



The Contribution of Beverages to Intakes of Energy and MyPlate Components by Current, Former, and Never Smokers in the United States



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ABSTRACT

Background Although beverage intake patterns have been shown to differ by smoking status, it is unknown whether the contributions of beverages to intakes of energy and MyPlate components also differ.

Objective The purpose of this study was to compare beverage intakes and contributions of energy and MyPlate components by source (food alone, beverages alone, and food and beverages together) in diets of adult current, former, and never smokers.

Design and participants Dietary data from 4,823 men and 4,672 women aged ≥ 20 years who participated in What We Eat in America, National Health and Nutrition Examination Survey 2005-2008, were analyzed.

Main outcome measures Beverage intake and the contributions to energy and MyPlate components by beverages.

Statistical analysis Regression analyses identified differences in intake among groups. **Results** Current smokers consumed more total beverages, coffee, and sugar-sweetened beverages than never and former smokers ($P < 0.001$). Male current smokers drank more alcoholic beverages than never and former smokers, whereas female current and former smokers both consumed more alcoholic beverages than never smokers. Current smokers obtained more energy from beverages than their nonsmoking counterparts, although total energy intake did not differ. Intakes of added sugars, alcohol, and empty calories were higher for current than never smokers, and differences were accounted for by current smokers' beverage choices.

Conclusions This study adds to the body of research on smoking and dietary behavior by showing that not only do smokers consume a higher volume of beverages, but they also have a higher intake of energy provided by beverages, mainly empty calories from added sugars and alcohol. Our findings highlight the importance of assessing beverages' contribution to the total diet. Recognizing the common co-occurrence of smoking and specific beverage choices can help target health promotion and disease prevention efforts for this subpopulation.

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THE MAJOR RISK FACTORS FOR MORBIDITY AND mortality in the United States include modifiable, lifestyle-related health behaviors that often occur in the same individual.¹⁻³ For example, most smokers report at least one additional risky behavior, such as poor dietary behaviors.⁴⁻⁸ Dietary behaviors include choices about not only foods but also beverages, which provide fluid and nutrients such as vitamin D and calcium, as well as empty calories from added sugars, solid fats, and alcohol.^{9,10}

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The Dietary Guidelines for Americans 2010 (DGA) provide guidance on choosing a healthy diet, with the dual goals of achieving and maintaining a healthy weight and focusing on nutrient-dense foods and beverages that provide essential nutrients.^{10,11} The DGA include recommendations for foods and nutrients to increase, as well as for foods and food components to reduce.¹⁰ To assist consumers in translating these DGA goals into action, the US Department of Agriculture (USDA) food guidance system provides information on the MyPlate symbol and other educational materials to the public.¹² Beverage-related DGA/MyPlate messages directed toward consumers include advice to drink water instead of sugary beverages, limit alcohol consumption to no more than one drink per day for women and two for men, and select nonfat or low-fat milk rather than whole milk.^{10,11}

Studies focusing on dietary patterns have identified two beverages that appear to differ consistently by smoking status. Current smokers have been shown to have higher consumption of alcohol^{13,14} and coffee¹⁵ relative to non-smokers. Among former smokers, consumption patterns for coffee¹⁵ and alcohol^{14,16} are generally intermediate between those of current and never smokers. Despite these observed differences, no comprehensive assessment of beverage intake patterns and/or the contribution of beverages to overall dietary intake by smoking status has ever been conducted. To address this gap, the purpose of this study was to compare beverage intakes and contributions of energy and MyPlate components from food alone, beverages alone, and food and beverages together in the diets of current, former, and never smokers in a nationally representative sample of US adults.

METHODS

Study Design and Participants

Data used in this study are from the US National Health and Nutrition Examination Survey (NHANES) 2005-2008.^{17,18} The NHANES sample was designed to be representative of the civilian, noninstitutionalized US population, with oversampling of various population subgroups (including people aged ≥ 60 years, low-income individuals, non-Hispanic blacks, and Hispanics) to improve accuracy of related estimates.^{17,18} Informed consent was obtained from all participants, and the National Center for Health Statistics Research Ethics Review Board approved the protocol.¹⁹ This study was approved as exempt by the Auburn University Institutional Review Board.

