A Longitudinal Analysis of Sugar-Sweetened Beverage Intake in Infancy and Obesity at 6 Years

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KEY WORDS

childhood obesity, sugar-sweetened beverages, infancy, population-based studies, public health

ABBREVIATIONS

AOR—adjusted odds ratio
CDC—Centers for Disease Control and Prevention
CI—confidence interval
IFPS II—Infant Feeding Practices Study II
SSB—sugar-sweetened beverage
Y6FU—Year 6 Follow-Up

Dr Pan conceptualized and designed the study, carried out the data analyses, interpreted the data, and drafted and took the lead in revising the manuscript; Dr Li conceptualized and designed the study, assisted with the data analyses, and critically reviewed and revised the manuscript; Dr Park conceptualized the study, assisted with the data analyses, and reviewed and revised the manuscript; Dr Galuska conceptualized and designed the study and critically reviewed and revised the manuscript; Dr Sherry conceptualized the study and reviewed and revised the manuscript; Dr Freedman conceptualized and designed the study, imputed missing data, and critically reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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abstract

OBJECTIVE: To examine whether sugar-sweetened beverage (SSB) intake during infancy predicts obesity at age 6 years.

METHODS: We included 1189 children who participated in the Infant Feeding Practices Study II in 2005–2007 and were followed up at 6 years in 2012. Children's weight and height were measured by mothers. Obesity was defined as gender-specific BMI-for-age ≥95th percentile. We used logistic regression to estimate the associations of any SSB intake and age at SSB introduction before 12 months and mean SSB intake during ages 10 to 12 months with obesity at 6 years controlling for baseline characteristics.

RESULTS: The obesity prevalence at 6 years among children who consumed SSBs during infancy was twice as high as that among non–SSB consumers (17.0% vs 8.6%). The adjusted odds of obesity at 6 years was 71% higher for any SSB intake and 92% higher for SSB introduction before 6 months compared with no SSB intake during infancy. Children who consumed SSBs ≥3 times per week during ages 10 to 12 months had twice the odds of obesity compared with those who consumed no SSBs in this period. However, among children who consumed SSBs, the odds of obesity at 6 years did not differ by age at SSB introduction during infancy or by mean weekly SSB intake during ages 10 to 12 months.

CONCLUSIONS: Children who consumed SSBs during infancy had higher odds of obesity at 6 years than non–SSB consumers. SSB consumption during infancy may be a risk factor for obesity in early childhood. Whether unmeasured behaviors contributed to the association is unclear. *Pediatrics* 2014;134:S29–S35

Childhood obesity is an important public health problem because of its persistence into adulthood[1–3] and short- and long-term adverse health consequences.[4–6] Obesity in childhood has been associated with other cardiovascular risk factors, increased health care costs, and premature death.[4–7] According to NHANES data, the prevalence of obesity among US children aged 2 to 5 years increased from 5.0% in the 1970s to 10.4% in 1999–2000.[8] Although there has been no statistically significant increase between 1999–2000 and 2009–2010, the prevalence of obesity was 12.1% among children in this age group in 2009–2010.[9,10]

Obesity is a complex condition involving biology, genetics, and environmental factors. In general, most obesity in children is assumed to be caused by unhealthy eating patterns resulting in excess energy intake as well as insufficient physical activity. In 2005–2008, preschool-aged children consumed ~13.0% of their calories from added sugars.[11] Sugar-sweetened beverages (SSBs), which include but are not limited to soda, fruit-ades and fruit drinks, and sports and energy drinks,[12] are the largest source of added sugars and contribute a significant amount of calories to the diets of US children.[13,14] If an increase in energy intake from SSBs is not associated with a subsequent reduction in food intakes or an increase in physical activity, excess energy intake from SSBs will increase total energy intake and may lead to obesity.[15] The American Academy of Pediatrics recommended that children should limit SSB consumption.[16]

Although SSB consumption is considered to be a modifiable risk factor for obesity, findings on the association between SSB intake and obesity among young children were inconsistent in previous studies.[17–26] In general, the associations tend to be stronger in studies with larger sample sizes or longer duration of follow-up.[17,18,20,23,26] Cross-sectional studies with smaller sample sizes or longitudinal studies with shorter follow-up periods often reported no association.[21,24,25] Few studies have examined the association between SSB intake during infancy and obesity during early childhood. A previous German study in 216 children born in the 1990s found that BMI *z* score at age 7 years was inversely related to added sugar intake from foods or beverages in the first year of life but positively related to added sugar intake between age 1 and 2 years.[19] To further explore this relationship, we conducted a longitudinal analysis to see whether any SSB intake and age at SSB introduction during infancy and the frequency of SSB intake at late infancy predict obesity at age 6 years.

