HHS Public Access

Author manuscript

Am J Health Promot. Author manuscript; available in PMC 2018 July 01.

Published in final edited form as:

Am J Health Promot. 2018 July ; 32(6): 1402–1408. doi:10.1177/0890117117717381.

Impact of Knowledge of Health Conditions on Sugar-Sweetened Beverage Intake Varies Among US Adults

Sohyun Park, PhD[1], **Elizabeth A. Lundeen, PhD**[1], **Liping Pan, MD, MPH**[1], and **Heidi M. Blanck, PhD**[1]

[1]Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA, USA

Abstract

Purpose—This study examined associations between knowledge of sugar-sweetened beverage (SSB)-related health conditions and SSB intake among US adults.

Design—Quantitative, cross-sectional study.

Subject—The 2014 *SummerStyles* survey data for 4163 US adults (≥18 years) were used.

Measures—The outcome measure was frequency of SSB intake (regular soda, fruit drinks, sports or energy drinks, sweetened coffee/tea drinks). Exposure measures were knowledge of 6 SSB-related health conditions: weight gain, diabetes, cavities, high cholesterol, heart disease, and hypertension.

Analysis—Six logistic regression models were used to estimate adjusted odds ratios (ORs) for consuming SSBs ≥2 times/d according to knowledge of SSB-related health conditions.

Results—Overall, 37.8% of adults reported consuming SSBs ≥2 times/d. Although most adults identified that weight gain (80.2%), diabetes (73.6%), and cavities (71.8%) are related to drinking SSBs, fewer adults identified high cholesterol (24.1%), heart disease (31.5%), and hypertension (33.0%) as being related to drinking SSBs. Crude analyses indicated that lower SSB intake was significantly associated with knowledge of the associations between SSBs and weight gain, diabetes, cavities, and heart disease. However, after adjustment for covariates, only lack of knowledge of the association between heart disease and SSBs was significantly associated with consuming SSBs ≥2 times/d (OR = 1.29) than non-SSB consumers.

Conclusions—The finding that knowledge of SSB-related health conditions, in general, was not associated with high SSB intake suggests that knowledge on SSB-related health conditions alone may not be sufficient for adult behavior change.

Corresponding Author: Sohyun Park, Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Highway, NE, Atlanta, GA 30341, USA. spark3@cdc.gov.

Authors' Note: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Declaration of Conflicting Interests: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Keywords

sugar-sweetened beverages; knowledge; adults; sociodemographic characteristics

Purpose

The prevalence of obesity remains high among US adults. Based on the 2013-2014 National Health and Nutrition Examination Survey, 38% of US adults were classified as obese (body mass index [BMI] ≥30 kg/m^2).[1] Frequent consumption of sugar-sweetened beverages (SSBs) (eg, one or more times per day) is linked to adverse health consequences in adults including obesity,[2-4] type 2 diabetes,[4-6] cardiovascular disease,[7,8] dental caries,[9] hypertension,[10] dyslipidemia,[11,12] and asthma.[13] Based on the 2015-2020 Dietary Guidelines for Americans, SSBs are defined as "liquids that are sweetened with various forms of added sugars. These beverages include, but are not limited to, soda (regular, not sugar-free), fruitades, sports drinks, energy drinks, sweetened waters, and coffee and tea beverages with added sugars."[14] In 2011-2014, 49.3% of US adults reported consuming at least 1 SSB on a given day, and mean caloric intake from SSBs was 145 kcal/d among US adults.[15] Additionally, SSBs are significant contributors of added sugars in the diet of US adults,[16] and the 2015-2020 Dietary Guidelines for Americans recommend that calories from added sugars should be less than 10% of total daily caloric intake.[14]

Individual knowledge and health literacy, perception, attitudes, and societal norms can influence obesity and weight-related behaviors, such as SSB consumption. [17-12] Although previous studies explored relationships between health-related knowledge and SSB consumption among adults, types of health-related knowledge examined varied widely among studies and findings are somewhat mixed.[18,19,21-23] The objectives of this study were to better understand knowledge of SSB-related health conditions and to examine whether knowledge is associated with SSB consumption after adjusting for sociodemographic characteristics among US adults.

Methods

Sample and Survey Administration

This cross-sectional study was based on the *SummerStyles* survey led by Porter Novelli during summer 2014. *SummerStyles* is an online survey of a panel sample of US adults (≥18 years of age) designed to assess a wide variety of health-related attitudes, knowledge, behaviors, and conditions surrounding important public health issues. The survey participants were selected from GfK's Knowledge Panel, which is a large-scale online panel using address-based sampling methods. If necessary, a computer and Internet access are provided to households. This analysis was exempt from the Centers for Disease Control and Prevention (CDC) institutional review board because personal identifiers were not included in the data provided to the CDC.

