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Added Sugars Intake among US Infants and Toddlers

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Abstract

Background—Limited information is available on added sugars consumption in US infants and toddlers.

Objectives—To present national estimates of added sugars intake among US infants and toddlers by sociodemographic characteristics, to identify top sources of added sugars, and to examine trends in added sugars intake.

Design—Cross-sectional analysis of 1 day of 24-hour dietary recall data.

Participants/setting—A nationally representative sample of US infants aged 0 to 11 months and toddlers aged 12 to 23 months (n=1,211) during the period from 2011 through 2016 from the National Health and Nutrition Examination Survey. Trends were assessed from 2005-2006 through 2015-2016 (n=2,795).

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AUTHOR CONTRIBUTIONS

K. A. Herrick conceptualized and designed the study, performed analyses, drafted the manuscript, and approved the final manuscript as submitted. C. D. Fryar performed analyses, reviewed and revised the manuscript, and approved the final manuscript as submitted. H. C. Hamner and S. Park reviewed and revised the manuscript, and approved the final manuscript as submitted. C. L. Ogden conceptualized and designed the study, reviewed and revised the manuscript, and approved the final manuscript as submitted.

STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

Main outcome measures—Among infants and toddlers, the proportion consuming any added sugars, the average amount of added sugars consumed, percent of total energy from added sugars, and top sources of added sugars intake.

Statistical analysis—Paired *t* tests were used to compare differences by age, sex, race/Hispanic origin, family income level, and head of household education level. Trends were tested using orthogonal polynomials. Significance was set at $P < 0.05$.

Results—During 2011 to 2016, 84.4% of infants and toddlers consumed added sugars on a given day. A greater proportion of toddlers (98.3%) consumed added sugars than infants (60.6%). The mean amount of added sugars toddlers consumed was also more compared with infants (5.8 vs 0.9 tsp). Non-Hispanic black toddlers (8.2 tsp) consumed more added sugars than non-Hispanic Asian (3.7 tsp), non-Hispanic white (5.3 tsp), and Hispanic (5.9 tsp) toddlers. A similar pattern was observed for percent energy from added sugars. For infants, top sources of added sugars were yogurt, baby food snacks/sweets, and sweet bakery products; top sources among toddlers were fruit drinks, sugars/sweets, and sweet bakery products. The mean amount of added sugars decreased from 2005-2006 through 2015-2016 for both age groups; however, percent energy from added sugars only decreased among infants.

Conclusion—Added sugars intake was observed among infants/toddlers and varied by age and race and Hispanic origin. Added sugars intake, as a percent of energy, decreased only among infants from 2005 to 2016.

Keywords

Nutrition; Survey; Added sugars; Infants; Toddlers

Consumption of added sugars has been associated with detrimental health conditions, such as dental caries,¹ asthma,² obesity,³ altered lipid profiles,⁴⁻⁶ and elevated blood pressure⁴⁻⁶ in children. Meeting adequate intake of essential nutrients, maintaining appropriate weight, and staving off chronic disease leaves little room for the consumption of added sugars.⁷ Recognizing this, the World Health Organization, a report by the 2015 Dietary Guidelines Advisory Committee, and the American Heart Association (AHA) all recommended limiting added sugars consumption to <10% of total energy intake for those aged 2 years and older.⁸⁻¹⁰ This roughly translates into 9 tsp added sugars per day for men, and 6 tsp for women and children aged 2 to 19 years.¹⁰ No national guidance on added sugars exists for infants and toddlers. The only professional body to provide guidance comes from a 2017 statement from the AHA that recommends children younger than 2 years old avoid consuming any added sugars.¹¹

The Dietary Guidelines for Americans 2015-2020 (2015-2020 DGA) provides recommendations for Americans aged 2 years and older. It shows that about 70% of Americans aged 2 years exceed recommendations for added sugars intake.⁷ The current and previous guidelines have not focused on infants and toddlers, principally due to lack of high-quality data.¹² Infants and toddlers consuming breast milk are often excluded from analyses because of difficulties related to assessing the amount of breast milk consumed. Consequently, limited information is available on added sugars consumption by US toddlers (aged 12 to 23 months)¹³ and even less is available for US infants (aged 0 to 11 months).¹⁴

In addition, of the few publications on added sugars consumption in infants and toddlers, none have examined trends in added sugars consumption over time. Given the mandate to include recommendations for infants and toddlers aged 0 to 23 months in the upcoming revision of the 2020-2025 DGA,¹⁵ more information is needed to provide baseline data that may be relevant to the upcoming 2020-2025 DGA for this age group.¹² This could also inform pediatricians about the amounts and sources of added sugars consumed by some of their youngest patients.

