


Summer 8-2019

THE IMPACT OF FOOD SECURITY STATUS ON THE FOOD SHOPPING BEHAVIOR AND PATTERNS OF 2018 BRIGHTER BITES PARTICIPANTS AT BASELINE

SARAH A. CRULCICH
UTHealth School of Public Health

Follow this and additional works at: https://digitalcommons.library.tmc.edu/uthsph_dissertsopen

 Part of the [Community Psychology Commons](#), [Health Psychology Commons](#), and the [Public Health Commons](#)

Recommended Citation

CRULCICH, SARAH A., "THE IMPACT OF FOOD SECURITY STATUS ON THE FOOD SHOPPING BEHAVIOR AND PATTERNS OF 2018 BRIGHTER BITES PARTICIPANTS AT BASELINE" (2019). *UT School of Public Health Dissertations (Open Access)*. 94.

https://digitalcommons.library.tmc.edu/uthsph_dissertsopen/94

This is brought to you for free and open access by the School of Public Health at DigitalCommons@TMC. It has been accepted for inclusion in UT School of Public Health Dissertations (Open Access) by an authorized administrator of DigitalCommons@TMC. For more information, please contact nha.huynh@library.tmc.edu.

THE IMPACT OF FOOD SECURITY STATUS ON THE FOOD SHOPPING BEHAVIOR
AND PATTERNS OF 2018 BRIGHTER BITES

PARTICIPANTS AT BASELINE

by

SARAH A. CRULCICH, BS

APPROVED:

LAURA MOORE, MEd, RD, LD

SHREELA SHARMA, PHD, RD, LD

CHRISTINE MARKHAM, PHD

Copyright
by
Sarah A. Crulcich, MPH, BS
2019

THE IMPACT OF FOOD SECURITY STATUS ON THE FOOD SHOPPING BEHAVIOR
AND PATTERNS OF 2018 BRIGHTER BITES
PARTICIPANTS AT BASELINE

by

SARAH A. CRULCICH
BS, PURDUE UNIVERSITY, 2017
BS, PURDUE UNIVERSITY, 2011

Presented to the Faculty of The University of Texas

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF PUBLIC HEALTH

THE UNIVERSITY OF TEXAS
SCHOOL OF PUBLIC HEALTH
Houston, Texas
August 2019

ACKNOWLEDGEMENTS

Thank you to the entire Brighter Bites team for your innovative efforts to fight both food insecurity and childhood obesity. A special thank you to the Houston Brighter Bites team and my thesis committee. You have all been extremely patient and have helped me grow so much in this process.

THE IMPACT OF FOOD SECURITY STATUS ON THE FOOD SHOPPING BEHAVIOR
AND PATTERNS OF 2018 BRIGHTER BITES

PARTICIPANTS AT BASELINE

Sarah A. Crulcich, MPH, BS
The University of Texas
School of Public Health, 2019

CE/Thesis Chair: Shreela Sharma, PhD, RD, LD

Households with children continue to have a greater prevalence of food insecurity compared to the national average. While the national food security rates have improved in recent years, it remains stagnant among children. The purpose of this study was to conduct a cross-sectional regression analysis on food shopping patterns and behavior among Brighter Bites participants stratified by food security status to offer more insight into how these households obtain fresh produce. We used baseline survey data from Brighter Bites participants completed during fall 2018. The results indicate that food insecure Brighter Bites households shop more frequently for produce at locations such as large chain grocery stores, warehouse stores, and food banks/pantries compared to food secure households in the study. Both food secure and food insecure households reported primarily shopping at large chain grocery stores for fruits and vegetables. The findings open up promising approaches to consider the role of Brighter Bites education in aiding healthful shopping behaviors.

TABLE OF CONTENTS

List of Tables	i
Background.....	1
Literature Review.....	1
Brighter Bites	6
Public Health Significance.....	7
Hypothesis, Research Question, Specific Aims or Objectives	8
Human Subjects, Animal Subjects, or Safety Considerations	8
Journal Article.....	9
The Impact of Food Security Status on Food Shopping Patterns and Behavior among Brighter Bites Participants	9
Target Journal: American Journal of Preventative Medicine	9
Journal References	29
Appendices.....	33
Proposal References.....	47

LIST OF TABLES

Table 1. Characteristics of Brighter Bites Households for the Total Sample and By Food Security Status	18
Table 2. Reported Fruit and Vegetable Shopping Patterns and Behavior	22
Table 3. Reported Fruit and Vegetable Shopping Patterns and Behavior by mRFEI.....	23
Table A. Number of schools enrolled in Brighter Bites for fall 2018	33
Table B. Food Shopping Store Responses	34
Table C. Food Security Responses	35
Table D. Houston Food Shopping Patterns and Behavior (n=2,806)	37
Table E. Austin Food Shopping Patterns and Behavior (n=605)	39
Table E. Dallas Food Shopping Patterns and Behavior (n=1,115).....	41
Table F. Southwest Florida Food Shopping Patterns and Behavior (n=188)	43
Table G. Washington, D.C. Food Shopping Patterns and Behavior (n=185).....	45

LIST OF APPENDICES

Appendix A: Brighter Bites School Participation Numbers by Region33
Appendix B: Brighter Bites Parent Pre-Survey Questions and Response Options34
Appendix C: Brighter Bites Food Shopping Patterns and Behavior Results by City36

BACKGROUND

Literature Review

Food shopping behavior and patterns

Recent research on food shopping patterns often includes a geo-ethnographic and spatial analysis to better assess how far different populations travel to shop. While the United States Department of Agriculture (USDA) defines low food access as living more than one mile from a supermarket,¹ research shows living near a supermarket does not predict increased store visits or alter dietary intake.^{2,3} In fact, there is evidence to support some urban residents bypass the nearest food stores and frequent multiple others farther away from home.^{4,5} According to a small study conducted among 35 non-Hispanic (NH) Black mothers of varying incomes, educational levels, and body-mass-index status, what may influence where certain groups shop for groceries is the convenience or geographical proximity of a food store to home or another routine destination.⁶ In a qualitative study using focus groups, participants from low-income and diverse communities identified the top factors that influence access to healthful foods. The most common factors reported were the cost of healthful foods and lack of geographic access to supermarkets. Poor quality of accessible healthful foods and overall poor quality of nearby stores were also discussed. To improve geographic access to healthful foods, participants preferred a supermarket nearby over smaller food stores.⁷ Better access to food stores may not be as effective as focusing on the type of food store.

To further understand whether physical proximity is a strong predictor of food access, the Seattle Obesity Study researched supermarket choice as a predictor of food access and

fruit and vegetable (F&V) consumption. Only ~33% of participants purchased their primary foods at the nearest supermarket. Shoppers who frequented low-cost supermarkets (~30% of sample) were not likely to utilize the supermarket closest to their place of residence but were likely to travel farther away for food items. Among shoppers who frequented high-cost supermarkets (~12% of the sample), F&V consumption was slightly higher when compared to the low-cost supermarket shoppers.³

Another aspect of describing food shopping patterns is related to the type of store. Stern et al. (2016) categorized stores into seven domains: 1) warehouse club, 2) mass merchandiser and supercenters, 3) grocery chains, 4) non-chain grocery stores, 5) convenience, drug or dollar stores, 6) ethnical and specialty stores, and 7) other stores, such as department stores.⁸ These researchers analyzed data from the National Consumer Panel and found no significant association between food shopping patterns and income. While the nutrient profile of processed food packages was found to be similar across racial-ethnic groups, NH Blacks purchased foods and sugar-sweetened beverages with higher energy, more total sugar, and higher sodium densities compared to Hispanic and NH White households. However, they did not differ when compared by food groups. The authors suggest that different racial-ethnic groups may purchase similar food items with slightly different nutrients, such as canned beans versus low-sodium canned beans. Note that the National Consumer Panel sample primarily consisted of NH White, highly educated, and above-U.S.-average-income households.⁸ There is a lack of data on the low-income population.

Food insecurity trends

Other variables to consider when assessing food shopping patterns and behavior are food access and the food security status of a population. Food security is the state of having enough food for an active and healthy life, while food insecurity is the lack of access to foods or a disruption of eating patterns to live an active and healthy life.⁹ Food insecurity may be a temporary or chronic experience for U.S. households.^{9,10} Research from 2017 found that 11.8% of U.S. households experienced food insecurity, compared to 14.9% in 2011.¹¹ Food insecure (FI) children were identified in 7.7% or 2.9 million households, which is similar to the 8% reported in 2016. A greater disparity existed among particular populations including households with incomes near or below the Federal poverty line (30.8% FI), NH Black- and Hispanic-headed households (13.4% and 18% FI respectively), and households with children and/or households led by a single parent.¹¹ Exploring the shopping patterns of low-income and FI households may offer insight into the essentially unchanged proportion of FI children.

Food shopping behavior and patterns among food desert residents

In a sample of 100 women in rural and urban North Carolina food deserts, the closest supermarkets to the participants ranged from 1.1 – 2.7 miles. All participants completed the majority of their food shopping at large supermarkets which bypassed small grocery stores, corner stores, and convenience shops closer to their place of residence. Among this sample, price was the main contributor to store choice. It was not uncommon to compare prices of the same product between several different stores even if that meant traveling to multiple stores to complete their shopping for both urban and rural women.¹² These findings challenge the notion that food access can be defined by proximity.