Participants selected for this analysis were aged ≥ 20 years and had completed 1 day of dietary recall in What We Eat in America (WWEIA), the dietary intake interview component of NHANES,^{20,21} and also answered the Smoking-Cigarette Use Questionnaire.^{22,23} Women who were pregnant or lactating were excluded. The final analytical sample included 9,495 adults (4,823 men and 4,672 women).

Dietary Assessment

WWEIA dietary intake data were collected using the USDA Automated Multiple-Pass Method (AMPM) for the 24-hour recall.²⁴ Detailed descriptions of the interview protocol are available online,^{25,26} as are the dietary data.^{27,28}

Beverage reports from the 24-hour recall were grouped into nine mutually exclusive categories. For the four highest-volume beverage groups other than plain water—that is, coffee, tea, sugar-sweetened beverages (SSBs), and alcoholic beverages—the predominant subgroup was also identified. Groups and subgroups are listed in [Figure 1](#). Nonbeverage items that were identified in the WWEIA, NHANES Individual Intakes File as being consumed along with a beverage, such as sugar and creamer added to coffee, were considered to be part of the beverage. On the other hand, beverage-type items that were consumed along with food, such as milk on cereal, were not considered to be beverages.

The Food and Nutrient Database for Dietary Studies (versions 3.0 and 4.1, as appropriate) was used to calculate energy (kilocalories) and alcohol (grams) intakes.²⁹ To examine intakes in terms of MyPlate components, the Food

Patterns Equivalents Database (versions for 2005-2006 and 2007-2008, as appropriate) was applied to convert intakes into amounts of fruit, vegetables, grains, protein foods, dairy, oils, solid fats, and added sugars.³⁰ “Empty calories” were calculated as the sum of calories from solid fats, added sugars, and alcohol.

Smoking Status

Cigarette smoking data were self-reported.^{22,23} Participants who reported smoking < 100 cigarettes in their lives were classified as “never smokers” ($n=4,917$).^{4,6,31,32} Among respondents who had smoked ≥ 100 cigarettes, those who did not smoke at the time of the survey were classified as “former smokers” ($n=2,430$), and those who smoked cigarettes every day or some days were classified as “current smokers” ($n=2,148$).

Statistical Analyses

Analyses were carried out using the statistical software packages SAS release 9.3 (2011, SAS Institute Inc) and SUDAAN release 11.0 (2012, Research Triangle Institute). SUDAAN was used to adjust for survey design effects resulting from NHANES' complex, multistage, probability sampling.³³ All analyses used sample weights to account for differential nonresponse and to balance the collection of 24-hour recalls across days of the week. Using the sampling weights allows estimates based on NHANES data to be nationally representative.

Using χ^2 tests of independence, analyses were conducted to identify significant relationships between smoking status and sociodemographic and lifestyle characteristics. Characteristics examined included age, education (highest level completed), family income, race/ethnicity, exercise level, and weight status. Measured weight and height values were used to calculate body mass index (BMI), and BMI values were classified according to National Institutes of Health guidelines.³⁴ Exercise level was based on minutes of leisure time activity per week collected through the NHANES Physical Activity and Physical Fitness Questionnaire.^{35,36}

Linear regression was used to estimate never, former, and current smokers' daily intake of each beverage category, energy, and MyPlate components from beverage and food sources separately and together with adjustment for the characteristics described above. Sex-specific analyses were conducted because of documented differences between men and women in smoking propensity^{8,31} and beverage intake, especially alcoholic beverage consumption.^{8,37} Analysis of variance was then applied to detect differences in intakes of beverage groups, energy, and MyPlate components by smoking status. Significant findings were investigated further using *t* tests to determine which smoking status categories differed from one another. In lieu of a Bonferroni adjustment to account for the number of tests performed, a conservative confidence level of 99.9% was used to determine the statistical significance of all probability tests ($P < 0.001$).

RESULTS

In this nationally representative sample of adults, more than one-quarter of men and approximately one-fifth of women were current smokers ([Table 1](#)). Fewer than half of men and more than half of women were never smokers. Differences across smoking status were found for most characteristics

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