

Less-healthy eating behaviors have a greater association with a high level of sugar-sweetened beverage consumption among rural adults than among urban adults

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Abstract

Background: Sugar-sweetened beverage (SSB) consumption is associated with the increasing prevalence of overweight and obesity in the United States; however, little is known about how less-healthy eating behaviors influence high levels of SSB consumption among rural adults.

Objective: We assessed the frequency of SSB consumption among rural and urban adults, examined the correlates of frequent SSB consumption, and determined difference in correlates between rural and urban adults in a large region of Texas.

Design: A cross-sectional study using data on 1,878 adult participants (urban = 734 and rural = 1,144), who were recruited by random digit dialing to participate in the seven-county 2006 Brazos Valley Community Health Assessment. Data included demographic characteristics, eating behaviors (SSB consumption, frequency of fast-food meals, frequency of breakfast meals, and daily fruit and vegetable intake), and household food insecurity.

Results: The prevalence of any consumption of SSB and the prevalence of high consumption of SSB were significantly higher among rural adults compared with urban counterparts. The multivariable logistic regression models indicated that a high level of SSB consumption (≥ 3 cans or glasses SSB/day) was associated with demographic characteristics (poverty-level income and children in the home), frequent consumption of fast-food meals, infrequent breakfast meals, low fruit and vegetable intake, and household food insecurity especially among rural adults.

Conclusions: This study provides impetus for understanding associations among multiple eating behaviors, especially among economically and geographically disadvantaged adults. New strategies are needed for educating consumers, not only about how to moderate their SSB intake, but also how to simultaneously disrupt the co-occurrence of undesirable eating and promote healthful eating.

Keywords: *sugar-sweetened beverages; household food insecurity; fast-food consumption; sugar drinks; rural*

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In the United States, trends of increasing obesity have been paralleled by increasing consumption of energy-dense and nutrient-poor sugar-sweetened beverages (SSBs) including soft drinks or soda, sport drinks, fruit drinks and punches, low-calorie drinks, and sweetened tea (1, 2). The SSBs are the most commonly consumed caloric beverage and a leading source of added sugars

(1–3). Several studies have demonstrated that SSB consumption is associated with higher intake of energy, added sugars, lower intake of fiber, and displacement of more healthful food and beverages (1, 3–5). Identified determinants of frequent SSB consumption among adults include low income, limited education, being black and male, younger age, consumption of fast-food meals, and

food availability, preferences, and culture (3, 4, 6–8). While the results are mixed (9–11), reviews and meta-analyses have found a positive association between SSB and obesity, increased risk for type 2 diabetes, cardiovascular disease, and metabolic syndrome for adults (1, 2, 12). Rural residents have several of the characteristics including widespread socioeconomic disadvantage and worse access to local sources of healthier foods that increase their risk for chronic diseases, food insecurity, poor dietary behaviors, and higher intakes of SSBs (13–16). Still there has been limited work on factors associated with SSB consumption among rural populations in the United States and very little on the behavioral context of SSB consumption for rural adults (17–19). Moreover, there are apparently no publications describing rural–urban differences for US adults’ SSB consumption (20–23). Considering the role of SSB consumption in reducing risk for chronic disease, it is critical to understand the correlates of increased SSB consumption for at-risk populations such as residents living in rural areas (2, 3). The current study seeks to assess the relations between SSB consumption and specific eating-related behaviors among rural adults by (1) assessing the frequency of SSB consumption among rural and urban adults, (2) examining the correlates of frequent SSB consumption, and (3) determining the difference in correlates between rural and urban adults in a large region of Texas.

Methods

Sample and study design

We used data from the 2006 Brazos Valley Community Health Assessment (BVHA), which was developed by a collaboration of local and regional academic and community-based organizations in the Brazos Valley of central Texas. Participants were recruited from adult community residents who resided in one of six rural and one urban county by a professional independent survey research firm that identified 9,940 valid telephone numbers through random digit dialing. Of these telephone numbers, 3,501 households were contacted on initial contact and agreed to participate. Further details of the sampling frame have been reported elsewhere (24). More than 2,500 adults (19.4% minority, 71% female, and 61% rural residents) who resided in the seven counties returned the mailed survey; the response rate was 73.8% (25). This study used data from 1,878 adult participants in the BVHA who had complete responses for demographic characteristics, eating behaviors, and household food-related hardship (experience of running out of food, without money to obtain more) (26, 27); 649 participants (25.7%) were excluded due to missing data. There were no statistically significant differences between included and excluded participants with regards to demographic characteristics or rural residence. The Texas A&M University

Institutional Review board approved the study protocol and all participants provided informed consent.