METHODS

Study Population

In 2005–2007, the Food and Drug Administration and the Centers for Disease Control and Prevention (CDC) in collaboration with partners conducted the Infant Feeding Practices Study II (IFPS II), a nationwide longitudinal study on infant health, food intake, and infant feeding practices. The study collected data from a sample of pregnant mothers from a consumer opinion mail panel of approximately half a million households. A series of 11 questionnaires were mailed to mothers during the last trimester of pregnancy and at ~1, 2, 3, 4, 5, 6, 7, 9, 10, and 12 months of age of their child. In 2012, a Year 6 Follow-Up (Y6FU) study was conducted in children who participated in IFPS II. Approximately 48% of the original participants were lost to follow-up at age 6 years.[27]

The Y6FU study included 1542 children who were ~6 years old in 2012 and who participated in IFPS II during infancy.[27] We excluded 16 children (1.0%) who were >13 months old at the surveys of IFPS II; 133 children (8.6%) who did not have anthropometric measurements at 6 years; 46 children (3.0%) whose height, weight, or BMI was biologically implausible at follow-up; and 158 children (10.2%) who did not have any original SSB data in the 1- to 6-month or the 7- to 12-month surveys, leaving 1189 children in the overall analytic sample. Biologically implausible *z* scores were defined as follows: height-for-age < -5.0 or >3.0, weight-for-age < -5.0 or >5.0, and weight-for-length BMI-for-age < -4.0 or >5.0.[28] The IFPS II and Y6FU studies were approved by the Food and Drug Administration Institutional Review Board. Our secondary analysis was deemed exempt by the CDC Institutional Review Board.

Anthropometric Measurements, SSB Intakes, and Covariates

Children's weight and height at age 6 years were measured by their mothers according to instructions included in the questionnaire. The mothers measured the weight of their child without shoes in pounds on a scale. The questionnaire also included a standard tape for mothers to measure the height of their child in inches. Obesity at age 6 years was defined as gender-specific BMI-for-age ≥95th percentile on the 2000 CDC growth charts.[16]

The 3 exposures of the study (any SSB intake during infancy, defined as age 1 month to 12 months; age at SSB introduction during infancy; mean weekly SSB intake during ages 10–12 months) were defined on the basis of the mother's responses to the question asked at each month's survey of the IFPS II: "In the past 7 days, how often was your baby fed sweet drinks: juice drinks, soft drinks, soda, sweet tea, Kool-Aid (Kraft foods, West Plains, NY), etc?" Because some mothers did not complete the survey questionnaire within several weeks of receiving it and thus their reported infants' ages were not consistent with the survey month, we created 10 consecutive time windows to assign each infant's age to the corresponding month of the survey. Any SSB intake during infancy was coded as “yes” if the mother reported any intake in the 10 postpartum surveys and coded as “no” if no SSB intake was reported in all of these surveys. Age at SSB introduction was calculated by taking the midpoint between an infant’s age when SSB intake was first reported and the age of the infant in the previous month’s survey, and a 3-level categorical variable (before 6 months, at or after 6 months, and never consumed SSBs during infancy) was then created. The frequency of SSB consumption was low during the first few months of infancy. The mean frequency of SSB intake during ages 10 to 12 months was more than twice that during ages 1 to 9 months (2.44 vs 1.03 times/week) among children who consume SSBs; thus, the dose-response relationship focused on SSB intake during ages 10 to 12 months. Mean SSB intake in the past 7 days was categorized as no SSBs and <1, 1 to <3, and ≥3 times per week.

The covariates of the study were from IFPS II. Children’s characteristics included gender, birth weight (≤4000 and >4000 g), solid food introduction before 4 months (yes or no), and breastfeeding duration (<6 and ≥6 months). Maternal characteristics included mother’s age (18–24, 25–29, 30–34, and ≥35 years), prepregnancy weight status (underweight and normal weight: BMI <25; overweight: 25 ≤ BMI <30; and obese: BMI ≥30)[29] on the basis of self-reported weight and height collected during the last trimester of pregnancy. The following sociodemographic characteristics were collected during the prenatal period: maternal race/ethnicity, maternal education (high school or less, some college, and college graduate), marital status (married or not married), and household income-to-poverty ratio (<185%, 185%–349%, or ≥350%).

