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U.S. adults and child snacking patterns among sugar sweetened beverage drinkers and non-drinkers

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Abstract

Objective—To provide national estimates of snack patterns for sugar sweetened beverage (SSB) drinkers and non-SSB drinkers among U.S. children and adults.

Methods—We analyzed 24-hour dietary recall data obtained from the National Health and Nutrition Examination Survey 1999–2010 among children (ages 2 to 19) and adults (aged 20 and older) (N = 46,932).

Results—For children and adults, SSB drinkers were significantly more likely than non-SSB drinkers to consume snacks (children: salty – 60% vs. 50%; sweet – 69% vs. 65%; adults: salty – 64% vs. 58%; sweet – 64% vs. 58%), calories from snacks (children: salty snacks – 258 vs. 213 kcal; sweet snacks – 322 vs. 291 kcal; adults: salty snacks – 261 vs. 236 kcal; sweet snacks – 370 vs. 350 kcal), and total calories (children: 2098 vs. 1804 kcal; adults: 2329 vs. 2049 kcal) ($p < 0.05$). Among adolescents, Blacks had a significantly higher percentage of SSB drinkers and salty snack consumers than Whites and Hispanics (SSB consumers: White – 79%; Black – 86%, Hispanic – 82%; salty snack consumers: White – 56%; Black – 62%, Hispanic – 54%; $p < 0.05$). All ages were more likely to consume sweet snacks at home ($p < 0.05$).

Conclusions—Adults and children who drink SSBs are more likely to snack and consume more calories from snacks than non-SSB drinkers, particularly Black adolescents and young adults.

Introduction

Overconsumption of calories is a key determinant of obesity (Wadden et al., 2001), which affects one fifth of U.S. children (Ogden et al., 2014), one third of U.S. adults (Ogden et al.,

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SNB conceived the study and developed the hypotheses. JAW analyzed the data. All authors contributed to the interpretation of study findings. SNB drafted the manuscript and all authors contributed to the final draft. SNB is the guarantor.

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2014), and increases the prevalence of weight-related problems such as high blood sugar (Dietz, 1998; Freedman et al., 2001; Steinberger et al., 2001). Two leading contributors to excess calorie consumption among both children and adults are sugar-sweetened beverages (SSBs) and snacks which have been well described in the literature (Bleich et al., 2009; Nielsen and Popkin, 2004a; Piernas and Popkin, 2010a, b). Between the late 1960s and early 2000s, SSB consumption increased considerably among children and adults (Bleich et al., 2009; Duffey and Popkin, 2007; Nielsen and Popkin, 2004b), making SSBs the single largest source of added sugar in the diet. Although SSB consumption appears to be declining in the overall population, the level of consumption has remained flat among minority youth (Kit BK et al., 2013), and SSBs still account for roughly 10% to 15% of total caloric intake (Hu and Malik, 2010; Kit BK et al., 2013; National Cancer Institute, 2010). Snack consumption has increased steadily over time, accounting for roughly a quarter of daily calories for children and adults (Piernas and Popkin, 2010a, b). Consumption of these discretionary calories is high regardless of whether an individual is trying to lose weight (Bleich SN and Wolfson JA, 2014).

The cumulative evidence from observational studies and experimental trials suggests that regular consumption of SSBs causes excess weight gain (Hu, 2013) and that snacking is associated with increased body weight (Nicklas et al., 2003). In addition, consumption of SSBs is associated with unhealthy foods and snacks (Ranjit et al., 2010), and households spending more on SSBs purchase less nutritious food at the grocery store than households spending more on non-SSBs (Binkley et al., 2000).

Prior studies have also described differences in SSB and snack consumption by location of consumption, finding higher SSB consumption in the home as compared to away from the home (Economic Research Service, 2014; Nielsen and Popkin, 2004b). However, limited evidence has explored whether snack patterns among U.S. children and adults differ between SSB drinkers and non-SSB drinkers, and whether these patterns vary depending on whether consumption occurred in the home or away from the home. Understanding consumption at home and away from home is important as roughly half of total caloric intake is consumed in each setting (Economic Research Service, 2014). Improved knowledge in this area may help identify concrete behavioral targets which can be used to inform public health and clinical interventions to help individuals reduce their caloric intake, particularly among minority subpopulations who are at higher risk for SSB consumption (Bleich et al., 2009; Wang et al., 2008) and obesity (Ogden et al., 2014).

The primary purpose of this study is to update prior analyses by describing patterns of snacking for individuals who drink SSB and those who do not among a nationally representative sample of U.S. children and adults from 1999–2010. We additionally build on prior literature by examining: 1) variations in this consumption by race/ethnicity for adolescents (aged 12 to 19) and young adults (aged 20 to 44) based on past research suggesting that these groups are the highest consumers of SSBs (Bleich et al., 2009; Wang et al., 2008) and 2) by the location of consumption (at home or away from home) based on past research suggesting that consumption of food prepared away from home plays an increasingly large role in the American diet, accounting for 43% of total calories in 2012 (Economic Research Service, 2014).