Measures

Demographic characteristics

Demographic characteristics included age (18–44 years, 45–64 years, and ≥ 65 years), race/ethnicity (non-Hispanic white vs. all others), household income (poverty: $\leq 100\%$ FPL [Federal Poverty Level], low income: 101–199% FPL, and above low income: $\geq 200\%$ FPL), employment status (employed full-time outside the home for wages vs. not employed full-time outside the home), marital status (married vs. not married), ≥ 1 child under the age of 18 years living in the household, and body mass index (BMI), which was calculated from self-reported height and weight (kg/m^2). The BMI was categorized as normal ($\text{BMI} < 25 \text{ kg}/\text{m}^2$), overweight ($\text{BMI} 25\text{--}29.9 \text{ kg}/\text{m}^2$), and obese ($\text{BMI} \geq 30 \text{ kg}/\text{m}^2$).

Eating behaviors

Eating behaviors were selected based on prior community-based work in North Carolina and included prevalence and consumption of SSBs, frequency of fast food meals, frequency of eating a regular breakfast meal, and daily intake of fruit and vegetables (25, 28, 29). SSB consumption was assessed with the following question: ‘How many cans of regular soda (not diet) or glasses of sweet tea do you drink on an average day?’ Six response categories included 0, 1, 2, 3, 4, 5, or 6; and more than 6. The prevalence of SSB consumption was defined as the proportion of adults who reported any consumption of SSB (≥ 1 can or glass per day). Based on a distribution of responses, a dichotomized variable for a high level of SSB consumption was defined as ≥ 3 cans or glasses per day versus < 3 cans or glasses. Frequency of fast food meals was determined from the question: ‘How many times a week do you eat fast food meals?’ The same six response categories were provided as above; and a similar approach for a dichotomized variable for frequent fast food meal consumption was defined (≥ 3 times/week vs. < 3 times/week). The following question was used to describe breakfast meals frequency: ‘How many days a week do you eat a regular breakfast meal?’ From the six possible responses, a dichotomized breakfast meal variable was constructed as < 3 days/week versus ≥ 3 days/week. Two questions from a validated, self-reported two-item screener were combined to describe fruit and vegetable intake: (1) How many servings of fruit do you usually eat each day (a serving = $\frac{1}{2}$ cup of fruit or $\frac{3}{4}$ cup of fruit juice)? and (2) How many servings of vegetables do you usually eat each day (a serving = $\frac{1}{2}$ cup of cooked or one cup raw vegetables)? (30, 31). A three-category variable was constructed for total daily intake of fruit and vegetables: 0–2 servings, 3–4 servings, and ≥ 5 servings.

Table 1. Difference in demographic characteristics, eating behaviors, and household food-related hardship between urban and rural adults ($n = 1,878$)^a

Variable	Urban ($n = 734$)	Rural ($n = 1,144$)	p-Value
	% (n)	% (n)	
Demographic characteristics			
Age, years			
18–44	42.4 (311)	27.2 (311)	<0.0001 ^b
45–64	40.7 (299)	47.6 (545)	0.003
≥65	16.9 (124)	25.2 (288)	<0.0001 ^b
Female	64.2 (471)	72.4 (828)	<0.0001 ^b
Race/ethnicity			
Minority	20.6 (151)	17.6 (201)	0.104
Household income			
Poverty ($\leq 100\%$ FPL)	13.6 (100)	16.1 (184)	0.147
Low income (101–199% FPL)	9.1 (67)	14.5 (166)	0.001 ^b
Above low income ($\geq 200\%$ FPL)	77.2 (567)	69.4 (794)	<0.0001 ^b
Employment ^c			
Full-time outside home for wages	51.5 (372)	44.7 (501)	0.004
Marital status			
Not married	24.1 (177)	23.7 (271)	0.833
Children in household			
≥1 Child	40.3 (296)	34.3 (392)	0.008
BMI (kg/m^2) ^d			
Normal (< 25)	36.0 (257)	30.4 (338)	0.014
Overweight (25–29.9)	33.7 (241)	34.3 (381)	0.802
Obese (≥ 30)	30.2 (216)	35.2 (391)	0.028
Eating behaviors			
Fast food ^e	24.5 (180)	18.9 (216)	0.003
Breakfast ^f	35.8 (263)	42.2 (483)	0.006
Fruit and vegetable consumption ^g			
0–2	28.1 (206)	34.4 (394)	0.004
3–4	45.5 (334)	43.8 (501)	0.467
≥5	26.4 (194)	21.8 (249)	0.020
Sugar-sweetened beverages			
Prevalence ^h	43.7 (321)	52.4 (599)	<0.0001 ^b
High level of consumption ⁱ	10.5 (77)	17.7 (203)	<0.0001 ^b
Household food-related hardship			
Food not last in past 30 days	17.2 (126)	23.7 (271)	0.001 ^b

