



## Family food purchases of high- and low-calorie foods in full-service supermarkets and other food retailers by Black women in an urban US setting

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### ARTICLE INFO

#### Keywords:

Obesity  
Store choice  
Food choice  
Food shopping  
Supermarkets  
African Americans

### ABSTRACT

Public health interventions to increase supermarket access assume that shopping in supermarkets is associated with healthier food purchases compared to other store types. To test this assumption, we compared purchasing patterns by store-type for certain higher-calorie, less healthy foods (HCF) and lower-calorie, healthier foods (LCF) in a sample of 35 black women household shoppers in Philadelphia, PA. Data analyzed were from 450 food shopping receipts collected by these shoppers over four-week periods in 2012. We compared the likelihood of purchasing the HCF (sugar-sweetened beverages, sweet/salty snacks, and grain-based snacks) and LCF (low-fat dairy, fruits, and vegetables) at full-service supermarkets and six other types of food retailers, using generalized estimating equations. Thirty-seven percent of participants had household incomes at or below the poverty line, and 54% had a BMI > 30. Participants shopped primarily at full-service supermarkets (55%) or discount/limited assortment supermarkets (22%), making an average of 11 shopping trips over a 4-week period and spending mean (SD) of \$350 (\$222). Of full-service supermarket receipts, 64% included at least one HCF item and 58% at least one LCF. Most trips including HCF (58%) and LCF (60%) expenditures were to full-service or discount/limited assortment supermarkets rather than smaller stores. Spending a greater percent of total dollars in full-service supermarkets was associated with spending more on HCF ( $p = 0.03$ ) but not LCF items ( $p = 0.26$ ). These findings in black women suggest a need for more attention to supermarket interventions that change retailing practices and/or consumer shopping behaviors related to foods in the HCF categories examined.

### 1. Introduction

Full-service supermarkets offer the widest variety of foods at competitive prices compared to other types of food retailers (Krukowski et al., 2013), and are the primary food shopping destinations for most Americans, including low-income households (Ver Ploeg et al., 2015). Living near supermarkets has been associated with higher diet quality (Laraia et al., 2004; Moore et al., 2008). Because of this, numerous programs have incentivized supermarket development in underserved, low-income neighborhoods (“food deserts”) (Chrisinger, 2016a; Lang, 2013), though few evaluations have documented improved health outcomes (Cummins et al., 2014; Elbel et al., 2015; Fuller et al., 2015). Thus, while supermarkets are the focus of many public policy efforts, their influence on food shopping and diet is not fully understood.

Smaller retailers, such as corner and convenience stores, are often

identified as unfavorable consumer food environments (Glanz et al., 2005). These stores typically feature higher prices and narrower product assortments compared to full-service supermarkets, though they may offer urban residents convenience when nearby supermarket access is lacking (Ver Ploeg et al., 2009). Efforts to improve these in-store environments often provide retailers with material and technical support to stock healthier food products (Gittelsohn et al., 2012). For instance, in Philadelphia, Pennsylvania, one in three eligible stores had joined a “Healthy Corner Store Network” by 2012 (The Food Trust, 2014a, 2014b). Evidence of the long-term effectiveness of these small store interventions to change consumer behavior is limited (Gittelsohn et al., 2009; Ortega et al., 2016; Song et al., 2009). Other food access interventions have used produce markets, though economic and cultural factors have been identified as potential barriers, especially among racial/ethnic minority populations (Rice, 2014; Wetherill and

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Gray, 2015).

These efforts to increase physical access to healthy foods may overlook the complexity of food shopping decisions. In selecting a store, shoppers consider transportation options, price, convenience, store and food quality, cultural acceptability, perceived safety, or items needed when determining which store to use and the size of trip to make (based on amount spent), in addition to the distance of a retailer from home (Cannuscio et al., 2014; Chamhuri and Batt, 2009; Chrisinger, 2016b; Kerr et al., 2012; Krukowski et al., 2013). Additionally, distinctions between full-service supermarkets, which provide many departments (e.g., bakery, deli, pharmacy), and other store types (e.g., limited assortment stores, wholesalers, big box stores, deep-discount store) may be important to consider when trying to promote healthy food choices, especially if the types of purchases made between types of retailers are nutritionally different (Dubowitz et al., 2015; Hillier et al., 2015; Jilcott et al., 2011). However, the relationship between store type, individual characteristics, and whether a shopper purchases healthier or less-healthy options has not been fully explored.

This study tests assumptions about the healthfulness of supermarket shopping by exploiting the unique product-specific and contextual data made possible by collecting food shopping receipts over the course of an entire month (Cullen et al., 2007; French et al., 2010; Tang et al., 2016). Additionally, this study focuses on a specific population of interest: black women who are supermarket users living in an urban area and shopping for families with children. Relative to white households, black households are typically further away from full-service supermarkets (Moore and Diez Roux, 2006; Powell et al., 2007), have lower dietary quality scores (Dubowitz et al., 2008; Kant et al., 2007), and are more likely to have diet-related diseases, such as obesity and diabetes (Flegal et al., 2012; Gaskin et al., 2013).