Statistical Methods

The percentages of children with missing data ranged from 0.9% in month 1 to 27.2% in month 10 for SSB and solid food intakes. The percentages of missing data on other covariates were relatively small (ranging from 0% for gender to 4.6% for maternal education). We used multiple imputation to estimate these missing exposures and covariates on the basis of nonmissing values of SSB intake, solid food intakes, and all other covariates. In general, when data are not missing completely at random, analyzing only subjects with nonmissing data can produce biased estimates.[30] Multiple imputation can reduce these biases by adjusting for differences between complete and incomplete cases on the basis of values of other observed variables. Furthermore, by performing more than a single imputation, the additional uncertainty introduced by estimating missing data can be accounted for. We used the Amelia II package in R (R Foundation for Statistical Computing, Vienna, Austria) to perform 25 imputations.[31,32] Because of the longitudinal nature of the surveys during infancy, with SSB and solid food intakes assessed 10 times, we treated these surveys as a time series for each child.

All other data analyses were performed with the SAS-callable SUDAAN version 9.3 (SAS Institute, Cary, NC). SUDAAN incorporated the uncertainty of the imputations into all standard errors[33] by analyzing each of the 25 imputation sets separately and then combining the results.

To estimate the adjusted odds ratio (AOR) of obesity for each of our predictors, we conducted separate logistic regression analyses for each main exposure after controlling for all the covariates. In addition to conducting analyses among all the children, we performed logistic regression for age at introduction during infancy and mean SSB intake during ages 10 to 12 months among children who consumed SSBs during the same time periods. We also conducted a sensitivity analysis for the association between any SSB intake during infancy and obesity at follow-up by adding SSB intake at 6 years to our original multivariable model.

RESULTS

As shown in Table 1, ~13% of the children had a birth weight >4000 g, 45% were fed solid foods before age 4 months, and 49% were breastfed for <6 months. Among mothers, 88% were non-Hispanic white, 84% had at least some college education, and 26% were overweight and 25% were obese before pregnancy (Table 1). Overall, the prevalence of any SSB intake during infancy was 25.9%, and the prevalence of obesity at age 6 years was 10.8% (Table 1). The variations in any SSB intake and obesity were in the same direction within all the population subgroups. The prevalence of any SSB intake during infancy and obesity at 6 years both significantly varied by age at solid food introduction, breastfeeding duration, maternal age, race/ethnicity, maternal education, marital status, and income-to-poverty ratio ($P < .05$ for χ^2 tests). Additionally, the prevalence of obesity varied by child’s birth weight and mother’s pregnancy weight status (Table 1).

The prevalence of obesity at 6 years among children who consumed SSBs during infancy (17.0%) was twice as high as that among non–SSB consumers (8.6%) (Table 2). The prevalence was the highest among children who were introduced to SSBs before age 6 months and children who consumed SSBs ≥3 times per week during ages 10 to 12 months (Table 2).

The odds ratio for the association of obesity at age 6 years with any SSB intake during infancy was attenuated but remained statistically significant after controlling for covariates (Table 2). The adjusted odds of obesity at 6 years was 71% higher for any SSB intake during infancy compared with no SSB intake. When adding SSB intake at 6 years to the multivariable model, the AOR decreased to 1.63 but was still statistically significant (95% confidence interval [CI]:

TABLE 1 Sample Distribution and the Prevalence of SSB Intake During Infancy and Obesity at Age 6 Years by Baseline Maternal and Child Characteristics