The *SummerStyles* survey was sent to the same persons who participated in Porter Novelli's *SpringStyles* survey during March and April 2014. The *SpringStyles* survey was distributed

to a random sample of 7873 panelists (≥18 years) and a supplemental sample of 3145 panelists with children aged 12 to 17 years to make sure adequate dyad cases for the *SummeryStyles* survey; 6713 completed the survey, yielding a response rate of 60.9%. The *SummerStyles* survey was sent to a random sample of the 6159 adults who completed the *SpringStyles* survey during June and July 2014. A total of 4269 adults completed the *SummerStyles* survey, yielding a response rate of 69.0%. The data were weighted based upon age, sex, race/ethnicity, education level, household income, household size, census region, metro status, and prior Internet access to match with US Current Population Survey proportions.

Of those 4269 adults who completed the *SummerStyles* survey, a total of 106 adults were excluded because of missing data on SSBs (n = 68, 2.0%) or exposure variables (n = 38, 1.6%; ie, knowledge of the 6 SSB-related health conditions), leaving an analytic sample of 4163 adults. There were no differences in age, sex, race/ethnicity, education level, marital status, annual household income, weight status, and census region of residence between the final analytic sample and those who were excluded.

Outcome Variable

The outcome of interest was total SSB intake. Frequency of SSB intake was determined by the following 4 questions: (1) “During the past month, how often did you drink REGULAR SODA or pop that contains sugar? Do NOT include diet soda”; (2) “During the past month, how often did you drink COFFEE, including lattes, and TEA, including bottled tea, that was sweetened with sugar or honey? Do not include drinks with things like Splenda or Equal”; (3) “During the past month, how often did you drink SPORTS and ENERGY drinks such as Gatorade, Red Bull, and Vitamin water?”; and (4) “During the past month, how often did you drink sweetened fruit drinks, such as Kool-aid, cranberry cocktail, and lemonade? Include fruit drinks you made at home and added sugar to.” For each question, response options were none, 1-6 times/wk, 1 time/d, 2 times/d, 3 times/d, ≥4 times/d. To calculate daily intake, 1-6 times/wk was converted to 0.5 times/d (3.5 divided by 7), and ≥4 times/d was converted to 4 times/d. To calculate the frequency of total daily SSB intake, we summed the responses from intake of regular soda, sweetened coffee/tea drinks, sports or energy drinks, and fruit drinks. Four mutually exclusive categories (0, >0 to <1, 1 to <2, or ≥2 times/d) were created for total SSB intake.

Exposure Variables

The main exposure variables were knowledge of 6 SSB-related health conditions determined by the following question: “Which of the following conditions do you think are related to drinking sugary drinks, such as regular sodas, fruit drinks (eg, Kool-Aid, lemonade), sports or energy drinks (eg, Gatorade, Red Bull), and sweetened teas?” Respondents were asked to choose one or more health conditions: weight gain, diabetes, cavities, high cholesterol, heart disease, and high blood pressure (hereafter referred to as hypertension).

Covariates

Mutually exclusive response categories for each covariate were created. Sociodemographic variables were age (18-24 years, 25-44 years, 45-64 years, and ≥65 years), sex, race/

ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or non-Hispanic other), education level (<high school, high school, some college, and college graduate), and marital status (married/domestic partnership and not married). Not married included widowed, divorced, separated, or never married. Annual household income was categorized as <US$35 000, US$35 000-US$74 999, US$75 000-US$99 999, or ≥US$100 000. Using self-reported weight and height data, weight status was categorized as underweight/normal weight (BMI <25 kg/m^2), overweight (BMI 25-<30 kg/m^2), or obese (BMI ≥30 kg/m^2).[24] Census region of residence was categorized as Northeast, Midwest, South, and West.[25]

Statistical Analysis

Chi-square tests were used to examine the bivariate relationships between SSB intake, knowledge of the 6 SSB-related health conditions, and sociodemographic characteristics, with a *P* value of <.05 indicating statistical significance. Independent, multinomial logistic regression analyses were used to estimate adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for the odds of consuming SSBs ≥2 times/d among those who did not have knowledge of the SSB-related health condition versus those who did have knowledge. While the outcome variable of SSB intake had 4 categories, adjusted ORs were provided for only highest SSB intake group (≥2 times/d) using 0 times/d as the reference group in order to compare high versus no SSB intake groups. Each logistic regression model included 1 health condition due to possible collinearity among the 6 health conditions and controlled for age, sex, race/ethnicity, education level, marital status, annual household income, weight status, and census region of residence. All statistical analyses were executed with the Statistical Analysis Software (SAS; version 9.3; SAS Institute Inc, Cary, North Carolina) and integrated appropriate procedures to account for the sample design by using SURVEYFREQ and SURVEYLOGISTIC with WEIGHT statements.

Results

Among the 4163 adults included in the analytic sample, 37.8% of adults reported drinking SSBs at least twice a day during the past month (Table 1). SSB intake significantly differed by age, sex, race/ethnicity, education level, annual household income, weight status, and census regions of residence (χ^2 tests, $P < .05$). Within sociodemographic groups with significant differences, the proportion of adults who consumed SSB ≥2 times/d was highest among adults aged 25-44 years, males, Hispanics, those with ≤high school education, those with annual household income of <US$35 000, adults with obesity and those living in the South (Table 1).

