

Caloric Beverage Intake Among Adult Supplemental Nutrition Assistance Program Participants

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People in the United States consume about 20% of their calories from beverages, a share that has increased greatly over recent decades.¹ Calories from beverages may be less satiating than calories from food and may therefore contribute to weight gain.²⁻⁵ Calories from sugar-sweetened beverages (SSBs) may be particularly problematic because they provide little if any essential nutrients. Policies suggested or enacted to reduce SSB consumption include taxing SSB purchases⁶⁻⁹ and restricting the size of SSBs sold by food service establishments. Most recently, the discussion has moved to whether participants in the Supplemental Nutrition Assistance Program (SNAP) should be prohibited from using benefits to purchase SSBs. SNAP provides nutrition assistance to low-income individuals and families through electronic benefit transfer cards that can be used to purchase food at authorized food retailers. SNAP benefits can be used to purchase almost all foods, with the exceptions of hot foods or food that will be eaten in the stores, alcoholic beverages and tobacco products.

New York City requested a waiver from the Food and Nutrition Service of the US Department of Agriculture to restrict the use of SNAP benefits for purchases of some SSBs¹⁰ but was denied. Several high-profile commentators argued that the SNAP program may be subsidizing obesity and should be modified to encourage greater consumption of healthy foods and reduced consumption of empty calories such as SSBs.^{11,12} Others have argued that such restrictions could increase administrative costs but would have little impact on consumption patterns because most participants' SNAP benefit only covers a portion of the household's total food spending, and they could just use their cash food budgets to purchase SSBs.¹³ It has also been argued¹⁴ that imposing restrictions on only 1 part of the population is unfair when consumption of SSBs and obesity are fairly widespread among all Americans. Restrictions on SNAP purchases could have unintended

Objectives. We compared sugar-sweetened beverage (SSB), alcohol, and other caloric beverage (juice and milk) consumption of Supplemental Nutrition Assistance Program (SNAP) participants with that of low-income nonparticipants.

Methods. We used 1 day of dietary intake data from the 2005–2008 National Health and Nutrition Examination Survey for 4594 adults aged 20 years and older with household income at or below 250% of the federal poverty line. We used bivariate and multivariate methods to compare the probability of consuming and the amount of calories consumed for each beverage type across 3 groups: current SNAP participants, former participants, and nonparticipants. We used instrumental variable methods to control for unobservable differences in participant groups.

Results. After controlling for observable characteristics, SNAP participants were no more likely to consume SSBs than were nonparticipants. Instrumental variable estimates showed that current participants consumed fewer calories from SSBs than did similar nonparticipants. We found no differences in alcoholic beverage consumption, which cannot be purchased with SNAP benefits.

Conclusions. SNAP participants are not unique in their consumption of SSBs or alcoholic beverages. Purchase restrictions may have little effect on SSB consumption. (*Am J Public Health.* 2014;104:e80–e85. doi:10.2105/AJPH.2014.301970)

consequences, such as reducing participation or substitution with other energy-dense foods.

Despite the prominent appeals to restrict SNAP participants' purchases, little evidence has shown that SNAP participants' SSB consumption is different from that of the average consumer or other low-income consumers. Using longitudinal data for a cohort of US youths, no differences were found between SNAP participants and otherwise similar nonparticipants in the frequency of consumption (not total calories) of soft drinks, 100% fruit juice, and milk.¹⁵ Purchases of different beverages at 1 chain grocery store in New England for a sample of families that participated in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program over a 2-year period showed that among the participants, those who also received SNAP benefits purchased a higher percentage of SSBs than did non-SNAP participants.¹⁶ This study did not consider all SNAP households (or any other low-income households that did not participate in either SNAP or the Special Supplemental Nutrition Program for Women,

Infants, and Children); examined beverage purchases at only 1 grocery store chain in New England; did not consider beverage purchases at bars, restaurants, or other food retailers; and did not consider beverage intake among household members. Both of these studies examined only a segment of all SNAP participants.