Research Methods and Procedures

Data and Design

Data was obtained from the nationally representative continuous National Health and Nutrition Examination Survey (NHANES) 1999–2010. The NHANES is a population-based survey designed to collect information on the health and nutrition of the U.S. population. Participants were selected based on a multi-stage, clustered, probability sampling strategy. Our analysis combined all available years of the continuous NHANES data collection (1999–2010) to look at overall patterns during that time period. A complete description of data-collection procedures and analytic guidelines are available elsewhere (www.cdc.gov/nchs/nhanes.htm).

Study Sample

The study sample consists of children and adults with a completed 24-hour dietary recall. Survey respondents were excluded if they were pregnant or had diabetes at the time of data collection due to different dietary guidelines for these sub-groups, or if their dietary recall was incomplete or unreliable (as determined by the NHANES staff). The final analytical sample included 46,932 children and adults aged 2 or older.

Measures

Beverages and Snacks—Survey respondents reported all food and beverages consumed in a prior 24-hour period (midnight to midnight) and reported type, quantity and time of each food and beverage consumption occasion. The main meal planner/preparer was asked to report intake information for any children under the age of 12. The dietary interview was administered by a trained interviewer. Following the dietary interview, all reported food and beverage items were systemically coded using the U.S. Department of Agriculture Food and Nutrient Database. Caloric content and other nutrients derived from each consumed food or beverage item were calculated based on the quantity of food and beverages reported and the corresponding nutrient contents by the National Center for Health Statistics.

We identified SSBs (from 162 beverage items) including the following drink types: soda, sport drinks, fruit drinks and punches, low-calorie drinks, sweetened tea, and other sweetened beverages. See Appendix A for more details.

We identified two mutually exclusive snack categories (from 772 snack items): 1) salty snacks (including hush puppies, all type of chips, popcorn, pretzels, party mixes, french fries, and potato skins (76 items) and 2) sweet snacks, including ice cream, other desserts (custards, puddings, mousse, etc.), sweet rolls, cakes, pastries (crepes, cream puffs, strudels, croissants, muffins, sweet breads, etc.), cookies, pies, candy (696 items). The sweet snack category did not include solid foods with naturally occurring sugar such as fruit. See Appendix B for more details.

Body Weight Status—In the NHANES, weight and height were measured using standard procedures in a mobile examination center. For children, weight categories were based on BMI-for-age percentiles where healthy weight was the 5th percentile to less than the 85th

percentile; overweight was the 85th percentile to less than the 95th percentile; and obese was equal to or greater than the 95th percentile. For adults, healthy weight was defined as a body mass index (BMI) from 18.5 to 24.99 kg/m²; overweight, BMI from 25 to 29.99 kg/m²; and obese, BMI ≥ 30 kg/m² (WHO, 1988).

Other measures—Sociodemographic measures were categorized as follows: race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other; hereafter referred to as White, Black and Hispanic), sex, age, marital status (married, married before, living with a partner, never married), education (less than high school, high school, more than high school) and employment status (unemployed (including retirees and those not actively looking) and employed). The poverty income ratio (PIR) – the ratio of household income to a family's appropriate poverty threshold – was based on self-reported household income. We dichotomized the PIR into lower and higher income groups based on eligibility for food assistance programs (i.e. ≥ 130% of the poverty level). Location of consumption was defined as at home or away from home assessed by the survey question – “Did you eat this meal at home?” with the response categories of yes/no.

Analysis

All analyses were weighted to be representative of the general population and conducted using Stata, version 13 (StataCorp, L.P., College Station, TX) to account for the complex sampling structure, and the day of the week the dietary recall was collected (weekend vs. weekday). To describe patterns of snacking for individuals who drink SSB and those who do not, we used the following outcome variables: percent drinkers/snackers and energy intake (overall, and from SSBs, sweet snacks, and salty snacks). We calculated the percent of drinkers and the percent of snackers as the number of people who consume any of a particular item divided by the number of people who did not consume any of that item (for example, SSB drinkers = the number of people drinking SSBs / number of people who did not). For the binary outcomes (percent drinkers/snacks), we used Logit models to estimate overall consumption and differences between SSB and non-SSB drinkers, adjusting for covariates (other measures described above). Covariates were selected based on previous literature, regardless of statistical significance. For continuous outcomes (calories from sweet snack, salty snacks, and total calories), we used ordinary least squares models to estimate overall consumption and differences between SSB and non-SSB drinkers, adjusting for covariates (other measures described above). We calculated the number of calories for each snack type as the average calories consumed from each snack type among consumers of those items (for example, salty snacks = calories consumed from salty snacks, among individuals who consumed any salty snacks). Total calories were calculated as all calories consumed in a 24-hour period. To understand variations in consumption by race/ethnicity, we stratified these models by: 1) race/ethnicity for adolescents (aged 12 to 19) and young adults (aged 20 to 44) and 2) by location of consumption (at home vs. away from home). For all models, we used post-estimation commands to calculate the predicted mean for each outcome variable based on the multivariate regression models described above.