This study provides recent national estimates of added sugars consumption among infants (aged 6 to 11 months) and toddlers (aged 12 to 23 months) from 2011 to 2016. We describe the proportion of infants and toddlers consuming added sugars, the amounts they consumed, the percent of energy from added sugars, and the leading sources of added sugars in their diets by age, sex, race and Hispanic origin, family income level (as a percentage of the federal poverty level [FPL]), and head-of-household education attainment. In addition, trends in added sugars consumption from 2005-2006 through 2015-2016 are examined.

METHODS

Study Design

The current study used data from the National Health and Nutrition Examination Survey (NHANES), a complex, stratified, multistage probability sample of the US civilian noninstitutionalized population.¹⁶ NHANES is conducted by the National Center for Health Statistics (NCHS) and detailed information on the study design and methods are available elsewhere.^{17,18} Briefly, participants receive a detailed in-home interview, followed by a physical examination and dietary interview, at a mobile exam center (MEC). Written parental consent was obtained for infants' and toddlers' participation. The NHANES protocol was approved by the NCHS Research Ethics Review Board. National estimates of added sugars intake were based on data from three survey cycles, 2011-2012, 2013-2014, and 2015-2016. These cycles represent the most recent national data available from NHANES that balance sufficient sample size to produce estimates with greater precision and smaller sampling error, while minimizing the potential influence of secular changes. Ten-year trends in added sugars consumption, beginning with the 2005-2006 cycle, are also presented. Although trend analysis starting in 1999-2000 is possible, changes to both the nutrient database and the instrument used to collect the dietary recall differed, so for consistency 10-year trends¹⁹ were evaluated. The unweighted examination response rates for infants and toddlers aged <2 years for 2005-2006, 2007-2008, 2009-2010, 2011-2012, 2013-2014, and 2015-2016 were 89%, 86%, 87%, 80%, 77%, and 68%, respectively. Response rates for NHANES participants aged younger than 1 year and 1 to 5 years are available on the NHANES website.²⁰

Dietary Intake

The dietary component in NHANES is collected by trained interviewers, using the US Department of Agriculture (USDA) Automated Multiple-Pass Method.²¹ The Automated Multiple-Pass Method uses a computer-assisted dietary interview system that includes a multiple-pass format with standardized probes to collect the type and amount of all food and

Demographic Characteristics and Socioeconomic Status Variables

Demographic characteristic variables used to describe added sugars intake included age (6 to 11 months or 12 to 23 months), sex (male or female), and race and Hispanic origin (non-Hispanic white, non-Hispanic black, non-Hispanic Asian, and Hispanic). Non-Hispanic participants reporting more than one race are not shown separately but are included in the total. Two dimensions of socioeconomic status were used to describe added sugars intakes: head-of-household educational attainment (less than high school or high school degree/General Equivalency Diploma, and greater than high school education) and family income level relative to the federal poverty level (FPL) (<185% or >185% of FPL). Studies have shown that families of lower socioeconomic status (ie, income or education level) often use suboptimal weaning diets.²⁹⁻³¹

FPL is based on the income-to-poverty ratio, a measure of the annual total family income divided by the federal poverty guidelines³² adjusted for family size and inflation. The income standard for participation in the Special Supplemental Nutrition Program for Women, Infants, and Children cannot exceed 185% of the poverty guidelines,³³ the cutoff of 185% of FPL was used because of its relevance to infants and toddlers' nutritional status. In 2016, almost half (47%) of all infants in the United States and about one-quarter (24%) of children aged 1 to 4 years received the Special Supplemental Nutrition Program for Women, Infants, and Children benefits.³⁴

Analysis

Among infants (aged 6 to 11 months) and toddlers (aged 12 to 23 months), the following estimates were calculated: the proportion consuming any added sugars on a given day, the average amount of added sugars consumed, and percent of total energy from added sugars. To identify top sources of added sugars in the diets of infants and toddlers, the population proportion by amount of added sugars consumed and the percent of total energy from added sugars³⁵ was estimated and ranked by decreasing contribution. Table 1 defines the collapsed food categories used.

Day 1 dietary weights were applied to the current analysis. Dietary weights account for nonresponse, intake day of the week, differential probabilities of selection, and post-stratification standard. All variance estimates and statistical testing accounted for the complex survey design by using Taylor series linearization. Differences (in means or proportions) were determined using adjusted Wald tests ($P<0.05$). The hypotheses of no linear trend in added sugars intake between 2005-2006 and 2015-2016 were tested using orthogonal contrast matrixes ($P<0.05$). The current analysis presents mean and 95% Wald CIs, and proportions and 95% Clopper-Pearson CIs, calculated by the Korn and Graubard method.³⁶ The stability of means was evaluated with the relative standard error (RSE); RSE >30 was considered unreliable. The stability of proportions was assessed using NCHS data presentation standards for proportions.³⁷

Data analyses were conducted using SAS software,³⁸ and SUDAAN.³⁹ The current study identified 1,333 infants and toddlers aged 6 to 23 months who participated in NHANES 2011-2016. Participants who did not have a dietary recall were excluded (n=122), leaving a

final sample size of 1,211. Among infants aged 0 to 5 months, added sugars intake was very low; $<2\% \pm 0.6\%$ consumed any added sugars on a given day, and the amount consumed was small: 0.02 ± 0.01 tsp (data not shown); therefore, this analysis focuses on children aged 6 to 23 months. For trends in added sugars intake from 2005 to 2006 through 2015 to 2016, the sample size was 2,795.

