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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

Benjamin W. Chrisinger[a,*], Katherine Isselmann DiSantis[b], Amy E. Hillier[c], Shiriki K. Kumanyika[d]

[a] Stanford University, School of Medicine, Stanford Prevention Research Center, Palo Alto, CA, USA
[b] Arcadia University, College of Health Sciences, Department of Community & Global Public Health, Glenside, PA, USA
[c] University of Pennsylvania, School of Social Policy and Practice, Philadelphia, PA, USA
[d] Drexel University, Dornsife School of Public Health, Philadelphia, PA, USA

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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

* Corresponding author at: Stanford Prevention Research Center, Stanford University School of Medicine, 1070 Arastradero Road, Suite 300, Palo Alto, CA 94304, USA.
E-mail address: bchris@stanford.edu (B.W. Chrisinger).

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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 ≥ 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 ≥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

Table 1
Store type definitions adapted from common categories used in food environment research (Morland et al., 2002a, 2002b).

Store type	Definition
Full-service supermarkets	Large food stores with surface or structured parking, including both chain and independently-operated retailers; often include several in-store departments (e.g., bakery, meat counter, prepared foods section).
Discount/limited assortment supermarkets	Large food stores, though smaller than full-service supermarkets and with fewer or no in-store departments; may also emphasize price discounts (e.g., deep discount stores).
General retailers with food section	Household retailers (e.g., Target, Walmart, CVS) that devote most space to non-food items, but also offer limited selection of grocery items; some may offer large quantities of food (e.g., big box stores), though they typically have a limited amount of perishable foods and no in-store departments.
Corner stores	Small neighborhood stores and convenience stores, and carry a narrower product assortment that includes both household and non-food items.
Produce markets	Farmers' markets, carts, or other vendors selling predominantly produce.
Wholesalers	Membership-only warehouse retailers selling bulk quantity items.
"Other"	All other vendors, including delis and butchers.

supermarkets, total number of receipts, and longest gap between shopping trips (in days). To represent the shortest possible trip, the linear distance between a participant's home and the retailer was calculated. Trip size was measured by total dollars spent per receipt.

3.5. Statistical analyses

Using SPSS Statistics 21 (IBM Corporation), we generated descriptive data on participant expenditures and trip characteristics. Cross-tabulations were performed to examine relationships between receipt size (in dollars), store's distance from home, and store type. Both individual and group averages were calculated to understand the trip variation within and among participants. To provide additional context about overall spending, descriptive statistics and crosstabs were generated for receipts including LCF or HCF items. Interaction effects were explored between individual and trip variables.

For the main analysis, a repeated-measures generalized estimating equation (GEE) model was performed on the dataset of 450 receipts using SAS™ (Version 9.3) to calculate the likelihood of spending money on LCF or HCF items depending on a variety of individual characteristics, including: shopping for a larger household (≥three persons), shopping at fewer stores (< seven stores), lower income status, deal consciousness, use of nutrition labels, response to nutrition claims, and use of a written shopping list (Lipsitz et al., 1991). Participants' unique identifier was used as the repeated measure value. A backward elimination procedure was used to improve models by systematically removing non-significant variables if their omission improved the quasi-likelihood under the independence model criterion statistic (QIC) (Pan, 2001). In order to understand whether spending a greater percent of a household's food expenditures at a supermarket predicted the healthfulness of foods (% of LCF/HCF expenditures) purchased, a linear regression model was used with adjustments made for age, obesity, and trip size.

4. Results

In the following section, we describe participant characteristics and behaviors, expenditures by product category, store type, and income category; inter-individual variation in expenditures; and associations between HCF/LCF expenditures and shopper characteristics or behaviors.

4.1. Participant characteristics and behaviors

Table 2 presents characteristics of participants who completed four weeks of receipt collection (n = 36). One participant's data was excluded from the analyses because she provided an unusually large number of receipts (n = 70). A total of 450 food shopping trips across 35 participants were analyzed. Per eligibility criteria, the participants were all black women who shopped for a household with at least 1 child. More than half of participants lived near a full-service supermarket or limited service store. About 40% of shoppers indicated nutrition conscious or deal conscious behaviors, and 37% had incomes at or below the WIC income eligibility cutoff, and 19 were classified as obese.

Table 2
Descriptive data on participants, shopping behaviors, and food expenditures and shopping trips over four weeks.