Although the majority of adults knew that weight gain (80.2%), diabetes (73.6%), and cavities (71.8%) are associated with drinking SSBs, fewer adults knew that high cholesterol (24.1%), heart disease (31.5%), and hypertension (33.0%) are associated with drinking SSBs. Additionally, knowledge of the 6 SSB-related health conditions significantly differed by certain sociodemographic characteristics (χ^2 tests, $P < .05$). For example, though knowing that weight gain is associated with SSB intake differed significantly by age, sex, race/ethnicity, education level, marital status, annual household income, weight status, and census

region of residence, knowing that hypertension is associated with SSB intake varied significantly by education level and weight status (Table 2).

Based on bivariate analyses, SSB intake significantly varied by knowledge that weight gain, diabetes, cavities, and heart disease are related to SSB intake (χ^2 tests, $P<.05$). Results of multinomial logistic regression analyses demonstrated that compared to non-SSB consumers, the odds of consuming SSBs ≥2 times/d were significantly higher among adults who did not know that heart disease is related to drinking SSBs (OR = 1.29) versus those who knew, after controlling for covariates. However, knowledges on other health conditions were no longer significantly associated with consuming SSBs ≥2 times/d after controlling for covariates (Table 3).

Discussion

The present study found that although the majority of adults knew that weight gain, type 2 diabetes, and cavities are associated with drinking SSBs, fewer adults knew that high cholesterol, heart disease, and hypertension are associated with drinking SSBs. Based on unadjusted analyses, knowing weight gain, diabetes, cavities, and heart disease are related to drinking SSBs were each associated with SSB intake. However, after controlling for covariates, only adults who did not know that heart disease is related to drinking SSBs had higher odds of being high SSB consumers, as compared to those who had this knowledge. Inconsistent with our findings, a previous study found a significant association between knowledge that drinking SSBs can contribute to weight gain and high SSB intake (≥2 times/d). However, knowledge of energy content in a 24-oz fountain drink was not associated with high SSB intake among US adults.[19]

About 2 in 3 adults reported drinking SSBs at least once a day, and almost 2 in 5 adults drank them at least twice a day in the present study. The prevalence of consuming SSBs at least once a day in our study (68.3%) was somewhat similar to a previous study using 2010 National Health Interview Survey data (63.9%) among US adults.[26] However, the prevalence of high SSB intake (≥2 times/d) was much higher in our study (37.8%) than a previous study using 2010 HealthStyles survey data (20.0%).[19] The discrepancy between studies could be partially because of a difference in survey methods (ie, mail vs online surveys). Nonetheless, this higher level is concerning because of the calories and added sugars it could add to the diet. For example, consuming two 12-oz (355 mL) cans or two 20-oz (591 mL) bottles of regular soda per day could provide 310-516 kcal of extra calories or 74-122 grams of added sugars per day.[27]

The lack of association found between knowledge of SSB-related health conditions (except heart diseases) and high SSB intake in the present study could be partially due to the fact that knowledge on SSB-related health conditions alone during adulthood may not be adequate for behavior change related to SSBs. Future studies should identify barriers or facilitators of behavior changes in addition to improving knowledge. It is possible that adults may consider heart disease as a serious health condition and individuals might only try to reduce SSB intake if they think the disease is serious or perhaps having that level of knowledge may imply a high health literacy level. Another possibility is that people may not

consider certain chronic conditions to be serious problems because they are highly prevalent in the US population. For instance, almost 2 in 5 US adults (aged ≥20 years) were classified as having obesity in 2013-2014,[1] 90.9% of US adults aged 20-64 years had dental caries in permanent teeth, and 27% had untreated dental caries in 2011-2012.[28]

In a prior study of SSB intake and health literacy using the Newest Vital Sign tool, in which participants view nutrition information label and respond how they would interpret and act on the information, limited health literacy was associated with higher SSB intake among adults living in the rural Lower Mississippi Delta.[18] Educating adults on the adverse health impact of frequent SSB consumption may be still important because previous studies reported beneficial effects of nutrition education on improving knowledge or SSB intake.[18,19,23,29] For example, an experimental study found that when concrete sugar-content information was presented to subjects (ie, image with sugar cubes that represents sugar content in a cola), attractiveness of SSBs and intention to consume SSBs decreased versus when no sugar-content information was provided.[23] Another study conducted in 2381 US adults reported that having a safety warning label on beverage bottles, such as “Drinking beverages with added sugars contributes to obesity, diabetes, and tooth decay,” improved parents' understanding of the harmful effects of frequent SSB intake and decreased parents' intention to purchase SSBs for their children.[29]

Despite a large sample, there are several limitations in the present study. First, the *SummerStyles* survey is a cross-sectional survey, so causality cannot be determined. Second, because the *SummerStyles* survey data are self-reported, they are subject to recall and social desirability bias. Third, although the data were weighted to key demographic distributions from the US census, the initial sample is selected from persons willing to be part of the larger knowledge panel, thus findings might not be generalizable to the entire US adult population. Finally, SSB intake was measured in frequency instead of volume of intake; thus, the amount of SSBs consumed cannot be calculated.