^aComparisons were performed using χ^2 test.

^bStatistically significant after using Bonferroni correction for multiple comparison (Bonferroni-corrected $p = 0.002$).

^c $n = 1,875$ due to missing data on employment status.

^d $n = 1,824$ due to missing data on self-reported height or weight.

^eEat fast food meals ≥ 3 times, compared with < 3 times a week.

^fEat a regular breakfast meal < 3 days, compared with ≥ 3 days a week.

^gServings of fruit and vegetables usually eaten each day.

^h ≥ 1 can or glass of regular soda or sweet tea on an average day, compared with < 1 on an average day.

ⁱ ≥ 3 cans or glasses of regular soda or sweet tea on an average day, compared with < 3 on an average day.

Household food-related hardship

The first quantitative food depletion item in the household hunger dimension of the Radimer-Cornell measure of hunger and food insecurity was used to determine the

presence of *household food insecurity* in the past 30 days (27, 32–35). Respondents were asked to choose the frequency (often true, sometimes true, or never true) that the following occurred for their household in the

past 30 days: ‘The food that we bought didn’t last and we didn’t have enough money to buy more.’ Responses of often true and sometimes true were combined to indicate food-related hardship (often true or sometimes true) versus no food-related hardship (never true). This measure describes the household experience of running out of food without money to obtain more (26, 27).

Statistical analyses

Release 11 of Stata Statistical Software was used for all statistical analyses; $p < 0.05$ was considered statistically significant. Descriptive statistics were estimated for demographic characteristics, eating behaviors, and food-related hardship. The difference between rural and urban adults was assessed with contingency tables by using the χ^2 statistic. Bivariate correlations between theoretically selected variables (demographic characteristics, eating behaviors, and food-related hardship shown in Table 1) and SSB intake were estimated. Correlations at $p < 0.10$ were retained for inclusion in the logistic regression model that included rural and urban respondents; excluded variables included sex, overweight, ages 45–64 years, and employment status. Using backward elimination of all variables with $p > 0.05$, a combined multivariable logistic regression model ($n = 1,878$) was estimated for high level of SSB consumption (≥ 3 cans/glasses per day vs. < 3 cans/glasses). Using the final model for the combined sample, separate multivariable logistic regression models were estimated for the 734 urban respondents and the 1,144 rural respondents.

Results

Sample characteristics for urban and rural respondents are shown in Table 1. Rural respondents were older than urban counterparts; a larger proportion were women, reported a household income 101–199% FPL, and were obese; and a smaller proportion were employed full-time outside the home for wages or had at least one child under the age of 18 years living in the household. Compared with urban respondents, the prevalence and high level of SSB consumption (≥ 3 cans or glasses of SSB/day) was greater among rural adults. A greater proportion of rural adults ate a regular breakfast meal less than three times a week and consumed fewer servings of fruit and vegetables. On the other hand, a larger proportion of urban adults ate fast food meals at least three times a week. Finally, a larger proportion of rural adults reported household food-related hardship than urban counterparts (23.7% vs. 17.2%). Several differences between urban and rural adults remained significant after correcting for multiple comparisons with a Bonferroni-corrected level of statistical significance.