Alcoholic beverages contribute a sizable share of total beverage calories for those who consume them. Alcoholic beverages cannot be purchased with SNAP benefits. If SSB purchases are restricted in SNAP, participants could use other resources to purchase SSBs, just as they may to purchase alcoholic beverages. Although there are important distinctions between SSBs and alcohol (e.g., tax rates, controlled points of purchase, limits on who can purchase, and some health benefits of moderate consumption), examining how alcohol consumption differs between participants and nonparticipants may provide insight into how a restriction on SSBs could affect purchases among SNAP participants.

We used national-level data on individual beverage intake to investigate intake of SSBs, alcohol, and other caloric beverages (milk and

juice) for SNAP participants and otherwise similar nonparticipants. After comparing average intake of these beverage types, we used regression to explore whether differences across participant groups are explained by differences in observable characteristics. We separately estimated the probability of consuming each beverage type and the total number of calories consumed among consumers of each beverage. We augmented our main estimates with instrumental variable estimates that account for self-selection of SNAP participants.

METHODS

The National Health and Nutrition Examination Survey (NHANES) collects detailed information about health outcomes, body size, individual and household demographic characteristics, and dietary intake for a representative sample of adults and children in the United States. Although the survey is continuous, data are released and analyzable in 2-year cycles. We used data from 2 cycles, covering the period 2005–2008.

We examined consumption of 2 types of beverages that provide little nutritional value and a third category of caloric beverages that do provide nutritional value and help meet recommended daily intake of dairy and fruit. These 3 categories are SSBs (which include flavored milks, carbonated and noncarbonated soft drinks, fruit drinks, and sweetened coffees and teas), alcohol (all alcoholic beverages, including cocktail mixers), and milk (which includes unflavored soy and other substitute milks) and juice (100% fruit and vegetable juices). We excluded noncaloric beverages, diet beverages (those with < 5 calories per 8 oz), and meal-replacement beverages.

We restricted the sample to adults aged 20 years and older, living in households with income at or below 250% of the annual US Census Bureau federal poverty thresholds averaged between the corresponding 2 years covered by each survey wave, who reported the first day of dietary intake (response rates are substantially lower for the second day of intake). We restricted our sample by household income relative to the poverty line (calculated by taking the midpoint of the household income categories and dividing by the poverty line for the household's size) to compare SNAP

participants with other low-income nonparticipants. The gross income limit for SNAP eligibility is monthly income at or below 130% of the federal poverty line. However, considerable income volatility across the year for low-income families means that some with annual incomes more than 130% of poverty are still eligible and receive SNAP during some months of the year.¹⁷ Moreover, some SNAP participants gain eligibility through participation in other public assistance programs even though their gross monthly income is more than 130% of the poverty line. Thus, we included individuals in households with income at or lower than 250% of the poverty line. Our final sample included 4594 adults.

We grouped adults into 3 SNAP participation categories on the basis of household-level reports of SNAP receipt: (1) current participants (household received SNAP within 30 days before the survey), (2) former participants (household received SNAP within the past 12 months, but was not currently receiving it), and (3) nonparticipants (household did not receive SNAP in the 12 months before the survey). We compared the proportion that reported consuming each beverage as well as the average calories from each beverage type across the 3 groups.

Although these comparisons may reveal possible differences in beverage consumption between SNAP participants and eligible nonparticipants, other economic and demographic differences between these 2 groups may be driving the differences. Previous literature has documented the positive gradient of education and income on health and behaviors such as smoking, alcohol consumption, and diet and exercise.^{18,19} Disparities in health and health behaviors across racial and ethnic subgroups that cannot be explained completely by income, education, and other observable factors have also been documented.^{20,21} Types and quantities of beverages consumed are also likely to be associated with these economic and demographic factors. A simple comparison of mean beverage consumption across the SNAP-participant groups is likely to reflect differences in these other characteristics because SNAP participants differ from nonparticipants in observable characteristics and are likely to be different in ways that are not observed. For example, previous studies have found that income-eligible households are less

likely to participate in SNAP if they have higher income and earnings, are childless, or if the head of the household has a higher education level, is married, or is non-Hispanic White.²²

We used regression to determine whether the differences across SNAP participation groups were robust to controlling for observable characteristics that also predict beverage consumption. We used probit models to estimate the probability that a sample member consumes SSBs, alcoholic beverages, and other caloric beverages separately. We used ordinary least squares models to estimate the logged number of calories consumed from these 3 beverage types for those who consumed each beverage type. We used the individual, household, and intake-day characteristics included in Table 1 as control variables in these models (with the exception of food calories consumed). This 2-step approach follows that of previous research on food and beverage consumption.^{23,24} The advantage of this approach is that the determinants of whether to consume a beverage and how much to consume of each beverage are allowed to vary, which has been supported empirically in our research and in other studies.