Characteristics at Baseline	*N* (%)[a]	Prevalence of Any SSB Intake During Infancy, % (95% CI)	Prevalence of Obesity at Age 6 Years, % (95% CI)
Total	1189 (100.0)	25.9 (23.0 to 28.7)	10.8 (9.0 to 12.5)
Child's gender			
Male	595 (50.0)	24.7 (20.8 to 28.7)	9.9 (7.5 to 12.3)
Female	594 (50.0)	27.0 (23.1 to 30.9)	11.6 (9.0 to 14.2)
Child's birth weight[b]			
≤4000 g	1036 (87.1)	25.8 (22.7 to 28.9)	9.9 (8.1 to 11.8)
>4000 g	153 (12.9)	26.4 (18.7 to 34.1)	16.3 (10.5 to 22.2)
Introduction to solid foods before 4 months[b,c]			
No	651 (54.8)	17.9 (14.5 to 21.2)	8.9 (6.7 to 11.2)
Yes	538 (45.2)	35.6 (30.9 to 40.3)	13.0 (10.1 to 15.9)
Breastfeeding duration[b,c]			
<6 months	578 (48.6)	31.2 (26.8 to 35.5)	13.1 (10.4 to 15.9)
≥6 months	611 (51.4)	20.9 (17.4 to 24.3)	8.5 (6.3 to 10.7)
Maternal age[b,c]			
18–24 years	161 (13.5)	48.0 (39.4 to 56.7)	15.5 (9.9 to 21.1)
25–29 years	395 (33.2)	24.7 (19.8 to 29.6)	9.1 (6.3 to 12.0)
30–34 years	384 (32.3)	24.0 (19.2 to 28.8)	11.7 (8.5 to 14.9)
≥35 years	249 (20.9)	16.3 (11.2 to 21.4)	8.8 (5.3 to 12.4)
Maternal race/ethnicity[b,c]			
White, non-Hispanic	1046 (88.0)	24.9 (22.0 to 27.9)	10.0 (8.2 to 11.8)
Black, non-Hispanic	40 (3.4)	46.9 (28.8 to 65.1)	27.9 (13.9 to 41.9)
Hispanic	57 (4.8)	35.7 (21.8 to 49.5)	19.5 (9.1 to 29.9)
Other, non-Hispanic	46 (3.9)	16.7 (4.0 to 29.4)	2.3 (−2.1 to 6.7)
Maternal education[b,c]			
High school or less	192 (16.1)	36.5 (28.9 to 44.1)	19.8 (14.1 to 25.5)
Some college	414 (34.8)	32.1 (27.0 to 37.3)	11.9 (8.7 to 15.0)
College graduate	583 (49.0)	17.9 (14.5 to 21.4)	7.0 (4.9 to 9.1)
Marital status[b,c]			
Not married	182 (15.3)	42.1 (34.2 to 50.1)	18.0 (12.3 to 23.8)
Married	1007 (84.7)	22.9 (19.9 to 26.0)	9.4 (7.6 to 11.3)
Income-to-poverty ratio[b,c]			
<185%	399 (33.6)	34.4 (29.1 to 39.7)	15.0 (11.5 to 18.5)
185%–349%	451 (37.9)	24.9 (20.5 to 29.4)	9.3 (6.6 to 12.0)
≥350%	339 (28.5)	17.1 (12.5 to 21.7)	7.7 (4.8 to 10.5)
Prepregnancy weight status[b]			
Underweight and normal weight (BMI <25.0)	582 (48.9)	24.8 (20.7 to 28.9)	5.9 (3.9 to 7.8)
Overweight (BMI 25 to <30)	307 (25.8)	23.5 (18.4 to 28.5)	13.6 (9.8 to 17.5)
Obese (BMI ≥30)	300 (25.2)	30.4 (24.2 to 36.6)	17.3 (13.0 to 21.7)

From the IFPS II (2005–2007) and Y6FU study (2012). SSBs during infancy included juice drinks, soft drinks, soda, sweet tea, Kool-Aid (Kraft foods, West Plains, NY), etc. Obesity was defined as gender-specific BMI-for-age ≥95th percentile on the 2000 CDC growth charts.[16]

[a] Percentages may not add up to 100% because of rounding.

[b] $P < .05$ for χ^2 tests that compared the prevalence of obesity at age 6 years across categories.

[c] $P < .05$ for χ^2 test that compared the prevalence of any SSB intake during infancy across categories.

1.03 to 2.56; data not shown). Children who were fed SSBs before age 6 months had 92% higher odds of obesity than children who never consumed SSBs during infancy (Table 2). However, among children who consumed SSBs during infancy, there was no significant difference in odds of obesity for children who were fed SSBs before age 6 months versus those who were fed at or after 6 months (AOR: 1.32; 95% CI: 0.31 to 5.57; data not shown). Children who consumed SSBs ≥3 times per week during ages 10 to 12 months had a twofold odds of obesity at 6 years compared with non–SSB consumers (Table 2). However, among children who were fed SSBs during ages 10 to 12 months, a dose-response relationship was not observed when comparing children who consumed more SSBs with children who consumed SSBs <1 time per week (AOR: 1.05; 95% CI: 0.33 to 3.36 for 1 to <3 times/week; AOR: 1.12; 95% CI: 0.22 to 5.68 for ≥3 times/week; data not shown).