Results

The characteristics of the NHANES 1999–2010 sample are presented in Table 1, overall and by age group. For each of the characteristics, we observed significant differences among the age groups ($p < 0.05$).

SSB and snack patterns among children and adults

Table 2 reports typical daily consumption of SSBs and snacks among children. Overall, 76 percent of children consumed SSBs (averaging 262 calories among consumers), 57 percent consumed salty snacks (averaging 249 calories among consumers) and 68 percent consumed sweet snacks (averaging 315 calories among consumers) with a total intake of 2028 calories. Significant associations ($p < 0.05$) are described. Children consuming SSBs consumed a higher percentage of calories from snacks and more total calories than children not consuming SSBs: salty snacks (60% or 258 kcal vs. 50% or 213 kcal); sweet snacks (69% or 322 kcal vs. 65% or 291 kcal); and total calories (2098 kcal vs. 1804) ($p < 0.05$). This same pattern was true for children aged 2 to 5, where those drinking SSBs were more likely to consume snacks and consume calories from snacks: salty snacks (62% or 180 kcal vs. 49% or 149 kcal); sweet snacks (73% or 225 kcal vs. 67% or 193 kcal); and total calories (1651 kcal vs. 1474). Among children aged 6 to 11 and 12 to 19, differences between SSB and non-SSB drinkers were observed for salty snacks and total calories: 6 to 11 (salty snacks – 61% or 238 kcal vs. 53% or 202 kcal; total – 2042 kcal vs. 1820 kcal) and 12 to 19 (salty snacks – 57% or 312 kcal vs. 49% or 250 kcal; total – 2350 kcal vs. 1914 kcal).

Table 3 reports typical daily consumption of SSBs and snacks among adults. Overall, 60 percent of adults consumed SSBs (averaging 303 calories among consumers), 42 percent consumed salty snacks (averaging 252 calories among consumers) and 61 percent consumed sweet snacks (averaging 362 calories among consumers) with a total intake of 2217 calories. Significant associations ($p < 0.05$) are described. Adults consuming SSBs consumed a higher percentage of calories from snacks and more total calories than adults not consuming SSBs: salty snacks (45% or 261 kcal vs. 36% or 236 kcal); sweet snacks (64% or 370 kcal vs. 58% or 350 kcal); and total calories (2329 kcal vs. 2049). Among adults in each age group, those who drank SSBs consumed a higher percentage of salty and sweet snacks and more total calories than non-SSB drinkers: 20 to 44 (salty snacks – 49% vs. 39%; sweet snacks – 61% vs. 54%; total calories – 2479 kcal vs. 2124 kcal); 45 to 64 (salty snacks – 43% vs. 35%; sweet snacks – 65% vs. 60%; total calories – 2237 kcal vs. 2012 kcal); and 65 and older (salty snacks – 36% vs. 27%; sweet snacks – 74% vs. 68%; total calories – 1940 kcal vs. 1772 kcal). Among young adults, aged 20 to 44, who consumed salty snacks, SSB drinkers also consumed more calories from salty snacks than non-SSB drinkers (285 kcal vs. 253 kcal). The percentage of adults consuming salty and sweet snacks declines with age, regardless of SSB consumption.

SSB and snack patterns among adolescents and young adults by race/ethnicity

Table 4 reports typical daily consumption of SSBs and snacks for adolescents and young adults by race/ethnicity. Significant associations ($p < 0.05$) are described. Among adolescents (aged 12 to 19), Blacks had a significantly higher percentage of SSB drinkers

