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Sex, Race, Food Security, and Sugar Consumption Change Efficacy among Low-Income Parents in an Urban Primary Care Setting

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Excess dietary intake of added sugar is linked to a number of adverse health outcomes, with consumption of sugar-sweetened beverages (SSBs) and snacks (SSNs) being a primary source of delivery.[1–6] Studies show that individuals who regularly consume SSBs (one to two servings per day) are at higher risk of developing obesity, cardiovascular diseases, dental caries, Type 2 diabetes[7], and some cancers.[2,8] Recent data from the National Center for Health Statistics (NCHS) indicate that in the United States, approximately, 49% of adults and 63% of youth drink at least one SSB daily, contributing approximately 145 additional calories a day to their diets. Compared to their white and higher income counterparts, African American, Latino and low-income populations have higher consumption of SSBs.[9–11] Additionally, some evidence suggests that SSB consumption may also be increasing more dramatically in racial/ethnic minorities than whites.[12]

Consumption of SSN also can contribute to an increase in added sugar intake and chronic disease risk. Snack foods tend to be energy dense, including items such as sweet bakery goods, candy, and sweets.[13] In the U.S. about 25% of daily energy intake come from snacks.[14] An analysis of disparities in snacking trends in the U.S. from 1977 to 2012 by Dunford and Popkin[15] found that energy intake from snacks for adults has significantly increased over the last 35 years. However, non-Hispanic blacks had a higher intake of calories from snacks than all other racial/ethnic groups and the highest intake of calories from desserts and sweets from 2009–2012. No significant differences were found between income or education groups.

Given the high consumption of SSBs and SSNs and its relationship to health, identifying factors that contribute to these dietary behaviors is important to improving population health in the U.S. overall and reducing racial/ethnic and socioeconomic disparities specifically. One

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factor that may contribute to differences in SSB and SSN intake is food insecurity. Defined by the U.S. Department of Agriculture (USDA) as "a lack of consistent access to enough food for an active, healthy life"[16], food insecurity has an impact on dietary quality and contributes to poor health. Individuals who are considered to be food insecure and who have lower discretionary incomes often face economic challenges in accessing healthy food options. Disparities in food insecurity are similar to those for high SSB and SSN consumption, with African American, Latino, and low-income households being more at risk.[17,18] Although previous studies suggest that food insecurity can negatively impact snacking patterns and SSB intake, few studies have examined the mechanisms underlying these relationships.[19,20] Price and income are important factors in food choice, particularly among low income populations. Furthermore, low-income and racial/ethnic minorities frequently live in communities with high availability of energy dense foods and limited availability of healthy food options.[21] SSBs and SSNs are readily available and economically accessible compared to healthier food options. Consequently, the individuals and families at the highest risk may find it especially difficult to avoid consuming these foods.[22]

Reducing sugar consumption is an important focus of efforts to reduce obesity-related health disparities. Confidence has been shown to be an important component in the effort to make behavioral modifications that improve health outcomes. Self-efficacy has been a central focus in the weight management literature which is founded on the basic premise that individual beliefs about their ability to achieve personal goals choices have implications for behavior change outcomes. Self-efficacy is commonly used in nutrition and physical activity interventions; however, many of these studies have not considered environmental factors influencing self-efficacy. Food insecurity is associated with social, economic, and political disadvantages at the community level in addition to household-level instability associated with the cyclical nature of having enough food at the beginning of the month followed by food insecurity at the end of the month. It has been suggested that social environment has implications for myriad of psychosocial factors including self-efficacy.[23–26] The purpose of this study was to examine relationships between food security and parents' self-efficacy to reduce consumption of sugar-sweetened beverage (SSB) and sugary snack (SSN) in a sample of parents of children between 2 and 18 years of age who were patients at community-based primary care clinics in West Tennessee.

Methods

Participants

Data from this study were drawn from a large surveillance study among low-income patients attending community-based primary care clinics in Memphis, Tennessee in 2006–2007. The study was approved by the ***blinded university*** Institutional Review Board. Eligible participants were parents and children in the clinic waiting room. A research staff member provided additional information about the study to interested adults and children and confirmed eligibility. Eligible children signed assent forms and their parents signed consent forms allowing data to be collected from their children.

