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Personal characteristics, cooking at home and shopping frequency influence consumption

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ABSTRACT

This study examines how the consumption of fruits and vegetables is affected by home cooking habits and shopping patterns, including distance to patronized stores and frequency of shopping, in two low-income predominantly African American urban neighborhoods in New Orleans, Louisiana.

In-person interviews were conducted in 2013 with 901 adult residents who identified themselves as the primary household shopper. Respondents were asked where and how often they shopped and answered a food frequency questionnaire. Addresses were geocoded and distances to the stores where respondents shopped were calculated. Multivariable logistic regression was used to examine the relationship between food consumption and personal factors, neighborhood factors and shopping habits.

Consumption of daily servings of fresh produce increased by 3% for each additional trip to a grocery store, by 76% for shopping at a farmer's market, and by 38% for preparing food at home. Each additional trip to a convenience store increased the frequency of consumption of chips, candy and pastries by 3%. The distance from residence to the type of store patronized was not associated with consumption of produce or chips, candy or pastries.

Shopping at full-service grocery stores, farmer's markets and cooking at home were positively associated with the consumption of fresh produce while shopping at convenience stores was associated with increased consumption of chips, candy and pastries. These findings are useful for designing programmatic interventions to increase fresh fruit and vegetable consumption among residents in low-income urban communities.

1. Introduction

Diets are important determinants of health (Hung et al., 2004). Fruit and vegetable (F/V) consumption is known to promote health and prevent diseases such as CVD, type 2 diabetes, hypertension, osteoporosis, and cancer due to their concentration of nutrients including vitamins, folate, potassium, minerals, and dietary fiber (Hung et al., 2004; Heimendinger et al., 1996; Steffen, 2006; Bazzano, 2006; Dietary Guidelines Advisory Committee, 2010). Frequent consumption of food high in calories, fat, salt and sugar may increase one's overall daily energy intake and is associated with overweight and obesity, risk factors for developing CVD, diabetes, and hypertension [(van der Horst et al., 2008; Hu & Malik, 2010; Mrdjenovic & Levitsky, 2003; Roberts & Barnard, 2005; Joint WHO/FAO Expert Consultation, 2003). Understanding the determinants of food consumption and identifying related health promotion opportunities are crucial to the prevention of chronic diseases such as cancer, cardiovascular disease, Type 2 diabetes, obesity and metabolic syndrome (Heimendinger et al., 1996; van der Horst et al., 2008; McCrory et al., 1999; Zenk et al., 2005; Wu et al., 2011).

Age, income, and education have been found to be related to food choices (Zenk et al., 2005). F/V consumption is greater in older, higher income and more educated people (Zenk et al., 2005; Wu et al., 2011; Jaime et al., 2009). Men tend to consume F/V less frequently than women (Fraser et al., 2000; Krebs-Smith et al., 1995). Food choices are important in determining an individual's BMI [(Rose et al., 2009; Tohill et al., 2004). Uglem and colleagues found that young men with high intakes of plant foods were less likely to have a high BMI than their counterparts (Uglem et al., 2011). In contrast, restaurant food consumption, especially fast food, has been associated with higher BMI

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among adults (McCrory et al., 1999; Bowman & Vinyard, 2004). Kant et al. found that in the US, younger individuals consume greater amounts of beverages and snacks compared to older individuals with a higher percentage of energy consumed as sweetened beverages among younger individuals (Kant et al., 2012).

The food environment is an important factor associated with food consumption patterns (Zenk et al., 2009). People are more likely to meet national guidelines for F/V consumption when there are supermarkets or grocery stores in their neighborhood (Rose et al., 2009; Zenk et al., 2009; Morland et al., 2002a). Residents in poor and minority communities are less likely to have access to these stores and therefore, healthy food, than those in nonminority and higher income communities (Morland et al., 2002b; Apparicio et al., 2007; Crabtree & Mushi-Brunt, 2013). Recent studies indicated that distance to a grocery store was important but only in the context of frequency of shopping (Gustat et al., 2015; Aggarwal et al., 2014). A grocery store farther away was related to a lower frequency of shopping trips and lower consumption of produce. These barriers may influence people's dietary choices.