In conclusions, most adults reported knowing that SSB consumption was associated with weight gain, diabetes, and cavities. The proportion of adults who knew that drinking SSB is associated with cardiovascular disease (ie, high cholesterol, heart disease, and hypertension) was much lower than the proportion that knew that drinking SSBs is associated with other health conditions (ie, weight gain, diabetes, and cavities), and knowledge significantly differed by certain sociodemographic characteristics. Our finding that knowledge of SSB-related health conditions was not associated with high consumption of SSBs, except heart disease, suggests that knowledge alone as an aspect of health literacy may not be sufficient for adult behavior change. Additionally, there might be other health literacy concepts related to SSB intake that are important aside from adverse health outcomes that may occur in the distant future. Understanding what types of knowledge influence SSB intake could help in the design of interventions to reduce their consumption.

Acknowledgments

Funding: The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Flegal KM, Kruszon-Moran D, Carroll MD, Fryar CD, Ogden CL. Trends in obesity among adults in the United States, 2005 to 2014. JAMA. 2016; 315(21):2284–2291. [PubMed: 27272580]
2. Ebbeling CB, Feldman HA, Osganian SK, Chomitz VR, Ellenbogen SJ, Ludwig DS. Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: a randomized, controlled pilot study. Pediatrics. 2006; 117(3):673–680. [PubMed: 16510646]
3. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. Am J Clin Nutr. 2006; 84(2):274–288. [PubMed: 16895873]
4. Malik VS, Hu FB. Sweeteners and risk of obesity and type 2 diabetes: the role of sugar-sweetened beverages. Curr Diab Rep. 2012; 12(2):195–203.
5. Malik VS, Popkin BM, Bray GA, Despres JP, Willett WC, Hu FB. Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. Diabetes Care. 2010; 33(11): 2477–2483. [PubMed: 20693348]
6. de Koning L, Malik VS, Rimm EB, Willett WC, Hu FB. Sugar-sweetened and artificially sweetened beverage consumption and risk of type 2 diabetes in men. Am J Clin Nutr. 2011; 93(6):1321–1327. [PubMed: 21430119]
7. de Koning L, Malik VS, Kellogg MD, Rimm EB, Willett WC, Hu FB. Sweetened beverage consumption, incident coronary heart disease, and biomarkers of risk in men. Circulation. 2012; 125(14):1735–1741. [PubMed: 22412070]
8. Huang C, Huang J, Tian Y, Yang X, Gu D. Sugar sweetened beverages consumption and risk of coronary heart disease: A meta-analysis of prospective studies. Atherosclerosis. 2014; 234(1):11–16. [PubMed: 24583500]
9. Bernabe E, Vehkalahti MM, Sheiham A, Aromaa A, Suominen AL. Sugar-sweetened beverages and dental caries in adults: a 4-year prospective study. J Dent. 2014; 42(8):952–958. [PubMed: 24813370]
10. Malik AH, Akram Y, Shetty S, Malik SS, Yanchou Njike V. Impact of sugar-sweetened beverages on blood pressure. Am J Cardiol. 2014; 113(9):1574–1580. [PubMed: 24630785]
11. Stanhope KL, Medici V, Bremer AA, et al. A dose-response study of consuming high-fructose corn syrup-sweetened beverages on lipid/lipoprotein risk factors for cardiovascular disease in young adults. Am J Clin Nutr. 2015; 101(6):1144–1154. [PubMed: 25904601]
12. Welsh JA, Sharma A, Abramson JL, Vaccarino V, Gillespie C, Vos MB. Caloric sweetener consumption and dyslipidemia among US adults. JAMA. 2010; 303(15):1490–1497. [PubMed: 20407058]
13. Park S, Akinbami LJ, McGuire LC, Blanck HM. Association of sugar-sweetened beverage intake frequency and asthma among U. S. adults, 2013. Prev Med. 2016; 91:58–61. [PubMed: 27496394]
14. U.S. Department of Agriculture, U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2015-2020. 8th. Washington, DC: U.S. Government Printing Office; 2015. http://health.gov/dietaryguidelines/2015/guidelines/?linkId=20169028 [Accessed June 19, 2017]
15. Rosinger A, Herrick K, Gahche J, Park S. Sugar-sweetened Beverage Consumption Among U.S. Adults, 2011-2014. NCHS Data Brief. (No. 270):1–8.
16. Drewnowski A, Rehm CD. Consumption of added sugars among US children and adults by food purchase location and food source. Am J Clin Nutr. 2014; 100(3):901–907. [PubMed: 25030785]
17. Kumanyika, S., Morssink, C. Overweight and weight management. In: Dalton, S., editor. Cultural Appropriateness of Weight Management Programs. Gaithersburg, MD: Aspen Publishers; 1997. p. 69-106.
18. Zoellner J, You W, Connell C, et al. Health literacy is associated with Healthy Eating Index scores and sugar-sweetened beverage intake: findings from the rural Lower Mississippi Delta. J Am Diet Assoc. 2011; 111(7):1012–1020. [PubMed: 21703379]
19. Park S, Onufrak S, Sherry B, Blanck HM. The relationship between health-related knowledge and sugar-sweetened beverage intake among US adults. J Acad Nutr Diet. 2014; 114(7):1059–1066. [PubMed: 24360502]