and salty snack consumers than Whites and Hispanics (SSB consumers: White – 79%; Black – 86%, Hispanic – 82%; salty snack consumers: White – 56%; Black – 62%, Hispanic – 54%). Compared to White adolescents, Black adolescents also had a higher percentage of sweet snack consumers (White – 61%, Black – 65%). However, calories from SSBs among consumers and total calories were lower among Blacks and Hispanics as compared to Whites (SSB calories: White – 352 kcal, Black – 318 kcal, Hispanic – 316 kcal; total calories: White – 2298 kcal, Black – 2219 kcal, Hispanic – 2207 kcal). Among SSB drinkers, Black adolescents had the highest percentage of salty snack consumers compared to White and Hispanic adolescents (White – 56%, Black – 64%, Hispanic – 57%). Black and Hispanic adolescents who consumed SSBs were significantly more likely to report eating salty snacks and consumed a greater number of total calories as compared to Black and Hispanic adolescents who did not consume SSBs (Black salty snack consumers: SSB drinker – 64% vs. non-SSB drinker – 48%; Hispanic salty snack consumers: SSB drinker – 57% vs. non-SSB drinker – 37%; Black total calories: SSB drinker – 2279 kcal vs. non-SSB drinker – 1842 kcal; Hispanic total calories: SSB drinker – 2296 kcal vs. non-SSB drinker – 1802 kcal). Black adolescents were more likely than Hispanic adolescents to consume calories from sweet snacks, regardless of SSB status (sweet snacks among SSB drinkers: 402 kcal vs. 326 kcal; sweet snacks among non-SSB drinkers: 362 kcal vs. 291 kcal). Among Hispanic adolescents, those drinking SSBs consumed more calories from salty snacks than those not consuming SSBs (300 kcal vs. 247 kcal).

Among young adults overall, Blacks had a higher percentage of SSB drinkers than Whites and Hispanics (White – 65%, Black – 78%, Hispanic – 74%). Compared to Hispanics, Blacks were more likely to have salty snack consumers (50% vs. 40%), consume calories from salty snacks (303 kcal vs. 257 kcal), and consume calories from sweet snacks (388 kcal vs. 341 kcal). However, Black and Hispanics consumed fewer calories from SSBs than Whites (White – 375 kcal, Black – 349 kcal, Hispanic – 299 kcal) and Hispanics consumed fewer total calories than Whites (2288 kcal vs. 2427 kcal). Among SSB drinkers, Hispanics had fewer salty snack consumers and ate fewer calories from salty snacks than Blacks and Whites (salty snack consumers: White – 50%, Black – 53%, Hispanic – 43%; salty snack calories: White – 291 kcal, Black – 315 kcal, Hispanic – 256 kcal). Also among SSB drinkers, Black and Hispanics consumed fewer total calories than Whites (White – 2535 kcal, Black – 2466 kcal, Hispanic – 2394 kcal).

Comparing SSB drinkers to non-SSB drinkers for young adults, all race groups were more likely to consume salty and sweet snacks and eat more total calories if they drank SSBs (White salty snack consumer: SSB drinker – 50% vs. non-SSB drinker – 41%, Black salty snack consumer: SSB drinker – 53% vs. non-SSB drinker – 37%; Hispanic salty snack consumers: SSB drinker – 43% vs. non-SSB drinker – 32%; White sweet snack consumer: SSB drinker – 60% vs. 54%, Black sweet snack consumer: SSB drinker – 61% vs. non-SSB drinker – 53%; Hispanic sweet snack consumers: SSB drinker – 63% vs. non-SSB drinker – 54%; White total calories: SSB drinker – 2535 kcal vs. 2221 kcal, Black total calories: SSB drinker – 2466 kcal vs. non-SSB drinker – 1969 kcal; Hispanic total calories: SSB drinker – 2394 kcal vs. non-SSB drinker – 1982 kcal).

SSB and snack patterns by location of consumption

We examined patterns of SSB and snack consumption by location of consumption (Appendix C). For each age group and regardless of SSB consumption, significantly more calories from sweet snacks were consumed at home (see figures A1 and A2). Few differences were observed in the amount of salty calories consumed at home vs away from home. A few age groups consumed more calories from salty snacks at home; among SSB drinkers this included children aged 2 to 5 and adults aged 45 to 64 and among non-SSB drinkers this included children aged 6 to 11 and adults aged 65 and older (see figures A3 and A4).

Discussion

This study examined the frequency of snacking and SSB consumption among U.S. children and adults who consume those items. Our results indicate that children and adults who drink SSBs are significantly more likely to consume salty and sweet snacks as well as eat more total calories compared to those who do not. On a typical day, children who drink SSBs consume 258 calories from salty snacks, 322 calories from sweet snacks, and 2098 total calories; adults who drink SSBs consume 261 calories from salty snacks, 370 calories from sweet snacks, and 2329 total calories. Higher consumption of snacks, particularly sweet snacks, may be related to the craving for sugar triggered by sweetened beverages (Liem and de Graaf, 2004).