RESULTS

Any Added Sugars Intake

About 60.6% (95% CI, 55.6% to 65.4%) of infants aged 6 to 11 months and 98.3% (95% CI, 97.0% to 99.2%) of toddlers aged 12 to 23 months consumed added sugars on a given day between 2011 and 2016 (Table 2). The proportion of toddlers consuming any added sugars was significantly higher than among infants for all sociodemographic variables ($P < 0.001$). Among infants, variation in the proportion consuming any added sugars did not differ significantly by sex, race and Hispanic origin, family income level, and head-of-household educational attainment. The estimate for non-Hispanic Asian infants was found to be unreliable and was therefore suppressed according to NCHS data standards.³⁷

The only significant difference among the proportions of toddlers consuming any added sugars was observed between non-Hispanic white toddlers (99.6%, 95% CI 97.2% to 100.0%) and non-Hispanic black toddlers (94.1%, 95% CI 86.4% to 98.1%) ($P = 0.03$).

Mean Added Sugars Intake

On average, infants consumed almost 1 tsp (0.9 tsp, 95% CI 0.7 to 1.1 tsp) of added sugars on a given day, and toddlers consumed 5.8 tsp (95% CI 5.3 to 6.4 tsp) (Figure 1). Toddlers consumed significantly more added sugars than infants, regardless of sex, race and Hispanic origin, family income level, or head-of-household educational attainment ($P < 0.001$). Among infants, no difference was found in added sugars consumption by sex, family income level, or head-of-household educational attainment. Non-Hispanic Asian infants (0.3 tsp, 95% CI 0.0 to 0.5 tsp) consumed fewer teaspoons of added sugars compared with non-Hispanic white (1.0 tsp, 95% CI 0.1 to 1.4 tsp), non-Hispanic black (1.1 tsp, 95% CI 0.4 to 1.5 tsp) and Hispanic (0.8 tsp, 95% CI 0.5 to 1.0 tsp) infants. However, the RSE of the estimates for both non-Hispanic Asian (RSE=44) and non-Hispanic black (RSE=31) infants exceeded 30 and should be interpreted with caution.

Among toddlers, mean added sugars consumption did not differ by sex, head-of-household educational attainment or family income level, but significant differences were observed by race and Hispanic origin. Non-Hispanic black toddlers (8.2 tsp, 95% CI 6.7 to 9.7 tsp) consumed more added sugars compared with non-Hispanic white (5.3 tsp, 95% CI 4.6 to 6.0; $P < .001$), non-Hispanic Asian (3.7 tsp, 95% CI 2.6 to 4.7 tsp; $P < 0.001$), and Hispanic toddlers (5.9 tsp, 95% CI 5.0 to 6.8 tsp; $P = 0.01$). In addition to having a lower consumption than non-Hispanic blacks, non-Hispanic Asian toddlers consumed the fewest teaspoons of added sugars, also lower than non-Hispanic white toddlers ($P = 0.02$) and Hispanic toddlers ($P < 0.01$).

Mean Percent of Total Energy from Added Sugars

Overall, added sugars contributed <2% (ie, 1.5%) of total energy intake on a given day for infants and about 8% (ie, 7.6%) of total energy for toddlers (Table 3). The contribution of added sugars to total energy was significantly larger for toddlers compared with infants ($P<0.001$). The contribution of added sugars to total energy did not vary by sex, head-of-household educational attainment, or family income level among infants. The contribution of added sugars to total energy was lower among non-Hispanic Asian infants (0.6%, 95% CI 0.1% to 1.0%) compared with non-Hispanic white (1.8%, 95% CI 1.1% to 2.4%) and Hispanic infants (1.3%, 95% CI 0.9% to 1.8%). The difference between non-Hispanic Asian and non-Hispanic black infants was not significant. Differences should be interpreted with caution because the RSE was >30 for both non-Hispanic black and non-Hispanic Asian infants.