Convenience stores are often located throughout low-income neighborhoods and can be a substitute for supermarkets that may be located farther away (Sharkey et al., 2013). It has been shown, however, that convenience stores do not typically offer fresh produce and are known to have an unhealthier mix of food compared to larger food stores (Glanz et al., 2007). A study by O'Malley et al. indicated that shopping at corner stores was associated with the purchase of prepared foods and beverages (O'Malley et al., 2013).

Farmer's markets are another mechanism to supplement access to fresh foods. People who shop at a farmers' market at least once a week are more likely to consume F/V than those not shopping at a farmers' market (Bower et al., 2014; Kahin et al., 2016; McCormack et al., 2010). Farmer's markets may be a way to increase neighborhood access to F/V especially in low-income areas (McCormack et al., 2010). However, more research is needed in this area.

Cooking dinner at home is associated with healthy dietary patterns. Respondents in one study who cooked dinner six to seven times per week consumed less fat and sugar per day compared with those who cooked dinner zero to once per week.(Wolfson & Bleich, 2015) In our busy modern society, people spend more time at work or work multiple jobs making it more difficult to prepare meals at home from scratch than buying pre-prepared food, fast food or box mixes. The term 'scratch' refers to meals prepared at home without box or pre-prepared mixes and sauces. However, research is not clear how people understand and use this term (Smith et al., 2013; Wolfson et al., 2016). Nevertheless, a connection is seen with cooking at home and increased consumption of F/V (Wolfson & Bleich, 2015). A study by Pérez-Lizaur found that children with parents who cook at home have diets higher in consumption of F/V than other children (Pérez-Lizaur et al., 2008). Additionally, Monsivais et al. identified time as an essential factor in healthy eating habits among adults (Monsivais et al., 2014). The food industry has produced a range of convenient alternatives to cooking from scratch at home (Gehlhar & Regmi, 2005; Monteiro et al., 2013). These convenient alternatives such as frozen pizza, prepared and canned foods, are often high in sodium, fat and non-essential nutrients (Ahuja et al., 2015; Maalouf et al., 2015; Monteiro et al., 2010; Baker & Friel, 2014; Ryan et al., 2004). Cooking at home may affect daily intake of fresh F/V.

In order to better understand the relationship with patterns of food consumption among residents of low-income primarily African American urban neighborhoods, we examined various factors such as shopping frequency, cooking food at home, shopping at a farmer's market, grocery, corner and convenience stores with consumption of fresh F/V, total F/V and consumption of chips, candy and pastries in a neighborhood sample.

2. Materials and methods

2.1. Participants and recruitment

In-person interviews were conducted by trained interviewers in 2013 with 901 adults who identified themselves as the primary household shopper in two neighborhoods in New Orleans in this cross-sectional study. The neighborhoods were selected because of similar area household density, number of people per household, racial composition, age distribution, median income and homeownership and were chosen to examine future changes in anticipation of a grocery store being opened in one of the neighborhoods. All blocks within each neighborhood were enumerated by listing residential addresses and selecting every third housing unit for inclusion in the study sample. Households selected for inclusion were visited up to six times to obtain an initial contact for the interview.

In order for respondents to be included, they had to be the main shopper for the household, at least 18 years old and residing in the neighborhood for a minimum of three months and have the ability to speak English. The interview took approximately 20 min and assessed demographic characteristics, average distance to the store or place where the respondent purchased food, number of food shopping trips per month, how often food was prepared at home from scratch, and dietary patterns. Consumption of food was assessed in a modified food frequency format including frequency of fresh, canned, and frozen produce along with other food categories such as salty snacks, candy and pastries/sweet baked goods, and diet and regular carbonated drinks. The questions were based on the Behavioral Risk Factors Surveillance System (BRFSS) questions and used by the authors in a previous telephone survey conducted city-wide in 2011 (Gustat et al., 2015; Centers for Disease Control and Prevention, 2011). All respondents provided oral consent and all protocols were approved by the Tulane Institutional Review Board.

