5.2	(1.3)	5.1	(1.5)

Adjusted for mean-centered household income-to-poverty ratio and maternal age (in years) at the time of child's birth.
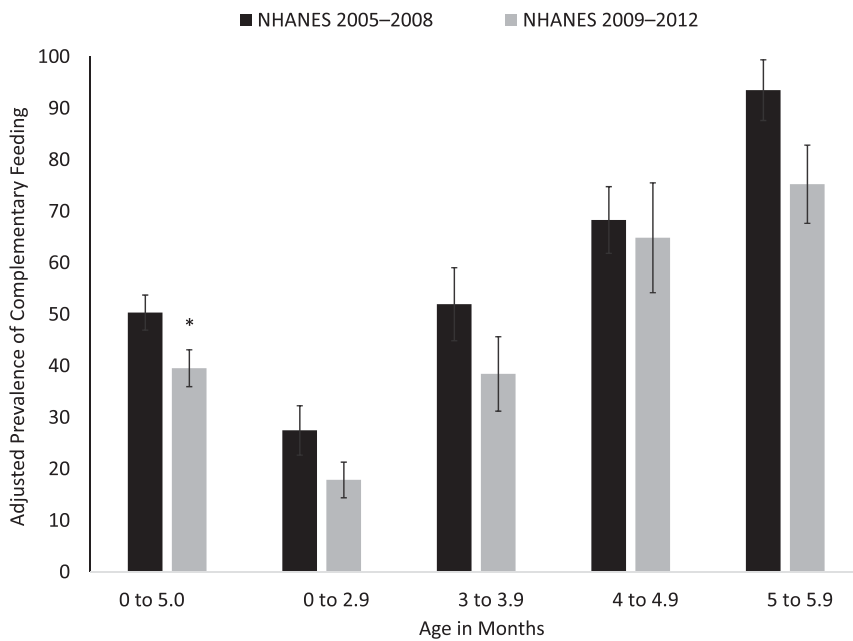
[a] Includes soy-based formulas.

* $P < .05$ for t test significant of equality of means across years.

but infant formula remained the most commonly consumed milk type for this age group (Table 2). However, the percentage of Mexican Americans in this age group who consumed breast milk was 36.4% in 2009–2012 compared with 50.5% in 2005–2008 ($P = .03$; data not shown).

As shown in Fig 1, complementary feeding (ie, consumption of foods or beverages other than breast milk and infant formula) declined more than 10% among all 0- to 5-month-olds (from 50.4% to 39.6%; $P = .04$). The prevalence of solid food consumption in particular decreased from 41.8% in 2005–2008 to 29.6% in 2009–2012 ($P = .008$). These trends were largely driven by declines in the prevalence of infant cereal consumption (the most commonly consumed food in this age group) and fruit juice consumption.

Older Infants (6- to 11-Month-Olds) and Young Toddlers (12- to 23-Month-Olds)

Table 3 summarizes foods and beverages consumed by older infants and young toddlers across 6 overarching categories: milk, fruit and fruit juice, vegetables, other (nonmilk) protein sources, grains

the Supplemental Nutrition Program for Women, Infants, and Children (WIC). Prevalence estimates were adjusted for mother's age at birth and household income-to-poverty ratio (a measure used to determine eligibility for many federal programs, including WIC)[28] to account for demographic and economic shifts in the US population occurring during the study period.[29,30]

RESULTS

The demographic characteristics of the study population remained relatively unchanged between 2005 to 2008 and 2009 to 2012 (Table 1). However, the proportion of 0- to 23-month-olds falling below the fifth percentile of weight-for-length decreased, and the proportion falling above the 85th percentile increased during this period.

Young Infants (0- to 5-Month-Olds)

In general, the prevalence of breast milk and infant formula consumption remained stable among 0- to 5-month-olds: more than one-third of young infants consumed breast milk,

FIGURE 1

Adjusted prevalence of complementary feeding among 0- to 5-month-olds in the United States: NHANES, 2005–2012. Estimates were adjusted for mean-centered, household income-to-poverty ratio and maternal age (in years) at the time of child's birth. * $P < .05$ for t test of equality of means across years.

and grain products, and snacks (including sweetened beverages). Similar to young infants, formula was the most commonly consumed milk type among 6- to 11-month-olds. However, more than 20% of infants in this age group in the 2005–2008 set and nearly 15% in the 2009–2012 set consumed cow's milk on a typical day. Whole-fat cow's milk was the most commonly consumed milk type among 12- to 23-month-olds. However, a substantial proportion of children in this age group consumed reduced-fat cow's milk in both 2005–2008 and 2009–2012 (32.3% and 26.2%, respectively).