Survey Questionnaire

Once informed consent was acquired, participants completed a self-administered survey in the waiting area. The survey was designed to assess the overall health of children in primary care clinics with an emphasis on obesity-related behaviors (i.e., nutrition, physical activity). The survey questionnaire consisted of items designed to collect information about household characteristics including food insecurity as well as to measure self-perceptions of body image, body mass index (BMI), self-reported behavioral patterns, and confidence level regarding making healthy food choices. The food insecurity questions were drawn from the United States Department of Agriculture (USDA) U. S. Household Food Security Survey Module.[27] A substantial number of items on the survey for children were replicated from the Youth Risk Behavior Surveillance System (YRBSS)[28], and many of the items for adults were drawn from the Behavioral Risk Factor Surveillance System (BRFSS) Questionnaire.[29,30] Both the YRBSS and BRFSS, designed by the Centers for Disease Control and Prevention (CDC), monitors modifiable risk and health behaviors or conditions related to the leading causes of death and disability such as cardiovascular disease, cancer, diabetes, and injuries.[28,30]

Study Variables

SSB consumption change efficacy and SSN consumption change efficacy were the outcomes of interest for this study. They were derived from items asking about their confidence to "drink water instead of sweet drinks" to "eat fewer sweet snacks", respectively. The response categories for both items were "not sure," "sort of sure," and "very sure." Each measure was transformed into a dichotomous variable indicating that individuals were "very sure" (coded 1) they could replace sugared beverages with water or eat fewer sugary snacks. The, "not sure" or "sort of sure" responses to both items were coded 0.

Food security status was the primary independent variable of interest. This measure was derived from six items on the U. S. Household Food Security Survey Module.[27,31] Food insecure households were those with individuals had affirmative responses to at least two of the items. Food insecure household were coded 1 and secure households were coded 0. Dietary intake of SSBs and SSNs was derived from items asking about their consumption of SSBs (regular soda, kool-aid, fruit drinks, punch, sports drinks or sweetened tea) or SSNs (cakes, cookies/pies, donuts, and ice cream), respectively. The response categories for each item was "never", "on special occasions", "a little", and "a lot." Each respective item was transformed into a dichotomous variable indicating that individuals consumed the specific sugary beverage or snack "a lot" (coded 1). The SSB consumption score was the sum of the "drink at lot" responses; similarly, the SSN consumption scores was composite of the "eat a lot" responses. The physical activity variable for this analysis was a dichotomous variable indicating whether or not participants met national recommendations for exercise. This variable was derived from responses to three questions asking the number of days over the past week that respondents: participated in: vigorous physical activity for at least 20 minutes; moderate physical activity for 30 minutes; or strength training. "The responses to each of these questions ranged from "0 days" (coded 1) to "7 days" (coded 8). According to the *Physical Activity Guidelines for Americans,*[32] adults should engage in at least 150 minutes of moderate intensity, 75 minutes of vigorous intensity physical activity or an

equivalent combination of the two types of aerobic exercise weekly. The guidelines also stated that physical activity should be bolstered with muscle-strengthening activity or at least moderate intensity for at least 2 days per week. Respondents who engaged in 20 minutes of vigorous activity for at least 4 days per week or 30 minutes of moderate intensity exercise for at least 5 days per week and had two or more days of strength training on a weekly basis were coded as 1, all others were coded 0.

Other covariates were demographic measures including age, sex, and self-reported race. Age was derived from an item in which participants chose one of eight possible categories containing their age. The age measure was a dichotomous variable indicating whether respondents were older than 35 years of age (coded 1). Sex was a dichotomous variable in which males were coded 0 and females were coded 1. Race was derived from an item asking respondents to identify themselves as white/Caucasian, black/African American, Hispanic, Asian/Pacific Islander, or other. Because the number of Hispanic, Asian/Pacific Islander and Other respondents were small, these respondents were collapsed in to the Other categories. The race variable in the analysis was a three-category variable in which Whites were coded 0, African Americans were coded 1, and participants in the Other category were coded 2.

Analytic Strategy

Study population characteristics were described overall by race, sex, and food security using mean and standard deviation for continuous variables and proportions for categorical variables. Student's t-tests and Chi-square tests were used in analyses assessing how groups (i. e., sex, race, food security) varied across key indicators. Logistic regression models were specified to examine the association between sex, race, food security, and the outcome variables. All statistical analyses were conducted with StataSE Version 14.