Those who choose to participate in SNAP may be different from those who are eligible but do not participate in ways that cannot be observed and that may be correlated with beverage intake. We used an instrumental variable approach to address this potential selection bias and assess the robustness of the main regression results that do not account for this selection. We used state and year indicators as instruments for SNAP participation and the predicted SNAP participation status to estimate the relationship between SNAP and beverage consumption. State and year indicators controlled for the considerable number of changes in SNAP policies across states over the time period in reference, which were likely to predict SNAP participation but to be uncorrelated with beverage consumption. A previous study found a decrease in intake of added sugars from soda from 1999 to 2008.²⁵ However, we did not find a significant change in total calories from all SSBs in our sample of low-income adults (or for the total NHANES sample) over the 2005–2008 period of our study. Thus, we are not concerned that our instrument for SNAP participation is correlated with our outcome of interest. Our instrumental

TABLE 1—Demographic Characteristics by SNAP Participation Status: United States, NHANES 2005–2008

Characteristic	Current SNAP, Mean (SE)	Former SNAP, Mean (SE)	No SNAP Past 12 Months, Mean (SE)
Individual			
Age, y	39.09 (0.935)	39.21 (1.301)	48.51*** (0.818)
Male, proportion	0.37 (0.023)	0.43 (0.031)	0.47*** (0.010)
Race/ethnicity			
Non-Hispanic Black, proportion	0.30 (0.047)	0.32 (0.054)	0.12*** (0.017)
Hispanic, proportion	0.20 (0.041)	0.22 (0.045)	0.20 (0.022)
Other race, proportion	0.04 (0.011)	0.04 (0.024)	0.05 (0.008)
Married, proportion	0.40 (0.029)	0.57*** (0.049)	0.57*** (0.019)
Education			
Some college, proportion	0.21 (0.016)	0.27 (0.056)	0.29** (0.019)
≥ 4-y college degree, proportion	0.04 (0.010)	0.06 (0.027)	0.11*** (0.010)
BMI			
Measured, kg/m ²	30.51 (0.538)	28.96* (0.358)	28.47*** (0.254)
Overweight (25 ≤ BMI < 30), proportion	0.26 (0.025)	0.40* (0.053)	0.34* (0.012)
Obese (BMI ≥ 30), proportion	0.44 (0.023)	0.33* (0.040)	0.34* (0.015)
On restricted diet, proportion	0.17 (0.013)	0.13 (0.033)	0.14* (0.009)
Household			
Household size, no.	3.66 (0.107)	3.91 (0.205)	3.06*** (0.077)
Household income to US Census Bureau federal poverty thresholds.	0.91 (0.033)	1.15 (0.083)	1.60*** (0.022)
Children aged < 17 y in household	0.54 (0.036)	0.57 (0.054)	0.28*** (0.016)
Intake day			
Total food calories consumed, no.	1614.97 (41.099)	1763.97 (90.536)	1697.82* (27.134)
Intake day			
Friday, proportion	0.12 (0.013)	0.13 (0.034)	0.13 (0.008)
Saturday, proportion	0.14 (0.014)	0.21 (0.042)	0.13 (0.008)
Sunday, proportion	0.12 (0.013)	0.11 (0.022)	0.14 (0.010)
Observations, no.	851	229	3514

Note. BMI = body mass index; NHANES = National Health and Nutrition Examination Survey; SNAP = Supplemental Nutrition Assistance Program. Weighted means reported; complex survey design taken into account to estimate standard errors. Categories not shown are non-Hispanic White, ≤ high school education, and BMI < 25. Estimates use data from the 2005–2008 NHANES, adults aged ≥ 20 years with household income ≤ 250% of the annual US Census Bureau federal poverty thresholds average for the corresponding NHANES survey wave years.