20. Onufrak SJ, Park S, Sharkey JR, Sherry B. The relationship of perceptions of tap water safety with intake of sugar-sweetened beverages and plain water among US adults. Public Health Nutr. 2014; 17(1):179–185. [PubMed: 23098620]

21. Rampersaud GC, Kim H, Gao Z, House LA. Knowledge, perceptions, and behaviors of adults concerning nonalcoholic beverages suggest some lack of comprehension related to sugars. Nutr Res. 2014; 34(2):134–142. [PubMed: 24461314]

22. Nelson MC, Lytle LA, Pasch KE. Improving literacy about energy-related issues: the need for a better understanding of the concepts behind energy intake and expenditure among adolescents and their parents. J Am Diet Assoc. 2009; 109(2):281–287. [PubMed: 19167955]

23. Adams JM, Hart W, Gilmer L, Lloyd-Richardson EE, Burton KA. Concrete images of the sugar content in sugar-sweetened beverages reduces attraction to and selection of these beverages. Appetite. 2014; 83:10–18. [PubMed: 25108238]

24. National Heart, Lung, and Blood Institute. The evidence report. National Institutes of Health; 1998. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. NIH Publication No. 984083http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf [Accessed June 19, 2017]

25. United States Census Bureau. [Accessed June 19, 2017] 2010 Census Regions and Divisions of the United States. http://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

26. Park S, McGuire LC, Galuska DA. Regional differences in sugar-sweetened beverage intake among US adults. J Acad Nutr Diet. 2015; 115(12):1996–2002. [PubMed: 26231057]

27. U.S. Department of Agriculture. [Accessed June 19, 2017] Agricultural Research Service. USDA National Nutrient Database for Standard Reference, Released September 2015. Nutrient Data Laboratory. http://ndb.nal.usda.gov/

28. Dye B, Thornton-Evans G, Li X, Iafolla T. Dental caries and tooth loss in adults in the United States, 2011-2012. NCHS Data Brief. (No. 197):1–8.

29. Roberto CA, Wong D, Musicus A, Hammond D. The influence of sugar-sweetened beverage health warning labels on parents' choices. Pediatrics. 2016; 137(2):e20153185. [PubMed: 26768346]

SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Individual knowledge and health literacy, perception, attitudes, and societal norms can influence obesity and weight-related behaviors, such as sugar-sweetened beverage (SSB) consumption. Although previous studies explored relationships between health-related knowledge and SSB consumption among adults, types of health-related knowledge examined varied widely among studies and findings are somewhat mixed.

What does this article add?

Although most adults identified that weight gain, diabetes, and cavities are related to drinking SSBs, fewer adults identified high cholesterol, heart disease, and hypertension as being related to drinking SSBs. After adjustment for covariates, only lack of knowledge of the association between heart disease and SSBs was significantly associated with consuming SSBs ≥2 times/d (OR = 1.29) than non-SSB consumers.

What are the implications for health promotion practice or research?

The finding that knowledge of SSB-related health conditions, in general, was not associated with high SSB intake suggests that knowledge on SSB-related health conditions alone may not be sufficient for adult behavior change. Understanding what types of knowledge influence SSB intake could help in the design of interventions to reduce their consumption.

Table 1

Characteristics of Respondents and Their Associations With Sugar-Sweetened Beverage (SSB)[a] Intake Among US Adults Participating in the SummerStyles Survey, 2014[b].