Among toddlers, the contribution of added sugars to total energy varied by race and Hispanic origin. Added sugars consumption contributed about 5% to total energy consumption among non-Hispanic Asian toddlers (5.2%, 95% CI 3.6% to 6.7%); significantly less than non-Hispanic black (9.5%, 95% CI 7.7% to 11.3%; $P<0.01$), Hispanic (7.8%, 95% CI 6.8% to 8.9%; $P<0.01$), and non-Hispanic white (7.2%, 95% CI 6.3% to 8.1%; $P=0.03$) toddlers. The percent of total energy from added sugars was also significantly higher for non-Hispanic black compared with non-Hispanic white toddlers ($P=0.02$).

Top Sources of Added Sugars

Table 4 presents the top-eight food and beverage sources of added sugars in the diets of US infants and toddlers; each item accounted for 5% or more of added sugars intake. Among infants, yogurt contributed 17.7% (95% CI 8.7% to 22.6%) to added sugars in the diet, followed by baby snacks and sweets (11.5%, 95% CI 7.1% to 16.0%); sweet bakery products (11.0%, 95% CI 5.6% to 16.5%); and flavored milk, dairy drinks, and milk substitutes (9.6%, 95% CI 1.1% to 18.1%). Fruit drinks contributed 7.1% (95% CI 0.1% to 14.0%) to added sugars intake among infants.

Among toddlers, fruit drinks accounted for 19.6% (95% CI 13.5% to 25.7%) of added sugars in the diet. Sweet bakery products (14.9%, 95% CI 13.0% to 16.8%), sugar and candy (10.3%, 95% CI 8.6% to 12.1%), yogurt (9.0%, 95% CI 5.7% to 12.3%), and sweetened beverages (7.5%, 95% CI 4.7% to 10.2%) were among the top-five sources of added sugars in the diet of US toddlers.

Trends in Added Sugars Intake from 2005-2006 through 2015-2016

The percent of infants consuming any added sugars declined from 2005-2006 through 2015-2016 ($P<0.01$). There was no significant change in the percent of toddlers consuming any added sugars during the same time period ($P=0.6$) (Figure 2A). In addition, mean consumption of added sugars among infants decreased from 1.4 tsp (95% CI 0.9 to 1.9 tsp) during 2005-2006 to 0.8 tsp (95% CI 0.5 to 1.1 tsp) in 2015-2016 ($P<0.01$). A similar decline was observed among toddlers, from 6.7 tsp (95% CI 6.0 to 7.4 tsp) to 5.2 tsp (95% CI 4.5 to 6.0 tsp) ($P=0.02$) (Figure 2B). A decline in the percent of total energy from added

sugars was observed among infants; from 2.0% (95% CI 0.7% to 4.7%) to 1.4% (95% CI 0.2% to 4.4%) ($P=0.01$), but not among toddlers ($P=0.08$) (Figure 2C).

DISCUSSION

Findings from the current analysis demonstrate that added sugars consumption starts early in life and quickly increases. Although the period of data collection (2011 to 2016) predates the AHA 2017 recommendation,¹¹ applying it retrospectively demonstrates how pervasive added sugars are in the US diet. By the time children reach their second birthday, almost all have some exposure to added sugars.

To our knowledge, this is the first report of trends in added sugars consumption among infants and toddlers. The present study found that the amount (in teaspoons) of added sugars consumed has declined over time for infants and toddlers, but the decrease in percent energy from added sugars was only statistically significant among infants. This finding is complementary to patterns observed among older US children and adolescents (aged 2 to 18 years), where added sugars consumption has decreased during the past decade, but the decrease seems to have leveled off in recent years.⁴⁰⁻⁴²

No association was found between added sugars intake and sex, family income level, or head-of-household educational attainment, but added sugars consumption was associated with race and Hispanic origin. Although interpretation of added sugars consumption among infants should be approached with caution due to limited sample size, among toddlers, the finding was more robust. Non-Hispanic black toddlers consumed significantly more added sugars than toddlers in all other race and Hispanic origin groups, and the mean consumption amount (8 tsp) exceeded the recommended limit for children aged 2 to 18 years.¹¹ Using NHANES data from 2009 through 2012, Welsh and Figueroa¹³ found that non-Hispanic black toddlers consumed more added sugars than non-Hispanic white toddlers. The current analysis also found that added sugars accounted for a larger mean percentage of total energy among non-Hispanic black toddlers compared with non-Hispanic white and non-Hispanic Asian toddlers. Added sugars contributed nearly 10% of total energy for non-Hispanic black toddlers; this almost matches the recommendation for all individuals aged 2 years and older.^{7,8}

Yogurt, sweet bakery products, and fruit drinks were featured among the top-five sources of added sugars for both infants and toddlers, although their individual rankings were different for infants and toddlers. Among infants, yogurt was the top source of added sugars, followed by baby snacks and sweets. The only other report of sources of added sugars for infants (aged 0 to <1 year) found crackers/popcorn/pretzels/corn chips as the leading source of added sugars.¹⁴ The difference likely stems from the approach used to identify important sources of added sugars in the diets of infants and toddlers. The current analysis identified important sources of added sugars using the roughly 150 WWEIA food categories and collapsing categories to maintain stable estimates and produce summary categories relevant to eating patterns in infants and toddlers. Wang and colleagues¹⁴ appear to have used 11 predefined categories that were not tailored to the eating patterns of infants and toddlers.