Another study assessed the shopping patterns of two predominantly NH Black neighborhoods with low access to healthful foods. The majority of participants were overweight or obese (78.8%) and female (77.8%). Food receipts revealed that full-service supermarkets were shopped at most frequently, and convenience stores were shopped at second most frequently. Approximately 38% of household food expenditures were attributed to high protein foods, and 22.5% were attributed to energy dense empty calorie foods, such as sweets. Sugar-sweetened beverages accounted for 40.2% of household beverage expenditures.¹³ These results support those of Stern et al.⁸ Less healthful diets more common among racial-ethnic minorities may be a result of inaccessible stores with affordable healthful foods.¹⁴ In fact, poor access to stores with healthful foods was one of the main barriers to healthy dietary behavior found by Evans et al.⁷ In some situations when participants from low-income households and high-income households shop in the same store, participants from low-income households purchase less healthful foods.¹⁵ This leads some researchers to believe the interaction of food availability and marketing inside the store have a greater impact on food purchases than food availability alone.^{16,17} These findings support the notion that efforts may need to shift from type of grocery store to type of advertisements found in grocery stores to address disparities in racial/ethnic food choices.

Food shopping behavior and patterns of food insecure households

To our knowledge, there are few published studies examining the food shopping behavior of low-income populations by food security status. Of these, two were conducted in the U.S.^{18,19} and one was conducted in Canada.²⁰

In a natural experiment, researchers evaluated the effect of an independent grocery store, which was introduced in Flint, Michigan. Thirty-four percent of participants identified as food insecure (FI), and the majority of all participants had an annual income of less than \$20,000. FI participants reported living closer to a grocery store compared to food secure (FS) participants, which the authors suggest may be a coping mechanism by increasing their food access. Participants closest to the new grocery store were significantly more likely to eat out and purchase unhealthy prepared meals from stores when compared from 2009 to 2011. The study did not find any significant relationship between F&V consumption and distance to a grocery store.¹⁸

Ma, et al. explored food security status in relation to food shopping behavior in low-income neighborhoods in South Carolina. The lower the food security status, the more likely the participants were to shop at a convenience or dollar store frequently compared to food FS participants. However, regardless of food security status, most participants shopped at a supermarket or supercenter (80%, 92% respectively) despite the geographic areas being labeled as food deserts. Overall, those with very low food security were the most likely to shop in stores with the least healthful options.¹⁹

As racial/ethnic minority populations in the U.S. continue to grow, it is important for healthcare providers to consider where their patients' foods are being purchased. In addition, policy makers and researchers need to be aware of where FI residents shop so nutrition assistance programs can be more effective. There is a lack of empirical evidence and, therefore, a lack of data regarding where people shop and what is purchased, especially

among racial/ethnic minorities who are more likely to be low-income compared to NH Whites.⁸

Brighter Bites

This study is made possible through the partnership between Brighter Bites (BB) and The University of Texas Health Science Center at Houston (UTHealth), School of Public Health. BB is a 501c3 non-profit, evidence-based, and effective food co-op program implemented in select public and charter schools in racially/ethnically diverse, low-income neighborhoods. The program runs for 16 weeks during the school year, eight weeks in the fall semester and eight weeks in the spring semester. A parent or family member from each family enrolled is actively engaged in the program by assisting with produce distribution at the schools. There are three main components to BB: 1) weekly distribution of approximately 30 pounds or 50-60 servings of fresh produce donated from a local food bank, 2) weekly recipe tastings available when produce is picked up which features produce items in the bags, and 3) health education in the school utilizing the Coordinated Approach to Child Health (CATCH) curriculum.²¹ CATCH is evidence-based, validated, and implemented in schools throughout the nation.²² BB is grounded in Social Cognitive Theory and The Theory of Planned Behavior. Families who participated in BB in the fall 2018 school year will serve as the analytic sample for this analysis. All study documents were provided in English and Spanish. Documents in Arabic were produced for select families.

Public Health Significance

Given that food insecurity has declined as a whole in recent years, it is concerning that food insecurity among children remains stagnant. Childhood is a crucial time for cognitive and physical development. A recent review summarized that FI children were at 2-3 times the risk for anemia as well as an increased risk for cognitive issues, aggression, and anxiety compared to FS children.²³ It is also known that FI children consume fewer fruits than FS children and may suffer from inadequate fiber intake and other micronutrients. Meanwhile, FI adults consume fewer servings of F&V and dairy, and they have lower intakes of vitamin A, vitamin B6, calcium, magnesium, and zinc compared to FS adults.²⁴

Food insecurity may also coexist with obesity in the same individual. There are hypothesized mechanisms that may explain the paradox, including household dependence on affordable energy-dense foods and household experiences of cyclic food consumption from sporadic availability.²⁵ If this is true, then FI may contribute to the 17.3% of obese 2-19 year olds from 2011-2012 National Health and Nutrition Examination Survey data.²⁶ Childhood obesity is also associated with cardiac abnormalities in youth as well as an increased risk for hypertension, dyslipidemia, cardiovascular disease, and type 2 diabetes if children remain obese into adulthood.^{11,27,28}

In a national survey, 58% of FI households had or were currently participating in the Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and/or the National School Lunch Program (NSLP).¹¹ Government nutrition assistance programs may provide critical support to FI children. Therefore, it is essential that research is conducted to better understand where

low-income and FI households purchase their groceries so that SNAP- and WIC-approved foods are readily available at these locations.

Hypothesis, Research Question, Specific Aims or Objectives

The aim of this study is to:

1. Describe the food shopping patterns for F&V of BB participants, including type of food store, specific examples of stores, and frequency.
2. To analyze the relationship between household food security status and food shopping patterns among BB participants. We will investigate whether food security status (exposure) is associated with where people shop and how often they shop (outcome). We hypothesize that low-income FI BB households will primarily shop at supercenters for groceries and shop less frequently for groceries overall compared to their FS counterparts.

Human Subjects, Animal Subjects, or Safety Considerations

This study was approved by the Institutional Review Board of the University Health Science Center School of Public Health at Houston: HSC-SPH-23-0480, reference number 117118.

JOURNAL ARTICLE

**The Impact of Food Security Status on Food Shopping Patterns and Behavior among
Brighter Bites Participants**

Target Journal: American Journal of Preventative Medicine

Introduction

Lack of access to nutritious foods creates a cycle of inescapable stress and hardship on families including poor coping strategies, chronic disease, subsequent health care expenditures, and spending tradeoffs.¹ There are 6.5 million children in food insecure (FI) households across the country.² The U.S. Department of Agriculture (USDA) defines food insecurity as either low food security, “reports of reduced quality, variety, or desirability of diet with little or no indication of reduced food intake” or very low food security, “reports of multiple indications of disrupted eating patterns and reduced food intake”.³

A report by the Economic Research Service showed a significant decrease in FI households nationwide from 12.3% to 11.8%. However, 15.7% of households with children under 18 years of age are FI. Furthermore, FI children were identified in 7.7% or 2.9 million households across the country in 2017 opposed to 8% in 2016.³ Given that food insecurity has declined as a whole in recent years, it is concerning that food insecurity among children remains high. Single mothers with children, households with an income-to-poverty ratio under 1.85, and households headed by a non-Hispanic Black parent are at greatest risk.³

Childhood is a crucial time for cognitive and physical development. A recent review summarized that FI children were at 2-3 times the risk for anemia as well as an increased risk for cognitive issues, aggression, and anxiety compared to food secure (FS) children.⁴ Food insecure children also consume fewer fruits than FS children and may suffer from inadequate fiber intake and other micronutrients. Meanwhile, FI adults consume fewer servings of fruits,

vegetables, and dairy. They may also have lower intakes of vitamin A, vitamin B6, calcium, magnesium, and zinc compared to FS adults.⁵

Food insecurity can coexist with obesity in the same individual. There are hypothesized mechanisms that may explain the paradox, including household dependence on affordable energy-dense foods and household experiences of cyclic food consumption from sporadic availability.⁶ If this is true, then FI may contribute to the 17.3% of obese 2-19 year olds from 2011-2012 National Health and Nutrition Examination Survey data.⁷ Childhood obesity is also associated with cardiac abnormalities in youth as well as an increased risk for hypertension, dyslipidemia, cardiovascular disease, and type 2 diabetes if children remain obese into adulthood.^{8,9} In general, food insecurity is correlated with a higher prevalence diabetes in adulthood and poorer management of the condition.¹⁰⁻¹²

While the USDA defines low food access as living more than one mile from a supermarket,¹³ research shows living near a supermarket does not predict increased store visits or alter dietary intake.^{14,15} In fact, there is evidence to support some urban residents bypass the nearest food stores and frequent multiple others farther away from home.^{16,17} The Seattle Obesity Study researched supermarket choice as a predictor of food access and fruit and vegetable consumption. Approximately 33% of participants purchased their primary fresh produce at the nearest supermarket. Shoppers who frequented low-cost supermarkets, ~30% of the sample, were not likely to shop at supermarkets closest to their place of residence but were likely to travel farther away.¹⁵

Nutrition interventions and anti-hunger efforts should consider the food shopping patterns and behavior of growing racial/ethnic minority populations¹⁸ as they are disproportionately more likely to be FI compared to non-Hispanic Whites.³ Studying the location and frequency of where FI families shop for groceries can enhance the initiatives of policy makers and researchers. This information may be beneficial when proposing the types of foods eligible for nutrition assistance programs, location availability, and even the implementation of federal child nutrition programs.

To our knowledge, there are few published studies examining the food shopping behavior of low-income populations by food security status. Therefore, it is not well known whether the low-income FS population shops differently from the low-income FI population. Exploring the fresh produce shopping patterns and behavior of low-income and FI households may offer insight into the essentially unchanged proportion of FI children. The purpose of this study is to investigate and describe the fruit and vegetable shopping patterns and behavior of an all low-income sample stratified by food security status who participated in the Brighter Bites (BB) program.