Older infants and young toddlers also consumed a variety of foods and nonmilk beverages, and their food group consumption patterns were generally similar in both time periods. Apples and bananas were the most popular fruit varieties. Deep-yellow vegetables were the most commonly consumed vegetable type for 6- to 11-month-olds, whereas white potatoes were the most popular among 12- to 23-month-olds.

Dark-green vegetables were the least commonly consumed vegetable type in both age groups. The percentage of 6- to 23-month-olds consuming any fruit or vegetable on a typical day remained relatively unchanged between 2005–2008 (6- to 11-month-olds: 91.3%; 12- to 23-month-olds: 96.0%) and 2009–2012 (6- to 11-month-olds: 93.8%; 12- to 23-month-olds: 96.2%). However, the proportion of older infants and young toddlers consuming fruits and vegetables on both intake days was lower in both time periods. For example, 52.6% of 6- to 11-month-olds and 57.8% of 12- to 23-month-olds had any reported consumption of fruit on both recall days in 2009–2012. The percentage of 6- to 11-month-olds and 12- to 23-month-olds who consumed vegetables on both recall days in 2009–2012 was 42.7% and 42.3%, respectively.

There were a few notable changes in fruit, fruit juice, and vegetable consumption among older infants and young toddlers. The prevalence

of 100% fruit juice consumption declined among 6- to 11-month-olds such that less than half had any reported intake during the later time period (the prevalence was 60.2% in 2005–2008 and 47.7% in 2009–2012; $P = .02$). Similarly, a decline from 74.7% to 60.3% ($P = .01$) was observed among older infants participating in WIC, who had a higher prevalence of fruit juice consumption than infants in this age group overall. Among 12- to 23-month-olds, the percentage of children consuming canned or frozen fruit decreased by more than 10% (from 37.0% to 26.2%; $P = .01$) as shown in Table 3. The prevalence of dark-green vegetable consumption also decreased by more than 50% in this age group (from 15.3% to 7.5%; $P = .02$); a 1-year-old was more likely to consume fried white potatoes on an average day in 2009–2012. There were also changes in the vegetable consumption habits of WIC-enrolled toddlers: consumption of white potatoes declined from 56.1% in 2005–2008 to 43.4% in 2009–2012 ($P = .03$), and consumption of other starchy vegetables declined from 28.1% to 15.7% ($P < .05$) in the same period.

Consumption of meat and other (nonmilk) protein sources and grains and grain products was prevalent among 12- to 23-month-olds and, to a lesser extent, among 6- to 11-month-olds (Table 3). Protein from mixed dishes was consistently the most popular protein source among older infants, although their consumption of foods in this category declined by 13.3% between 2005–2008 and 2009–2012 ($P = .03$). No changes were observed in the consumption of grains and grain products among 6- to 11-month-olds or protein consumption among 12- to 23-month-olds. However, the percentage of young toddlers with any reported consumption of breads, rolls, and quick breads (2005–2008: 55.2%; 2009–2012: 44.4%; $P < .05$)

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TABLE 3 Adjusted Prevalence (SE) of Food and Beverage Consumption Among 6- to 23-month-olds in the United States: NHANES, 2005–2012