2.2. Measures and outcomes

Four dependent variables were examined in the present study: fresh F/V consumption, total F/V consumption, consumption of chips, candy and pastries including regular (sweetened) carbonated drinks and consumption of chips, candy and pastries not including regular carbonated drinks (Block, 2004). The question assessing fresh fruit consumption was phrased "How many servings of FRESH fruit do you usually eat?" Similar questions were used to assess fresh, canned and frozen F/V consumption. Respondents could indicate their consumption in terms of day, week, month or year. The food frequency information was converted to servings per day or times per day by dividing (i.e. If respondent consumed 10 servings per week, it was divided by 7 to obtain daily servings). The fresh produce consumption variable was created by summing average daily servings of fresh F/V. The consumption of total F/V variable was created by summing daily servings of fresh, canned, and frozen F/V. Consumption of chips, candy and pastries with regular carbonated drinks was created by summing the frequencies of average daily consumption for responses to the following items: "How often do you eat chips or salty snacks?"; "How often do you eat candy?"; "How often do you eat cookies, doughnuts, sweetened baked goods or pastries?"; "How often do you drink sugar sweetened carbonated drinks such as Coke, Pepsi, Sprite, Big Shot, Barq's root beer, et cetera?" Because we were unsure of the influence of regular carbonated beverage consumption on overall consumption of chips, candy and pastries, we examined consumption of these items with and without regular carbonated beverages. As the main outcomes were not normally distributed, we used quartiles as the cut-off points. For fresh F/V and total F/V, consumption was categorized into two groups, (top three quartiles versus bottom quartile). The cut point of the bottom quartile of fresh produce was ≤1 serving per day. The cut point of the bottom quartile of total produce was ≤1.7 servings per day. Chip, candy and pastry consumption was

categorized into two groups (top quartile vs. bottom three quartiles) with and without regular carbonated beverage consumption. For those who consumed chips, candy and pastries without regular carbonated beverages, the cut point of the top quartile was ≥2.5 times per day. For consumption of chips, candy and pastries with regular carbonated beverages, the cut point of the top quartile was ≥4.0 times per day.

Demographic variables were self-reported and included age, gender, household size, ethnicity, education, marital status, household income, participation in a food assistance program, and car ownership. Since the residents of the two neighborhoods in this study were primarily African Americans, we combined other races/ethnicities such as white, Asian, and Hispanic/Latino into one group. The highest grade or year of school participants completed was recorded as their education level. Education was then categorized into three groups: less than high school, high school graduate, and more than a high school education. Co-habitating individuals were analyzed in the married group. Household income was categorized with the mid-point of each category and treated as an ordinal variable in the bivariate and multivariable models. For example, if the household income was between $10,000 and $25,000, we recoded it as $17,500. The food assistance program variable was derived from the question "Do you participate in any of the following food assistance programs: WIC (Special Supplemental Nutrition Program for Women, Infants and Children); SNAP (Supplemental Nutrition Assistance Program), food stamps, EBT (Electronic Benefits Transfer) or Louisiana Purchase Card?" We created the "access to a car" variable from two questions. "Do you or anyone in your household own a car?" and "Do you have access to a car?" Participants were considered to have access to a car if they responded "yes" to either question. Body mass index (BMI: kg/m^2) was calculated from self-reported height in feet and inches and weight in pounds.