		SSB Intake During the Past 30 Day, % ± SE				
Characteristic	**All, % ± SE**	**0 times/d**	**>0 to <1 time/d**	**1 to <2 times/d**	**≥2 times/d**	***P* Value[c]**
Total sample (n = 4163)	100	16.0 ± 0.6	15.7 ± 0.7	30.5 ± 0.9	37.8 ± 0.9	
Age (n = 4163)						
18-24 years	12.4 ± 0.8	6.7 ± 1.6	16.9 ± 2.5	39.9 ± 3.3	36.5 ± 3.2	<.0001
25-44 years	34.0 ± 0.9	13.0 ± 1.2	13.6 ± 1.2	31.2 ± 1.6	42.2 ± 1.7	
45-64 years	35.0 ± 0.8	16.4 ± 1.0	16.3 ± 1.0	28.3 ± 1.2	39.1 ± 1.3	
≥65 years	18.5 ± 0.6	27.1 ± 1.6	17.9 ± 1.4	26.9 ± 1.6	28.2 ± 1.7	
Sex (n = 4163)						
Male	47.9 ± 0.9	14.5 ± 0.9	14.1 ± 0.9	30.3 ± 1.2	41.0 ± 1.3	.001
Female	52.1 ± 0.9	17.3 ± 0.9	17.2 ± 0.9	30.6 ± 1.2	34.9 ± 1.3	
Race/ethnicity (n = 4163)						
White, non-Hispanic	66.6 ± 0.9	18.5 ± 0.8	18.0 ± 0.8	27.3 ± 0.9	36.3 ± 1.0	<.0001
Black, non-Hispanic	11.4 ± 0.6	11.1 ± 1.8	10.6 ± 1.7	38.0 ± 2.8	40.3 ± 2.9	
Hispanic	14.7 ± 0.8	8.2 ± 1.4	11.3 ± 1.8	36.5 ± 2.8	44.1 ± 2.9	
Other, non-Hispanic	7.2 ± 0.6	17.0 ± 3.2	12.6 ± 2.9	35.1 ± 4.1	35.3 ± 4.0	
Education level (n = 4163)						
High school or less	42.0 ± 0.9	14.1 ± 1.0	12.7 ± 1.0	29.2 ± 1.4	44.1 ± 1.5	<.0001
Some college	29.0 ± 0.8	14.9 ± 1.1	17.6 ± 1.3	32.8 ± 1.6	34.8 ± 1.6	
College graduate	29.1 ± 0.8	19.9 ± 1.2	18.3 ± 1.2	30.0 ± 1.5	31.8 ± 1.5	
Marital status (n = 4163)						
Married/domestic partnership	61.0 ± 0.9	17.0 ± 0.8	16.1 ± 0.8	29.0 ± 1.0	38.0 ± 1.1	.10
Not married[d]	39.0 ± 0.9	14.5 ± 1.1	15.2 ± 1.1	32.8 ± 1.5	37.5 ± 1.5	
Annual household income (n = 4163)						
<US$35 000	27.6 ± 0.8	14.8 ± 1.2	13.8 ± 1.2	28.4 ± 1.6	43.1 ± 1.8	.0001
US$35 000-US$74 999	32.4 ± 0.9	14.9 ± 1.1	15.2 ± 1.1	29.4 ± 1.4	40.4 ± 1.6	
US$75 000-US$99 999	15.6 ± 0.7	15.8 ± 1.6	17.0 ± 1.8	33.4 ± 2.3	33.9 ± 2.3	
≥US$100 000	24.5 ± 0.8	19.0 ± 1.3	17.9 ± 1.4	32.3 ± 1.8	30.8 ± 1.8	

Characteristic	All, % ± SE	SSB Intake During the Past 30 Day, % ± SE				*P* Value[c]
		0 times/d	>0 to <1 time/d	1 to <2 times/d	≥2 times/d	
Weight status[e] (n = 4028)						
Underweight/normal weight	38.1 ± 0.9	14.8 ± 1.0	16.9 ± 1.2	33.1 ± 1.5	35.2 ± 1.5	.02
Overweight	31.2 ± 0.9	14.8 ± 1.1	14.9 ± 1.1	30.8 ± 1.5	39.4 ± 1.6	
Obese	30.7 ± 0.9	18.0 ± 1.2	14.8 ± 1.1	27.3 ± 1.5	39.9 ± 1.6	
Census regions of residence (n = 4163)						
Northeast	18.3 ± 0.7	18.3 ± 1.6	15.4 ± 1.5	27.5 ± 2.0	38.8 ± 2.1	.008
Midwest	21.5 ± 0.7	15.7 ± 1.3	14.1 ± 1.2	32.0 ± 1.7	38.2 ± 1.8	
South	37.0 ± 0.9	14.4 ± 1.0	16.3 ± 1.1	28.6 ± 1.4	40.8 ± 1.5	
West	23.1 ± 0.8	17.0 ± 1.4	16.8 ± 1.5	34.4 ± 2.0	31.9 ± 1.9	

Abbreviations: SSB, sugar-sweetened beverage.

[a]Frequency of SSB intake was calculated by adding 4 types of SSB (ie, regular soda, fruit drink, sports/energy drink, and sweetened coffee/tea drink).

[b]Weighted percent may not add up to 100% because of rounding.

[c]χ^2 tests were used for each variable to examine differences across categories.

[d]Widowed, divorced, separated, or never married.

[e]Weight status was based on calculated body mass index (BMI; kg/m^2): underweight/normal weight, BMI<25; overweight, BMI 25 to <30; Obese, BMI ≥30.

Am J Health Promot. Author manuscript; available in PMC 2018 July 01.

Table 2

Characteristics of Respondent by Knowledge of Health Conditions Related to Sugar-Sweetened Beverage (SSB) Intake Among US Adults Participating in the SummerStyles Survey, 2014[a,b].