	Mean (SD) or N (% all participants)
Personal characteristics	
Age (years)	39.0 (11.3)
BMI	31.7 (8.6)
Number of children in household	2.0 (1.5)
Distance to closest supermarket used during study period (mi.)	1.3 (1.3)
Used SNAP at least once during 4 week period	21 (60%)
Used WIC at least once during 4 week period	6 (17%)
Income ≤ federal poverty line	13 (37%)
Shopping behaviors	
Usually check nutrition labels	16 (44%)
Influenced by nutrition claims	14 (39%)
Deal consciousness (sd = (composite score > median)	14 (39%)
Shopped with a list	13 (37%)
Food expenditures and trip characteristics	
Total $ spent over 4-weeks (all trips)	362 (206)
% of total $ spent in supermarkets	65.2 (24.8)
% of total $ spent on most expensive trip	36.0 (15.8)
Number of trips (# receipts)	12.9 (7.1)
% of receipts from supermarkets	57.2 (25.0)
# stores visited	5.9 (3.0)

Participants spent a mean of $362.39 (SD = $206.41) over the 4-week period, and made an average of 12.9 trips (SD = 7.1). On average, participants visited 6 stores (SD = 3) over 4 weeks, and spent 36% (SD = 16%) of their monthly food expenditure during their most expensive trip (mean = $123.05, SD = $89.42). Median values and interquartile ranges for these variables are reported in the table. Supermarket spending was especially prevalent, with 86% of all food expenses from these retailers. Although not statistically significant, a higher percentage of expenditures at supermarkets was found for those living within 0.5 miles of a full-service supermarket (87% vs. 76%; $p \leq 0.10$). Also associated but not significant, households with young children had a somewhat lower percentage of expenditures at supermarkets (77% vs. 85%; $p = 0.09$) compared to households where children were 3 years or older. Compared to higher income shoppers, lower income shoppers utilized fewer stores (7.3 vs. 5.1; $p = 0.04$).

4.2. Food expenditures by product category

Fig. 1 illustrates the distribution of food expenditures by food

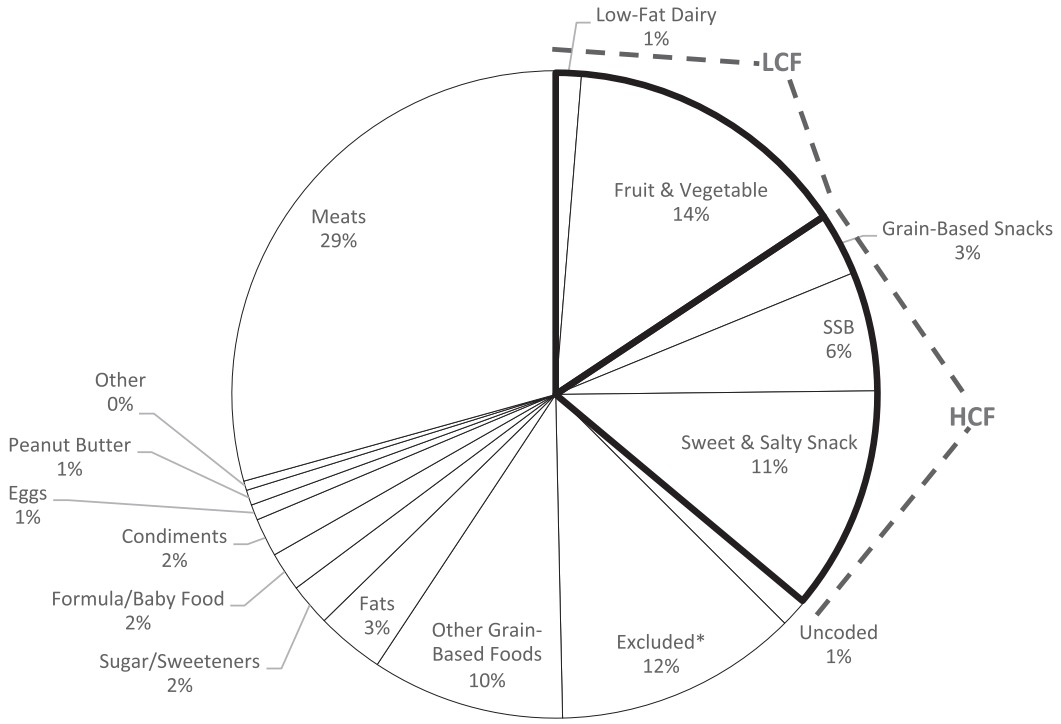

Fig. 1. Breakdown of all dollars spent by food type categories, including both foods in LCF and HCF coded categories and other food categories not included in the analysis.

categories. In this dataset, 48.1% of foods were coded under an HCF (20.4%) or LCF (15.7%) category, or were "excluded" products (12.2%). The remaining expenditures were coded as "other foods" (50.3%), or were not able to be coded (1.4%). Of "other" foods (excluded from subsequent analyses), meat was the dominant category, representing 29.3% of all dollars spent.