The current analysis found the same top-three sources of added sugars (fruit drinks, sweet bakery products, and sugars/candy) for toddlers as Welsh and Figueroa¹³ did using NHANES data from 2009 through 2012. Similar to studies in older children (aged 2 to 8 years), sweet bakery products were among the top-three sources of added sugars.¹⁴ In the current analysis, fruit drinks were separated from other sweetened beverages; however, in the case that these two categories were collapsed, results would likely match those of older children¹⁴ and other studies that have found that sugar-sweetened beverages (SSBs) are the top source of added sugars in the US diet.^{43,44}

Eating patterns established early in life have been shown to shape later eating patterns.⁴⁵⁻⁴⁷ For example, the odds of consuming SSBs at least once per day was 2.2 times higher among 6-year-olds who had consumed any SSBs before age 1 year, compared with 6-year-olds who had never consumed an SSB before age 1 year.⁴⁸

This study is not without limitations. For infants and toddlers who reported consuming breast milk, the amount consumed was estimated because it is not collected in NHANES. This could influence the mean percent of total energy from added sugars in subgroup comparisons. Infants and toddlers are unable to report food and beverage consumption for themselves. Plus, because they may be in child care, the person reporting intake may not be the person most familiar with intake. As with any dietary recall, memory is fallible and subject to bias,^{49,50} particularly related to under- or overreporting of certain food items based on their social influences.⁵¹ The food composition tables that underpin NHANES are continuously updated, and a recent change has potential to influence estimates. In the 2011-2012 FPED, “fruit juice concentrates added as ingredients and not diluted, were assigned to added sugars, whereas in the previous FPEDs these were placed in the fruit juice component.”⁵² National estimates have been unaffected by this change, providing reassurance that our findings of trends in added sugars consumption over time are robust; however, at the individual level differences might be possible.⁵² Finally, although there was a sufficient sample size to examine added sugars intake among infants and toddlers overall and for most characteristics, for a few groups reliable estimates could not be made.

The current analysis has many strengths. National estimates for infants and toddlers are presented in preparation for periodic revision of the DGAs. In addition, estimates of added sugars intake were presented in teaspoons, a metric easily understood and conveyed to practitioners and the lay public. Two new contributions of this work are the estimation of top sources of added sugars for infants aged 6 to 11 months and estimates of trends over time for both infants and toddlers. In addition, breastfed infants were included in all of the current estimates. This group is often excluded because of the difficulties associated with assigning a consumption amount to breast milk. Although the nutrient values ascribed to breast milk in the food composition tables have not been updated for close to 40 years,⁵³ the data provide a starting point and allows for the inclusion of this important group in national estimates.

CONCLUSIONS

In this nationally representative survey of US infants and toddlers aged 6 to 23 months, almost 85% consumed added sugars on a given day. From 2005-2006 through 2015-2016,

fewer infants consumed added sugars, and the amount they consumed decreased and the percent energy from added sugars also decreased. The amount of added sugars consumed also declined for toddlers. Yogurt was the top source of added sugars for infants, and fruit drinks were the top source for toddlers. These findings provide insight into added sugars intake among US infants and toddlers and may inform efforts to reduce added sugars intake and establish healthy dietary practices in early childhood.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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RESEARCH SNAPSHOT

Research Question: What are the amounts, sources, and trends in added sugars intake among US infants and toddlers?

Key Findings: Nearly two-thirds of infants and almost all toddlers consume added sugars. Between 2005 and 2016, fewer infants consumed added sugars, the amount they consumed decreased, and the percent energy from added sugars also decreased. Only the amount of added sugars consumed declined significantly for toddlers.

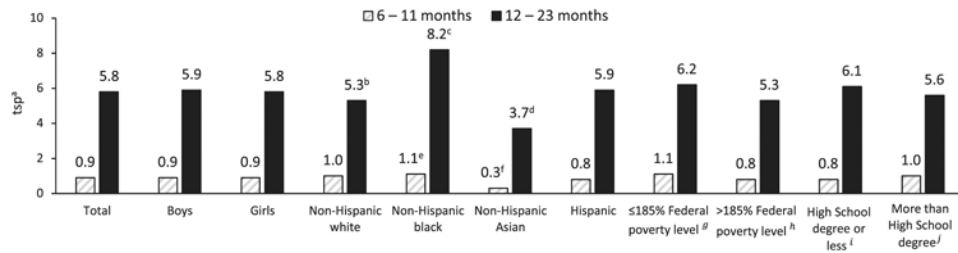


Figure 1.

