

The Relationship between Health-Related Knowledge and Sugar-Sweetened Beverage Intake among US Adults

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ABSTRACT

Because there is limited information on associations between health-related knowledge and sugar-sweetened beverage (SSB) intake, our cross-sectional study examined this question using the 2010 HealthStyles Survey data for 3,926 adults (aged ≥ 18 years). Multivariable logistic regression analysis was used to estimate the adjusted odds ratios and 95% CIs for drinking SSBs ≥ 2 times per day. About 31% of adults consumed SSBs ≥ 1 time per day, with 20% doing so ≥ 2 times per day. About eight of 10 adults agreed that drinking SSBs can contribute to weight gain, yet, eight of 10 adults in this study did not know the actual kilocalorie content of a 24-oz fountain soda. After controlling for age, sex, race/ethnicity, education level, annual household income, and geographic region, the odds for drinking SSBs ≥ 2 times per day were significantly higher among adults who neither agreed nor disagreed (ie, were neutral) that drinking SSBs can contribute to weight gain (odds ratio 1.61, 95% CI 1.15 to 2.25 vs agree); however, knowledge about the energy content of regular soda was not associated with SSB intake. Our finding that knowledge about the adverse effects of SSB intake is significantly associated with SSB intake among adults suggests that health education regarding the potential contribution of excess energy intake from SSBs to weight gain could contribute to lowered consumption and lower rates of obesity. Although knowledge about the kilocalorie content of regular soda was unrelated to SSB intake, health education on the kilocalorie content of SSBs may still be beneficial because most adults did not know the actual kilocalorie content of SSBs. Longitudinal studies are needed to explore associations between knowledge about energy provided by SSBs and SSB intake.

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THE PREVALENCE OF OBESITY AMONG US ADULTS IS high. For example, in 2009-2010, about 36% of US adults aged ≥ 20 years were obese (ie, body mass index ≥ 30).¹ This high prevalence of obesity is a major public health concern because of associated adverse health and economic consequences.^{2,3} Furthermore, one of the factors associated with obesity is the consumption of sugar-sweetened beverages (SSBs).⁴⁻⁶ Based on the 2010 Dietary Guidelines for Americans, SSBs are defined as "liquids that are sweetened with various forms of sugars that add calories. These beverages include, but are not limited to, soda, fruit ades and fruit drinks, and sports and energy drinks."⁷ SSBs are the largest source of added sugars and an important contributor of energy in the diet of US adults.⁸ Based on the National Health and Nutrition Examination Survey (NHANES) data in 2009-2010, about 50% of Americans consumed SSBs on any given day.⁹ In addition to obesity, SSB intake has been associated with increased risk for type 2 diabetes,^{6,10,11} cardiovascular disease,^{6,12-14} and decreased diet quality.¹⁵

Individual knowledge influences behaviors associated with obesity.¹⁶ Because one weight-related behavior is the consumption of SSBs, it is possible that knowledge about SSBs may influence their consumption. Previous studies examined associations between knowledge and SSB intake using a small sample size, but findings were inconsistent.^{17,18} For example, one study among adults in the rural Lower Mississippi Delta reported that those in the lowest health literacy category consumed 230 kcal/day SSBs, whereas those in the adequate health literacy category consumed 111 kcal/day SSBs.¹⁸ With the exception of this Mississippi study, little is known about whether knowledge about SSBs is associated with their consumption among US adults. Another study conducted among adolescents reported that knowledge about energy-related issues (eg, energy intake, expenditure, and balance) was not significantly associated with their SSB intake.¹⁷ Therefore, the purposes of our study were to assess knowledge about SSBs and examine whether these are associated with SSB intake after controlling for sociodemographic factors among US adults. The authors hypothesized that

correct knowledge about SSBs would be associated with a lower consumption of SSBs.