The observed association between SSB consumption and increased consumption of salty and sugary snacks is consistent with past research suggesting that households spending more on SSBs purchase less nutritious food at the grocery store than households spending more on non-SSBs (Binkley et al.). Interestingly, we found that Black adolescents consumed significantly fewer total calories than White adolescents, regardless of whether they consumed SSBs. This may be due to lower calorie intake from non-snack sources (e.g., meals) among Blacks. It is surprising as the risk of obesity is higher among Black adolescents as compared to White adolescents (Ogden et al., 2014). More research is needed to understand this observed pattern.

Another notable finding is the significantly higher consumption of calories from sweet snacks at home as compared to away from home for every age group. This is contrary to a large body of literature which has characterized food outside the home as having higher calories (Economic Research Service, 2014). More research is needed to understand the nature of the association between SSBs and snacking and whether higher consumption of sweet snacks at home is due to purchasing behavior at food outlets for consumption at home or preparation in the home. It will also be important to understand whether people have a preference for eating sweet snacks in the home which may help inform the development of future interventions. It is possible that interventions and policies aimed at decreasing consumption of SSBs may present an opportunity to also decrease consumption of discretionary calories from salty and sweet snacks. On the other hand, as individuals consume less SSBs, they may substitute with other snacks (Bleich et al., 2014), therefore public health efforts to decrease SSB consumption should be careful to consider the way in which SSB consumption and snacking are related throughout the life course. Some

promising environmental strategies to decrease consumption of these discretionary calories include providing information about calorie content in an easily understandable format (such as miles of walking to burn off a bottle of soda) (Bleich SN, 2014) or increasing prices through taxes (Finkelstein et al., 2010). In the home, consumption of these discretionary calories could be reduced by simply reducing their availability as convenience is a critical determinant of dietary choices (Glanz, 1998).

The present study has several limitations. First, our reliance on single 24-hour dietary recalls may introduce inaccuracy and bias to our analyses due to: underreporting, unreliability, and conversion error. With respect to underreporting, previous research indicates that adults underreport their dietary consumption by approximately 25% (Bingham et al., 1994; Briefel et al., 1997). With respect to unreliability, a single 24-hour dietary recall may not accurately represent usual dietary intake for an individual. Lack of reliability of the dietary recall, with respect to overall eating habits, will reduce the precision of our estimates but it will not bias our regression estimates where total energy intake is the dependent variable (Fox J, 1997). With respect to conversion error, inaccuracy exists in the conversion of reported beverage consumption to energy intake because the assumptions on serving size and food composition are defined by the food and nutrient database. Using these standard database assumes a 'representative' nutritional content for a given food or beverage. The inevitable variation in actual intake and reporting bias may introduce measurement errors, particularly for the estimation of total energy intake. However, this error is likely less significant for packaged, standard-sized beverages or snacks. Second, the NHANES data are cross-sectional, which only allows us to address associations rather than causality. Therefore, this analysis does not attempt to examine the effect of SSB or non-SSB consumption on snack consumption. Third, our inclusion of low calorie beverages in the SSB category may bias our results related to energy intake towards zero. However, only a small percentage of all the beverages in the SSB category are low calorie (15%), so we do not expect this to significantly impact the results.

To conclude, adults and children who drink SSBs consume more snacks than those who do not consume SSBs, particularly Black adolescents and young adults. Discouraging young children from drinking SSBs may be important for reducing snack consumption over the life course. The home is an important venue for reducing snack consumption given that all age groups consume more sweet snacks in this setting.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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HIGHLIGHTS

- We used a nationally representative sample of U.S. adults and children
- We described snack patterns for sugar sweetened beverage (SSB) drinkers and non-SSB drinkers
- Individuals who drink SSBs are more likely to snack than non-SSB drinkers
- Individuals who drink SSBs consume more calories from snacks than non-SSB drinkers
- All ages are more likely to consume sweet snacks at home

Characteristics of U.S. children and adults in the National Health and Nutrition Examination Survey (NHANES) 1999–2010⁷ overall and by age group