Methods

Study Design

This was a secondary analysis of cross-sectional data collected as part of the BB evaluation study in the 2018-2019 school year. Brighter Bites is a non-profit program that delivers fresh produce to schools throughout the school year while also providing health education, food samples, and recipes for families. A comprehensive explanation of the BB program can be found in previously published literature.¹⁹

Study Population

Brighter Bites, an evidenced-based and non-profit organization, is implemented at participating public and charter elementary schools and Head Start programs where at least 75% of students are eligible for free- or reduced-lunch, a proxy indicator for household income. Each school needs a minimum of 150 students enrolled as well as the ability and commitment to implement the Coordinated Approach to Child Health (CATCH) curriculum in classrooms. Most schools reside in urbanized regions, and there is at least one farming community. Communities are typically low-income and considered food deserts, which lack healthful food options. Participants are recruited in parent-child dyads in which the parent includes primary caregivers. Surveys were collected from 83 schools located in Houston, Dallas, Austin, Washington, D.C., and Southwest Florida in the fall semester of 2018 by The University of Texas Health Science Center (UTHealth), School of Public Health at Houston. A breakdown of schools by region can be found in Appendix A.

This study was approved by the Institutional Review Board of the University Health Science Center School of Public Health at Houston: HSC-SPH-23-0480, reference number 117118.

Data Collection

Data for this study was made available in partnership with UTHealth at Houston School of Public Health and BB. The BB program collects all process evaluation data while UTHealth monitors program dosage, reach, fidelity, and acceptability from families enrolled in the program. There are two surveys completed by parents twice each year that report on acceptability, usage, and perceived effectiveness of each BB program component.

All pre-surveys completed by a parent were available in printed and digital form, in English, Spanish, and Arabic. In week 1 of fall 2018 produce distribution, parents who enrolled in the program were sent a digital link to the parent pre-survey by e-mail and by text message the day after produce distribution. A second digital message was sent to non-responders the morning of week 2 produce distribution. If <50% of a school's cohort completed the digital survey, then a paper version was issued to parents at the time of the produce pick-up. The survey was optional, and was only offered to parents who had not completed one previously for fall 2018. Survey completion was monitored and led by the BB program coordinator for each district in which the program was implemented. The parent pre-survey with baseline characteristics was administered until 50% of each school's BB cohort completed the survey. Parent pre-surveys were collected from all enrolled schools, and approximately three-fourths of all surveys collected were digital.

Paper surveys were entered in Qualtrics by trained UTHealth staff and interns. Each survey is entered a second time by an experienced staff member for quality control. Due to time constraints, 6,527 digital surveys (approximately 73% of all surveys) from fall 2018 were included in this analysis.

Measures

Sociodemographic variables considered in the analysis include child gender, respondents' relationship to child, both parent and child race/ethnicity, parent employment status, parent education level, and government assistance program enrollment. Program options included the Special Supplemental Nutrition Program for Women, Infants, and Children, Supplemental Nutrition Assistance Program (SNAP), Double Dollars, Medicaid, Medicare, National School Lunch and/or Breakfast Programs, and Children's Health Insurance Program.

Food security status was collected using the parent pre-survey and was self-reported by the parent or another adult in the family. Household status was assessed using the validated Hunger Vital Sign™ screening questionnaire developed and validated by Hager et al.²⁰ Participants were asked to respond to the following two statements: "You worried whether your food would run out before you got money to buy more." and "The food you bought just didn't last and you didn't have money to get more." If the participant responded "often true"

or “sometimes true” to either of the two questions, then the household was considered FI. If a participant answered “never true” to both questions, then the household was considered FS.

Food shopping patterns and behavior were collected using the parent pre-survey and were self-reported by the parent or another adult in the family. This section of the survey was adapted from the National Cancer Institute’s 2007 Food Attitudes and Behavior (FAB) Survey.²¹ Brighter Bites participants reported on the frequency and type of store their household shopped at for fruits and vegetables. Types of stores include large chain grocery stores, natural or organic supermarkets, warehouse club stores, discount superstores, small local stores, convenience stores, ethnic markets, farmer’s markets, food banks, and personal gardens. At least one example of each type of store was provided on the pre-survey except for farmer’s markets, food banks, and gardens. See Appendix B, Tables B and C for questions and response options to food security status and food shopping patterns and behavior.

Data Analysis

All analyses were performed using STATA 15. Significance is denoted by $p < 0.05$ and a 95% confidence interval (CI). Descriptive data were analyzed from parent pre-survey data using means and standard deviations (SD). Differences between descriptive variables of FS and FI groups were tested using Pearson’s Chi-square test. Continuous variables were assessed using a t-test. All confounding variables including child’s age, number of children in household, SNAP participation, free- and reduced-meal participation, race/ethnicity of child,

and city were adjusted for in the analysis. For associations between the exposure (food security status) and the outcomes (food shopping frequency and type of store), a linear regression analysis was performed.

An adjustment for different cities as covariates in the exposure-outcome analysis and stratification by city was performed to account for different types of stores. A regression was not performed for stratification by city due to the smaller sample sizes.

Store options were then categorized into healthy, green, or non-healthy stores using the Modified Retail Food Environment Index (mRFEI).²² The three variables were analyzed using logistic regression analysis controlling for child's age, number of children in household, SNAP participation, free- and reduced-meal participation, race/ethnicity of child, and city.

Results

Demographics

Participant characteristics at baseline are shown in Table 1. Responding parents were primarily mothers (93%), Hispanic (85%), unemployed (60.4%), and earned a high school diploma, equivalent, or less (71%). The average parent age was 34.3 years (SD=7.0). The average child age was 6.5 years (SD=1.9) and 50.1% were female.

The majority (66%) of participants were FI regardless of education, race/ethnicity, employment status, or government assistance program enrollment. The rate of food insecurity was slightly higher among those employed (71.6%) compared to those unemployed (68.9%).

Table 1. Characteristics of Brighter Bites Households for the Total Sample and By Food Security Status

Characteristics	Total (n=4,899)	Food Secure (n=1,406)	Food Insecure (n=3,258)	p-value ^a
	mean (SD) ^b		t-Test	
Child's age (y)	6.4 (1.9)	6.3 (1.9)	6.4 (1.9)	0.0235
Parent's age (y)	34.3 (7.0)	34.5 (7.3)	34.2 (6.9)	0.2552
Number of adults in your household	2.4 (1.0)	2.3 (0.9)	2.4 (1.1)	0.0313
Number of children younger than 18 years in your household	2.6 (1.1)	2.5 (1.1)	2.6 (1.1)	0.0226
	n (%)		Chi-sq. test	
Child's gender				p = 0.426
Boy	2,385 (49.9)	704 (30.9)	1,578 (69.1)	
Girl	2,391 (50.1)	676 (29.8)	1,595 (70.2)	
Respondents' relationship to child				p = 0.818
Mother	4,581 (93.8)	1,312 (30.1)	3,054 (69.9)	
Father	85 (1.7)	32.1 (32.1)	55 (67.9)	
Others (guardian)	218 (4.5)	65 (31.7)	140 (68.3)	
Parent's race/ethnicity				p = 0.001
Hispanic, Latino, or Mexican American	4,098 (85.8)	1,196 (30.6)	2,717 (69.4)	
Black or African American	356 (7.5)	89 (26.2)	251 (73.8)	
White	185 (3.9)	63 (35.6)	114 (64.4)	
Asian	76 (1.6)	24 (34.3)	46 (65.7)	
Other ^c	59 (1.2)	5 (8.9)	51 (91.1)	
Child's race/ethnicity				p = 0.090
Hispanic, Latino, or Mexican American	4,010 (84.4)	1,179 (30.8)	2,652 (69.2)	
Black or African American	367 (7.7)	85 (24.2)	267 (75.8)	
White	188 (3.9)	60 (33.2)	121 (66.8)	
Asian	74 (1.6)	20 (29.9)	47 (70.1)	
Other ^c	114 (2.4)	29 (26.9)	79 (73.1)	
Parent's employment status				p = 0.046
Employed (full/part time)	1,850 (39.6)	504 (28.4)	1,274 (71.6)	
Unemployed	2,823 (60.4)	840 (31.1)	1,858 (68.9)	
Parent's highest education level				p = 0.000
Never attended school or did not graduate	1,674 (35.5)	424 (26.5)	1,179 (73.5)	
Grades 12 or GED	1,716 (36.4)	516 (31.3)	1,122 (68.7)	
College 1 year to 3 years	969 (20.6)	280 (30.2)	648 (69.8)	
College 4 years or more	355 (7.5)	138 (40.6)	202 (59.4)	
Assistance Enrollment				
WIC (Women Infants and Children) ^d				p = 0.226
Yes	1,277 (26.4)	349 (28.7)	869 (71.3)	
No	3,570 (73.6)	1,040 (30.5)	2,369 (69.5)	
SNAP Benefits / Lone Star EBT ^e				p = 0.000
Yes	1,641 (34.3)	356 (22.3)	1,961 (77.7)	
No	3,143 (65.7)	1,022 (34.3)	2,078 (65.7)	
Double Dollars Incentive Program				p = 0.638
Yes	28 (0.6)	7 (25.9)	20 (74.1)	

No	4,809 (99.4)	1,381 (30.1)	3,209 (69.9)	
Medicaid/Texas Health Steps				p = 0.001
Yes	2,801 (58.4)	754 (28.2)	1,920 (71.8)	
No	1,995 (41.6)	627 (32.8)	1,284 (67.2)	
Medicare				p = 0.055
Yes	272 (5.6)	65 (24.8)	197 (75.2)	
No	4,565 (94.4)	1,325 (30.4)	3,034 (69.6)	
Free/Reduced meals at school				p = 0.000
Yes	3,579 (75.4)	980 (28.7)	2,438 (71.3)	
No	1,170 (24.6)	386 (34.3)	739 (65.7)	
CHIP ^f				p = 0.285
Yes	943 (19.7)	259 (28.7)	644 (71.3)	
No	3,834 (80.3)	1,118 (30.5)	2,547 (69.5)	

^aBoldface indicates statistical significance at $p \leq 0.05$.