Results

The distribution of sample characteristics for the 444 low income parents by sex, race, and household food security is displayed in Table 1. The sample is primarily comprised of African Americans (76.6%) and female (87.3%) parents. Approximately two-thirds of the sample responded that they were very sure that could replace SSB with water and slightly of half of respondents (52.5%) reported that they could eat fewer sweets. The mean SSB consumption score for sample members was 1.9 (SD=1.7) and the average SSN consumption score was 2.8 (SD=1.2) indicating that participants reported consuming "a lot" of 2 sugary beverages and 3 sugary snacks on average. Roughly four out of every 10 sample members experienced food insecurity and 18.9% of study participants reported experiencing very low food security. A majority of the study sample (61.3%) met the physical activity guidelines.

When comparing the characteristics by sex, a larger proportion of males (75.0%) reported meeting national physical activity guidelines than females (59.3%) in the study. Males and females were similar across the remaining variables. As it relates to race differences across the sample characteristics, the proportion of White respondents over 35 years of age (40.6%) was significantly different from the proportions of respondents in the Black (21.1%) or Other (20.7%) categories. White participants were also the group with the largest proportion

of individuals (84.4%) who were very sure they could eat fewer sweets relative to the respondents who reported their race as Black (47.7%) or Other (63.8 Black participants, on average, consumed more sugar than the other racial groups as they had the highest mean levels of SSB and SSN intake.

Examining food secure status across the characteristics, those individuals who experienced food insecurity had higher average SSB consumption scores (2.1±1.7) than food secure sample members (1.8±1.6). Respondents who reported being food secure were found to be similar to those who reported being food insecure across the remaining characteristics.

Results from regression models estimated to examine factors associated with confidence to replace SSB with water consumption change efficacy for the total sample and by household food security are presented in Table 2. The results in the pooled model indicated that the consumption of sugary snacks can have implications for confidence in substituting SSBs with water. As the mean number of SSNs consumed increased by 1, the odds of individuals being confident they could replace SSB with water decreased by 22 percent. This inverse relationship varied by food security as SSN consumption was not significant in the food security model while the results in food insecure model indicated that SSN consumption was associated with decreased confidence in their ability to substitute SSBs with water (OR=0.68, CI=0.51–0.92). It was also noteworthy that sex differences were only significant in the food insecure model. Female parents who were food insecure were considerably more confident in their ability to substitute SSBs with water than food insecure male parents. The likelihood of food insecure mothers being very sure they could replace SSBs with water were nearly three times greater (OR= 2.78, CI=1.04–7.37) than food insecure fathers in the sample.

Regression models examining factors associated with confidence to reduce SSN consumption for the total sample and by household food security are presented in Table 3. Results in the pool model indicated that race, SSN, and physical activity were associated with confidence to reduce SSN consumption. The pooled model presented results indicating that the odds that Black parents in the study were significantly less confident in their ability to reduce sugar consumption than their White peers (OR=0.21, CI=0.08–0.57). SSN consumption had an inverse relationship with SSN change efficacy as results indicated that participants were 29% less confident in their ability to eat fewer sugary snacks with every 1 unit increase in SSN consumption score. Physical activity had an opposite relationship with SSN consumption change efficacy. Parents in the study who met national physical activity guidelines were 49% percent more confident they could eat fewer sugary snacks than their peers who were less physically active.

Table 3 also provided evidence that factors associated with SSN consumption change efficacy can vary by household food security. Findings presented in the in the food secure model are similar to the results in the pooled model. Race continues to be significant as food secure Black parents have odds of being confident in SSN reduction that are 81% lower than the corresponding odds for White food secure parent in the study. The relationship between SSN consumption and confidence to eat fewer snacks was also similar to the pooled model as every single point increase in the SSN consumption score was associated with a

corresponding 31% decrease in the odds of food secure parents being more confident they could eat fewer sugar-sweetened snacks. The food insecure model was the least robust model as only SSN consumption was found to be inversely associated with confidence to eat fewer sugary snacks (OR=0.71, CI=0.54–0.95).

Discussion

Excess sugar intake has been linked to multiple cardiometabolic conditions including obesity, diabetes, hypertension, chronic kidney disease, and cardiovascular disease.[8] In this study using data drawn from a racially-diverse sample of low-income parents attending community-based primary care clinics in the Memphis, Tennessee area, we examined race, sex, and food security and their respective relationships with SSB and SSN behavioral modification efficacy.