TABLE 1

	TOTAL	Age 2–5 years	Age 6–11 years	Age 12–19 years	Age 20–44 years	Age 45–64 years	Age 65 and older	P for diff
Total [n (%)]	46,932 (100)	4,879 (6)	6,266 (9)	10,978 (12)	11,228 (37)	7,677 (24)	5,904 (11)	
Sex [n (%)]								
Female	23,268 (51)	2,390 (49)	3,162 (49)	5,328 (49)	5,539 (49)	3,913 (52)	2,936 (57)	<0.001
Male	23,664 (49)	2,489 (51)	3,104 (51)	5,650 (51)	5,689 (51)	3,764 (48)	2,968 (43)	
Race-ethnicity [n (%)]								
Non-Hispanic White	18,985 (69)	1,566 (58)	1,773 (60)	2,998 (62)	4,871 (66)	3,855 (77)	3,922 (85)	<0.001
Non-Hispanic Black	11,006 (12)	1,175 (14)	1,799 (15)	3,323 (14)	2,336 (12)	1,559 (10)	814 (7)	
Hispanic	14,850 (14)	1,830 (21)	2,371 (19)	4,162 (17)	3,490 (16)	1,954 (9)	1,043 (6)	
Other	2,091 (5)	308 (7)	323 (6)	495 (7)	531 (6)	309 (5)	125 (2)	
Household income [n (%)]								
Lower income ²	15,622 (24)	2,280 (36)	2,545 (33)	4,295 (32)	3,357 (25)	1,687 (14)	1,458 (20)	<0.001
Higher income ²	27,714 (76)	2,254 (64)	3,294 (67)	5,832 (68)	7,079 (75)	5,351 (86)	3,904 (80)	
Weight category ³								
Healthy weight	21,900 (45)	3,515 (77)	3,986 (67)	6,914 (67)	4,055 (40)	2,002 (29)	1,428 (31)	<0.001
Overweight	11,614 (29)	597 (12)	998 (16)	1,770 (15)	3,564 (31)	2,818 (37)	1,867 (40)	
Obese	11,670 (27)	563 (11)	1,242 (16)	2,190 (17)	3,477 (29)	2,795 (34)	1,403 (29)	
Employment status ⁴ [n (%)]								
Unemployed	8,890 (35)	-	-	-	2,466 (24)	2,203 (30)	4,221 (83)	<0.001
Employed	12,345 (65)	-	-	-	71,84 (76)	4,405 (70)	756 (17)	
Education								
Less than high school	7,174 (18)	-	-	-	2,862 (18)	2,120 (16)	2,192 (27)	<0.001
High school	5,981 (25)	-	-	-	2,757 (25)	1,754 (25)	1,470 (29)	
More than high school	11,616 (56)	-	-	-	5,598 (58)	3,796 (59)	2,222 (44)	
Marital status [n (%)]								
Currently married	13,120 (56)	-	-	-	5,160 (47)	4,750 (68)	3,210 (58)	<0.001
Previously married	5,356 (18)	-	-	-	1,158 (10)	1,957 (21)	2,341 (38)	
Living with a partner	1,702 (7)	-	-	-	1,268 (11)	366 (4)	68 (1)	

	TOTAL	Age 2–5 years	Age 6–11 years	Age 12–19 years	Age 20–44 years	Age 45–64 years	Age 65 and older	P for diff
Never married	4,240 (19)	-	-	-	3,472 (32)	578 (7)	190 (3)	

Note: p-value was considered statistically significant at the $p < 0.05$ level

¹ Percentage of US population estimated with survey weights to adjust for unequal probability of sampling

² Income level was dichotomized based on the poverty index ratio (ratio of annual family income to federal poverty line). Lower income refers to persons below 130% of poverty, which represents eligibility threshold for the federal food stamp program.

³ Weight categories are based on BMI-for-age percentiles where healthy weight is the 5th percentile to less than the 85th percentile; overweight is the 85th percentile to less than the 95th percentile; and obese is equal to or greater than the 95th percentile

⁴ not available for the 1999–2000 cycle

TABLE 2

Snack patterns (percentage and calories) among children, overall and by SSB status, NHANES 1999–2010.

	TOTAL	Age 2–5 years	Age 6–11 years	Age 12–19 years
Overall				
SSB drinker (% ± SE)	76.2 ± 0.7	66.2 ± 1.4 [†]	76.7 ± 1.0 ^{†‡}	80.5 ± 0.9
Salty snacks consumer (% ± SE)	57.3 ± 0.6	57.5 ± 1.3	59.4 ± 1.0 [†]	55.5 ± 0.9
Sweet snacks consumer (% ± SE)	67.8 ± 0.6	71.2 ± 1.0 [†]	73.9 ± 1.0 ^{†‡}	61.6 ± 0.9
SSB (kcal ± SE) ¹	262 ± 4.2	159 ± 3.9	212 ± 4.1	339 ± 5.9
Salty snacks (kcal ± SE) ²	249 ± 3.5	171 ± 4.7	230 ± 4.7	302 ± 6.2
Sweet snacks (kcal ± SE) ²	315 ± 3.4	215 ± 4.5	321 ± 6.7	365 ± 6.4
Total calories (kcal ± SE)	2028 ± 11	1591 ± 13	1989 ± 16	2265 ± 17
SSB Drinker				
Salty snacks consumer (% ± SE)	59.5 ± 0.7	61.6 ± 1.4 [†]	61.4 ± 1.0 [†]	57.1 ± 1.0
Sweet snacks consumer (% ± SE)	68.5 ± 0.6	73.1 ± 1.1 [†]	74.6 ± 1.0 [†]	61.9 ± 1.0
Salty snacks (kcal ± SE) ²	258 ± 4.0	180 ± 6.0	238 ± 5.3	312 ± 6.6
Sweet snacks (kcal ± SE) ²	322 ± 4.5	225 ± 5.5	327 ± 7.9	372 ± 7.0
Total calories (kcal ± SE)	2098 ± 13	1651 ± 13	2042 ± 20	2350 ± 20
Non-SSB Drinker				
Salty snacks consumer (% ± SE)	50.1 ± 1.5 [*]	49.4 ± 2.5 [*]	52.9 ± 2.4 [*]	49.1 ± 2.1 [*]
Sweet snacks consumer (% ± SE)	65.4 ± 1.4 [*]	67.3 ± 1.9 ^{*†}	71.8 ± 2.3 [†]	60.4 ± 2.1
Salty snacks (kcal ± SE) ²	213 ± 6.7 [*]	149 ± 7.8 [*]	202 ± 12.7 [*]	250 ± 12.6 [*]
Sweet snacks (kcal ± SE) ²	291 ± 8.2 [*]	193 ± 7.4 [*]	301 ± 15.2	335 ± 18.4
Total calories (kcal ± SE)	1804 ± 19 [*]	1474 ± 24 [*]	1820 ± 29 [*]	1914 ± 35 [*]