4.3. LCF and HCF expenditures by store type

Table 3 shows how trips were distributed by store type and the presence of LCF/HCF items within each store type. As shown, 61% of all trips included at least one HCF item, while 54% of trips included at least one LCF item. Within full-service supermarkets and discount/limited assortment stores, trips with at least one LCF/HCF item were in relatively similar proportions. Within corner stores, general retailers with food, and wholesalers, receipts with a LCF food were relatively less common than those with a HCF food.

Table 3
Distribution of the 450 food shopping trips made by 35 shoppers over four weeks, by store type and presence of HCF/LCF items within store type.

Store type	Number (%) of trips by store type	Number (%) of trips within store type	
		Included at least 1 LCF[a] item	Included at least 1 HCF[a] item
Full-service supermarket	249 (55)	145 (58)	160 (64)
Disc/ltd. assort. grocery	100 (22)	63 (63)	54 (54)
General retailer	70 (16)	17 (24)	46 (66)
Corner store	6 (1)	3 (50)	4 (67)
Wholesaler	10 (2)	5 (50)	8 (80)
Produce market	10 (2)	9 (90)	1 (10)
Other store	5 (1)	1 (20)	1 (20)
Total	450 (100)	242 (54)	274 (61)

[a] HCF = High-calorie food item; LCF = Low-calorie food item; see text for explanation of food categories.

4.4. Expenditures by store type and income category

Fig. 2 presents total spending over the four-week study period by store type for lower and higher income shoppers. Lower income households spent an average of $401.79 (SD = $226.91) for all food items and an average of $60.22 (SD = $42.97) and $83.11 (SD = $38.03) for LCFs and HCFs, respectively. Higher income households spent an average of $309.39 (SD = $168.53) for all food items and an average of $52.19 (SD = $33.92) and $61.84 (SD = $57.48) for LCFs and HCFs, respectively. On average, higher income households spent $87.61 (SD = $47.96) per household member and lower income households spent $116.24 (SD = $44.51) per household member, though household sizes were the same between the two income groups (average = 3.65, SD = 1.96 for lower; average = 3.67, SD = 1.01 for higher). Related to store type, most of the household spending occurred at supermarkets, across income levels, representing a mean of 65% (SD = 25%) food expenditures over the 4-week period. Lower income households spent a higher percent of their food dollars at limited-assortment grocers, particularly for LCFs. Lower income households also spent more on HCFs at general retail stores and corner stores, compared to higher income households.

4.5. Inter-individual variation in expenditures

Fig. 3 shows inter-individual variation in spending on LCFs and HCF, in lower and higher income participants by store type. There is considerable variation in the proportion of expenditures in full-service supermarkets for both LCF and HCF. However, in both income strata, 50% or more of the spending for LCF and HCF was in full-service supermarkets for the majority of participants. For LCF purchases, limited assortment stores were the second most common source, while sources of HCF other than full-service supermarkets are more mixed. A regression of supermarket expenditures on LCF and HCF expenditures found that the percent of total food expenditures spent at full-service supermarkets predicted an increase in the percent of total food expenditures spent on HCF purchases, where for every $100 spent in full-service supermarkets, there was $11.00 more spent on HCFs