## 2. Methods

### 2.1. Participants

Participants were recruited in seven ZIP codes within Philadelphia, Pennsylvania, using advertising in supermarkets, other food retail outlets, community centers, churches, and word-of-mouth. The ZIP codes were selected because residents were predominately black and represented a mix of income levels (based on median household income) and because they were generally within the same geographic area of Philadelphia. Thus this ZIP code selection allowed for focus on a particular neighborhood, as the city has broad neighborhood variation, including unique transportation resources (e.g., access to highways, subway, bus) and food store availability (U.S. Census Bureau, 2013). Women who were primary food shoppers for their household, self-identified as black, and did not intend to move during the study period were eligible to participate. Additional inclusion criteria were having at least one child (< 18 years old) in the home and purchasing food at a supermarket at least once per month.

Exclusion criteria were being pregnant, participating in a weight loss study, reporting a severe food allergy or digestive disease/condition which greatly impacts food purchasing, or reporting that it was “very” or “extremely difficult” to afford food on a monthly basis. Recruitment was stratified by obesity status (BMI  $\geq$  30) and income level (lower, defined as eligible for the Supplemental Nutrition Program for Women, Infants, and Children (WIC), and higher income households above this threshold), to balance the sample in terms of these characteristics. This study protocol was approved by the Institutional Review Board at [name of institution blinded for review].

## 3. Data collection

### 3.1. Receipt data

Participants were asked to collect receipts from all food purchases

(including non-alcoholic beverage purchases), inclusive of household and personal food purchases of prepared and non-prepared items from any store or restaurant type, and foods delivered to home. Research staff collected receipts from participants at in-person interviews, after two weeks and at the end of four weeks, to clarify receipt information including the store name, store location, prices, and product descriptions (e.g., “light,” “low-fat,” “sugar-free,” “regular,” “whole fat,” “2% fat”). Each line item was entered into a database, including store name, store location, total amount spent, price per item, and quantity purchased. Receipts were excluded if they were not correctly labeled by participants or staff (n = 6), or from stores that could not be located (n = 1). Only receipts for non-prepared, non-restaurant food were included in this analysis. Additional details about the receipt collection procedure are described elsewhere (DiSantis et al., 2016).

### 3.2. Coding of receipt food items

Purchased items were coded as high-calorie, less healthy (HCF) or low-calorie, healthier (LCF) items, coded based on energy density according to methods previously developed and described (Holsten, 2010; Phipps et al., 2014). The coding system identifies seven commonly purchased food groups that can be related to obesity risk by energy density: fruits, vegetables, and low-fat dairy as LCF, and sweet snacks, salty snacks, sugar-sweetened beverages (SSBs), and ready-to-eat grain-based foods as HCF. This coding system also designates “excluded” food items that resemble HCF/LCF-classified products, but did not meet other nutritional criteria (e.g., yogurts with > 15 g of added sugar were excluded from low-fat dairy). Foods such as raw meats, raw grains, condiments, and food mixes (e.g., side dish mix) were coded as “other foods” and not included in the main analyses because they may be prepared in ways that affect energy density.

### 3.3. Shopper characteristics

Participant characteristics were collected by a self-administered survey, and formed the following categorical variables: age (above or below 40), household size (above or below three persons), presence or absence of young child (3 years or younger), income level (lower income defined as equal or below the WIC eligibility threshold; higher income above this threshold), and obesity status (participants reported current height and weight; obesity defined as BMI  $\geq$  30) (NHLBI Obesity Education Initiative Expert Panel, 1998). Participation in WIC or in the Supplemental Nutrition Assistance Program (SNAP) was confirmed from receipts. Participant proximity to a full-service supermarket was also calculated as a straight-line distance based on home address; participants were then classified as high proximity or low proximity (supermarket < 0.5 mi. from home or not). Participants were also asked questions about shopping behaviors, such as checking nutrition labels and deal consciousness (tendency to respond to advertised discounts).

### 3.4. Trip characteristics

To classify trips by store type, we adapted general categories based on commonly-used terms in food environment research, especially the distinctions between larger food retailers, such as full-service and limited-assortment supermarkets (Morland et al., 2002a, 2002b) and retailers who typically devote a large amount of space to non-food merchandise (Beatty and Senauer, 2013; Dubowitz et al., 2015; Hillier et al., 2015). These definitions were used to classify 159 unique retailers where participants shopped during the study period. Stores were placed into one of seven categories: full-service supermarket, discount/limited assortment supermarket, general retailer with food section, corner store, produce market, wholesaler, and other (see Table 1).

Trip characteristics calculated from receipts included the number and types of stores visited, percent of total dollars spent in

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