METHODS

Sample and Survey Administration

Our cross-sectional study was based on the HealthStyles Survey conducted by Porter Novelli during fall 2010. The HealthStyles Survey is a mail survey of US adults (aged ≥ 18 years) and is designed to assess a wide variety of respondents' health-related attitudes, knowledge, behaviors, and conditions surrounding important public health issues. The HealthStyles Survey is sent to the same individuals who complete and return Porter Novelli's ConsumerStyles Survey, which is a consumer mail panel survey. The ConsumerStyles Survey assesses consumer habits, lifestyles, attitudes, purchasing behaviors, traditional and social media habits, and technology use among US adults. The sampling and data collection are conducted by Synovate, Inc, a market research firm.¹⁹ The consumer mail panel consists of about 200,000 members throughout the United States; this is a convenience sample. The ConsumerStyles Survey is sent to a stratified random sample drawn from the panel ($n=20,000$). Although the survey participants are drawn from a convenience sample, the sampling is stratified on region, household income, population density, age, and household size to create a sample distribution similar to the national distribution. In 2010, a total of 10,328 people completed the ConsumerStyles survey, yielding a response rate of 51.6%. A total of 6,255 HealthStyles Surveys were sent to a stratified random sample of households that returned the ConsumerStyles Survey. Responses were received from 4,184 HealthStyles participants, yielding a response rate of 66.9%. Participants in HealthStyles Survey 2010 were assigned weights based on sex, age, income, race, and household size to match US Current Population Survey proportion in 2009. This analysis was exempt from the Centers for Disease Control and Prevention Institutional Review Board process because personal identifiers were not included in the data provided to the Centers for Disease Control and Prevention. Among the 4,184 adults who completed the survey, a total of 258 participants were excluded from the study because of missing data on SSB intake ($n=101$), knowledge about SSBs ($n=129$), and education level ($n=28$). Comparing adults who were excluded from the study, those who were included had significantly higher proportions of women and lower-income adults, but did not differ according to age, race/ethnicity, education level, marital status, annual household income, and knowledge about SSBs.

Outcome Variable

SSB intake was determined by the following question: "During the past 7 days, how many times did you drink sodas, fruit drinks, sports or energy drinks, and other sugar-sweetened drinks? Do not include 100% fruit juice, diet drinks, or artificially sweetened drinks." Response choices were none, one to six times per week, one time per day, two times per day, three times per day, and ≥ 4 times per day. For bivariate analyses, four mutually exclusive categories were created: none, one to six times per week, one time per day, and ≥ 2 times per day. For logistic regression analysis, SSB intake variable was dichotomized

(<2 and ≥ 2 times per day). The cutpoint of two times per day was based on the estimated 85th percentile of energy intake from SSB on any given day, which was about 300 kcal (two 12-oz cans of soda) among Americans (US Department of Agriculture National Nutrient Database for Standard Reference, Release 26, 2013).²⁰

Knowledge about SSBs

The main exposure variables were two knowledge questions about SSBs, and mutually exclusive response categories were created. For the following statement, participants were asked to rate their agreement with: "Drinking regular sodas, fruit drinks, sports or energy drinks, and other sugar-sweetened drinks can cause weight gain." Response options available were strongly disagree, somewhat disagree, neither agree nor disagree, somewhat agree, and strongly agree. Three categories were created for this variable: agree (strongly/somewhat agree), neither, and disagree (strongly/somewhat disagree). For the second parameter, participants were asked to response to the following statement: "How many calories does a regular 24-oz fountain drink, such as a non-diet cola, have?" Response options available for this question were 150 kcal or less, 151 to 250 kcal, 251 to 350 kcal, 351 to 400 kcal, >400 kcal, and do not know. Four response categories were created for this variable: ≤ 250 kcal (underestimate), 251 to 350 kcal (correct), ≥ 351 kcal (overestimate), and do not know. Because this question was asking about knowledge, "do not know" was considered as a valid response category.

Sociodemographic Variables

Sociodemographic variables included were age (18 to 24 years, 25 to 44 years, 45 to 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 $< \$35,000$, $\$35,000$ to $\$74,999$, $\$75,000$ to $\$99,999$, or $\geq \$100,000$. Geographic regions were categorized as New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific based on the Census regions.

Statistical Analysis

The relationship between SSB intake and the variables described above was examined using χ^2 tests and a P value < 0.05 was the cutpoint for statistical significance. Multivariable logistic regression analysis was used to estimate adjusted odds ratios and 95% CIs for health-related knowledge associated with SSB intake ≥ 2 times per day after controlling for age, sex, race/ethnicity, education level, annual household income, and geographic regions. The multivariable logistic regression model included two knowledge variables and aforementioned covariates in one model. All statistical analyses were performed with Statistical Analysis Software (version 9.2, 2009, SAS Institute Inc) and incorporated appropriate procedures to account for the sample design by

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