Several demographic variables were not correlated with SSB consumption; namely sex, overweight status (BMI

Table 2. Odds ratios and 95% CI from multiple variable logistic regression models correlating demographic characteristics, eating behaviors, and household food-related hardship with consumption of sugar-sweetened beverages among 1,144 rural adults^a

Variable	OR (95% CI)	p-Value
Demographic characteristics		
Income		
Poverty	2.32 (1.53, 3.52)	<0.0001
Low income	1.37 (0.87, 2.17)	0.173
Above low income	1.0	
Children in household ^b	1.68 (1.21, 2.33)	0.002
Eating behaviors		
Fast food meals ^c	1.80 (1.24, 2.62)	0.002
Breakfast meals ^d	1.50 (1.07, 2.10)	0.017
Fruit and vegetable		
0–2 servings/day	2.41 (1.42, 4.11)	0.001
3–4 servings/day	1.80 (1.06, 3.03)	0.028
≥ 5 servings/day	1.0	
Household food-related hardship		
Food not last in past 30 days ^e	1.69 (1.16, 2.47)	0.006
Pseudo R^2 of model		0.098
Significance of χ^2 in model		<0.0001

^aDependent variable is consumption of ≥ 3 cans/glasses of regular soda or sweet tea on an average day compared with < 3 cans/glasses. All variables simultaneously entered; backward elimination of variables not statistically significant.

^b ≥ 1 child under 18 years living in the household with the adult respondent compared with no children.

^cEat ≥ 3 fast food meals a week, compared with < 3 times a week.

^dEat a regular breakfast meal < 3 days a week compared with ≥ 3 days a week.

^eIn the last month, food bought didn’t last and there was not enough money to buy more compared with food did last.

25–29.9 kg/m²), age category of participants 45–64 years, and employment status. Although statistically significant, the strength of individual correlations was weak ($r \leq 0.15$). Age category of participants 18–44 years ($r = 0.11$, $p < 0.001$), minority status ($r = 0.10$, $p < 0.001$), poverty-level household income ($r = 0.15$, $p < 0.001$), presence of ≥ 1 child in the household ($r = 0.14$, $p < 0.001$), and obesity ($r = 0.07$, $p = 0.005$) were positively correlated with SSB consumption; older age category (≥ 65 years) was negatively correlated. Among the variables for eating behaviors, frequency of fast food meals ($r = 0.09$, $p < 0.001$), low fruit and vegetable intake ($r = 0.15$, $p < 0.001$), and consuming < 3 breakfast meals/week ($r = 0.17$, $p < 0.001$) were positively correlated with SSB consumption; high fruit and vegetable intake of ≥ 5 servings/day was negatively correlated with SSB consumption ($r = -0.12$, $p < 0.001$). Food-related hardship was positively associated with SSB consumption ($r = 0.21$, $p < 0.001$).

Table 3. Odds ratios and 95% CI from multiple variable logistic regression models correlating demographic characteristics, eating behaviors, and household food-related hardship with consumption of sugar-sweetened beverages among 734 urban adults^a

Variable	OR (95% CI)	p-Value
Demographic characteristics		
Income		
Poverty	1.91 (0.99, 3.68)	0.054
Low income	2.08 (1.00, 4.31)	0.050
Above low income	1.0	
Children in household ^b	1.89 (1.14, 3.14)	0.014
Eating behaviors		
Fast food meals ^c	1.23 (0.71, 2.13)	0.461
Breakfast meals ^d	2.45 (1.42, 4.22)	0.001
Fruit and vegetable		
0–2 servings/day	1.50 (0.69, 3.29)	0.306
3–4 servings/day	1.44 (0.69, 3.04)	0.334
≥5 servings/day	1.0	
Household food-related hardship		
Food not last in past 30 days ^e	2.46 (1.38, 4.36)	0.002
Pseudo R^2 of model		0.129
Significance of χ^2 in model		<0.0001

^aDependent variable is consumption of ≥ 3 cans/glasses of regular soda or sweet tea on an average day compared with < 3 cans/glasses. All variables simultaneously entered; backward elimination of variables not statistically significant.

^b ≥ 1 Child under 18 years living in the household with the adult respondent compared with no children.

^cEat ≥ 3 fast food meals a week, compared with < 3 times a week.

^dEat a regular breakfast meal < 3 days a week compared with ≥ 3 days a week.

^eIn the last month, food bought didn't last and there was not enough money to buy more compared with food did last.