^bStandard deviation.

^cAsian, Native Hawaiian, Pacific Islander, American Indian or Alaska Native, more than one race, other.

^dWIC = Special Supplemental Nutrition Assistance Program for Women, Infants, and Children.

^eSNAP = Supplemental Nutrition Assistance Program.

^fEBT = Electronic Benefits Transfer.

^gCHIP = Children's Health Insurance Program.

Association between Food Security and Grocery Shopping Patterns and Behavior

Those who were FI were 12% less likely to shop for fruits and vegetables at large chain grocery stores as compared to those who were FS ($p=0.000$, OR=0.88, CI=0.82-0.94). See Table 2. More than half of both FS (73.0%) and FI (73.8%) households purchased fruits and vegetables from a large chain grocery store at least once per week. Food insecure households were 16% less likely, (OR=0.84, 95% CI=0.78 to 0.89, $p=0.000$) to shop at warehouse club stores as compared to those who were FS. Overall, 39.3% of households reported never purchasing fruits and vegetables at warehouse club stores compared to 8.0% who reported never purchasing these items from a large chain grocery store. Those who were FI were 7% less likely (OR=0.93, 95% CI=0.87 to 0.98, $p=0.022$) to shop at discount superstores as compared to those who were FS. FI households reported shopping more frequently at discount superstores than FS households. For example, 71.9% of FI households reported shopping at a discount superstore at least twice per week compared to 28.1% of FS

households. FI households were 18% more likely (OR=1.18, 95% CI=1.08 to 1.29, $p=0.000$) to shop at convenience stores as compared to those who were FS. The majority of both groups (FS 81.1%, FI 73.3%) reported never purchasing fruits and vegetables from convenience stores. Those who were FI were 32% more likely (OR=1.32, 95% CI=1.17 to 1.50, $p=0.000$) to receive fruits and vegetables from a food bank or pantry as compared to those who were FS and 80% overall reported never using food banks or pantries for fresh produce. FI households were 13% less likely (OR=0.87, 95% CI=0.77 to 0.98, $p=0.025$) to receive fresh produce from their own garden as compared to those who were FS.

mRFEI Index

FI households were 15% less likely (OR=0.85, 95% CI=0.77 to 0.93, $p=0.001$) to shop at a healthy store and 5% more likely (OR=1.06, 95% CI=1.00 to 1.12, $p=0.044$) to shop at a less healthy store as compared to those who were FS. Although the FI households are less likely than FS households to shop at a healthy grocery store for fresh produce, the majority of FI households (79.7%) shop at a healthy store one or more times per week.

Shopping Patterns and Behavior by City

Tables for shopping patterns and behavior by city can be found in Appendix C. There was a significant difference between Houston FS and FI households who shop for fruits and vegetables at large chain grocery stores ($p=0.001$), natural or organic supermarkets ($p=0.001$), warehouse club stores ($p=0.004$), convenience stores ($p=0.000$), and food banks/pantries ($p=0.000$). Among all three store types, both FS and FI households shop at large chain grocery stores most frequently for fresh produce. In Austin, the only significant

difference between FS and FI households was found for fresh produce purchases at large chain grocery stores ($p=0.002$). There were significant differences between shopping patterns at large chain grocery stores ($p=0.003$), warehouse club stores ($p=0.001$), discount superstores ($p=0.028$), and food banks/pantries ($p=0.004$) among FS and FI households in Dallas. Significant differences were found among FS and FI households in Southwest Florida when shopping at farmer's markets and food banks/pantries. Food secure households were more likely to use farmer's markets at least once per week compared to FI households.

Table 2. Reported Fruit and Vegetable Shopping Patterns and Behavior

Type of Store	Total (n= 4,899)	Food Secure (n=1,406)	Food Insecure (n=3,258)	Adjusted OR ^a , CI ^b , P-value ^c
Large chain grocery store ^d	4,857			0.881 (0.823, 0.944)
Never	387 (8.0)	101 (7.2)	267 (8.3)	p= 0.000
Less than once a month	330 (6.8)	85 (6.1)	233 (7.2)	
1-2 times per month	899 (18.5)	207 (14.8)	657 (20.4)	
1 time per week	1,963 (40.4)	630 (44.9)	1,226 (37.9)	
2+ times per week	1,278 (26.3)	379 (27.0)	846 (26.2)	
Natural or organic supermarket ^e	4,811			1.029 (0.957, 1.107)
Never				p= 0.438
Less than once a month	3,332 (69.3)	971 (70.2)	2,199 (68.6)	
1-2 times per month	655 (13.6)	170 (12.3)	459 (14.3)	
1 time per week	435 (9.0)	149 (10.8)	271 (8.4)	
2+ times per week	269 (5.6)	72 (5.2)	185 (5.8)	
Warehouse club store ^f	4,826			0.842 (0.788, 0.899)
Never	1,895 (39.3)	471 (33.8)	1,335 (41.5)	p= 0.000
Less than once a month	1,226 (25.4)	357 (25.7)	827 (25.8)	
1-2 times per month	1,266 (26.2)	429 (30.8)	772 (24.0)	
1 time per week	286 (5.9)	91 (6.5)	176 (5.5)	
2+ times per week	153 (3.2)	44 (3.2)	102 (3.2)	
Discount superstore ^g	4,858			0.931 (0.875, 0.989)
Never	531 (10.9)	142 (10.1)	367 (11.4)	p= 0.022
Less than once a month	1,074 (22.1)	272 (19.4)	752 (23.3)	
1-2 times per month	1,615 (33.3)	466 (33.3)	1,069 (33.1)	
1 time per week	956 (19.7)	338 (24.1)	572 (17.7)	
2+ times per week	682 (14.0)	184 (13.1)	470 (14.5)	
Small local store or corner store ^h	4,801			1.033 (0.973,1.097)
Never				p= 0.283
Less than once a month	2,947 (61.4)	902 (65.1)	1,894 (59.3)	
1-2 times per month	680 (14.2)	169 (12.2)	481 (15.1)	
1 time per week	524 (10.9)	126 (9.1)	375 (11.7)	
2+ times per week	407 (8.5)	119 (8.6)	275 (8.6)	
Convenience store ⁱ	4,794			1.181 (1.080, 1.291)
Never	3,648 (76.1)	1,127 (81.1)	2,336 (73.3)	p= 0.000
Less than once a month	595 (12.4)	138 (9.9)	442 (13.9)	
1-2 times per month	274 (5.7)	63 (4.5)	203 (6.4)	
1 time per week	177 (3.7)	40 (2.9)	129 (4.1)	
2+ times per week	100 (2.1)	22 (1.6)	75 (2.3)	
Ethnic market ^j	4,814			1.003 (0.948, 1.062)
Never	2,640 (54.9)	777 (55.9)	1,749 (54.5)	p = 0.905
Less than once a month	690 (14.3)	190 (13.7)	469 (14.6)	
1-2 times per month	623 (12.9)	170 (12.2)	420 (13.1)	
1 time per week	577 (12.0)	168 (12.1)	381 (11.9)	
2+ times per week	284 (5.9)	84 (6.1)	188 (5.9)	
Farmer's market/co-op/school farm stand	4,787			1.027 (0.926, 1.139)
Never	3,966 (82.9)	1,146 (83.1)	2,639 (82.6)	p = 0.614
Less than once a month	443 (9.3)	126 (9.1)	306 (9.6)	
1-2 times per month	221 (4.6)	66 (4.8)	147 (4.6)	
1 time per week	108 (2.3)	27 (2.0)	70 (2.2)	
2+ times per week	49 (1.0)	14 (1.0)	33 (1.0)	
Food bank/pantry	4,761			1.329 (1.176, 1.501)
Never	3,961 (83.2)	1,249 (89.2)	2,976 (80.5)	p = 0.000
Less than once a month	426 (8.9)	54 (5.8)	102 (10.5)	
1-2 times per month	241 (5.1)	42 (3.4)	64 (5.8)	
1 time per week	96 (2.0)	26 (1.4)	35 (2.1)	
2+ times per week	37 (0.8)	14 (0.2)	25 (1.1)	

Garden	4,805			0.875 (0.778, 0.983)
Never	4,420 (92.0)	1,249 (90.2)	2,976 (92.9)	p= 0.025
Less than once a month	160 (3.3)	54 (3.9)	102 (3.2)	
1-2 times per month	111 (2.3)	42 (3.0)	64 (2.0)	
1 time per week	68 (1.4)	26 (1.9)	35 (1.1)	
2+ times per week	46 (1.0)	14 (1.0)	25 (0.8)	

^aOdds ratio adjusted for age of child, number of children in a single household, education level of guardian, participation in the Supplemental Nutrition Assistance Program, free and reduced school lunch participation, race/ethnicity of child, and city.

^b95% confidence interval.

^cBoldface indicates statistical significance at $p \leq 0.05$.