DISCUSSION

Our longitudinal analyses revealed that compared with children who had no SSB intake during infancy, the odds of obesity at age 6 years was 71% higher for any SSB intake and 92% higher for SSB introduction before age 6 months. Furthermore, the odds of obesity at 6 years among children who consumed SSBs ≥3 times per week during ages 10 to 12 months was twice as great as that among non–SSB consumers. However, among those who had any SSB intake, childhood obesity was not related to age at SSB introduction during infancy or mean weekly SSB intake during ages 10 to 12 months.

As we documented previously, only 1 study in 216 children examined the association between SSB intake during infancy and childhood obesity and found that higher BMI *z* score at 7 years was associated with lower added sugar intake from foods or beverages during the first year but higher added sugar intake during the second year of life.[19] However, a number of longitudinal and cross-sectional studies have examined the association between SSB intake in early childhood and overweight and obesity among children.[17,18,21,23–26] Findings from prospective cohort studies with large sample sizes or longer follow-up periods and cross-sectional studies with larger sample sizes usually suggest a positive association.[17,18,20,23,26] For example, DeBoer et al[17] conducted cross-sectional and prospective analyses in 9600 children 2 to 5 years old, who were included in the Early Childhood Longitudinal Survey 2001 birth cohort. In cross-sectional analysis, higher levels of SSB consumption were associated with higher BMI *z* scores among children aged 4 and 5 years but not among those aged 2 years. In prospective analysis, children aged 2

TABLE 2 Association of SSB Intake During Infancy With Obesity at Age 6 Years

SSB Intake During Infancy	Obesity at Age 6 Years			
	N (%)[a]	Prevalence, % (95% CI)	Unadjusted OR (95% CI)	AOR (95% CI)[b]
Any SSB intake during infancy[c]				
No SSBs	881 (74.1)	8.6 (6.7 to 10.5)	Reference	Reference
Any SSBs	308 (25.9)	17.0 (12.6 to 21.5)	2.19 (1.45 to 3.30)[d]	1.71 (1.09 to 2.68)[d]
Age at SSB introduction[c]				
Never consumed SSBs during infancy	881 (74.1)	8.6 (6.7 to 10.5)	Reference	Reference
SSB introduction at or after 6 months	213 (18.8)	15.6 (10.2 to 20.9)	1.97 (1.21 to 3.20)[d]	1.61 (0.96 to 2.71)
SSB introduction before 6 months	95 (8.5)	20.4 (11.4 to 29.3)	2.72 (1.47 to 5.02)[d]	1.92 (1.01 to 3.66)[d]
Mean SSB intake during 10–12 months[c]				
No SSBs	990 (83.3)	9.2 (7.3 to 11.0)	Reference	Reference
<1 time/week	55 (4.6)	16.7 (5.6 to 27.8)	1.96 (0.84 to 4.56)	1.64 (0.65 to 4.14)
1 to <3 times/week	73 (6.1)	17.0 (7.1 to 26.8)	2.00 (0.94 to 4.26)	1.51 (0.65 to 3.48)
≥3 times/week	71 (6.0)	21.8 (11.9 to 31.8)	2.76 (1.46 to 5.19)[d]	2.00 (1.02 to 3.90)[d]

From the IFPS II (2005–2007) and Y6FU study (2012). SSBs during infancy included juice drinks, soft drinks, soda, sweet tea, Kool-Aid (Kraft foods, West Plains, NY), etc. Obesity was defined as gender-specific BMI-for-age ≥95th percentile on the 2000 CDC growth charts.[16] OR, odds ratio; AOR, adjusted odds ratio.

[a] Percentages may not add up to 100% because of rounding.

[b] Any SSB intake during infancy, age in months when SSBs were introduced during infancy, and mean SSB intake during 10 to 12 months were modeled separately after adjusting for child's gender, child's birth weight, age at solid food introduction, breastfeeding duration, maternal age, maternal race/ethnicity, maternal education, marital status, income-to-poverty ratio, and prepregnancy weight status.

[c] $P < .05$ for χ^2 tests that compared the prevalence of obesity at age 6 years across categories.