Food shopping and preparation patterns were also assessed. We examined how often respondents cooked at home. Respondents indicated how many times they prepared meals from scratch at home per day. We also asked how often they ate meals prepared at home using a box mix such as Hamburger Helper, Zatarain's, macaroni and cheese or other food from a box or other 'meal in a minute' type products. Frequency of grocery shopping was assessed and included the number of times per month the respondent shopped at a grocery store, at a convenience store, and at a corner store. Grocery stores are full service food stores. Convenience stores are often with a gas station, do not primarily sell fresh food, and can include chain discount stores and drug stores (Farley et al., 2009). Corner stores are small neighborhood (non-chain) stores. Trips to a farmer's market were assessed categorically (yes/no) if the respondent had visited the market over a three-month period. Distance between each respondents' home and store frequented was calculated using ArcGIS 10 (ESRI, Redlands, CA). Driving distance from residence to patronized store was derived using the ArcGIS Network Analyst Extension (ESRI & ArcGIS) (Charreire et al., 2010).

2.3. Statistical analysis

Because some variables were not normally distributed, medians and interquartile ranges (IQR) are presented for the continuous variables. Means and standard deviations are presented when variables are normally distributed. Frequency distributions and percentages for the categorical variables were computed and presented. Bivariate associations were examined between the independent variables and each of the four dependent variables using logistic regression. A variable with a p-value < 0.05 at the bivariate level was considered significant for inclusion in the multivariable model. Multivariable logistic regression models were then developed for each of the dependent variables with the variables significant at the bivariate stage. Estimates were adjusted for the other variables in the model. Estimated Odds Ratio (OR) and 95% confidence intervals (CI) were determined. All analyses were conducted using SAS (version 9.3; SAS Institute, Inc., Cary, North Carolina).

3. Results

Baseline characteristics of the respondents are shown in Table 1. There were 901 participants included in the analysis representing an overall response rate of about 65%. The mean age of the residents of our study sample was 48.0 (±16.7) years. Most of the respondents were female (72.0%) and the sample was predominantly African American (81.8%). The mean BMI was 28.9 kg/m^2. The median number of persons in a household was 2.0. Residents consumed a median of 2.0 servings of fresh F/V per day. Chips, candy and pastries with and without regular soft drinks were consumed a median of 1.2 and 1.9 times daily, respectively. The average distance from a respondents' home to where they shopped for groceries was 4.5 (±3.4) kilometers. On average, respondents shopped at a grocery store about 6.0 times (±9.1) per month. Approximately 28% had shopped at a farmer's market in the three months before the interview (Table 1).

Both the bivariate and multivariable associations are presented for each of the four outcomes: fresh F/V consumption, any F/V consumption, chips, candy and pastries including regular carbonated drinks

Table 1
Study characteristics of the respondents; New Orleans, Louisiana; 2013 (n = 901).

	Mean ± SD, median; IQR or **no. (%)**
Demographic	
Age (year)	*48.0 ± 16.7*
Gender	
Female	**646 (72.0)**
Race/ethnicity	
African American	**722 (81.8)**
Education	
<High school	**705 (78.8)**
≥High school	**190 (21.2)**
Marital status	
Married and co-habitating	**232 (25.9)**
Others	**665 (74.1)**
Income	
<10,000	**323 (38.8)**
10, 000–25,000	**274 (32.9)**
>25,000	**235 (28.3)**
BMI (kg/m^2)	*28.9 ± 7.4*
Household size (persons)	2.0; 3.0
Use of a food assistance program	**455 (50.5)**
Own or access to a car	**749 (83.7)**
Consumption	
Fresh fruit and vegetables (servings per day)	2.0; 3.0
Total fruit and vegetables (servings per day)	3.3; 3.5
Chips, candy and pastries with regular soda (servings per day)	1.2; 2.1
Chips, candy and pastries without regular soda (servings per day)	1.9; 3.3
Box mix food[a] (times per day)	0.3; 4.0
Fast food (times per day)	0.1; 7.0
Average number of times cooking at home from scratch per day	0.7; 1.7
Geographic factors	
Average distance to store respondent patronized (km)	*4.5 ± 3.4*
Shopping frequency[b]	
To grocery store (trips per month)	*6.0 ± 9.1*
To corner store (trips per month)	*1.1 ± 11.1*
To convenience store (trips per month)	*1.8 ± 7.0*
To farmer's market (respondent visits in past 3 months)	**255 (28.3)**