Mean added sugars consumption (tsp) among US infants and toddlers aged 6 to 23 months, National Health and Nutrition Examination Survey, 2011-2016, (n=1,211). ^atsp=teaspoons. ^bNon-Hispanic white toddlers significantly different from non-Hispanic black ($P=0.001$) toddlers and non-Hispanic Asian toddlers ($P=0.02$). ^cNon-Hispanic black toddlers significantly different from non-Hispanic Asian ($P<0.001$) toddlers and Hispanic toddlers ($P=0.01$). ^dNon-Hispanic Asian toddlers significantly different from Hispanic toddlers ($P=0.003$). ^eRelative standard error >30. ^fRelative standard error >30; non-Hispanic Asian infants significantly different from non-Hispanic white infants ($P=0.001$), non-Hispanic black infants ($P=0.04$), and Hispanic infants ($P=0.002$). ^gFederal poverty level missing for 50 participants 6-11 months. ^hFederal poverty level missing for 54 participants 12-23 months. ⁱHead-of-household educational attainment missing for 23 participants 6-11 months. ^jHead-of-household educational attainment missing for 19 participants 12-23 months.

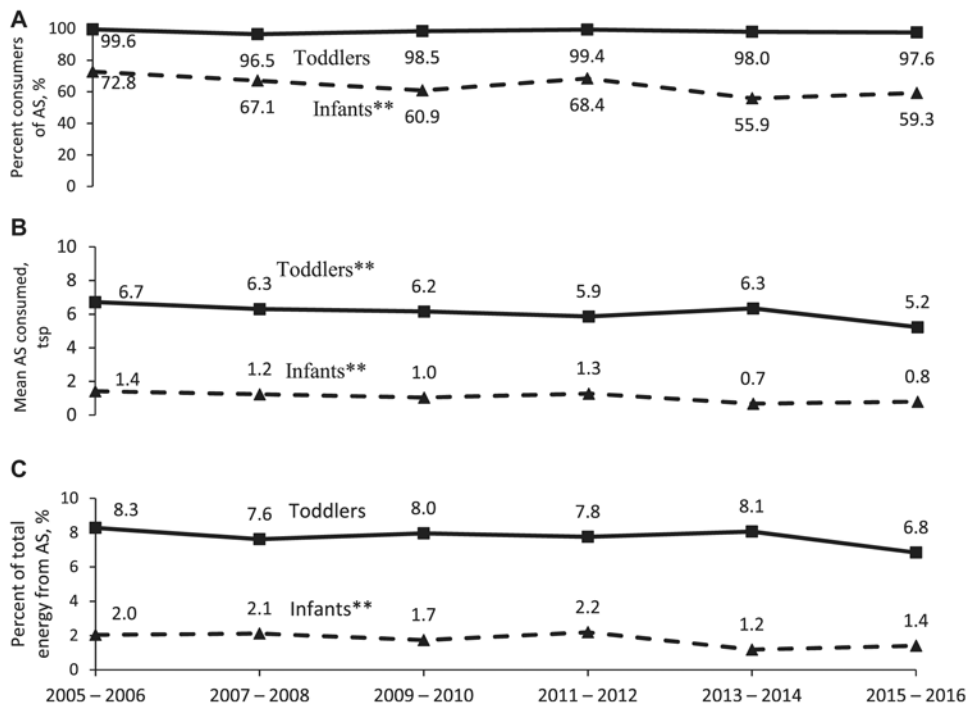


Figure 2. Trends in percent consumers of added sugars (AS) (A), mean added sugars (teaspoons [tsp]) consumed (B), and added sugars as a percent of total energy intake (C) among US infants and toddlers aged 6 to 23 months from the National Health and Nutrition Examination Survey, 2005-2006 through 2015-2016 (n=2,795). **Significant linear decrease ($P<0.01$).

Table 1.

Food groups and associated What We Eat in America (WWEIA) food group category number used in the current analysis of added sugars intake among US infants and toddlers in the National Health and Examination Survey, 2011–2016