[d] CIs for these estimates do not include 1.

years who drank SSBs regularly had a greater increase in BMI *z* score over the 2-year follow-up period compared with infrequent or non–SSB consumers.[17] Welsh et al[26] examined the risk of BMI-for-age ≥95th percentile (labeled as overweight in this study) among >10 000 low-income children aged 2 to 3 years by quartile of SSB intake and found that SSB intake was associated with increased risk of overweight among children whose BMI was in the 85th to <95th percentile. In contrast, cross-sectional studies with smaller sample sizes or longitudinal studies with shorter durations of follow-up usually suggested no association between SSB consumption and change in BMI or weight status among young children.[21,24,25] For example, Rodríguez-Artalejo et al[25] conducted a cross-sectional analysis in 1112 children aged 6 to 7 years who lived in 4 Spanish cities and found no association between SSB consumption and BMI.

Three potential mechanisms might account for the possible causal link between SSB intake during infancy and obesity at age 6 years. First, SSBs contribute additional calories to the diet[13,14] and the high content of high-fructose corn syrup in many SSBs does not provide satiety signals.[21,34] Thus, weaker compensatory dietary responses often follow SSB consumption.[35–37] If there is no corresponding reduction in subsequent energy intake from other foods and beverages, the increases in total calorie intake may lead to weight gain in the long term.[21,37] Our analyses found that the highest level of SSB consumption (≥3 times/week) had twice the odds of obesity compared with that for non–SSB consumers. However, obesity did not differ by level of consumption among infants who consumed SSBs. This lack of a dose-response relationship among SSB consumers may be due to the relatively low levels of SSB consumption among infants. The mean SSB intake was 2.44 times per week during late infancy in the current study. Each serving (8 oz) of SSBs corresponds to a net increase of 106 kcal.[14] Even if an infant consumed 8 oz of SSBs each time, the extra calorie consumption from SSBs would only be 259 kcal per week or 37 kcal per day. Second, SSB intake during infancy may be a marker of SSB intake in early childhood. A study conducted by Park et al[38] using the same data source found that the odds of SSB intake at 6 years was more than twofold greater among children who consumed any SSBs during infancy versus non–SSB consumers. Our additional analysis that included SSB intake at 6 years in the current multivariable model found a weaker but significant association between any SSB intake during infancy and obesity at follow-up. Of note, we were not able to statistically control for SSB intake between infancy and age 6 years. Third, SSB intake may be associated with other obesity-related dietary factors. For example, children with higher SSB intakes may also consume more fast foods because fast foods are often consumed with SSBs.[18] SSB intake may also be associated with physical inactivity, television viewing, and poor diet quality as indicated by Healthy Eating Index scores among children.[21,25,39] In our study we were not able to account for these behavioral factors throughout childhood, and it is possible that the observed association is due to one of these interrelated behaviors or some other aspect of child feeding or parenting styles or practices.

Our study has 2 major strengths. First, IFPS II is the largest longitudinal study of infant feeding practices in the United States. IFPS II and its follow-up study allowed us to examine the longitudinal association between SSB consumption during infancy and obesity at age 6 years. Second, IFPS II collected a wide range of covariates related to infant feeding and allowed us to adjust for various confounding factors in our analyses.

Our study, however, is subject to at least 4 limitations. First, children's weight and height were measured by their mothers. No validation study was conducted to confirm the accuracy of the measurements. Second, SSB intake and age at SSB introduction were defined on the basis of reported frequency of intake during the past 7 days, which may not reflect children's exact amount of SSB consumption across the entire time period. Third, IFPS II was not a nationally representative sample and approximately half of the original sample was lost to follow-up. This might limit the generalizability of the study findings. Among mothers, 88% were non-Hispanic white and 84% had at least some college education. These proportions were higher than the proportions in the general population. Finally, the data set had missing data and data had to be imputed. Although we used multiple imputation to estimate the missing values on SSB intake and covariates to reduce the biases caused by missing data, we do not know how much residual bias remains.

CONCLUSIONS

We found that children who consumed any SSBs during infancy had increased odds of obesity at age 6 years compared with children who were not fed SSBs, indicating that SSB consumption might be a risk factor for childhood obesity. However, whether unmeasured behaviors contributed to the association is unclear. The findings add to the literature by revealing the association between SSB consumption during infancy and obesity during early childhood.

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