SD: standard deviation; IQR: interquartile range.
Bold indicates number of respondents and (percentage of the sample); italics indicate mean ± standard deviation.
[a] Box mix food refers to meals prepared at home using a box mix such as Hamburger Helper, Zatarain's, macaroni and cheese or other food from a box or other 'meal in a minute' type products.
[b] Shopping frequency refers to the number of times respondents visited the indicated location.

and chips, candy and pastries without regular carbonated drinks in Tables 2 and 3. For fresh F/V consumption at the bivariate level, owning or having access to a car ($p < 0.001$), distance to patronized grocery store ($p < 0.05$), monthly shopping trips to a grocery store ($p < 0.05$), shopping at a farmer's market in the past 3 months ($p < 0.001$) and cooking from scratch ($p < 0.001$) were significantly associated with increased consumption of fresh F/V. Having less than a high school education ($p < 0.05$), shopping at a corner store ($p < 0.05$), and a convenience store ($p < 0.05$) were associated with decreased consumption of fresh F/V. At the multivariable level, car access (OR: 1.62; 95% CI: 1.08–2.43), trips to a grocery store (OR: 1.03; 95% 1.01–1.06), shopping at a farmer's market (OR: 1.76; 95% CI: 1.20–2.56) and cooking from scratch at home (OR: 1.38; 95% CI: 1.15–1.64) were associated with increased fresh F/V consumption while shopping at a corner store (OR: 0.96; 95% CI: 0.93–0.99) was associated with decreased fresh F/V consumption.

The pattern of consumption of total F/V was similar. At the bivariate level, being male was associated with decreased consumption ($p < 0.01$) while car access ($p < 0.01$), distance to patronized grocery store ($p < 0.05$), frequency of shopping at a grocery store ($p < 0.01$) and farmer's market ($p < 0.01$) and cooking from scratch ($p < 0.001$) were positively associated with increased total F/V consumption (Table 2). No significant association was observed between education level and total F/V consumption.

In the multivariable models for total F/V consumption, factors positively associated with increased consumption included car access (OR: 1.52; 95% CI: 1.00–2.31), frequency of shopping at a grocery store (OR: 1.05; 95% CI: 1.01–1.08) and farmer's market (OR: 1.58; 95% CI: 1.06–2.35), and number of times cooking from scratch (OR: 1.62; 95% CI: 1.32–1.98) (Table 2). Male gender was associated with a decrease of total F/V consumption (OR: 0.54; 95% CI: 0.38–0.78). Interactions between race, income and education were tested in the models for both fresh F/V and total F/V and found not significant (data not shown).

Factors associated with more frequent consumption of chips, candy and pastries not including regular carbonated beverages included African American race ($p < 0.001$), having less than a high school education ($p < 0.001$), participating in a food assistance program ($p < 0.001$), and frequently shopping at a convenience store ($p < 0.001$) at the bivariate level (Table 3). Age ($p < 0.001$) and being married or co-habitating ($p < 0.01$) were inversely associated with consumption of chips, candy and pastries without regular carbonated beverages. In the multivariable model, the same variables remained significantly associated. Being African American (OR: 2.65; 95% CI: 1.58–4.43), having less than a high school education (OR: 1.88; 95% CI: 1.29–2.75), participating in a food assistance program (OR:1.46; 95% CI: 1.04–2.06) and frequently shopping at convenience store (OR: 1.03; 95% CI: 1.01–1.05) were associated with increased chips, candy and pastry consumption without regular carbonated beverages. Age (OR: 0.98; 95% CI: 0.97–0.99) and being married or co-habitating (OR: 0.66; 95% CI: 0.45–0.99) were inversely associated with consumption of chips, candy and pastries not including regular carbonated beverages.