Collapsed food group category	Food types in food groups	WWEIA category ^a
Baby snacks and sweets	Snacks and sweets labeled for baby	9012
Breads, rolls, tortillas	Yeast breads, rolls and buns, bagels, English muffins, tortillas	4202, 4204, 4206, 4208
Sugar and candy	Sugars, honey, sugar substitutes, jams, syrups, toppings, candy containing chocolate, candy not containing chocolate	5702, 5704, 8802, 8804, 8806
Cereals, cooked and baby cereals	Oatmeal, grits and other cooked cereal, dry and jarred baby cereal	4802, 4804, 9002
Ice cream, pudding, gelatin	Ice cream, frozen dairy desserts, pudding, gelatins, ices, sorbets	5802, 5804, 5806
Flavored milk, dairy drinks, and milk substitutes	Flavored milk whole, reduced fat, low fat, nonfat, milk shakes and other dairy drinks, milk substitutes	1202, 1204, 1206, 1208, 1402, 1404
Fruits	Fruit purees, fruits packed in light or heavy syrup	6002-6018
Fruit drinks	Fruit flavored beverages, fruit nectars, and fruit juice drinks; juice content <100% juice	7204
Mixed dishes	Mixed dishes—all varieties, pizza, burgers, frankfurter sandwiches, chicken/turkey sandwiches, egg breakfast sandwiches, other sandwiches	3002-3802
Protein foods	Meats, poultry, seafood, eggs, cured meats/poultry, plant-based protein foods	2002-2806
Quick breads and bread products	Biscuits, muffins, quick breads, pancakes, waffles, French toast	4402, 4404
Ready-to-eat cereals	Ready-to-eat cereals, higher sugar (>21.2 g/100 g), ready-to-eat cereals, lower sugar (21.2 g/100 g)	4602, 4604
Savory snacks	Tortilla chips, popcorn, pretzels/snack mix, crackers, saltines	5004, 5006, 5008, 5202, 5204
Sweet bakery products	Cakes, pies, cookies, brownies, doughnuts, sweet rolls, pastries	5502, 5504, 5506
Sweetened beverages	Soft drinks, sport and energy drinks, nutritional beverages, smoothies, grain drinks, coffee and tea	7202, 7206, 7208, 7220, 7302, 7304
Yogurt	Yogurt, baby, Greek and regular	1820, 1822, 9010

^aWWEIA food groups and category number can be found at <https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/food-survey-s-research-group/docs/dmir-food-categories>.

Proportion of US infants and toddlers aged 6 to 23 months consuming any added sugars on a given day, National Health and Nutrition Examination Survey, 2011–2016

Table 2.

Characteristic	Infants Aged 6-11 mo		Toddlers Aged 12-23 mo ^d		Total Children Aged 6-23 mo	
	n ^b	% (95% CI) ^c	n	% (95% CI)	n	% (95% CI)
Total	560	60.6 (55.6-65.4)	651	98.3 (97.0-99.2)	1,211	84.4 (81.9-86.7)
Boys	275	59.5 (52.4-66.4)	341	98.6 (96.6-99.5)	616	84.7 (81.3-87.7)
Girls	285	61.8 (54.5-68.7)	310	98.1 (95.2-99.5)	595	84.0 (80.4-87.2)
Race and Hispanic origin^d						
Non-Hispanic white	185	65.2 (55.8-73.9)	177	99.6 (97.2-100.0) ⁱ	362	86.5 (81.5-90.5)
Non-Hispanic black	107	51.9 (40.1-63.5)	144	94.1 (86.4-98.1)	251	76.6 (69.5-82.7) ^k
Non-Hispanic Asian	33	<i>h</i>	47	96.7 (80.9-100) ^j	80	74.6 (58.7-86.9)
Hispanic	199	61.2 (51.6-70.2)	230	98.5 (94.0-99.9)	429	86.0 (81.9-89.5)
Family income level^e						
185% FPL ^f	306	62.6 (56.9-68.1)	351	98.5 (96.5-99.5)	657	85.3 (82.3-87.9)
>185% FPL	204	59.2 (51.8-66.3)	246	98.0 (95.0-99.4)	450	83.8 (79.9-87.1)
Head-of-household educational attainment^g						
High school degree or less	254	59.2 (51.5-66.5)	281	98.8 (96.6-99.7)	535	84.3 (80.1-87.9)
More than a high school degree	283	61.9 (54.4-69.0)	351	98.0 (95.7-99.3)	634	84.8 (81.1-88.0)

^aToddlers aged 12 to 23 months significantly different from infants aged 6 to 11 months for all subgroups ($P<0.001$).

^bUnweighted sample size includes responses from all reliable and complete recalls, including infants and toddlers who reported consuming breastmilk on the day of the recall (n=205).

^cThe Kom and Graubard method²⁷ was used to construct 95% CIs.

^dEstimates for non-Hispanic persons reporting more than one race are not shown separately but are included in the total.

^eFamily income level is missing for 50 participants aged 6 to 11 months and 54 participants aged 12 to 23 months.

^fFPL=federal poverty level.

^gHead-of-household educational attainment missing 23 participants for 6-11 months and 19 participants for 12-23 months.

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Estimate does not meet National Center for Health Statistics standards of reliability.³⁷

Non-Hispanic white toddlers significantly different from non-Hispanic black toddlers ($P=0.03$).