	6–11 Mo		12–23 Mo	
	2005–2008	2009–2012	2005–2008	2009–2012
Breast milk	23.6 (2.2)	22.2 (3.3)	6.3 (1.5)	7.4 (1.9)
Formula[a]	80.5 (3.2)	84.4 (2.9)	7.2 (1.8)	6.0 (1.5)
Cow's milk	20.1 (3.0)	14.6 (2.8)	89.8 (1.7)	87.8 (2.2)
Whole	13.4 (2.2)	10.2 (2.0)	72.2 (3.1)	69.5 (2.9)
Reduced-fat	13.4 (1.7)	4.9 (1.5)	32.3 (3.2)	26.2 (2.6)
Fruit and 100% fruit juice				
Any fruit or 100% fruit juice	90.0 (2.0)	91.1 (2.2)	94.4 (1.7)	94.8 (1.8)
Any fruit	77.1 (3.1)	82.5 (2.8)	81.9 (1.9)	82.7 (3.4)
Non-baby-food fruit	43.0 (3.7)	43.1 (3.8)	78.4 (2.4)	80.7 (3.4)
Baby-food fruit	52.9 (3.8)	60.4 (4.1)	8.6 (1.5)	5.6 (1.2)
Canned or frozen fruit	14.2 (2.5)	15.1 (2.5)	37.0 (2.9)	26.2 (2.8)*
Fresh fruit	35.0 (3.7)	36.6 (4.1)	68.2 (3.0)	73.0 (3.1)
100% fruit juice	60.2 (3.8)	47.7 (3.2)*	68.6 (3.2)	69.8 (2.8)
Vegetables				
Any	77.9 (2.1)	74.2 (2.4)	81.9 (2.5)	80.4 (2.7)
White potatoes	21.7 (2.9)	23.9 (2.7)	51.4 (3.1)	44.5 (3.5)
French fries, other fried white potatoes	10.0 (2.4)	6.0 (1.7)	31.5 (3.3)	25.9 (3.0)
Dark-green vegetables	6.1 (1.5)	6.6 (2.3)[b]	15.3 (2.9)	7.5 (1.5)*
Deep-yellow vegetables	47.8 (3.0)	42.0 (4.0)	21.8 (2.4)	16.5 (2.6)
Other starchy vegetables	16.1 (2.5)	18.2 (3.5)	27.9 (3.4)	20.0 (2.7)
Other vegetables	27.4 (2.9)	22.8 (3.6)	41.9 (3.1)	42.9 (3.5)
Any meat or protein source	74.6 (3.0)	64.7 (4.0)	97.1 (1.3)	98.5 (0.5)
Meat				
Beef	15.8 (3.2)	11.3 (2.6)	35.2 (2.9)	33.3 (3.2)
Chicken, turkey	27.0 (3.3)	28.0 (3.0)	66.5 (3.4)	65.2 (3.1)
Fish, shellfish	2.8 (1.0)[b]	1.8 (1.3)[b]	10.6 (2.2)	8.9 (1.6)
Hot dogs, sausages, cold cuts	8.7 (2.0)	8.8 (2.0)	27.3 (2.9)	26.5 (3.2)
Pork, ham	7.1 (1.9)	8.4 (2.6)[b]	24.8 (3.4)	21.5 (3.1)
Other protein sources	35.3 (3.2)	34.2 (3.2)	79.4 (2.3)	77.8 (3.0)
Dried peas or beans, vegetarian meat substitutes	8.2 (2.2)	9.0 (2.4)	14.3 (2.2)	16.0 (1.9)
Nut butters, nuts, seeds	0.0 (0.8)[b]	2.3 (1.4)[b]	8.8 (1.7)	7.0 (2.5)[b]
Cheese	12.7 (2.8)	16.6 (2.7)	44.7 (3.3)	46.4 (3.2)
Eggs	13.6 (2.1)	11.0 (1.9)	37.3 (3.2)	35.5 (3.6)
Yogurt	9.3 (2.6)	15.6 (2.4)	27.1 (2.4)	24.5 (2.7)
Protein sources in mixed dishes	58.1 (3.4)	44.8 (4.6)*	67.9 (3.1)	57.9 (4.3)
Any grain or grain product	92.1 (2.2)	93.6 (1.3)	98.3 (1.2)	99.0 (0.7)
Infant cereals	71.7 (3.3)	70.9 (3.4)	15.0 (2.4)	13.1 (2.3)
Non-infant cereals	32.3 (4.2)	24.4 (2.6)	71.8 (3.1)	71.9 (2.9)
Presweetened cereals	9.1 (2.3)	6.2 (1.7)	33.9 (3.1)	30.1 (2.7)
Bread, rolls, quick breads	21.6 (3.1)	21.0 (2.8)	55.2 (3.7)	44.4 (3.6)*
Crackers, rice cakes	40.1 (3.8)	41.0 (4.7)	60.0 (2.5)	52.1 (3.7)
Rice, pasta	15.0 (2.9)	12.3 (2.5)	29.1 (3.3)	32.7 (3.2)
Grains in mixed dishes	38.2 (3.5)	41.6 (4.3)	86.3 (2.4)	78.3 (2.8)*
Sandwiches	8.1 (1.7)	7.3 (2.1)	41.6 (2.8)	36.8 (4.0)
Burritos, tacos, enchiladas, nachos	9.3 (1.8)	8.6 (2.0)	20.0 (2.5)	23.2 (2.7)
Macaroni and cheese	11.8 (1.9)	12.6 (2.5)	25.1 (2.8)	22.5 (3.1)
Pizza	2.4 (0.7)	1.9 (0.6)[b]	15.7 (2.5)	13.4 (2.3)
Spaghetti, ravioli, lasagna	9.1 (1.8)	16.1 (3.1)	28.9 (2.7)	24.5 (2.6)
Any sweet or salty snacks, desserts, or sweetened beverages	62.0 (3.4)	50.5 (4.1)*	93.1 (2.2)	91.4 (2.0)
Sweet snacks, desserts	55.7 (3.6)	43.9 (4.5)	81.1 (2.7)	82.0 (2.4)
Cakes, pies, pastries, cookies	42.9 (3.8)	32.9 (4.0)	63.5 (3.4)	57.7 (3.8)
Infant cookies, teething biscuits, animal crackers	24.3 (3.3)	7.3 (1.7)***	32.5 (2.9)	20.3 (3.1)**
Other cookies	23.0 (3.1)	12.5 (2.3)**	33.2 (2.9)	30.6 (3.1)
Sweet rolls, muffins, doughnuts	2.1 (0.9)[b]	2.0 (0.8)[b]	5.0 (1.1)	10.7 (2.7)
Ice cream, frozen yogurt, pudding	7.5 (1.3)	6.1 (1.3)	27.6 (3.0)	21.4 (2.6)
Other desserts	5.6 (1.6)	3.2 (1.2)[b]	12.2 (2.1)	11.8 (2.3)
Candy	5.4 (1.5)	2.3 (0.7)[b],*	32.0 (3.3)	32.7 (2.9)