^dEx. Randall's, HEB, Kroger's Fiesta.

^eEx. Whole Foods or Sprouts.

^fEx. Sam's Club or Costco.

^gEx. Wal-Mart or Target.

^hUsually locally owned and do not sell gas.

ⁱEx. 7-11 or mini market, usually sell gas.

^jEx. Asian, Indian, or Hispanic.

Table 3. Reported Fruit and Vegetable Shopping Patterns and Behavior by mRFEI

Type of Store	Total (n= 4,899)	Food Secure (n=1,406)	Food Insecure (n=3,258)	OR ^a , (CI) ^c , P-value ^c
Healthy ^d	4,891			0.852 (0.774, 0.939)
Never	16 (0.4)	4 (0.3)	11 (0.3)	p= 0.001
Less than once a month	100 (2.0)	16 (1.1)	82 (2.5)	
1-2 times per month	773 (15.8)	170 (12.1)	569 (17.5)	
1 time per week	2,192 (44.8)	703 (50.0)	1,375 (42.3)	
2+ times per week	1,810 (37.0)	513 (36.5)	1,218 (37.4)	
Less Healthy ^e	4,839			1.060 (1.001, 1.123)
Never	2,651 (54.8)	831 (59.7)	1,678 (52.1)	p= 0.044
Less than once a month	780 (16.1)	193 (13.8)	558 (17.3)	
1-2 times per month	607 (12.6)	150 (10.8)	430 (13.3)	
1 time per week	495 (10.2)	138 (9.9)	340 (10.6)	
2+ times per week	306 (6.3)	81 (5.8)	217 (6.7)	
Green ^f	4,876			1.013 (0.949, 1.0813)
Never	2,949 (60.5)	852 (60.8)	1,994 (60.2)	p= 0.688
Less than once a month	791 (16.2)	212 (15.1)	595 (17.0)	
1-2 times per month	563 (11.5)	184 (13.1)	396 (11.0)	
1 time per week	378 (7.8)	109 (7.8)	281 (7.6)	
2+ times per week	195 (4.0)	44 (3.2)	162 (4.2)	

^aOdds ratio adjusted for age of child, number of children in a single household, education level of guardian, participation in the Supplemental Nutrition Assistance Program, free and reduced school lunch participation, race/ethnicity of child, and city.

^b95% confidence interval.

^cBoldface indicates statistical significance at $P \leq 0.05$.

^dHealthy includes grocery stores, supermarkets, warehouses, ethnic markets, farmer's markets, food banks and pantries, superstores, and gardens.

^eGreen includes supermarkets, farmer's markets, and gardens.

^fLess healthy includes convenience stores and local stores/corner markets.

Discussion

The purpose of this study was to 1) test if food security status is associated with where BB households shop and how often and 2) describe these shopping patterns and behavior. The results of our study suggest that the FI households who participate in BB shop more frequently for fresh produce at discount superstores, convenience stores, and food banks/pantries compared to FS households. However, both low-income FS and FI households in the study primarily shop at large chain grocery stores for fruits and vegetables.

There are nearly 40,000 grocery stores in the U.S. Although this seems like there is a large availability of food, individuals in low-income communities who had nutrition knowledge reported that one of the biggest barriers to healthful shopping behaviors includes inadequate geographic access to healthful food. This is in addition to the price of healthful food, poor quality of available healthful food, and the low quality of nearby retail stores.²³ One solution would be to build large chain grocery stores in these communities as opposed to providing healthier options in convenience stores which has not been proven to be as effective.

Consumers prefer a supermarket nearby over smaller food stores.²³ However, in a natural experiment where nutrition knowledge was not assessed and the average annual income of participants was less than \$20,000, participants closest to a new grocery store were more likely to eat out and purchase unhealthy prepared meals from stores when compared between 2009 and 2011. The study did not find any significant relationship between fresh produce consumption and distance to a grocery store.²⁴ Despite conflicting results, building new grocery stores closer to low-income families in their neighborhoods or along a frequently

used route could be one step of many to make the healthy choice, the easy choice by increasing physical access. Our data indicate that low-income families, regardless of food security status, primarily shop at large chain grocery stores for their fruits and vegetables.

Ma, et al. (2017) explored food security status in relation to food shopping behaviors in low-income neighborhoods. The lower the food security status, the more likely the participants were to shop at a convenience or dollar store frequently compared to FS participants. Our study did not look at the different levels food insecurity, but this could be a future direction to further delineate the differences between low-income groups. However, regardless of food security status, most participants shopped at a supermarket or supercenter (80%, 92% respectively) despite the geographic areas being labeled as food deserts which is reflective of our results for fresh produce.²⁵

In a study with predominantly non-Hispanic Black women in low-income neighborhoods, participants shopped at supermarkets (61%) most often followed by supercenters and warehouse clubs (27%) which were grouped together. The average distance to the nearest supermarket was 1.5 miles and 2.7 miles to the nearest supercenter/warehouse club, exceeding the recommended radius proposed by USDA.²⁶ The cross-sectional study also found that participants who shopped for all groceries more frequently at a supercenter or warehouse club stores had a significantly higher body-mass-index (BMI) compared to those who shopped more often at supermarkets.²⁷ Although we did not explore BMI, FI BB households did report purchasing fresh produce from discount superstores more often than

FS households. It would be interesting to further investigate and assess the potential implications this could have in relation to the obesity paradox among FI households.

Our results showed that FI households are more likely to receive fruits and vegetables from food banks and pantries and more frequently than FS households. Chronic conditions, such as diabetes, disproportionately affect low-income households who may be FI. However, glucose control may not vary between FS and FI participants unless food insecurity is broken down into low- and very low-food insecurity, in which case very low-food secure participants had poorer diabetes self-efficacy, poorer medication adherence, and higher prevalence of hypoglycemic episodes among other complications.²⁸ Although BB does not collect data on chronic conditions, it is important to consider how BB produce may assist families struggling with nutrition-related diseases and act as a buffer for pantry clients.

The shopping patterns and behavior of FI households is one step in better understanding how environment influences diet. There is moderately strong evidence to suggest community and consumer nutrition environments influence the dietary patterns of children. This includes location and accessibility of food outlets and the price, promotion, and placement of food choices.²⁹

Brighter Bites households have similar incomes but different shopping patterns depending on food security status. The reasons for differences in frequency are unknown but may be influenced by SNAP benefits or work schedules. There needs to be consideration regarding

time of week or month and how often these households grocery shop when designing interventions to improve fruit and vegetable among low-income and FI groups, especially when the interventions may alter shopping patterns.

The BB program is grounded in behavioral theory and approaches food insecurity on multi-levels. Programs, such as BB, may also serve as an educational enhancement to SNAP participants. Upon picking up fresh produce, families also sample a recipe, take the recipe directions home, and learn about nutrition from the handout. Therefore, BB may ‘nudge’ households to use their SNAP benefits for more nutrient-dense items at the grocery store. It is notable that the majority of households in this study shop for fresh produce at large chain grocery stores where the role of Registered Dietitians play a critical role in helping consumers make healthy choices through grocery store tours and nutrition education. Future research should further consider the role of Registered Dietitians in grocery stores.

Strengths and Limitations

This study has high external validity and generalizability as it is a large sample size of diverse, low-income group from different regions of the U.S. The results of the shopping patterns and behavior of a largely FI sample have implications for initiatives to improve access to healthful foods, particularly for growing children.

Regardless of these strengths, some limitations should be noted. The food shopping patterns and behavior questionnaire from the parent pre-survey were restricted to fruits and

vegetables, so we cannot assess any other food groups which may contribute many different nutrients. The fall 2018 pre-survey sample was not cross-sectional; thus, we can only infer correlation but not causation at one point in time. Lastly, only digital pre-surveys were analyzed which may introduce bias by excluding all participants who filled out a paper survey. As a consequence, this study may not include families who face additional barriers, such as inconsistent or a lack of access to internet or those who are uncomfortable using technology.

Conclusion

The BB program should continue to investigate the role of food security status by comparing shopping patterns and behavior before and after enrollment in the program.

Conflict of Interest Statement

Dr. Sharma is on the Executive Board of BB non-profit organization, the goal of which is to improve access to fresh fruits and vegetables and nutrition education among underserved communities. The other authors have no conflicts of interest relevant to this article to disclose.

JOURNAL REFERENCES

1. Hemmingsson E. A new model of the role of psychological and emotional distress in promoting obesity: conceptual review with implications for treatment and prevention. *Obes Rev.* 2014;15(9):769-79.
2. Key Statistics. United States Department of Agriculture Economic Research Service Web site. <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/>. Updated 2018. Accessed July 23, 2019.
3. Coleman-Jensen A, Rabbitt MP, Gregory CA, Singh A. United States Department of Agriculture Economic Research Service. Household Food Security in the United States in 2017. <https://www.ers.usda.gov/webdocs/publications/90023/err-256.pdf?v=0>. Accessed July 23, 2019.
4. Gundersen C, Ziliak JP. Food insecurity and health outcomes. *Health Aff (Millwood)*. 2015;34(11):1830-1839.
5. Hanson KL, Connor LM. Food insecurity and dietary quality in US adults and children: A systematic review. *Am J Clin Nutr.* 2014;100(2):684-692.
6. Dhurandhar EJ. The food-insecurity obesity paradox: A resource scarcity hypothesis. *Physiol Behav.* 2016;162:88-92.
7. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the united states, 2011-2012. *JAMA.* 2014;311(8):806-814.
8. Kelsey MM, Zaepfel A, Bjornstad P, Nadeau KJ. Age-related consequences of childhood obesity. *Gerontology.* 2014;60(3):222-228.