Note: Multivariate regression was used to adjust for sex, race/ethnicity, body-weight category, household income, and day of week (weekend vs. weekday)

* Difference between SSB drinkers and non-SSB drinkers within age categories significant at p<0.05

[†] Difference from 12–19 year olds within SSB drinker categories significant at p<0.05.

[‡] Difference between 2–5 and 6–11 year olds within SSB drinker categories significant at p <0.05

¹ Among consumers of SSBs (not per-capita)

² Among consumers of salty or sweet snacks (not per-capita)

TABLE 3

Snack patterns (percentage and calories) among adults, overall and by SSB status, NHANES 1999–2010.

	TOTAL	Age 20–44 years	Age 45–64 years	Age 65 and older
Overall				
SSB drinker (% ± SE)	60.0 ± 0.7	67.6 ± 0.8	54.9 ± 0.8 [†]	46.2 ± 0.9 ^{†‡}
Salty snacks consumer (% ± SE)	41.8 ± 0.7	45.3 ± 1.0	39.8 ± 0.9 [†]	32.3 ± 1.0 ^{†‡}
Sweet snacks consumer (% ± SE)	61.4 ± 0.6	58.1 ± 0.8	62.5 ± 1.1 [†]	71.6 ± 1.1 ^{†‡}
SSB (kcal ± SE) ¹	303 ± 4.8	362 ± 6.2	253 ± 5.0	174 ± 4.6
Salty snacks (kcal ± SE) ²	252 ± 3.0	274 ± 4.8	235 ± 5.0	179 ± 8.9
Sweet snacks (kcal ± SE) ²	362 ± 4.7	364 ± 7.6	368 ± 8.0	345 ± 10.6
Total calories (kcal ± SE)	2217 ± 12	2375 ± 14	2132 ± 15	1808 ± 15
SSB Drinker				
Salty snacks consumer (% ± SE)	45.4 ± 0.7	49.2 ± 1.0	43.3 ± 1.1 [†]	35.8 ± 1.7 ^{†‡}
Sweet snacks consumer (% ± SE)	63.6 ± 0.7	60.5 ± 1.0	64.5 ± 1.3 [†]	74.1 ± 1.5 ^{†‡}
Salty snacks (kcal ± SE) ²	261 ± 3.9	285 ± 5.8	241 ± 6.1	184 ± 11.8
Sweet snacks (kcal ± SE) ²	370 ± 5.9	369 ± 8.1	377 ± 10.4	360 ± 16.7
Total calories (kcal ± SE)	2329 ± 14	2479 ± 17	2237 ± 24	1940 ± 29
Non-SSB Drinker				
Salty snacks consumer (% ± SE)	36.2 ± 1.0 [*]	39.4 ± 1.4 [*]	34.6 ± 1.4 ^{*†}	27.3 ± 1.3 ^{*†‡}
Sweet snacks consumer (% ± SE)	58.0 ± 1.0 [*]	54.4 ± 1.5 [*]	59.5 ± 1.4 ^{*†}	68.1 ± 1.6 ^{*†‡}
Salty snacks (kcal ± SE) ²	236 ± 5.5 [*]	253 ± 7.6 [*]	223 ± 7.7	167 ± 9.0
Sweet snacks (kcal ± SE) ²	350 ± 6.6 [*]	356 ± 12.6	354 ± 11.5	327 ± 11.1
Total calories (kcal ± SE)	2049 ± 17 [*]	2124 ± 30 [*]	2012 ± 20 [*]	1772 ± 23 [*]

Note: Multivariate regression was used to adjust for sex, race/ethnicity, body-weight category, household income, education, employment, marital status, and day of week (weekend vs. weekday)

* Difference between SSB drinkers and non-SSB drinkers within age categories significant at p<0.05

[†] Difference from 20–44 year olds within SSB drinker categories significant at p<0.05.