Minority status ($p = 0.64$), employment status ($p = 0.57$), age ($p = 0.19$), and obesity ($p = 0.17$) were sequentially removed from the final model for the combined rural and urban sample, which adjusted for demographic characteristics, eating behavior, and household food-related hardship. Independent of demographic characteristics, eating behaviors, and food-related hardship, rural residence was associated with greater odds for reporting a high level consumption of SSBs (OR 1.8; 95% CI 1.3, 2.4; $p < 0.001$) than urban residence. Among all adults having a poverty-level household income (OR 2.2; 95% CI 1.6, 3.1), children in the household (1.8; 95% CI 1.3, 2.3), frequent consumption of fast-food meals (1.6; 95% CI 1.2, 2.2), infrequent breakfast meals (1.7; 95% CI 1.3, 2.3), low fruit and vegetable intake (OR 2.1; 95% CI 1.4, 3.3), and food-related hardship (OR 1.9; 95% CI 1.4, 2.6) increased the odds for a high-level consumption of SSB.

Table 2 shows the results from the multivariable regression model for rural adults. Among rural adults, a higher level of SSB consumption was associated with greater odds for respondents with poverty-level household income, presence of child in the household, frequent consumption of fast-food meals, infrequent consumption of regular breakfast, low fruit and vegetable intake, and food-related hardship. Among urban adults (Table 3), one eating behavior (infrequent consumption of a regular breakfast meal), household food-related hardship, and one demographic characteristic (children in the home) were associated with SSB consumption. Interestingly, frequency of fast-food meals and low fruit and vegetable intake were not associated with a high level of SSB consumption among urban adults.

Discussion

Although research findings suggest a link between consumption of SSBs and health outcomes (1, 2, 12), there are few studies that have examined the influence of less-healthy eating behaviors and food-related hardship on the consumption of high levels of SSB, especially among rural adults. This is critical considering the dramatic increase in prevalence of overweight and obesity (36, 37), SSB consumption (3, 9, 38–40), frequency of fast-food meal consumption (41), and nutrition and health disparities associated with rural residence (25, 42–46). However, studies of SSB consumption rarely have considered eating behaviors and adequacy of household food supplies as contributing factors. Findings from this study of 1,878 rural and urban adults extend our understanding of the influence of less-healthy eating behaviors and household food-related hardship on higher levels of SSB consumption. There are two major findings of this study. First, the prevalence and high level of consumption of SSB were significantly greater among rural adults compared with urban counterparts. Second, a high level of SSB consumption was associated with less-healthy eating behaviors, especially among rural adults. To our knowledge, this is apparently the first study that simultaneously evaluated the association of multiple eating behaviors and household food-related hardship among a large sample of rural adults. Several findings require further discussion.

Unlike primarily urban studies that used a single definition of SSB consumption such as once or more a week (17), ≥ 1 12-ounce serving of sugar-sweetened soda per day (6), ≥ 1 SSB/day (47), and > 1 bottle/day (48), this study considered prevalence (≥ 1 can or glass of SSB/day) and a high level of SSB consumption (≥ 3 cans or glasses of SSB/day). More than 52% of rural adults, compared with 43.7% of urban adults, consumed at least one SSB per day. This appears to be higher than a similar size study of rural adults ($n = 1,817$) in Wyoming, Montana, and Idaho that defined SSB

consumption as less than once/week versus once or more per week (17) or the large, primarily urban Nurses' Health Study II that found that 9.5% of the sample consumed ≥ 1 SSB/day (47). Compared with previous studies of SSB consumption, our finding that rural adults consumed higher levels of SSB than urban adults is apparently new. One possible explanation may be that previous studies did not attempt to examine high levels of SSB consumption; but chose lower levels of consumption, such as at least one SSB per day or week (6, 17, 47, 48). Another explanation may be that rural residents have greater access to convenience and non-traditional food stores and fast-food opportunities where SSB are more available and affordable (43, 45, 49–51). Preference and greater household availability for SSB such as regular soft drinks or sugar-sweet tea, which has been identified through household food inventories, may provide another explanation for high levels of SSB consumption (52, 53).

In addition to consumption of SSB, three additional less-healthy eating behaviors that are associated with poor diet quality were examined; namely, infrequent breakfast meals (28, 54, 55), frequent consumption of fast-food meals (56), and fewer portions of fruit and vegetables (57, 58). Rural adults compared less favorably with urban adults in two of these three eating behaviors. A greater proportion of rural adults infrequently consumed a regular breakfast meal and ate less than three daily servings of fruit and vegetables. Lower fruit and vegetable intake among rural adults may be the result of limited access to food stores that market fruit and vegetables – store availability and transportation infrastructure (46, 59, 60). In the United States, there has been an overall decline in breakfast consumption (61). One explanation for less frequent breakfast meal consumption among rural adults may be that rural adults travel a greater distance in the morning to work and do not have the time for a regular breakfast. In both urban and rural areas, there are increased opportunities for fast food through traditional fast-food restaurants and marketing of fast food through convenience and other retail stores, often referred to as 'channel blurring' (49, 50, 62). An explanation for greater utilization of fast-food meals by urban adults may be greater accessibility and availability.