P* < .05; *P* < .01; ****P* < .001; difference from current SNAP group.

variable estimates compared those in households who reported current SNAP participation with those in households who did not participate in SNAP in the past year. In these estimates, we excluded those in households who received SNAP in the past year but not those who currently received SNAP because we were not able to instrument for that participation status.

We incorporated the survey weights and complex survey design features of the NHANES in all estimations.

RESULTS

Table 1 reports weighted mean individual and household sample characteristics separately for the 3 SNAP participation groups. Current and former SNAP participants were nearly 10 years younger on average and were more likely to be female and non-Hispanic Black than nonparticipants. Only 40% of current SNAP participants were married, compared with 57% of former participants and

nonparticipants. Current SNAP participants had less education than nonparticipants. Current SNAP participants were less likely to be overweight and more likely to be obese than former participants and nonparticipants. As expected, current participants had lower average income (at 91% of the federal poverty line) than former participants and nonparticipants (115% and 160%, respectively). On average, current and former SNAP participants lived with more children younger than 17 than did nonparticipants.

Table 2 shows the share consuming each beverage and the average calories consumed for each beverage by SNAP participation status. Between 73% and 83% of our sample population consumed SSBs on the intake day, showing that SSB consumption is common. Just over half consumed other caloric beverages (55%–66%), and a much smaller share consumed alcoholic beverages (18%–24%). Current and former SNAP participants were more likely to consume SSBs than nonparticipants, with former participants consuming the largest amount of SSB calories. We found no significant differences in alcohol consumption across the 3 groups. Current participants were less likely to consume other caloric beverages than nonparticipants, but the difference in mean calorie intake from other beverages was not statistically significant. Beverage calorie intake ranged from 424 to 547 calories per day across the 3 groups, but current and former SNAP participants consume more beverage calories than nonparticipants.

Table 3 shows the marginal effects from probit estimates of the probability of consuming each beverage and ordinary least squares parameter estimates of the logged number of calories consumed on the intake day, conditional on consuming that beverage that day. Parameter estimates of other covariates are available upon request.

We found no differences in current SNAP participants' and nonparticipants' likelihood of consuming SSBs, nor in the number of calories consumed from these beverages (Table 3). These results put the estimates from Table 2 into context—when we controlled for other observable characteristics, SNAP participants were similar in their consumption of SSBs to nonparticipants. We did find, however, that former SNAP participants who consumed SSBs consumed slightly more calories than nonparticipants.

TABLE 2—Consumption of Beverages by Type and SNAP Participation Status, All Adults: United States, NHANES 2005–2008

Type of Beverage	Current SNAP Participant	Not Current, but Participated in SNAP in Past 12 Mo	Did Not Participate in SNAP in Past 12 Mo
Sugar-sweetened beverages			
Kcal consumed	275.5***	330.9***	215.2
Share consuming	0.83***	0.80	0.73
Alcohol			
Kcal consumed	79.5	100.2	87.9
Share consuming	0.18	0.24	0.20
Other beverages			
Kcal consumed	123.0	116.1	120.7
Share consuming	0.55***	0.57	0.66
Total Kcal consumed	478.0*	547.1**	423.9
Observations, no.	851	229	3514

Note. NHANES = National Health and Nutrition Examination Survey; SNAP = Supplemental Nutrition Assistance Program. Other caloric beverages include milk and 100% juice; weights and complex sample design applied in estimating means and conducting significance tests. Meal Kcal includes zeroes among nonconsumers. Estimates use data from the 2005–2008 NHANES, adults aged ≥ 20 years with household income $\leq 250\%$ of the annual US Census Bureau federal poverty thresholds averaged for the corresponding NHANES survey wave years. * $P < .05$; ** $P < .01$; *** $P < .001$; difference from non-SNAP group.

Table 3 also shows the instrumental variable results. In these estimates, we compare only current SNAP participants with nonparticipants (former participants were excluded). Estimates were not substantially different from the main results; SNAP participants were just as likely as nonparticipants to consume each of the beverages, and they consumed similar amounts. The 1 exception was the amount of calories from SSBs consumed. Here, SNAP participants who consumed SSBs consumed 1.3% fewer calories from SSBs than nonparticipants.