TABLE 3 Continued

	6–11 Mo		12–23 Mo	
	2005–2008	2009–2012	2005–2008	2009–2012
Other sweets[c]	8.8 (2.5)	5.1 (1.8)[b]	30.5 (2.4)	19.9 (2.1)**
Sweetened beverages	14.0 (2.0)	13.6 (2.0)	52.1 (2.6)	54.2 (3.4)
Carbonated soda	4.3 (1.0)	2.2 (0.6)	15.6 (1.8)	18.8 (3.5)
Fruit-flavored drinks	6.1 (1.6)	8.0 (1.3)	34.1 (2.7)	29.4 (3.9)
Sport drinks	3.6 (1.2)[b]	3.1 (1.4)[b]	7.7 (1.7)	5.7 (1.9)[b]
Presweetened tea, coffee	2.4 (0.9)[b]	2.4 (1.0)[b]	7.1 (1.1)	9.9 (2.8)
Other sweetened beverages	1.9 (0.7)[b]	1.7 (0.7)[b]	8.0 (1.9)	7.1 (2.0)
Salty snacks	19.1 (5.8)[b]	20.4 (5.6)	55.3 (11.4)	53.0 (11.8)

Adjusted for mean-centered household income-to-poverty ratio and maternal age (in years) at the time of child's birth.

[a] Includes soy-based formulas.

[b] Point estimate considered unreliable because relative SE is >30%.

[c] Includes sugar, syrup, preserves, and milk flavorings.

* $P < .05$ for t test significant of equality of means across years.

** $P < .01$ for t test significant of equality of means across years.

*** $P < .001$ for t test significant of equality of means across years.

as well as grains in mixed dishes (2005–2008: 86.3%; 2009–2012: 78.3%; $P = .04$) decreased over the study period.

