Factors Influencing Access to Fresh Fruits and Vegetables in Baton Rouge, Louisiana

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Abstract

Increasing obesity rates and associated poor diets are a major concern in the U.S. The USDA recommends that Americans increase fruit and vegetable intake. This study examines produce availability in Baton Rouge, Louisiana. Results indicate that competition, store type, and income may be associated with produce availability.

Keywords: Food Desert, Food Access, Food Stores, Supermarkets, Grocery Store Obesity, Availability, Accessibility, Fruits, Vegetables.

1. Introduction

Increasing obesity among children and adults as well as "lifestyle diseases" such as diabetes and heart disease resulting from, among other factors, a poor diet have become a major concern in the United States. In recent years, approximately 15% of households in the U.S. have been unable to meet their food need requirements while many other Americans consume less than the recommended amount of nutrients despite having adequate resources to acquire them. The USDA Dietary Guidelines for Americans recommends eating a diet which emphasizes nutrient dense food and beverages such as vegetables, fruits, whole grains, fat-free or low fat milk products, seafood, lean meats and poultry, eggs, beans and peas, and nuts and seeds. They also recommend that most Americans increase fruit and vegetable consumption, citing their nutrient density, association with reduced rates of chronic illness, and low energy density as reasons for the recommendation. The typical American diet includes only 59% of the recommended vegetable and 42% of the recommended fruit intake (USDA, 2010).

An important factor in increasing fruit and vegetable intake is accessibility to fresh produce (Blanchette & Brug 2005; Bere & Klepp 2004; Neumark-Sztainer et al., 2003). Increased accessibility to fresh vegetables has been shown to correlate to an increase in consumption (Bodor et al., 2007). A review of several produce availability studies conducted by Jago, Baranowski and Baranowski (2007) suggested that availability was a good predictor of fruit and vegetable consumption. While the authors indicate that these correlations need to be studied in greater detail before drawing definitive conclusions, the strong correlation between availability and consumption suggests that determining local

fruit and vegetable (F&V) availability is in an important step in the process of increasing consumption.

Concerns about food access have been extensively discussed in the literature pertaining to food deserts (Beaumont et al., 1995; Blanchard & Lyson, 2007; Walker, Keane & Burke, 2010). More recently, the term "food swamp" has been used to refer to an area that has a high availability of energy dense and nutrient sparse foods and a low availability of low calorie and nutrient dense foods (Bodor et al., 2009). Food availability is an important factor in determining overall food access. While other variables such as price, spatial environment, and the grocery-shopping environment will certainly play a role in overall food accessibility for a community, it is hard to imagine a thorough examination of food accessibility that does not include availability.

The aim of this study is to examine produce availability in Baton Rouge using a data set of food stores in East Baton Rouge (EBR) Parish. Produce availability data are analyzed using GIS and statistical software. The analysis compares spatial and demographic data with food availability for different census tracts in EBR.

2. Literature Review

This literature review examines several studies relevant to the question of produce availability. The studies reviewed are not necessarily exclusively produce availability studies, but include fruit and vegetable availability as part of the study. Many of the studies examined highlight the need for further produce availability studies, while others more explicitly measure fruit and vegetable availability in local food stores.

Twelve studies pertaining to food availability were examined. Several studies utilizing Nutrition Environmental Studies Measures Survey (NEMS) protocols were examined (Glanz et al., 2007; Krukowski et al., 2010; Franco et al., 2008). In each of the NEMS-based studies, food availability is positively correlated with income, suggesting that lower-income areas have lower food access. The same result is found in a study of neighborhood food availability in Albany, New York (Hosler et al., 2008) and is partially supported by the study of healthful food availability in Glasgow, Scotland (Cummings & Maintyre, 2002). In a qualitative literature review, Jago, Baranowski, & Baranowski (2007) suggest that more home availability is positively correlated to more fruit and vegetable consumption. This result was also found by Cheadle et al. (1991), but is contradicted by a study of African-American Boy Scouts (Edmonds et al., 2001). A study broadly examining home availability of F&V in 10 European countries (Naska et al., 2000) found that the majority of subjects in the study region did not have enough food available in their homes. While none of these studies attempts to exclusively examine produce availability in an urban or suburban environment, all of them suggest the need for studies that do so in order to investigate the cause of under-consumption of produce.

3. Data and Methodology

3.1 Study Area

Located in EBR, Baton Rouge is the capital city and second largest city in Louisiana with a population of 229,493. East Baton Rouge Parish had a population of 400,171 as of 2010**.** According to the 2010 U.S. Census, the ethnic makeup of Baton Rouge is 49.5% White, 45.9% African American, 3.0% Asian, 3.8% Hispanic, 0.3% Native American,

and 0.1% Pacific Islander. The population density of Baton Rouge is 906 people per square mile (U.S. Census, 2010).