Taking the main and instrumental variable results together, it is clear that observable and unobservable characteristics explain the differences in beverage consumption patterns of SNAP participants relative to nonparticipants. Although not reported here, some individual and household characteristics explained differences in calories from each beverage consumed among those who consumed them (although few covariates consistently predicted the likelihood that each type of beverage was consumed). For example, men who consume SSBs and alcohol consumed more calories from them than women. Age and having a college degree were also negatively associated with consumption levels of each beverage. Those who identified as Hispanic ethnically and

those who identified as a race other than non-Hispanic Black or non-Hispanic White consumed fewer calories from SSBs and alcohol than did non-Hispanic Whites.

DISCUSSION

Bivariate comparisons of SSB consumption among current SNAP participants and nonparticipants show that SNAP participants are more likely to consume SSBs than nonparticipants and consume about 60 more calories than nonparticipants. However, when other demographic, household, and dietary factors are controlled for, SSB, alcohol, and other beverage consumption by current SNAP participants is no different than consumption by low-income adults who do not receive SNAP. Moreover, when an instrumental variable approach was used to account for unobserved characteristics of SNAP participants, we found that they consumed fewer calories from SSBs than nonparticipants.

Given the minimal nutritional value but high caloric content of SSBs, some have proposed restricting their purchase with SNAP benefits. We observed that even though mean intake was higher among SNAP participants, other factors such as gender, education, and race/ethnicity explained differences in SSB consumption

across the 3 groups studied. SNAP participants are not unique in their beverage choices compared with other low-income nonparticipants.

SNAP benefits cannot be used to purchase alcohol, so some have posited that SNAP participants may consume less alcohol. We found no significant differences in alcohol consumption among SNAP participants and nonparticipants before or after controlling for many characteristics that predict alcohol consumption. SNAP participants who consume alcohol do so by using resources other than SNAP. Similarly, SNAP participants could use other resources to purchase SSBs if SSB purchases were restricted in SNAP.

Although we did not explicitly examine the effect of restricting SSB purchases with SNAP benefits, our findings suggest that limiting SNAP participants' SSB purchases may not greatly reduce SSB consumption, particularly because most SNAP recipients are inframarginal. Among current SNAP participants in our sample, 81% spend more on food than their monthly SNAP benefit level. The average sample participant receives \$284 in SNAP for the household and reports an average of \$493 in food spending each month. We should also note that changing SNAP program rules could change people's willingness to participate in the program and, thus, the effectiveness of SNAP in improving food security and in providing income support to low-income families.

It is possible that restricting SSBs could affect consumption for SNAP participants if the restriction presents a signal (or stigma) about SSBs. The restriction could also mean that participants pay more for SSBs if a state applies a sales tax on food or a tax on SSBs.²⁶ Currently, SNAP participants do not pay sales tax for SNAP purchases even if a state has a sales tax on food. However, if SSBs cannot be purchased with SNAP, then any SSB purchases may be taxable if another form of payment is used (state policies on how to tax mixed purchases [e.g., purchases using both SNAP and cash income] vary). That would effectively raise the price of SSBs for SNAP participants, which may lead to lower quantities purchased. A previous study estimated that a 20% tax-induced price increase on SSBs would decrease total daily beverage intake by 37 calories for the average adult.²⁷

Our results echo those of another study that found only modest differences in the

TABLE 3—Marginal Effects and OLS Parameter Estimates of SNAP Participation on Beverage Consumption by Type: United States, NHANES 2005–2008

SNAP Participation Status	Sugar-Sweetened Beverages		Alcohol		Other Beverages	
	Probability of Consuming, Marginal Effect (95% CI)	OLS on Log Calories, b (95% CI)	Probability of Consuming, Marginal Effect (95% CI)	OLS on Log Calories, b (95% CI)	Probability of Consuming, Marginal Effect (95% CI)	OLS on Log Calories, b (95% CI)
Current SNAP	0.020 (-0.034, 0.075)	0.078 (0.040, 0.196)	-0.001 (-0.056, 0.053)	-0.097 (-0.319, 0.125)	-0.030 (-0.081, 0.022)	0.086 (-0.074, 0.245)
Not current, SNAP past 12 mo	-0.004 (-0.099, 0.091)	0.227** (0.067, 0.386)	0.047 (-0.042, 0.136)	-0.184 (-0.522, 0.154)	-0.021 (-0.147, 0.106)	0.138 (-0.090, 0.366)
Observations, no.	4594	3460	4594	894	4594	2907
R ²		0.172		0.181	0.158	0.058
Current SNAP	-0.0062 (-0.014, 0.002)	-1.308*** (-1.791, 0.825)	0.0003 (-0.014, 0.015)	0.091 (-0.483, 0.665)	-0.0021 (-0.016, 0.012)	0.257 (-0.114, 0.628)
F for instruments	441.53	12.84	1114.26	6.42	62.46	76.93
Observations, no.	4365	3278	4365	845	4365	2775