The percentage of 6- to 11-month-olds consuming snacks, desserts, or sweetened beverages on a typical day declined from 62.0% in 2005–2008 to 50.5% in 2009–2012 ($P < .05$), but the prevalence remained relatively unchanged among 12- to 23-month-olds. There was a marked decline in consumption of infant cookies, teething biscuits, and animal crackers in both age groups: the prevalence decreased by 17.0% among 6- to 11-month-olds ($P < .001$) and 12.2% among 12- to 23-month-olds ($P = .007$). Additionally, the percentage of older infants consuming other types of cookies (2005–2008: 23.0%; 2009–2012: 12.5%; $P = .006$) and the percentage of young toddlers consuming other sweets such as milk flavorings (2005–2008: 30.5%; 2009–2012: 19.9%; $P = .001$) decreased over the study period.

Some trends in food and beverage consumption among 6- to 23-month-olds were limited to certain racial/ethnic groups (Table 4). Among 6- to 11-month-olds, the decline in the prevalence of fruit juice consumption was observed among non-Hispanic whites and non-Hispanic blacks but not Mexican Americans. Additionally,

the decline in the percentage of 12- to 23-month-olds consuming breads, rolls, and quick breads was not consistent across racial/ethnic groups: the prevalence decreased among non-Hispanic whites but increased among Mexican Americans. Furthermore, the decline in the percentage of 12- to 23-month-olds consuming other sweets was only observed among non-Hispanic whites.

Moreover, trends that were not observed in the overall population emerged within racial/ethnic groups. As shown in Table 4, there was an increase in the prevalence of any fruit consumption among 6- to 11-month-old Mexican Americans (from 77.6% to 88.4%; $P < .05$) and 12- to 23-month-old non-Hispanic blacks (from 71.9% to 84.2%; $P = .02$) over the study period. On the other hand, the prevalence of vegetable consumption in the latter group decreased (from 87.1% to 74.1%; $P < .05$), and the percentage of 12- to 23-month-old Mexican Americans consuming any whole fruits or vegetables on a typical day also declined (from 97.4% to 89.9%; $P = .02$). Additionally, the percentage of 6- to 11-month-old non-Hispanic whites consuming mixed pasta dishes more than doubled from 8.9% in 2005–2008 to 22.7% in 2009–2012 ($P = .04$). Other downward

trends that emerged among 12- to 23-month-olds include the following: the prevalence of ham and pork consumption among non-Hispanic blacks (from 39.3% to 16.7%; $P = .007$); mixed protein dishes (from 90.7% to 79.1%; $P = .03$) and carbonated soda (from 39.3% to 21.7%; $P = .003$) consumption among Mexican Americans; and consumption of ice cream, frozen yogurt, and pudding among non-Hispanic whites (from 33.5% to 22.4%; $P < .05$).

DISCUSSION

In this study, we used 2005–2012 data from the NHANES to describe the foods and beverages consumed by infants and young toddlers in the United States. Similar to previous studies,[11] we estimated that nearly 60% of 0- to 5-month-olds do not consume any breast milk. Additionally, we reported a decline in the prevalence of breast milk consumption among Mexican Americans. Continued public health efforts are needed to achieve broad, public awareness of the many benefits of breastfeeding.[32] Additionally, more support structures are needed in hospitals, communities, and workplaces to promote breastfeeding initiation and to make continued breastfeeding more feasible for new mothers.

We observed a decrease in the consumption of complementary feeding, including solid food consumption, among 0- to 5-month-olds, which aligns with the AAP recommendations. Yet, more than 38% of 3-month-olds, 64% of 4-month-olds, and 75% of 5-month-olds consumed foods or beverages other than breast milk or formula on a typical day in 2009–2012. Previous research suggests parental concerns about infant hunger and conflicting messages from health care providers about optimal timing of introduction to solids may be among the reasons mothers introduce solid foods to infants before 6 months.[33]