	Knowledge of Health Conditions Related to SSB Intake (Answering Yes)[c], % ± SE					
Characteristic	**Weight Gain**	**Diabetes**	**Cavities**	**High Cholesterol**	**Heart Disease**	**Hypertension**
Total sample (n = 4163)	80.2 ± 0.8	73.6 ± 0.8	71.8 ± 0.9	24.1 ± 0.8	31.5 ± 0.8	33.0 ± 0.9
Age (n = 4163)						
18-24 years	70.0 ± 3.1[d]	69.6 ± 3.1[d]	71.6 ± 3.1	25.3 ± 2.9[d]	30.6 ± 3.0[d]	31.9 ± 3.1
25-44 years	77.2 ± 1.5[d]	70.6 ± 1.6[d]	70.6 ± 1.6	20.5 ± 1.4[d]	28.4 ± 1.5[d]	31.7 ± 1.6
45-64 years	83.3 ± 1.1[d]	75.1 ± 1.2[d]	73.3 ± 1.2	24.9 ± 1.2[d]	33.4 ± 1.3[d]	34.6 ± 1.3
≥65 years	87.0 ± 1.3[d]	78.7 ± 1.5[d]	71.2 ± 1.7	28.4 ± 1.6[d]	34.4 ± 1.7[d]	32.9 ± 1.7
Sex (n = 4163)						
Male	77.0 ± 1.2[d]	71.9 ± 1.2	69.7 ± 1.2[d]	22.8 ± 1.1	31.5 ± 1.2	33.6 ± 1.2
Female	83.2 ± 1.1[d]	75.1 ± 1.2	73.7 ± 1.2[d]	25.3 ± 1.1	31.5 ± 1.2	32.4 ± 1.2
Race/ethnicity (n = 4163)						
White, non-Hispanic	85.0 ± 0.8[d]	75.4 ± 0.9[d]	76.0 ± 0.9[d]	23.2 ± 0.9[d]	33.0 ± 1.0[d]	33.7 ± 1.0
Black, non-Hispanic	66.2 ± 2.9[d]	69.7 ± 2.7[d]	58.4 ± 2.9[d]	26.8 ± 2.5[d]	23.5 ± 2.3[d]	27.3 ± 2.5
Hispanic	73.0 ± 2.6[d]	72.9 ± 2.6[d]	66.4 ± 2.8[d]	21.3 ± 2.3[d]	29.6 ± 2.6[d]	33.3 ± 2.7
Other, non-Hispanic	73.2 ± 3.8[d]	64.6 ± 4.1[d]	65.4 ± 4.1[d]	34.0 ± 4.1[d]	34.2 ± 4.0[d]	33.9 ± 4.0
Education level (n = 4163)						
High school or less	74.1 ± 1.4[d]	68.5 ± 1.5[d]	64.8 ± 1.5[d]	22.3 ± 1.2	26.6 ± 1.3[d]	28.8 ± 1.4[d]
Some college	81.6 ± 1.3[d]	75.8 ± 1.4[d]	74.5 ± 1.5[d]	24.3 ± 1.4	33.6 ± 1.6[d]	35.5 ± 1.6[d]
College graduate	87.7 ± 1.2[d]	78.6 ± 1.4[d]	79.2 ± 1.4[d]	26.5 ± 1.5	36.4 ± 1.5[d]	36.3 ± 1.6[d]
Marital status (n = 4163)						
Married/domestic partnership	83.4 ± 0.9[d]	75.2 ± 1.0[d]	73.9 ± 1.0[d]	24.2 ± 1.0	32.3 ± 1.0	33.6 ± 1.1
Not married[e]	75.2 ± 1.5[d]	71.0 ± 1.5[d]	68.5 ± 1.5[d]	24.0 ± 1.3	30.3 ± 1.4	32.0 ± 1.5
Annual household income (n = 4163)						
<US$35 000	73.4 ± 1.7[d]	69.6 ± 1.7[d]	63.8 ± 1.8[d]	23.4 ± 1.5	27.8 ± 1.5[d]	30.6 ± 1.6

Characteristic	Knowledge of Health Conditions Related to SSB Intake (Answering Yes)[c], % ± SE					
	Weight Gain	Diabetes	Cavities	High Cholesterol	Heart Disease	Hypertension
US$35 000-US$74 999	78.5 ± 1.4[d]	72.8 ± 1.4[d]	70.4 ± 1.5[d]	23.9 ± 1.3	31.4 ± 1.4[d]	33.1 ± 1.5
US$75 000-US$99 999	82.8 ± 2.0[d]	74.1 ± 2.2[d]	75.4 ± 2.1[d]	22.8 ± 2.0	33.9 ± 2.3[d]	32.7 ± 2.3
≥US$100 000	88.7 ± 1.3[d]	78.7 ± 1.6[d]	80.3 ± 1.5[d]	26.0 ± 1.7	34.3 ± 1.8[d]	35.6 ± 1.8
Weight status[f] (n = 4028)						
Underweight/normal weight	78.3 ± 1.4[d]	73.4 ± 1.4	72.0 ± 1.5	24.0 ± 1.4	30.3 ± 1.5	30.2 ± 1.5[d]
Overweight	82.0 ± 1.4[d]	74.9 ± 1.5	72.9 ± 1.5	26.0 ± 1.4	33.0 ± 1.5	35.5 ± 1.6[d]
Obese	83.0 ± 1.4[d]	74.3 ± 1.5	72.1 ± 1.5	22.8 ± 1.4	32.4 ± 1.5	35.4 ± 1.6[d]
Census regions of residence (n = 4163)						
Northeast	80.4 ± 1.8[d]	74.0 ± 2.0	70.5 ± 2.0	24.5 ± 1.8	32.5 ± 2.0	30.2 ± 1.9
Midwest	84.2 ± 1.4[d]	73.9 ± 1.6	74.4 ± 1.6	23.8 ± 1.6	31.9 ± 1.7	32.9 ± 1.7
South	77.9 ± 1.4[d]	72.6 ± 1.4	69.6 ± 1.5	24.4 ± 1.3	30.1 ± 1.4	33.0 ± 1.4
West	80.1 ± 1.8[d]	74.5 ± 1.9	73.9 ± 1.8	23.6 ± 1.7	32.6 ± 1.9	35.1 ± 2.0