Note. CI = confidence interval; NHANES = National Health and Nutrition Examination Survey; OLS = ordinary least squares; SNAP = Supplemental Nutrition Assistance Program. Weights and sampling design applied in estimation. Probit marginal effects are calculated at sample means for continuous variables and for binary variables, for moving from a value of 0 to 1. Additional controls include age, male indicator, race/ethnicity indicators, marital status, education, household size, household income relative to the federal poverty line, presence of children in the household, body mass index, and whether the individual is on a restricted diet. For both sets of estimates, the reference group is nonparticipants. Estimates use data from the 2005–2008 NHANES, adults aged ≥ 20 years with household income $\leq 250\%$ of the annual US Census Bureau federal poverty thresholds averaged for the corresponding NHANES survey years. *** $p < .01$; ** $p < .05$; * $p < .10$; difference from non-SNAP group.

quality of SNAP participants' diets relative to nonparticipants.²⁸ Promoting healthy food choices, such as through the SNAP Healthy Incentives Pilot Program, could offer more potential to improve diet quality among participants.²⁹

Limitations

A caveat to our results is that SNAP has been underreported in the NHANES relative to administrative records. If some nonparticipants were actually SNAP participants, and these true participants consumed greater quantities of SSBs than true nonparticipants, our estimates of the differences in consumption could be understated.

More generally, our analysis relies on self-reported data on food and beverage intake, which may be reported with error. Previous studies have found that food and beverage intake may be underreported, particularly alcohol intake.^{30–32} However, each of these studies has limitations, such as small, narrow subgroups of the population or reliance on a single day of dietary intake data. It is possible that survey participants who know that their daily food intake will be measured (as is the case with the NHANES sample) change their eating and drinking behaviors for that day; thus, reported intake may not represent a typical day but may not necessarily be underreported relative to true intake. Even if underreporting of intake occurs, it is unlikely to affect our results because the degree of underreporting is unlikely to differ across our comparison groups.

We did not include data from the 2009–2010 NHANES, the latest years for which SNAP participation data are available, for 2 main reasons. After the economic collapse in 2008, the number of SNAP participants grew substantially, from 28 million in 2008 to 40 million in 2010.³³ Most of this increase can be attributed to the rising unemployment rate over the period rather than to changes in eligibility rules or increases in take-up rates among previously eligible nonparticipants.³⁴ Thus, the composition of SNAP participants is likely different in 2009–2010 relative to the 2005–2008 period. Moreover, the American Recovery and Reinvestment Act increased the amount of benefits each participant received by an average of 15%, or about \$80 per month for a family of 4,³⁵ which could affect food consumption. Finally, the poor economy may also have changed food consumption

temporarily for the entire population. Given that these changes to SNAP and the recession are not likely to be permanent, we limited our analysis to a period in which SNAP was operating under more usual rules and benefit levels in a nonrecessionary time.

We used state and year indicators as instruments to predict SNAP participation because unobservable characteristics may be associated with both SNAP participation and beverage consumption. We also considered specific state policies, which varied over time and across states. However, these state policies were not as strong predictors of SNAP participation as the state and year indicators, perhaps because the NHANES data are in only a few states each year, which reduces the policy variation across states in our sample. Estimates of the effect of SNAP on beverage consumption using these state policy instruments were substantively similar to those reported here.

Conclusions

We find that SNAP participants are not unique in their consumption of SSBs or alcoholic beverages. While the empirical question of how restrictions on the use of SNAP for SSB purchases will affect consumption remains, our results suggest that purchase restrictions may have little effect on SSB consumption. ■

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Contributors

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Human Participant Protection

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