[‡] Difference between 44–65 and 65 year olds within SSB drinker categories significant at p <0.05

¹ Among drinkers of SSBs

² Among consumers of salty or sweet snacks

TABLE 4

Snack patterns (percentage and calories) among adolescents and young adults by race/ethnicity, NHANES 1999–2010, % (SE)

	Age 12–19 years				Age 20–44 years	
	Non-Hispanic White	Non-Hispanic Black	Hispanic	Non-Hispanic White	Non-Hispanic Black	Hispanic
Overall						
SSB drinker (% ± SE)	79.1 ± 1.2		86.4 ± 1.2 [†]	82.0 ± 1.1 [‡]	65.4 ± 1.0	77.9 ± 1.5 [†]
Salty snacks consumer (% ± SE)	55.7 ± 1.3		61.6 ± 1.4 [†]	53.6 ± 1.5 [‡]	46.6 ± 1.2	49.5 ± 1.6
Sweet snacks consumer (% ± SE)	60.8 ± 1.4		64.8 ± 1.5 [†]	61.8 ± 1.4	58.1 ± 1.0	58.9 ± 1.4
SSB (kcal ± SE) ¹	352 ± 8.5		318 ± 9.5 [†]	316 ± 6.9 [†]	375 ± 9.2	349 ± 8.8 [†]
Salty snacks (kcal ± SE) ²	300 ± 8.7		314 ± 10.0	293 ± 8.4	282 ± 6.1	303 ± 10.9
Sweet snacks (kcal ± SE) ²	373 ± 9.1		396 ± 10.8	320 ± 12 ^{†‡}	368 ± 8.1	388 ± 13.5
Total calories (kcal ± SE)	2298 ± 24		2219 ± 35 [†]	2207 ± 30 [†]	2427 ± 19	2357 ± 32
SSB Drinker						
Salty snacks (% ± SE)	56.3 ± 1.4		63.7 ± 1.4 [†]	57.1 ± 1.5 [‡]	49.5 ± 1.4	53.0 ± 1.6
Sweet snacks (% ± SE)	61.1 ± 1.5		64.9 ± 1.5	61.9 ± 1.5	60.3 ± 1.2	60.6 ± 1.6
Salty snacks (kcal ± SE) ²	313 ± 10.0		317 ± 10.7	300 ± 9.1 [‡]	291 ± 7.0	315 ± 12.9
Sweet snacks (kcal ± SE) ²	377 ± 10.2		402 ± 11.9	326 ± 13.1 ^{†‡}	369 ± 9.0	390 ± 16.8
Total calories (kcal ± SE)	2379 ± 30		2279 ± 37 [†]	2296 ± 30	2535 ± 22	2466 ± 36 [†]
Non-SSB Drinker						
Salty snacks (% ± SE)	53.4 ± 2.9		47.9 ± 3.2 [*]	37.1 ± 3.2 ^{**†‡}	41.1 ± 1.8 [*]	36.7 ± 3.0 [*]
Sweet snacks (% ± SE)	59.7 ± 2.8		63.8 ± 3.4	61.5 ± 2.9	53.8 ± 2.0 [*]	52.8 ± 2.8 [*]
Salty snacks (kcal ± SE) ²	251 ± 16.9 [*]		287 ± 17.8	247 ± 13.2 [*]	262 ± 10.0 [*]	246 ± 18.1 [*]
Sweet snacks (kcal ± SE) ²	367 ± 27.4		362 ± 30.0	291 ± 20.2 [‡]	364 ± 14.9	384 ± 28.8
Total calories (kcal ± SE)	1989 ± 46 [*]		1842 ± 65 [*]	1802 ± 51 [*]	2221 ± 39 [*]	1969 ± 59 ^{**†}

Note: Multivariate regression was used to adjust for sex, race/ethnicity, body-weight category, household income, education³, employment³, marital status³, and day of week (weekend vs. weekday)

* Difference between SSB drinkers and non-SSB drinkers within race and age categories significant at p<0.05

^{†‡} Difference from White within SSB drinker and age categories significant at p<0.05.

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[‡] Difference between Black and Hispanic within SSB drinker and age categories significant at $p < 0.05$

¹ Among drinkers of SSBs (not per-capita)

² Among consumers of salty or sweet snacks (not per-capita)

³ 20–44 year olds only