9. Bacha F, Gidding SS. Cardiac abnormalities in youth with obesity and type 2 diabetes. *Curr Diab Rep*. 2016;16(7):62-016-0750-6.
10. Seligman HK, Bindman AB, Vittinghoff E, Kanaya AM, Kushel MB. Food insecurity is associated with diabetes mellitus: results from the National Health Examination and Nutrition Examination Survey (NHANES) 1999–2002. *J Gen Int Med*. 2007;22(7):1018–1023.
11. Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. *J Nutr*. 2010;140(2):304–310.
12. Seligman HK, Jacobs EA, Lopez A, Tschann J, Fernandez A. Food insecurity and glycemic control among low-income patients with type 2 diabetes. *Diabetes Care*. 2012;35(2):233–238.
13. Breneman V, Farrigan T, Hamrick K, et al. Access to affordable and nutritious food: Measuring and understanding food deserts and their consequences. report to congress. *USDA ERS*. 2009.
14. Cummins S, Flint E, Matthews SA. New neighborhood grocery store increased awareness of food access but did not alter dietary habits or obesity. *Health Aff (Millwood)*. 2014;33(2):283-291.
15. Aggarwal A, Cook AJ, Jiao J, et al. Access to supermarkets and fruit and vegetable consumption. *Am J Public Health*. 2014;104(5):917-923.
16. Hirsch JA, Hillier A. Exploring the role of the food environment on food shopping patterns in Philadelphia, PA, USA: A semiquantitative comparison of two matched neighborhood groups. *Int J Environ Res Public Health*. 2013;10(1):295-313.

17. Cannuscio CC, Hillier A, Karpyn A, Glanz K. The social dynamics of healthy food shopping and store choice in an urban environment. *Soc Sci Med*. 2014;122:13-20.
18. Quick Facts. United States Census Bureau.
<https://www.census.gov/quickfacts/fact/table/US/PST045218>. Accessed July 23, 2019.
19. Sharma SV, Upadhyaya M, Bounds G, Markham C. A public health opportunity found in food waste. *Prev Chronic Dis*. 2017;108(14):160596.
20. Hager ER, Quigg AM, Black MM, et al. Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics*. 2010;126(1):e26-32.
21. Blanck HM, Thompson OM, Nebeling L, Yaroch AL. Improving fruit and vegetable consumption: Use of farm-to-consumer venues among US adults. *Prev Chronic Dis*. 2011;8(2):A49.
22. California Department of Public Health. Modified Food Retail Food Environment Index. <https://data.chhs.ca.gov/dataset/modified-retail-food-environment-index>. Accessed July 23, 2019.
23. Evans A, Banks K, Jennings R, et al. Increasing access to healthful foods: A qualitative study with residents of low-income communities. *Int J Behav Nutr Phys Act*. 2015;12 Suppl 1:S5-5868-12-S1-S5. Epub 2015 Jul 27.
24. Sadler RC, Gilliland JA, Arku G. A food retail-based intervention on food security and consumption. *Int J Environ Res Public Health*. 2013;10(8):3325-3346.

25. Ma X, Liese AD, Hibbert J, Bell BA, Wilcox S, Sharpe PA. The association between food security and store-specific and overall food shopping behavior. *J Acad Nutr Diet.* 2017;117(12):1931-1940.
26. Breneman V, Farrigan T, Hamrick K, et al. Access to affordable and nutritious food: Measuring and understanding food deserts and their consequences. report to congress. *USDA ERS.* 2009.
27. Liese AD, Ma X, Hutto B, Sharpe PA, Bell BA, Wilcox S. Food shopping and acquisition behaviors in relation to BMI among residents of low-income communities in South Carolina. *Int J Environ Res Public Health.* 2017;14(9):1075.
28. Ippolito MM, Lyles CR, Prendergast K, Marshall MB, Waxman E, Seligman HK. Food insecurity and diabetes self-management among food pantry clients. *Public Health Nutr.* 2017;20(1):183-189.
29. Engler-Stringer R, Le H, Gerrard A, Muhajarine N. The community and consumer food environment and children's diet: a systematic review. *BMC Public Health.* 2014;29(14):522.

APPENDICES

Appendix A: Brighter Bites School Participation Numbers by Region

Table A. Number of schools enrolled in Brighter Bites for fall 2018

City/Region	Number of schools
Houston, Texas	45
Dallas, Texas	18
Austin, Texas	10
New York City, New York	4
Washington, D.C.	5
Southwest Florida	5

Appendix B: Brighter Bites Parent Pre-Survey Questions and Response Options

Table B. Food Shopping Store Responses

Questionnaire Item: How often do you buy or get fruits and vegetables for the family from these locations?	Coded Responses
a. A large chain grocery store (such as Randall's, HEB, Kroger's, Fiesta)	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
b. A natural or organic supermarket (such as Whole Foods or Sprouts)	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
c. A small local store or corner store (usually locally owned and do not sell gas)	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
d. A warehouse club store (such as Sam's Club or Costco)	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
e. An ethnic market? (such as Asian, Indian, Hispanic)	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
f. A discount superstore (such as Wal-Mart or Target)	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
g. An ethnic market? (such as Asian, Indian, Hispanic)	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
h. A farmer's market/co-op/school farm stand	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
i. A food bank/pantry	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month 0 = Never
j. Your own garden	4 = 2+ times per week 3 = 1 time per week 2 = 1-2 times per month 1 = Less than once a month

0 = Never

Table C. Food Security Responses

Questionnaire Item: How true do you find the following statement? Please mark one answer choice for each statement.	Coded Responses
Within the past two months:	
a. You worried whether your food would run out before you got money to buy more	2 = Often true 1 = Sometimes true 0 = Never true
b. The food you bought just didn't last and you didn't have money to get more.	2 = Often true 1 = Sometimes true 0 = Never true

Appendix C: Brighter Bites Food Shopping Patterns and Behavior Results by City

Table D. Houston Food Shopping Patterns and Behavior (n=2,806)

	Food Secure (n=763)	Food Insecure (n=1,901)	p-value
Large chain grocery store			0.001
Never	19 (2.5)	71 (3.7)	
Less than once a month	36 (4.7)	128 (6.8)	
1-2 times per month	120 (15.7)	390 (20.6)	
1 time per week	356 (46.7)	770 (40.3)	
2+ times per week	232 (30.4)	534 (28.2)	
Natural or organic supermarket			0.001
Never			
Less than once a month	567 (75.7)	1,301(69.4)	
1-2 times per month	79 (10.6)	261 (14.0)	
1 time per week	66 (8.8)	148 (7.9)	
2+ times per week	28 (3.7)	109 (5.8)	
	9 (1.2)	55 (2.9)	
Warehouse club store			0.004
Never	282 (37.2)	813 (43.3)	
Less than once a month	199 (26.3)	496 (26.4)	
1-2 times per month	224 (29.6)	426 (22.7)	
1 time per week	33 (4.4)	88 (4.7)	
2+ times per week	19 (2.5)	54 (2.9)	
Discount superstore			0.059
Never	80 (10.5)	198 (10.5)	
Less than once a month	163 (21.4)	464 (24.6)	
1-2 times per month	257 (33.8)	644 (34.1)	
1 time per week	163 (21.4)	318 (16.8)	
2+ times per week	98 (12.9)	265 (14.0)	
Small local store or corner store			0.009
Never			
Less than once a month	487 (64.9)	1,087(58.3)	
1-2 times per month	86 (11.4)	293 (15.7)	
1 time per week	80 (10.6)	224 (12.0)	
2+ times per week	67 (9.0)	157 (8.4)	
	31 (4.1)	103 (5.6)	
Convenience store			0.000
Never	627 (83.5)	1,386(74.6)	
Less than once a month	70 (9.3)	252 (13.6)	
1-2 times per month	21 (2.8)	116 (6.3)	
1 time per week	21 (2.8)	68 (3.7)	
2+ times per week	12 (1.6)	35 (1.8)	
Ethnic market			0.402
Never	464 (61.5)	1,114(59.5)	
Less than once a month	122 (16.2)	275 (14.7)	
1-2 times per month	82 (10.8)	224 (11.9)	
1 time per week	59 (7.8)	172 (9.2)	
2+ times per week	28 (3.7)	88 (4.7)	
Farmer's market/co-op/school farm stand			0.081
Never			
Less than once a month	634 (84.4)	1,584(84.8)	
1-2 times per month	70 (9.3)	159 (8.5)	
1 time per week	35 (4.7)	68 (3.6)	
2+ times per week	6 (0.8)	43 (2.3)	
	6 (0.8)	15 (0.8)	
Food bank/pantry			0.000
Never	665 (88.4)	1,502(80.9)	
Less than once a month	46 (6.1)	190 (10.2)	
1-2 times per month	28 (3.7)	107 (5.8)	
1 time per week	11 (1.5)	38 (2.1)	
2+ times per week	2 (0.2)	19 (1.0)	

Garden			0.132
Never	677 (90.1)	1,733(92.9)	
Less than once a month	29 (3.9)	62 (3.3)	
1-2 times per month	26 (3.5)	41 (2.2)	
1 time per week	13 (1.7)	18 (1.0)	
2+ times per week	6 (0.8)	12 (0.6)	

Table E. Austin Food Shopping Patterns and Behavior (n=605)