The models examining frequency of chips, candy and pastry consumption including regular carbonated beverages showed similar associations at the bivariate level as models not including regular carbonated beverages (Table 3). In the multivariable model, being African American (OR: 3.63; 95% CI: 2.07–6.38), having less than a high school education, and frequency of shopping at a convenience store (OR: 1.02; 95% CI: 1.001–1.04) were positively associated with consumption of chips, candy, and pastries including regular carbonated beverages. Age remained inversely associated (OR: 0.98; 95% CI: 0.97–0.99). Interactions between race, income and education were tested in the models for both chips, candy and pastry consumption with and without carbonated beverages and found not significant (data not shown).

4. Discussion

The presence of grocery stores, supermarkets, and convenience stores has been shown to influence residents' dietary behaviors (Pérez-Lizaur et al., 2008; Ryan et al., 2004; Gustafson et al., 2013; Serdula et al., 1995; Swanson et al., 1993; Jacobson & Hurley, 2002; Robinson et al., 2013; Bodor et al., 2010; Sweetman et al., 2011). Although previous studies have shown that race, income, education, BMI, and distance to a store were factors that influence the consumption of fresh produce, total produce, and other food consumption patterns (Zenk et al., 2005; Wu et al., 2011; Jaime et al., 2009; Fraser et al., 2000; Krebs-Smith et al., 1995; Rose et al., 2009; Tohill et al., 2004;

Table 2
Bivariate and multivariate logistic regression models for factors related to consumption of fresh fruit and vegetables and total fruit and vegetables (including canned and frozen); New Orleans, Louisiana; 2013.

	Fresh F/V consumption ($N = 765$)[a]		Total F/V consumption ($N = 765$)[a]	
	Bivariate Model OR (95% C.I.)	Multivariable Model OR (95% C.I.)	Bivariate Model OR (95% C.I.)	Multivariable Model OR (95% C.I.)
Age (years)	1.01 (0.99–1.02)	–	1.01 (0.99–1.02)	–
Male gender	0.76 (0.55–1.05)	–	0.63 (0.45–0.88)**	0.52 (0.36–0.75)***
African American	0.70 (0.47–1.05)	–	0.90 (0.59–1.36)	–
<High school education	0.68 (0.48–0.96)*	0.73 (0.50–1.06)	0.81 (0.56–1.81)	–
Married and co-habitating	1.07 (0.76–1.51)	–	1.00 (0.70–1.43)	–
Income (USD)	1.00 (0.99–1.00)	–	1.00 (0.99–1.00)	–
BMI (body mass index: kg/m^2)	1.01 (0.99–1.03)	–	1.01 (0.99–1.04)	–
Use of a food assistance program	0.87 (0.65–1.17)	–	1.14 (0.83–1.56)	–
Own or access to a car	1.98 (1.37–2.87)***	1.62 (1.08–2.43)*	1.76 (1.19–2.61)**	1.66 (1.08–2.53)*
Box mix food[b]	1.19 (0.90–1.58)	–	1.51 (1.07–2.13)*	1.75 (1.18–2.61)*
Fast food	1.00 (0.70–1.45)	–	0.92 (0.64–1.33)	–
Average distance to store patronized	1.05 (1.00–1.10)*	1.01 (0.96–1.06)	1.06 (1.01–1.12)*	1.05 (0.99–1.11)
Shopping frequency				
To grocery store (trips per month)	1.03 (1.00–1.05)*	1.03 (1.01–1.06)*	1.05 (1.02–1.09)**	1.05 (1.02–1.08)**
To farmer's market (past 3 months) (yes/no)	2.07 (1.44–2.97)***	1.76 (1.20–2.56)**	1.74 (1.19–2.54)**	1.58 (1.06–2.35)*
To corner store (trips per month)	0.96 (0.93–0.99)*	0.96 (0.93–0.99)*	0.97 (0.94–1.00)	–
To convenience store (trips per month)	0.98 (0.96–0.99)*	0.99 (0.97–1.01)	0.98 (0.96–1.00)	–
Daily times of cooking from scratch (cooking at home)	1.40 (1.18–1.67)***	1.38 (1.15–1.64)***	1.65 (1.35–2.01)***	1.65 (1.34–2.03)***

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.
[a] Consumption of fresh fruit and vegetable and total fruit and vegetable consumption examined as the top three quartiles vs the bottom quartile.
[b] Box mix food refers to meals prepared at home using a box mix such as Hamburger Helper, Zatarain's, macaroni and cheese or other food from a box or other 'meal in a minute' type products.