Our findings also suggest a nontrivial percentage of young toddlers, particularly in some racial/ethnic groups (eg, non-Hispanic blacks), may not be meeting the AAP recommendation for fruit or vegetable consumption with every meal and snack. Furthermore, the sources of vegetable consumption among young children may be suboptimal: a 1-year-old was more likely to consume fried white potatoes than dark-green vegetables on an average day. This warrants attention because fried white potatoes are among the top sources of saturated fat in the American diet.[34] Another cause for concern is the percentage of 6- to 11-month-olds who consume cow's milk given the evidence linking this practice to iron deficiency during infancy.[35]

There were several positive changes in the beverage consumption habits of 6- to 23-month-olds. Fruit juice consumption decreased among 6- to 11-month-old non-Hispanic blacks, non-Hispanic whites, and infants enrolled in WIC. Furthermore, there was a decline in soda consumption among 12- to 23-month-old Mexican Americans. This is especially noteworthy given the high prevalence of obesity among Mexican American youth.[36]

TABLE 4 Adjusted Prevalence (SE) of Food and Beverage Consumption Among 6- to 23-month-olds in the United States by Racial/Ethnic Group: NHANES, 2005–2012

	6–11 Mo		12–23 Mo	
	2005–2008	2009–2012	2005–2008	2009–2012
Breast milk				
Non-Hispanic white	24.9 (3.1)	26.9 (4.1)	10.4 (2.5)	10.3 (3.3)[a]
Non-Hispanic black	15.7 (6.3)[a]	11.9 (2.7)	3.0 (1.6)[a]	4.0 (2.3)[a]
Mexican American	26.9 (3.5)	20.0 (3.8)	5.5 (1.9)[a]	8.4 (4.3)[a]
Cow's milk				
Non-Hispanic white	22.1 (3.8)	15.1 (4.6)[a]	87.2 (2.4)	87.8 (3.1)
Non-Hispanic black	10.3 (3.9)[a]	9.5 (3.4)[a]	89.9 (3.6)	82.0 (5.3)
Mexican American	24.0 (3.9)	17.3 (4.5)	92.5 (2.3)	94.9 (2.1)
100% fruit juice				
Non-Hispanic white	51.6 (6.0)	38.4 (5.7)*	58.3 (4.6)	58.1 (4.5)
Non-Hispanic black	84.8 (6.1)	58.7 (7.1)**	81.0 (6.7)	88.2 (4.7)
Mexican American	69.9 (4.9)	55.3 (6.5)	74.3 (6.1)	69.9 (5.0)
Fruit				
Non-Hispanic white	80.6 (4.5)	86.5 (3.8)	83.3 (3.3)	82.4 (5.1)
Non-Hispanic black	71.5 (10.1)	66.3 (6.7)	71.9 (3.4)	84.2 (4.1)*
Mexican American	77.6 (4.5)	88.4 (3.1)*	88.6 (3.0)	87.0 (3.0)
Any vegetables				
Non-Hispanic white	88.1 (2.7)	81.0 (3.2)	84.9 (3.3)	90.8 (3.6)
Non-Hispanic black	72.8 (10.8)	67.9 (7.2)	87.1 (2.8)	74.1 (5.7)*
Mexican American	62.4 (4.1)	72.6 (5.3)	66.6 (5.2)	61.5 (5.5)
Any meat or protein source				
Non-Hispanic white	72.5 (4.9)	60.8 (7.8)	96.4 (2.2)	98.8 (0.8)
Non-Hispanic black	75.8 (5.2)	61.1 (6.7)	98.0 (1.7)	96.8 (1.4)
Mexican American	83.7 (4.0)	72.0 (5.0)	97.8 (1.7)	99.7 (0.5)
Any grain or grain product				
Non-Hispanic white	91.9 (3.6)	95.2 (1.8)	98.0 (2.1)	98.5 (1.3)
Non-Hispanic black	98.5 (1.9)	89.4 (5.2)	98.2 (1.2)	99.9 (0.1)
Mexican American	94.4 (2.6)	91.2 (3.0)	98.2 (0.8)	98.7 (0.9)
Sweet snacks and desserts				
Non-Hispanic white	54.7 (4.7)	43.8 (7.9)	84.3 (4.1)	84.4 (4.6)
Non-Hispanic black	50.7 (8.4)	38.0 (7.7)	80.8 (3.8)	81.2 (6.0)
Mexican American	58.8 (4.4)	54.5 (6.2)	76.1 (3.9)	82.7 (4.0)
Sweetened beverages				
Non-Hispanic white	11.3 (2.5)	10.0 (3.1)[a]	46.0 (4.1)	49.0 (5.8)
Non-Hispanic black	2.0 (2.0)[a]	9.9 (4.4)[a]	59.2 (4.5)	52.2 (7.1)
Mexican American	28.6 (4.0)	19.1 (4.0)	70.9 (3.9)	62.6 (5.0)
Salty snacks				
Non-Hispanic white	7.2 (2.5)[a]	10.2 (3.5)[a]	43.0 (5.0)	36.5 (5.0)
Non-Hispanic black	19.1 (5.3)	13.6 (4.6)[a]	57.4 (4.8)	53.6 (9.2)
Mexican American	19.8 (3.9)	12.6 (3.9)[a]	42.3 (4.0)	31.8 (4.2)