The descriptive results indicate that race and food insecurity might be important factors for sugar consumption. African American parents have highest mean SSB and SSN scores and have the smallest proportion of individuals very sure they could eat fewer sugary snacks. These findings are consistent with results from recent studies indicating that African Americans have significantly higher levels of sugar consumption than Whites the same age[33] and lower levels of sugar intake behavioral change efficacy[24,25]. The descriptive findings are also noteworthy because they indicate that food secure and insecure parents in the study are remarkably similar. The one exception is sugary beverage consumption as food insecure parents have higher mean levels of SSB consumption than their food secure peers. Sugary beverages and snacks are often widely available in low resource communities; however, the respective SSB and SSN consumption level differences between food secure and insecure parents are notable. Additional research is needed to understand how food security can have implications for food consumption within low-resource environments with limited access to healthy foods and suitable drinking water.

The results from this study are significant because they highlight a need for precision when considering population characteristics such as poverty or health behaviors like sugar consumption. There is considerable heterogeneity among individuals with income at or below the poverty level and our study demonstrate that food security is a significant issue for some but not all low-income households. Our study underscores to the need for nuanced analysis as the results from the pooled regression models differ from those stratified by food security status. Sex or race differences were not present in the pooled models exploring the association of confidence to reduce SSB and SSN consumption respectively. Yet, female parents reporting food insecurity were much more confident in their ability to replace sugary drinks with water than male parents experiencing food insecurity. Further, African American parents in the sample who were food secure were much less likely to report confidence in their ability to reduce their consumption of sugary snacks than their White peers who were also food secure. Additional research is needed to gain a deeper understanding of how social determinants like race or gender interact with social class to have implications for health behavior change efficacy.

It is also important to note the significance of SSN consumption in our study. This is significant because sugary beverages and snacks are often widely available in low-income communities; yet, only SSN was found to be associated with lower confidence among participants to reduce both forms of sugar consumption. Self-efficacy is thought to be an important factor for behavioral change and has been included in a significant number of behavioral interventions.[24,25,35] But, our study presents findings indicative of a reciprocal relationship between self-efficacy and behavior. The pursuit of research questions exploring how behaviors such as SSN consumption lower confidence among African Americans, males, and individuals experiencing food insecurity to make behavioral change presents interesting avenues for future research.

The results from our study underscore the need for additional studies examining self-efficacy and behavioral modification among populations most at risk for obesity and other adverse health outcomes. There are some limitations worth noting. Our sample size was small and the number of independent variables included in regression analysis was limited. Further, a number of potential important variables known to have implications for diet modification (i.e., motivation, nutrition knowledge)[36–39] were not available to be included in the analysis. Both of these factors could potentially effect the robustness of results. The analytic models were estimated using data drawn from a sample of participants attending a community-based clinic in the South; therefore, the results are not generalizable to individuals who are not patients at community-based clinics or live in other regions of the country. The age of the data is also potential limitation because the number and type of sugary beverages and snacks available for consumption have changed considerably over the past decade. It is also important to note that the models in this study were estimated using cross-sectional data, which does not allow for the specification of temporal events or determination of causal inferences. Finally, these data are based on self-report. all of the usual limitations associated with self-report data apply.[40] Despite these limitations, no studies to our knowledge have examined the degree to which socioeconomic factors like food insecurity impact individuals' confidence in their ability to make healthy dietary choices.

CONCLUSION

Self-efficacy is an important factor for behavior change and our study highlights the need for additional research examining the degree to which social, psychological, and behavioral factors have implications for behavior change self-efficacy. It is also important to consider how these relationships vary across important social determinants including race, gender, food security, and other socioeconomic factors. Research extending from our analysis could open avenues for studies with findings that could enhance health promotion efforts and lead to tailored interventions designed to bolster confidence of participants to make desired lifestyle modifications to improve health outcomes and reduce health disparities.