Inadequate household food supplies or household food-related hardship are known to influence food choice and dietary intake (46, 51, 63). We identified great nutritional disparity between rural and urban adults, which has been absent from the literature. More than 23% of rural adults compared with 17.2% of urban adults reported that in the past 30 days purchased food did not last and there was no money to buy more, which is supported by secondary analysis of national surveys (64). One explanation for the higher prevalence of both household food-related hardship and SSB consumption

for rural adults may be related to the coping strategies food-insecure individuals employ to mitigate the consequences of food-related hardship (65–68) such as consuming inexpensive and inflationary-resistant energy-dense foods (69).

Findings from multiple variable regression models confirmed geographic differences and similarities in the association of demographic characteristics, eating behaviors, and food-related hardship with high levels of SSB consumption. Although poverty-level household income increased the odds for SSB consumption among rural adults and not urban adults, in both geographic groups the presence of a child in the household was associated with a high level of SSB consumption. All three eating behaviors – frequent fast-food meals, infrequent breakfast, and low intakes of fruit and vegetables – were associated with SSB consumption among rural adults, but only infrequent consumption was significant among urban residents. Food-related hardship was associated with SSB consumption among both rural and urban adults; the effect size was greater among the urban sample. Thus, multiple less-healthy eating behaviors have a greater association with SSB consumption among rural adults than among urban adults. Interestingly, two less-healthy eating behaviors were not independently associated with SSB consumption in our urban subsample.

A prior rural study found an increased likelihood of overweight or obesity associated with greater frequency of SSB and fast food (17). Thus, it is critically important to understand individual and household contextual influences on high levels of SSB consumption. Our findings revealed linkages among multiple less-healthy eating behaviors, which enhance results from a similar study of rural adults (25). Adults, especially rural adults who frequently ate fast-food meals, infrequently consumed a breakfast meal, or had fewer daily servings of fruit and vegetables were also more likely to consume high levels of SSB. Just as healthier food patterns are associated with healthier beverage patterns (70), the present study shows that consumption of SSB appears to be closely linked to less-healthy eating patterns (71, 72). As such, SSB consumption may serve as a marker of other less-healthy eating behaviors and overall poor nutrition.

There are several limitations to this study that warrant mention. First, the self-reported measure of SSB consumption may understate actual frequency and amount of SSB consumed on a usual day. Future work will include specific prompts for calorically sweetened beverages to include carbonated and non-carbonated soft drinks, fruit punch, fruit drinks, lemonade, sweetened powder drinks, bottled coffees, and coffees or teas with added sugar (73). Second, data did not provide information on seasonal variation. Third, data were not available on the type and amount of fast-food items consumed or

the source of fast-food meals or SSB. Finally, measures on sedentary behaviors (e.g. television viewing, computer use, video gaming) should be included (74).

Despite these limitations, this study advances our knowledge about less-healthy eating behaviors and household food-related hardship. Results from this study provide impetus for understanding interactions among multiple eating behaviors especially among economically and geographically disadvantaged adults. Considering that Americans are consuming more total calories per day, with much coming from SSB and fast food (75), new strategies are needed for educating consumers not only about how to moderate their SSB intake, but also how to simultaneously disrupt the co-occurrence of undesirable eating behaviors (e.g. fast-food consumption and skipping breakfast) and promote healthful behaviors (e.g. eating a regular breakfast and increasing fruit and vegetable intake). Challenges include the perception and observation that SSB are priced and promoted preferentially with meal deals at fast-food outlets and other venues that market fast-food items (49, 76), and that energy-dense foods are not only least expensive but also most resistant to inflation (69). Given the economic disincentive for consumers to make healthier selections at fast-food restaurants and other venues (49, 76, 77) and the reality of low-cost accessible energy-dense foods, strategies must consider convenience and cost (69) especially for low-income and/or rural families (51).

Statement of authors' contributions to manuscript

J.R.S. designed the research; J.R.S. analyzed the data; J.R.S., C.M.J., and W.R.D. wrote the paper; J.R.S. had primary responsibility for final content. All authors read and approved the final manuscript.

Conflict of interest and funding

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