Standard error based on <8 degrees of freedom.

Non-Hispanic black infants and toddlers significantly different from non-Hispanic white ($P=0.01$) and Hispanic infants and toddlers ($P=0.01$).

Table 3.

Mean percent of total energy from added sugars among US infants and toddlers aged 6 to 23 months, National Health and Nutrition Examination Survey, 2011-2016 (n=1,211)

Characteristic	Infants 6-11 mo	Toddlers 12-23 mo
	← % (95% CI) ^a →	
Total	1.5 (1.2-1.9)	7.6 (7.0-8.2)
Boys	1.6 (1.0-2.1)	7.7 (6.9-8.5)
Girls	1.5 (1.0, 2.1)	7.4 (6.6-8.3)
Race and Hispanic origin^b		
Non-Hispanic white	1.8 (1.1-2.4)	7.2 (6.3-8.1) ^h
Non-Hispanic black	1.7 (0.6-2.8) ^f	9.5 (7.7-11.3)
Non-Hispanic Asian	0.6 (0.1-1.0) ^g	5.2 (3.6-6.7) ⁱ
Hispanic	1.3 (0.9-1.8)	7.8 (6.8-8.8)
Family income level^c		
185% FPL ^d	1.6 (1.1-2.2)	7.9 (7.0-8.9)
>185% FPL	1.4 (1.0-1.8)	7.1 (6.1-8.0)
Head-of-household educational attainment^e		
High school degree or less	1.4 (0.7-2.1)	8.1 (7.1-9.1)
More than a high school degree	1.7 (1.2-2.1)	7.2 (6.4-7.9)

^aBased on Wald test.

^bEstimates for non-Hispanic persons reporting more than one race are not shown separately but are included in the total.

^cFamily income level missing for 50 participants aged 6 to 11 months and 54 participants aged 12 to 23 months.

^dFPL=federal poverty level.

^eHead-of-household educational attainment missing 23 participants for infants group aged 6 to 11 months and 19 participants for toddlers aged 12 to 23 months.

^fRelative standard error >30.

^gRelative standard error >30; non-Hispanic Asian infants significantly different from non-Hispanic white infants ($P=0.004$) and Hispanic ($P=0.012$) infants.

^hNon-Hispanic white toddlers significantly different from non-Hispanic black toddlers ($P<0.02$) and non-Hispanic Asian toddlers ($P=0.03$).

ⁱNon-Hispanic Asian toddlers significantly different from non-Hispanic black toddlers ($P=0.003$) and Hispanic ($P=0.005$) toddlers.

Table 4.

Top eight sources of added sugars in the diets of US infants and toddlers aged 6 to 23 months, National Health and Nutrition Examination Survey, 2011-2016 (n=1,211)

Source of added sugar	Mean contribution to added sugar intake
	% (95% CI) ^a
Infants aged 6-11 mo	
Yogurt, baby, Greek, and regular	17.7 (8.7-22.6)
Baby snacks and sweets ^b	11.5 (7.1-16.0)
Sweet bakery products ^c	11.0 (5.6-16.5)
Flavored milk, dairy drinks, and milk substitutes	9.6 (1.1-18.1)
Fruits ^d	8.2 (5.3-11.0)
Fruit drinks	7.1 (0.1-14.0)
Sugar and candy ^e	5.2 (0.0-11.8)
Ready-to-eat cereals ^f	5.0 (2.7-7.2)
Toddlers aged 12-23 mo	
Fruit drinks	19.6 (13.5-25.7)
Sweet bakery products ^c	14.9 (13.0-16.8)
Sugar and candy ^e	10.3 (8.6-12.1)
Yogurt, baby, Greek, and regular	9.0 (5.7-12.3)
Sweetened beverages ^g	7.5 (4.7-10.2)
Ready-to-eat cereals ^f	6.7 (5.0-8.3)
Flavored milk, dairy drinks, and milk substitutes	5.6 (3.4-7.8)
Ice cream, pudding, gelatin ^h	5.0 (3.2-6.7)

^aBased on Wald test.

^bIncludes products labeled as “baby food”; for example, baby pretzels, apple dessert, and baby food.

^cIncludes cakes, pies, cookies, brownies, doughnuts, sweet rolls, and pastries.

^dIncludes fruit purées and fruits pack in light or heavy syrup.

^eIncludes sugar, honey, sugar substitutes, jams, syrups, toppings, and candy with or without chocolate.

^fIncludes high sugar (>21.2 g/100 g) and low sugar (< 21.2 g/100 g).

^gIncludes soft drinks, sports and energy drinks, nutritional beverages, smoothies, grain drinks, and coffee and tea.

^hIncludes ice cream, frozen dairy desserts, pudding, gelatins, ices, and sorbets.