Table 3
Bivariate and multivariate logistic regression models for factors related to consumption of chips, candy and pastries with and without regular soda; New Orleans, Louisiana; 2013.

	Chips, candy and pastry consumption not including regular soda ($N = 765$)[a]		Chips, candy and pastry consumption including regular soda ($N = 765$)[a]	
	Bivariate Model OR (95% C.I.)	Multivariable Model OR (95% C.I.)	Bivariate Model OR (95% C.I.)	Multivariable Model OR (95% C.I.)
Age (years)	0.98 (0.97–0.99)***	0.99 (0.98–0.99)*	0.98 (0.97–0.99)***	0.98 (0.97–1.00)
Male gender	1.04 (0.74–1.45)	–	0.75 (0.53–1.08)	–
African American	2.35 (1.47–3.76)***	2.23 (1.30–3.82)*	3.13 (1.85–5.32)***	3.09 (1.72–5.55)***
<High school education	1.95 (1.38–2.75)***	1.96 (1.32–2.95)***	1.51 (1.06–2.16)*	1.54 (1.03–2.32)*
Married and co-habitating	0.56 (0.38–0.81)**	0.70 (0.46–1.07)	0.66 (0.46–0.96)*	0.82 (0.54–1.24)
Income (USD)	1.00 (0.99–1.00)	–	1.00 (0.99–1.00)	–
BMI (body mass index: kg/m^2)	1.00 (0.98–1.03)	–	1.02 (0.99–1.04)	–
Use of a food assistance program	2.06 (1.51–2.80)***	1.52 (1.06–2.18)*	1.56 (1.14–2.13)**	1.13 (0.78–1.62)
Own or access to a car	0.74 (0.50–1.09)	–	0.94 (0.62–1.42)	–
Box mix food[b]	2.31 (1.77–3.01)***	1.72 (1.28–2.31)**	2.33 (1.79–3.03)***	1.89 (1.41–2.53)***
Fast food	9.34 (5.12–17.1)***	7.15 (3.70–13.8)***	8.11 (4.50–14.6)***	6.04 (3.22–11.4)***
Average distance to store patronized	1.02 (0.97–1.06)	–	1.01 (0.97–1.06)	–
Shopping frequency				
To grocery store (trips per month)	1.00 (0.99–1.02)	–	1.01 (0.99–1.02)	–
To farmer's market (past 3 months, yes/no)	0.97 (0.69–1.36)	–	0.87 (0.61–1.23)	–
To corner store (trips per month)	0.99 (0.98–1.01)	–	0.99 (0.98–1.01)	–
To convenience store (trips per month)	1.04 (1.02–1.06)***	1.03 (1.00–1.05)*	1.02 (1.00–1.04)*	1.01 (0.99–1.04)
Daily times of cooking from scratch (cooking at home)	0.94 (0.80–1.10)	–	0.95 (0.81–1.11)	–

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.
[a] Consumption of junk food with and without regular soda examined as the top quartile vs. bottom three quartiles.
[b] Box mix food refers to meals prepared at home using a box mix such as Hamburger Helper, Zatarain's, macaroni and cheese or other food from a box or other 'meal in a minute' type products.