	Food Secure (n=172)	Food Insecure (n=409)	p-value
Large chain grocery store			0.002
Never	3 (1.7)	4 (1.0)	
Less than once a month	2 (1.2)	21 (5.2)	
1-2 times per month	20 (11.6)	81 (19.8)	
1 time per week	98 (57.0)	169 (41.4)	
2+ times per week	49 (28.5)	133 (32.6)	
Natural or organic supermarket			0.093
Never			
Less than once a month	102 (60.4)	288 (71.3)	
1-2 times per month	31 (18.3)	61 (15.1)	
1 time per week	42 (14.2)	33 (8.2)	
2+ times per week	10 (5.9)	17 (4.2)	
2 (1.2)	2 (1.2)	5 (1.2)	
Warehouse club store			0.530
Never	71 (42.5)	196 (48.5)	
Less than once a month	36 (21.6)	82 (20.3)	
1-2 times per month	46 (27.5)	91 (22.5)	
1 time per week	8 (4.8)	25 (6.2)	
2+ times per week	6 (3.6)	10 (2.5)	
Discount superstore			0.131
Never	33 (19.3)	76 (18.8)	
Less than once a month	44 (25.7)	130 (32.2)	
1-2 times per month	55 (32.2)	138 (34.1)	
1 time per week	28 (16.4)	38 (9.4)	
2+ times per week	11 (6.4)	22 (5.5)	
Small local store or corner store			0.163
Never			
Less than once a month	111 (64.9)	244 (60.9)	
1-2 times per month	26 (15.2)	60 (15.0)	
1 time per week	8 (4.7)	42 (10.4)	
2+ times per week	13 (7.6)	35 (8.7)	
13 (7.6)	13 (7.6)	20 (5.0)	
Convenience store			0.522
Never	124 (72.1)	285 (70.5)	
Less than once a month	23 (13.4)	50 (12.4)	
1-2 times per month	15 (8.7)	28 (6.9)	
1 time per week	6 (3.5)	25 (6.2)	
2+ times per week	4 (2.3)	16 (4.0)	
Ethnic market			0.584
Never	91 (54.2)	211 (52.2)	
Less than once a month	23 (13.7)	75 (18.6)	
1-2 times per month	25 (14.9)	63 (15.6)	
1 time per week	18 (10.7)	34 (8.4)	
2+ times per week	11 (6.5)	21 (5.2)	
Farmer's market/co-op/school farm stand			0.647
Never			
Less than once a month	134 (80.7)	324 (80.4)	
1-2 times per month	23 (13.9)	45 (11.2)	
1 time per week	7 (4.2)	23 (5.7)	
2+ times per week	1 (0.6)	7 (1.7)	
1 (0.6)	1 (0.6)	4 (1.0)	
Food bank/pantry			0.067
Never	153 (90.0)	318 (80.3)	
Less than once a month	9 (5.3)	44 (11.1)	
1-2 times per month	5 (2.9)	22 (5.6)	
1 time per week	3 (1.8)	9 (2.2)	
2+ times per week	0 (0.0)	3 (0.8)	

Garden			0.428
Never	154 (91.1)	385 (95.1)	
Less than once a month	7 (4.1)	11 (2.7)	
1-2 times per month	4 (2.4)	4 (1.0)	
1 time per week	3 (1.8)	3 (0.7)	
2+ times per week	1 (0.6)	2 (0.5)	

Table E. Dallas Food Shopping Patterns and Behavior (n=1,115)

	Food Secure (n=386)	Food Insecure (n=684)	p-value
Large chain grocery store			0.003
Never	25 (6.5)	69 (10.2)	
Less than once a month	45 (11.8)	62 (9.1)	
1-2 times per month	58 (15.1)	154 (22.7)	
1 time per week	166 (43.4)	244 (36.0)	
2+ times per week	89 (23.2)	149 (22.0)	
Natural or organic supermarket			0.320
Never			
Less than once a month	252 (66.1)	464 (69.1)	
1-2 times per month	54 (14.2)	94 (14.0)	
1 time per week	45 (11.8)	58 (8.6)	
2+ times per week	24 (6.3)	37 (5.5)	
	6 (1.6)	19 (2.8)	
Warehouse club store			0.001
Never	97 (25.3)	249 (36.9)	
Less than once a month	104 (27.2)	186 (27.6)	
1-2 times per month	128 (33.4)	169 (25.1)	
1 time per week	38 (9.9)	44 (6.5)	
2+ times per week	16 (4.2)	26 (3.9)	
Discount superstore			0.028
Never	23 (6.0)	55 (8.1)	
Less than once a month	54 (14.0)	112 (16.5)	
1-2 times per month	119 (30.9)	208 (30.6)	
1 time per week	122 (31.7)	159 (23.4)	
2+ times per week	67 (17.4)	146 (21.4)	
Small local store or corner store			0.486
Never			
Less than once a month	267 (70.4)	448 (66.3)	
1-2 times per month	46 (12.1)	86 (12.7)	
1 time per week	26 (6.9)	67 (10.0)	
2+ times per week	25 (6.6)	49 (7.3)	
	15 (4.0)	25 (3.7)	
Convenience store			0.052
Never	307 (80.3)	499 (74.3)	
Less than once a month	40 (10.5)	100 (14.9)	
1-2 times per month	22 (5.8)	34 (5.0)	
1 time per week	11 (2.9)	25 (3.7)	
2+ times per week	2 (0.5)	14 (2.1)	
Ethnic market			0.655
Never	187 (49.0)	326 (48.4)	
Less than once a month	38 (10.0)	86 (12.7)	
1-2 times per month	51 (13.3)	93 (13.8)	
1 time per week	73 (19.1)	119 (17.7)	
2+ times per week	33 (8.6)	50 (7.4)	
Farmer's market/co-op/school farm stand			0.403
Never			
Less than once a month	334 (88.4)	573 (85.7)	
1-2 times per month	23 (6.1)	64 (9.6)	
1 time per week	12 (3.2)	18 (2.7)	
2+ times per week	7 (1.8)	11 (1.6)	
	2 (0.5)	3 (0.4)	
Food bank/pantry			0.004
Never	347 (91.6)	550 (83.0)	
Less than once a month	18 (4.7)	61 (9.2)	
1-2 times per month	9 (2.4)	28 (4.2)	
1 time per week	4 (1.1)	16 (2.4)	
2+ times per week	1 (0.2)	8 (1.2)	

			0.503
Garden	345 (90.6)	630 (93.4)	
Never	16 (4.2)	17 (2.5)	
Less than once a month	8 (2.1)	13 (1.9)	
1-2 times per month	7 (1.8)	8 (1.2)	
1 time per week	5 (1.3)	7 (1.0)	
2+ times per week			

Table F. Southwest Florida Food Shopping Patterns and Behavior (n=188)

	Food Secure (n=54)	Food Insecure (n=116)	p-value
Large chain grocery store			0.078
Never	34 (63.0)	53 (45.7)	
Less than once a month	1 (1.8)	13 (11.2)	
1-2 times per month	7 (13.0)	14 (12.1)	
1 time per week	6 (11.1)	25 (21.5)	
2+ times per week	6 (11.1)	11 (9.5)	
Natural or organic supermarket			0.498
Never			
Less than once a month	37 (68.5)	76 (63.3)	
1-2 times per month	4 (7.4)	16 (13.3)	
1 time per week	6 (11.1)	17 (14.2)	
2+ times per week	5 (9.3)	5 (4.2)	
Warehouse club store	2 (3.7)	6 (5.0)	0.389
Never	14 (25.4)	37 (31.1)	
Less than once a month	13 (23.6)	25 (21.0)	
1-2 times per month	19 (34.6)	47 (39.5)	
1 time per week	8 (14.6)	7 (5.9)	
2+ times per week	1 (1.8)	3 (6.5)	
Discount superstore			0.946
Never	2 (3.6)	7 (5.9)	
Less than once a month	5 (9.1)	11 (9.2)	
1-2 times per month	21 (38.2)	48 (40.3)	
1 time per week	20 (36.4)	37 (31.1)	
2+ times per week	7 (12.7)	16 (13.5)	
Small local store or corner store			0.225
Never			
Less than once a month	18 (32.7)	44 (37.3)	
1-2 times per month	7 (12.7)	24 (20.4)	
1 time per week	11 (20.0)	26 (22.0)	
2+ times per week	9 (16.4)	15 (12.7)	
Convenience store	10 (18.2)	9 (7.6)	0.199
Never	45 (81.8)	77 (65.8)	
Less than once a month	4 (7.3)	19 (16.2)	
1-2 times per month	2 (3.6)	11 (9.4)	
1 time per week	1 (1.8)	5 (4.3)	
2+ times per week	3 (5.5)	5 (4.3)	
Ethnic market			0.318
Never	27 (50.0)	59 (50.0)	
Less than once a month	6 (11.1)	13 (11.0)	
1-2 times per month	5 (9.3)	23 (19.5)	
1 time per week	10 (18.5)	17 (14.4)	
2+ times per week	6 (11.1)	6 (5.1)	
Farmer's market/co-op/school farm stand			0.006
Never			
Less than once a month	27 (50.0)	73 (61.9)	
1-2 times per month	5 (9.2)	14 (11.9)	
1 time per week	9 (16.7)	23 (19.5)	
2+ times per week	9 (16.7)	2 (1.7)	
Food bank/pantry	4 (7.4)	6 (5.0)	0.035
Never	45 (81.8)	67 (57.3)	
Less than once a month	5 (9.1)	25 (21.4)	
1-2 times per month	4 (7.3)	20 (17.1)	
1 time per week	1 (1.8)	3 (2.5)	
2+ times per week	0 (0.0)	2 (1.7)	