Adjusted for mean-centered household income-to-poverty ratio and maternal age (in years) at the time of child's birth.
[a] Point estimate considered unreliable because relative SE is >30%.
* $P < .05$ for t test significant of equality of means across years.
** $P < .01$ for t test significant of equality of means across years.

However, the finding that more than 50% of all young toddlers have daily consumption of sweetened beverages is troubling. Not only are sweetened beverages outside of the AAP recommendations for children in this age group, but research suggests consumption of sugar-sweetened beverages in early life is associated with greater intake of

these beverages and increased odds of obesity later in childhood.[5,6,37,38]

The first 2 years of life are critical for setting the stage for diet and health throughout the life course. Flavors introduced and foods consumed during this period will influence later food intake.[1] A recent prospective study found evidence of a link between consumption of

fruits, vegetables, and sweetened beverages during infancy and intake levels at age 6 years.[38,39] Therefore, additional guidance is needed to help young children make the transition from a milk-based diet to one consisting primarily of family foods. Research is particularly needed to understand the factors that influence parents' early-feeding decisions, the challenges they experience during this transition period and beyond, and how providers and society can better support them in following AAP or other national recommendations. In the absence of federal policy guidance and programmatic efforts targeting this age group, health care providers play a key role in helping parents make appropriate choices for feeding infants and young toddlers. Providers should educate parents on the importance of modeling healthy food choices as well as assess early-feeding habits, offer clear messaging about optimal timing of introduction to solid foods, discourage consumption of sweetened beverages, encourage fruit and vegetable intake, suggest strategies to increase variety in the types of vegetables consumed, and discuss common early-feeding challenges (eg, food rejection).

This study provides the most recent description of the food and beverage consumption habits of all 0- to 23-month-olds in the United States. Furthermore, because we report estimates adjusted for maternal age at birth and poverty status, the trends reported may not be fully explained by demographic changes that occurred in the United States during the study period. However, these findings should be interpreted with some caution given the limited research validating dietary assessment methods in infants and young toddlers and the tendency for parents to overreport energy intake for children in this age group.[40] This may have resulted in an overestimation of the prevalence of consumption in some food or beverage categories, especially those perceived as more socially acceptable. On the other hand, we may have underestimated the prevalence of consumption in some categories by treating food mixtures as a single food item. Additionally, we did not account for variability in portion sizes in the current study. However, future research should seek to estimate usual intake levels of key nutrients in this population and compare them against the dietary reference intake recommendations set forth by the Institute of Medicine's Food and Nutrition Board.[41,42]

CONCLUSIONS

While there have been some improvements in the diets of 0- to 23-month-olds in recent years, there are areas in which this population continues to fall short of meeting current recommendations for early feeding. This underscores the need for clear policy guidance for providers and education for parents and caretakers on helping infants and young toddlers achieve healthy diets. Findings from the current study highlight key issues (eg, increasing vegetable consumption, decreasing sweetened beverage consumption) that should be monitored by clinicians and addressed by future dietary guidelines for the birth-to-24-months population.

ABBREVIATIONS

AAP: American Academy of Pediatrics
FNDDS: Food and Nutrient Database for Dietary Studies
WIC: Supplemental Nutrition Program for Women, Infants, and Children
WWEIA: What We Eat in America

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