Uglem et al., 2011; McCrory et al., 1999; Bowman & Vinyard, 2004), we did not find significant associations with income, BMI or distance. Race, however, was significant in the chip, candy and pastry models in the present study. Also, we found that younger people consumed more chips, candy and pastries with and without sweetened carbonated beverages, which is consistent with previous findings (Gustafson et al., 2013). Young adults have been found to be high consumers of snacks that are high in sugar, salt and fat (Sweetman et al., 2011). High calorie snack food are major contributors to overweight and obesity (Wolfson & Bleich, 2015). As in our previous work (Gustat et al., 2015), we found that shopping frequency and type of store played more of a role in consumption than distance. In the present study, more frequent visits to grocery stores and farmer's markets was related to increased consumption fresh and total F/V while more frequent trips to a convenience store was associated with more frequent consumption of snack foods high in sugar, salt, and fat.

Food prepared at home is more likely to be healthier than that from a restaurant or that comes from a box mix. As national trends indicate an increase in people eating outside the home and buying prepared foods, it will be important to emphasize strategies for increasing cooking at home (Smith et al., 2013). In this analysis, we found that cooking at home was associated with the consumption of fresh F/V and total F/V. This emphasizes the role of cooking at home towards a healthy lifestyle (Wolfson & Bleich, 2015; Worsley et al., 2015).

4.1. Study limitations and strengths

There are a number of study limitations to consider. The cross-sectional design precludes assessment of causal associations. The missing data for those not reporting income was sizable so models were run with and without the inclusion of the income variable and little difference was seen. The servings or frequencies of food consumption were reported by the main household shoppers and may not represent the distribution of the intake patterns of other household residents. Additionally, the majority of the residents were low income (>70% of respondents reported annual household incomes less than $25,000) and the results are likely not generalizable to populations with higher incomes. We asked directly about foods prepared from scratch at home. But we did not know exactly what people considered as meals prepared from scratch. Perceptions of cooking are complex and varied (Wolfson et al., 2016).

Study strengths should be noted. Most studies have focused on the association of risk factors and food consumption among Caucasian populations. The target population, low income African Americans, in this study has not been well studied previously. This study was conducted in New Orleans, a city with documented disparities in access to supermarkets and healthy food options (Bodor et al., 2008). Our data included actual stores where people reported shopping. Most other research in the food environment literature only accounts for geographic proximity and does not account for the actual locations of the stores where neighborhood residents shop. Much of the current literature has focused on factors associated with the consumption of healthy food (Rose et al., 2009; Zenk et al., 2009; Morland et al., 2002a; Morland et al., 2002b; Apparicio et al., 2007; Crabtree & Mushi-Brunt, 2013; Gustat et al., 2015; Trude et al., 2016; Haynes-Maslow et al., 2013; Clum et al., 2016). This study not only assessed the consumption of healthy food but also the consumption of high calorie foods full of sugar, salt and fat with the types of store such as corner stores and convenience stores frequently located in low-income primarily African American neighborhoods.

4.2. Conclusions

Although some studies have demonstrated that distance is a factor influencing consumption behaviors, this study supports the growing concept that distance is only a part of the food consumption picture. Shopping frequency is an important factor also associated with consumption. Making healthy options available in corner and convenience stores in low income communities could increase the availability and sale of healthy food, specifically fresh produce (Song et al., 2009). This may be an alternative to increasing the number of the grocery stores in these types of neighborhoods. Moreover, policy initiatives like the Healthy Food Financing Initiative (HFFI) (Healthy Food Financing Initiative, 2017) and Fresh Food Retailers Initiative (FFRI) (Fresh Food Retailers Initiative, 2014; Ulmer et al., 2012) that provide grants and low-interest loans for the development of supermarkets in low access

neighborhoods and funds for small store owners and farmer's market operators to expand their capacity to provide fresh quality produce at competitive prices in neighborhoods underserved by supermarkets – typically low-income communities of color – can increase access to healthy, affordable food in these historically under-resourced neighborhoods. Additionally, researchers need to investigate barriers to cooking at home, practitioners need to advocate the benefits of cooking at home, and the food industry should be encouraged to invest in marketing and production efforts to develop fresh, low-cost, quality convenient meal options. Cooking at home may be a relatively straight-forward way to increase F/V consumption (Healthy Food Financing Initiative, 2017; Ulmer et al., 2012).

Conflict of interest

None.

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