Garden			0.096
Never	48 (87.3)	105 (89.0)	
Less than once a month	2 (3.6)	10 (8.5)	
1-2 times per month	2 (3.6)	0 (0.0)	
1 time per week	2 (3.6)	3 (2.5)	
2+ times per week	1 (1.9)	0 (0.0)	

Table G. Washington, D.C. Food Shopping Patterns and Behavior (n=185)

	Food Secure (n=30)	Food Insecure (n=144)	p-value
Large chain grocery store			0.622
Never	20 (66.7)	70 (52.3)	
Less than once a month	1 (3.3)	9 (6.7)	
1-2 times per month	2 (6.7)	18 (13.4)	
1 time per week	4 (13.3)	18 (13.4)	
2+ times per week	3 (10.0)	19 (14.2)	
Natural or organic supermarket			0.112
Never			
Less than once a month	13 (43.3)	70 (50.7)	
1-2 times per month	2 (6.7)	27 (19.6)	
1 time per week	8 (26.6)	15 (10.9)	
2+ times per week	5 (16.7)	17 (12.3)	
2 (6.7)	2 (6.7)	9 (6.5)	
Warehouse club store			0.542
Never	7 (23.3)	40 (29.0)	
Less than once a month	5 (16.7)	38 (27.5)	
1-2 times per month	12 (40.0)	39 (28.3)	
1 time per week	4 (13.3)	12 (8.7)	
2+ times per week	2 (6.7)	9 (6.5)	
Discount superstore			0.052
Never	4 (13.3)	31 (22.5)	
Less than once a month	6 (20.0)	35 (25.4)	
1-2 times per month	14 (46.7)	31 (22.5)	
1 time per week	5 (16.7)	20 (14.4)	
2+ times per week	1 (3.3)	21 (15.2)	
Small local store or corner store			0.534
Never			
Less than once a month	19 (63.4)	71 (52.6)	
1-2 times per month	4 (13.3)	18 (13.3)	
1 time per week	1 (3.3)	16 (11.9)	
2+ times per week	5 (16.7)	19 (14.1)	
1 (3.3)	1 (3.3)	11 (8.1)	
Convenience store			0.471
Never	24 (80.0)	89 (65.9)	
Less than once a month	1 (3.3)	21 (15.6)	
1-2 times per month	3 (10.1)	14 (10.4)	
1 time per week	1 (3.3)	6 (4.4)	
2+ times per week	1 (3.3)	5 (3.7)	
Ethnic market			0.314
Never	8 (26.7)	39 (28.3)	
Less than once a month	1 (3.3)	20 (19.5)	
1-2 times per month	7 (23.3)	17 (12.3)	
1 time per week	8 (26.7)	39 (28.3)	
2+ times per week	6 (20.0)	23 (16.6)	
Farmer's market/co-op/school farm stand			0.615
Never			
Less than once a month	17 (56.7)	85 (62.5)	
1-2 times per month	5 (16.7)	24 (17.7)	
1 time per week	3 (10.0)	15 (11.0)	
2+ times per week	4 (13.3)	7 (5.1)	
1 (3.3)	1 (3.3)	5 (3.7)	
Food bank/pantry			0.870
Never	26 (86.7)	113 (83.1)	
Less than once a month	2 (6.7)	13 (9.5)	
1-2 times per month	1 (3.3)	6 (4.4)	
1 time per week	1 (3.3)	2 (1.5)	
2+ times per week	0 (0.0)	2 (1.5)	

Garden	25 (86.2)	123 (89.1)	0.917
Never	0 (0.0)	2 (1.5)	
Less than once a month	2 (7.0)	6 (4.4)	
1-2 times per month	1 (3.4)	3 (2.1)	
1 time per week	1 (3.4)	4 (2.9)	
2+ times per week			

PROPOSAL REFERENCES

1. Breneman V, Farrigan T, Hamrick K, et al. Access to affordable and nutritious food: Measuring and understanding food deserts and their consequences. report to congress. *USDA ERS*. 2009.
2. Cummins S, Flint E, Matthews SA. New neighborhood grocery store increased awareness of food access but did not alter dietary habits or obesity. *Health Aff (Millwood)*. 2014;33(2):283-291.
3. Aggarwal A, Cook AJ, Jiao J, et al. Access to supermarkets and fruit and vegetable consumption. *Am J Public Health*. 2014;104(5):917-923.
4. Hirsch JA, Hillier A. Exploring the role of the food environment on food shopping patterns in philadelphia, PA, USA: A semiquantitative comparison of two matched neighborhood groups. *Int J Environ Res Public Health*. 2013;10(1):295-313.
5. Cannuscio CC, Hillier A, Karpyn A, Glanz K. The social dynamics of healthy food shopping and store choice in an urban environment. *Soc Sci Med*. 2014;122:13-20.
6. DiSantis KI, Hillier A, Holaday R, Kumanyika S. Why do you shop there? A mixed methods study mapping household food shopping patterns onto weekly routines of black women. *Int J Behav Nutr Phys Act*. 2016;13:11-016-0333-6.

7. Evans A, Banks K, Jennings R, et al. Increasing access to healthful foods: A qualitative study with residents of low-income communities. *Int J Behav Nutr Phys Act.* 2015;12 Suppl 1:S5-5868-12-S1-S5. Epub 2015 Jul 27.
8. Stern D, Poti JM, Ng SW, Robinson WR, Gordon-Larsen P, Popkin BM. Where people shop is not associated with the nutrient quality of packaged foods for any racial-ethnic group in the united states. *Am J Clin Nutr.* 2016;103(4):1125-1134.
9. Definitions of food security. United States Department of Agriculture Economic Research Service Web site. <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/definitions-of-food-security/>. Updated 2018. Accessed 10/30, 2018.
10. Nord M, Andrews M, Carlson S. Measuring food security in the united states: Household food security in the united states, 2005. *USDA ERS.* 2005;29.
11. Household food security in the united states in 2017. United States Department of Agriculture Economic Research Service Web site. United States Department of Agriculture Economic Research Service. Updated 2018. Accessed 10/30, 2018.
12. MacNell L. A geo-ethnographic analysis of low-income rural and urban women's food shopping behavior. *Appetite.* 2018;128:311-320.
13. Vaughan CA, Cohen DA, Ghosh-Dastidar M, Hunter GP, Dubowitz T. Where do food desert residents buy most of their junk food? supermarkets. *Public Health Nutr.* 2017;20(14):2608-2616.

14. Karpyn A, Manon M, Treuhaft S, Giang T, Harries C, McCoubrey K. Policy solutions to the 'grocery gap'. *Health Aff (Millwood)*. 2010;29(3):473-480.
15. Handbury J, Rahkovsky I, Schnell M. What drives nutritional disparities? Retail access and food purchases across the socioeconomic spectrum. . 2015.
16. Bodor JN, Rose D, Farley TA, Swalm C, Scott SK. Neighbourhood fruit and vegetable availability and consumption: The role of small food stores in an urban environment. *Public Health Nutr*. 2008;11(4):413-420.
17. Ghosh-Dastidar B, Cohen D, Hunter G, et al. Distance to store, food prices, and obesity in urban food deserts. *Am J Prev Med*. 2014;47(5):587-595.
18. Sadler RC, Gilliland JA, Arku G. A food retail-based intervention on food security and consumption. *Int J Environ Res Public Health*. 2013;10(8):3325-3346.
19. Ma X, Liese AD, Hibbert J, Bell BA, Wilcox S, Sharpe PA. The association between food security and store-specific and overall food shopping behavior. *J Acad Nutr Diet*. 2017;117(12):1931-1940.
20. Kirkpatrick SI, Tarasuk V. Assessing the relevance of neighbourhood characteristics to the household food security of low-income toronto families. *Public Health Nutr*. 2010;13(7):1139-1148.

21. Sharma SV, Markham C, Chow J, Ranjit N, Pomeroy M, Raber M. Evaluating a school-based fruit and vegetable co-op in low-income children: A quasi-experimental study. *Prev Med.* 2016;91:8-17.
22. Hoelscher DM, Springer AE, Ranjit N, et al. Reductions in child obesity among disadvantaged school children with community involvement: The travis county CATCH trial. *Obesity (Silver Spring).* 2010;18 Suppl 1:S36-44.
23. Gundersen C, Ziliak JP. Food insecurity and health outcomes. *Health Aff (Millwood).* 2015;34(11):1830-1839.
24. Hanson KL, Connor LM. Food insecurity and dietary quality in US adults and children: A systematic review. *Am J Clin Nutr.* 2014;100(2):684-692.
25. Dhurandhar EJ. The food-insecurity obesity paradox: A resource scarcity hypothesis. *Physiol Behav.* 2016;162:88-92.
26. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the united states, 2011-2012. *JAMA.* 2014;311(8):806-814.
27. Kelsey MM, Zaepfel A, Bjornstad P, Nadeau KJ. Age-related consequences of childhood obesity. *Gerontology.* 2014;60(3):222-228.
28. Bacha F, Gidding SS. Cardiac abnormalities in youth with obesity and type 2 diabetes. *Curr Diab Rep.* 2016;16(7):62-016-0750-6.

29. Liao Y, Tucker P, Giles WH. Health status among REACH 2010 communities, 2001-2002. *Ethn Dis*. 2004;14(3 Suppl 1):S9-13.

30. Hager ER, Quigg AM, Black MM, et al. Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics*. 2010;126(1):e26-32.

31. Blanck HM, Thompson OM, Nebeling L, Yaroch AL. Improving fruit and vegetable consumption: Use of farm-to-consumer venues among US adults. *Prev Chronic Dis*. 2011;8(2):A49.