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

[b] χ^2 tests were used for each variable to examine differences across categories.

[c] Determined by the question, “Which of the following conditions do you think are related to drinking sugary drinks, such as regular sodas, fruit drinks (eg, Kool-Aid, lemonade), sports or energy drinks (eg, Gatorade, Red Bull), and sweetened teas?”

[d] $P < .05$ based on χ^2 test.

[e] Widowed, divorced, separated, or never married.

[f] Weight status was based on calculated body mass index (BMI; kg/m^2): underweight/normal weight, BMI<25; overweight, BMI 25 to <30; Obese, BMI ≥30.

Table 3

Associations Between Sugar-Sweetened Beverage (SSB)[a] Intake and Knowledge of Health Conditions Related to SSB Intake Among US Adults Participating in the SummerStyles Survey, 2014.

	Bivariate Analysis[c] (n = 4163)					Multinomial Logistic Regression Analysis[d] (n= 4028)
	SSB Intake During the Past 30 Day, % ± SE					
Knowledge of Health Conditions Related to SSB Intake[b]	0 times/d	>0 to <1 time/d	1 to <2 times/d	≥2 times/d	*P* Value[e]	SSB Intake ≥2 times/d, aOR (95% CI)
Weight gain						
Yes	16.4 ± 0.7	16.3 ± 0.7	31.8 ± 1.0	35.5 ± 1.0	<.0001	Reference
No	14.3 ± 1.6	13.4 ± 1.6	25.1 ± 2.0	47.2 ± 2.3		1.04 (0.75,1.43)
Diabetes						
Yes	15.8 ± 0.7	16.3 ± 0.8	32.5 ± 1.0	35.4 ± 1.0	<.0001	Reference
No	16.4 ± 1.4	14.2 ± 1.3	24.8 ± 1.6	44.5 ± 1.9		1.03 (0.79, 1.33)
Cavities						
Yes	15.8 ± 0.7	16.4 ± 0.8	32.2 ± 1.0	35.5 ± 1.0	.0002	Reference
No	16.4 ± 1.3	14.0 ± 1.3	25.9 ± 1.6	43.7 ± 1.8		1.00 (0.77, 1.29)
High cholesterol						
Yes	14.9 ± 1.2	16.0 ± 1.3	31.6 ± 1.8	37.6 ± 1.8	.74	Reference
No	16.4 ± 0.8	15.7 ± 0.8	30.1 ± 1.0	37.9 ± 1.0		0.83 (0.65, 1.07)
Heart disease						
Yes	17.0 ± 1.1	16.6 ± 1.2	34.3 ± 1.6	32.1 ± 1.5	<.0001	Reference
No	15.5 ± 0.8	15.3 ± 0.8	28.7 ± 1.0	40.4 ± 1.1		1.29 (1.03, 1.61)[f]
Hypertension						
Yes	15.3 ± 1.0	17.1 ± 1.2	32.0 ± 1.5	35.7 ± 1.5	.15	Reference
No	16.4 ± 0.8	15.1 ± 0.8	29.7 ± 1.1	38.9 ± 1.1		0.98 (0.78, 1.23)

Abbreviations: CIs, confidence intervals; ORs, odds ratios ; SSB, sugar-sweetened beverage.

[a] SSB was calculated by adding 4 types of SSB (ie, regular soda, fruit drink, sports/energy drink, and sweetened coffee/tea drink).

[b] Determined by the question, “Which of the following conditions do you think are related to drinking sugary drinks, such as regular sodas, fruit drinks (eg, Kool-Aid, lemonade), sports or energy drinks (eg, Gatorade, Red Bull), and sweetened teas?”

[c] Weighted percentage may not add up to 100% because of rounding.

[d] Values are adjusted ORs (95% CIs). The outcome variable was SSB, and the exposure variables were knowledge of health conditions related to SSB intake. The reference category was SSB intake of 0 times/d. Because of potential collinearity issues among 6 exposure variables, 6 multinomial logistic regression models were fit to include each exposure variable separately and controlled for age, sex, race/ethnicity, education level, marital status, annual household income, weight status, census region of residence.

[e] χ^2 tests were used for each variable to examine differences across categories.

[f] Considered statistically significant based on the 95% CI.