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Table 1

Distribution of Sample Characteristics of Low Income Parents for the Total Sample by Sex, Race, and Household Food Security

Characteristics	Overall Sample (N=444)	Sex			Race				Household Food Security		
		Male (N=56)	Female (N=388)	*p*	White (N=32)	Black (N=354)	Other (N=58)	*p*	Secure (N=264)	Insecure (N=180)	*p*
Female (%)	87.3	--	--	--	90.6	88.4	79.3	.13	87.1	87.8	.840
Race (%)				.130	--	--	--	--			.620
White	7.2	5.4	7.5		--	--	--	--	8.0	6.1	
African American	79.7	73.2	80.7		--	--	--	--	79.9	79.4	
Other	13.1	21.4	11.9		--	--	--	--	12.1	14.4	
Age over 35(%)	22.5	32.1	21.1	.070	**40.6**	**21.2**	**20.7**	**.040**	21.6	23.9	.570
Household Food Insecurity (%)	40.5	39.3	40.7	.840	34.4	40.4	44.8	.620	--	--	
Household Food Insecurity & Hunger (%)	18.9	16.1	19.3	.560	9.4	20.1	17.2	.320	--	--	
Very sure they could replace SSBs with water (%)	67.6	66.1	67.8	.800	81.3	66.7	65.5	.230	68.6	66.1	.590
Very sure they could eat fewer sweets (%)	52.5	48.2	53.1	.490	**84.4**	**47.7**	**63.8**	**.001**	51.4	54.4	.490
SSB consumption score, (mean ± sd)	1.9±1.7	1.9±1.7	1.9±1.7	.820	**1.3±1.3**	**2.0±1.7**	**1.5±1.5**	**.010**	**1.8±1.6**	**2.1±1.7**	**.030**
SSN consumption score, (mean ± sd)	2.8±1.2	2.9±1.1	2.7±1.2	.230	**2.3±1.6**	**2.9±1.1**	**2.3±1.3**	**.001**	2.8±1.1	2.7±1.3	.090
Meet physical activity guidelines (%)	61.3	**75.0**	**59.3**	**.020**	78.1	59.0	65.5	.080	60.6	62.2	.730

Table 2

Association of Confidence to Reduce Sugar-sweetened Beverage Consumption among Low Income Parents for Pooled Sample and by Household Food Security

Variable	Pooled Model OR (95% CI)	Food Secure OR (95% CI)	Food Insecure OR (95% CI)
Female	1.09 (0.59–2.02)	0.55 (0.23–1.36)	**2.78 (1.04–7.37)**
Race *			
African American	0.61 (0.24–1.56)	0.43 (0.12–1.57)	1.09 (0.25–4.76)
Other	0.49 (0.17–1.43)	0.37 (0.09–1.61)	0.91 (0.17–4.97)
Age over 35 years	1.50 (0.90–2.52)	1.88 (0.90–3.93)	1.12 (0.52–2.44)
Food Insecurity	0.88 (0.58–1.33)	--	--
SSB Consumption Score	0.92 (0.82–1.04)	0.89 (0.76–1.05)	0.99 (0.82–1.20)
SSN Consumption Score	**0.78 (0.65–0.94)**	0.89 (0.69–1.14)	**0.68 (0.51–0.92)**
Meets Physical Activity Guidelines	1.30 (0.85–1.97)	1.04 (0.60–1.82)	1.75 (0.89–3.43)

Note: CI, confidence interval; OR, odds ratio

*The reference category contains White parents

Table 3

Association of Confidence to Reduce Sugary Snack Consumption among Low Income Parents for Pooled Sample and by Household Food Security

Variable	Pooled Model OR (95% CI)	Food Secure OR (95% CI)	Food Insecure OR (95% CI)
Female	1.31 (0.73–2.39)	1.01 (0.47–2.19)	2.20 (0.81–5.98)
Race *			
African American	**0.21 (0.08–0.57)**	**0.19 (0.05–0.69)**	0.28 (0.06–1.42)
Other	0.34 (0.11–1.07)	0.25 (0.06–1.06)	0.76 (0.12–4.83)
Age over 35 years	1.42 (0.88–2.31)	1.41 (0.74–2.68)	1.34 (0.64–2.82)
Food Insecurity	1.09 (0.73–1.64)	--	--
SSB Consumption Score	0.98 (0.87–1.11)	0.94 (0.80–1.10)	1.04 (0.86–1.25)
SSN Consumption Score	**0.71 (0.59–0.84)**	**0.69 (0.54–0.88)**	**0.71 (0.54–0.94)**
Meets Physical Activity Guidelines	**1.49 (1.00–2.24)**	1.63 (0.96–2.78)	1.34 (0.70–2.56)

Note: CI, confidence interval; OR, odds ratio

*The reference category contains White parents.