Baton Rouge is relatively low-income compared to the national average. About 19% of its residents live below the poverty line, compared with the national average of 15%. The median household income is $48,274 annually compared to the national average of $53,046. The annual per capita money income is $27,267 compared with the national average of $28,051 (U.S. Census, 2010).

Obesity in the state and parish are well above the national average. The childhood obesity rate in EBR is 40% for children between the ages of 10 and 17; the national average for children 12-19 is 21%. About 28% of adults in the U.S. are obese; 28% of adults in EBR are obese. Louisiana has the highest obesity rate in the nation with 35% of adults categorized as obese (CDC, 2013).

3.2 NEMS Survey

NEMS is a research protocol developed to measure the nutrition environment within retail food stores using observational measures. The survey assesses the availability of healthy food based on diversity of produce available, price, and quality. The initial survey was carried out in the Atlanta, Georgia, Metropolitan Area. Using the methods from the original study (detailed below), a similar study was carried out on stores in the Baton Rouge Metropolitan Statistical Area.

Stores were split into three distinct groups: grocery stores, convenience stores, and other. Number of cash registers per store was used to determine store size. The original store list included 652 stores of which 561 (roughly 80%) were successfully surveyed. Of these,

373 of the stores surveyed were located in EBR. Of the stores not surveyed, 20 were not surveyed due to the same store being listed at duplicate addresses, 16 of the listed stores were found to be restaurants, 24 were ethnic food stores that did not carry the items on the list or were too small to audit, 45 were closed at the time of the survey, and 19 stores refused to let the auditors complete the survey.

"Healthful" foods were identified based on criteria drawn from federal publications (Food and Drug Administration, 1999; U.S. Department of Health and Human Services, 2005) and previous research (American Heart Association, 2005; Mullis, Snyder & Hunt, 1990). The survey methodology also stipulates that the foods be broken into 10 indicator food groups. These groups are fruit, vegetables, milk, ground beef, hot dogs, frozen dinners, baked goods, beverages (soda/juice), whole grain breads, and baked chips. The survey focuses on measuring the availability of recommended food groups, their price, and the quality of produce available. For all groups and categories, price and quantity are recorded. Additional variables and specifications were determined for each of the 10 food groups examined. Details about the fruit and vegetable groups, which are the basis for this study, are outlined below.

The survey includes the 10 most consumed fruits and vegetables in the United States based on national food sales and national food consumption data (Putnam, Allhouse & Kantor, 2003). Based on previously-used dietary assessment methods (Vainio & Bianchini, 2003), potatoes were excluded from the list of vegetables examined. The fruits examined included bananas, apples, oranges, grapes, cantaloupe, peaches, strawberries, honeymelon, watermelon, and pears. Vegetables included were carrots, tomatoes, sweet peppers, broccoli, lettuce, corn, celery, cucumbers, cabbage and cauliflower. Quality of

produce was measured with an acceptable/ unacceptable rating based on whether the majority (more than 50%) of the produce appeared to be bruised, old-looking, over-ripe or spotted. While in general this variable was graded on a pass/ fail basis, surveyors were instructed to note in the comment section if the quality of produce was approximately 50% acceptable/ 50% unacceptable. For the survey performed in Baton Rouge, very few produce items were marked as unacceptable and none were marked 50/50. Because of the very low rate at which unacceptable produce occurred in the Baton Rouge survey (0.21%), it is excluded from this analysis. In addition to the total number of each fruit or vegetable that is available, surveyors also recorded the number of different types of specific produce items that were available.

3.3 Competition Model

A between-store competition variable is calculated as a spatial competition gravity index variable, where competition is a function of between-store distance. Formally:

(1) $Comp_{ij} = \sum_{j=1}^{n} \frac{Distance_{ij}}{(Distance_{ij})^2}$,

where *i* refers to store *i* and *n* is the total number of competing stores, *j*, that lie within a ten-mile radius of store *i.* Stores farther than 10 miles from store *i* were not considered as competition (Blanchard & Matthews, 2003) and were not included in the gravity model. Distances are calculated as total travel distance, not straight-line distance, as travel distance is a more accurate measure of travel distance between stores. This model, used by Gillespie, O'Neil, & Hatzenbuehler (2012), was adapted from Bucklin (1971).

3.4 Variables

Two dependent and eight independent variables are used in this analysis. The dependent variables examined are count variables for both F&V ranging from 0 to 10 that show total numbers of different fruit or vegetable items available in a given store. The explanatory variables used are median household income, neighborhood racial makeup, population density, a between-store competition index, store size, two variables related to store classification, and an interaction term relating median household income and convenience store classification. All demographic variables were analyzed at the census tract level and collected from the 2010 U.S. Census. Neighborhood racial makeup is characterized by the percentage of African Americans in a given census tract. Between-store competition is determined using the competition index specified above. Store size is quantified by the number of registers per store. The store classification variables are derived from the classifications indicated by the NEMS survey. Dummy variables were constructed identifying stores as either convenience stores or specialty stores. Grocery stores are designated as neither. Stores classified as convenience stores were marked as such in the NEMS survey while stores marked as "other" in the NEMS survey were classified as specialty stores. "Dollar" stores, initially considered "other" stores, are considered convenience stores for the purpose of this analysis. An interaction term between convenience store classification and median household income is also specified. The purpose of this term is to examine the effect income has on the number of fruits and vegetables carried in a convenience store.

3.5 Statistical Models

Fruit and vegetable availabilities were analyzed separately. Poisson and negative binomial regression models were both considered for this analysis. Examination of the

summary statistics (presented in the Results section) shows that the means and variances for the fruit and vegetable count variables are different. This suggests that Poisson regression may not be a valid specification for this data. The likelihood ratio test for the negative binomial regression, which tests whether this model is significantly different from the Poisson model, indicates that the negative binomial model is indeed different. The Poisson model was therefore rejected and excluded from this analysis.

4. Results

Table 4.1 Summary Statistics of Fruit and Vegetable Variables.

Variable	Obs	Mean	Std. Dev	Min	Max
Fruit	373	2.23	3.57	0	10
Veg	373	2.30	3.81	0	10

Table 4.2 Fruit Count Data Regression Results.

Fruit	Coefficient	Std. Error
African American	-0.00172	0.00460
Median Household Income	-0.00213	0.00803
Population Density	-0.00002	0.00007
Competition	9.38479*	4.87364
Cash Registers	-0.00279	0.02096
Convenience Store	-1.81008***	0.51687
Speciality Store	-1.11251***	0.37505
Convenience × Income	-0.01694**	0.00864
Constant	1.12979	0.97088

Count data variables, summarized in Table 4.1, were analyzed using a negative binomial model. The count data variable for fruit, which ranges from 0 to 10 fruits per store, was negatively associated convenience store classification, specialty store classification, and

the convenience store and median household income interaction term. It was positively associated with the competition index. The coefficients for convenience and specialty store classification are both significant with values of -1.8 and -1.1, respectively. The interpretation is that convenience stores have, on average, 1.8 fewer fruits than grocery stores and specialty stores have 1.1 less fruits than grocery stores. The convenience store and income interaction term was also significant. The coefficient is -0.2, meaning that convenience stores in higher income areas carry fewer fruits than convenience stores in lower income areas. This may be caused by a food desert phenomenon, where convenience stores in low-income areas carry some fruit to make up for a lack of grocery stores. Competition was also statistically significant, suggesting that in areas of greater competition, store need to carry greater fruit variety.

Table 4.4 Vegetable Count Data Regression Results

Veg	Coefficient	Std Err
African American	0.00407	0.00543
Median Household Income	0.00406	0.00906
Population Density	-0.00004	0.00007
Competition	6.72382	5.02071
Cash Registers	-0.00473	0.02167
Convenience Store	-0.78664	0.60212
Speciality Store	-0.88714**	0.39472
Convenience × Income	-0.06118***	0.01191
Constant	0.89304	1.04372

The vegetable count analysis, presented in Table 4.3, reveals similar results for store type. Specialty store classification and the convenience store and income interaction term are negatively associated with the vegetable count variable. Specialty store classification

has a coefficient of -0.9. The convenience store and income interaction term is -0.1. The meaning of this coefficient is that as income increases, convenience stores carry fewer vegetables. In low-income areas convenience stores carry greater numbers of vegetables, possibly responding to demand not served due to a for a lack of grocery stores in food deserts.

5. Conclusions

Results of this study show that, as expected, convenience and specialty stores are clearly associated with lower amounts of fruit and specialty stores are associated with lower amounts of vegetables carried. Greater competition is associated with a larger number of fruits being available in stores. The convenience store classification and income interaction term was negative in both cases, suggesting that convenience stores carry more F&V in lower income areas.

Results of this study do not suggest that median household income and percent African American are, by themselves, associated with F&V availability in grocery stores. However, the significant interaction term for income and convenience stores suggests there are some store-type responses that deserve further consideration in examining the dynamics of food availability in grocery stores.

Before drawing conclusions about a multi-dimensional problem such as food access, it is important to consider all factors affecting accessibility. This study finds no conclusive evidence to suggest that examined stores carry fewer F&V items in low-income or African American areas. It suggests the need for an analysis of availability of grocery stores in low-income areas. We do not address whether stores are equally available in

low-income areas, only whether the stores that are available carry similar numbers of different fruits and vegetables. A more localized spatial analysis is necessary to uncover underserved areas. Price analysis is also an important factor in examining food availability. Whether or not low-income households pay more for produce and if they face prices that make healthful foods affordable are important aspects of accessibility analysis. However, these issues are beyond the scope of this paper, and will be left to future research.

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