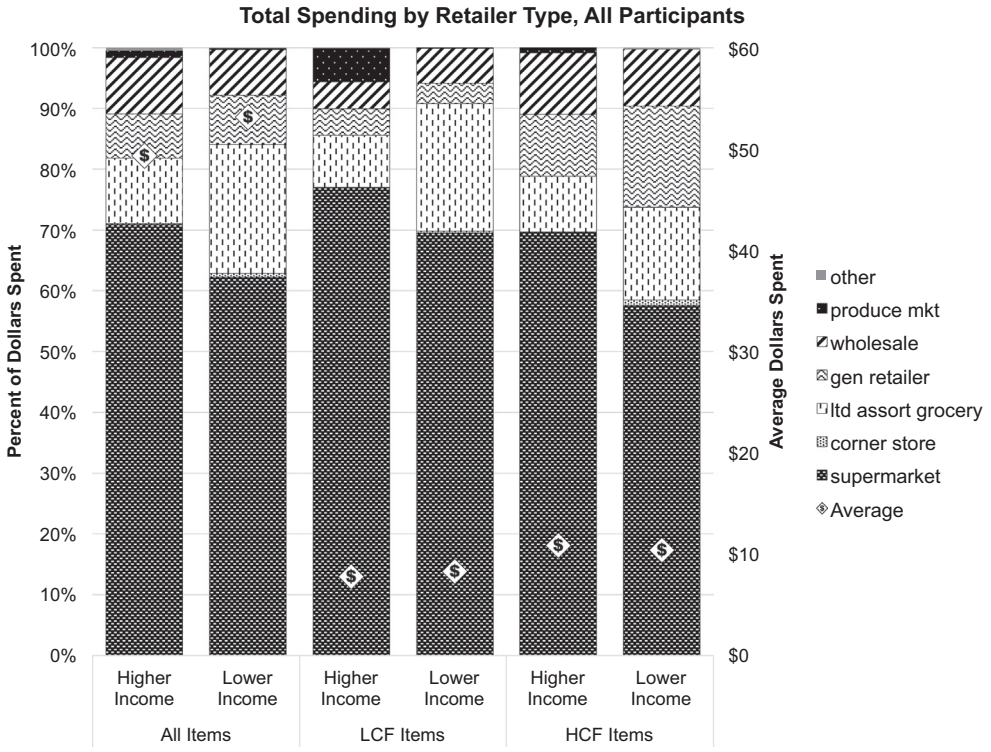

Fig. 2. Percentage breakdown of participants' aggregate expenditures by store type for all food items purchased and for only LCF and HCF items stratified by income category (left axis). The dollar sign icon signifies the average total food expenditure in dollars for its respective bar (right axis).

(SE = 0.05, p = 0.03) (not shown); there was no association of total expenditures with the percent spent on LCF.

4.6. Associations of LCF and HCF expenditures with shopper characteristics or behaviors

Table 4 reports relationships between participant characteristics and shopping patterns and their expenditures on the LCFs and HCFs in statistical models. Several statistically significant associations were observed. Shopping for a larger household was associated with lower expenditures on vegetables (p = 0.096). Shopping at fewer stores was associated with buying fewer salty snacks (p = 0.005). Being deal conscious was associated with higher expenditures on fruit and lower expenditures on vegetables (p = 0.023, p = 0.021, respectively). Usually reading nutrition labels was associated with higher expenditures on vegetables and lower expenditures on SSBs (p = 0.032, p = 0.002, respectively). Being influenced by nutrition label claims was associated with higher expenditures on fruits and with lower SSB expenditures (p = 0.022, p = 0.003, respectively).

5. Discussion

This study found that supermarkets were the main store type for expenditures on both healthful and unhealthful foods and beverages. Spending a greater amount of a household's food expenditures at supermarkets predicted increased expenditures on high calorie, less healthful items, but did not predict greater expenditures in low calorie, more healthful items. Thus, although some HCF purchases were made in other types of stores, this finding strongly supports the potential value of initiatives designed to shift expenditures in full-service supermarkets toward a relatively healthier product mix. Our data further suggest that similar initiatives directed to limited assortment stores may be beneficial for increasing LCF purchases, perhaps particularly so for lower income households. Additionally, we find a proportionately high purchasing of HCFs compared to LCFs, which is consistent with national data indicating lower adherence to the dietary guidelines for black and/or low-income households (Kirkpatrick et al., 2012).

Numerous health interventions have been studied or implemented in supermarket environments, including strategies ranging from education and promotions, to 'nudge' approaches informed by behavioral economics (Ball et al., 2011; Cawley et al., 2015; Milliron et al., 2012). Some examples include point-of-purchase strategies that help consumers to identify healthful foods, such as the "Guiding Stars Program," as well as the use of subliminal cues, such as product placement within supermarket aisles or on shelves (Foster et al., 2014; Milliron et al., 2012; Rahkovsky et al., 2013). Other approaches have sought to build consumers' nutritional and culinary knowledge with in- and out-of-store programming such as food tastings or cooking demonstrations (Dannefer et al., 2012; Reicks et al., 2014). Even when successful, these interventions often carry limitations, such as reliance on a single educational session and/or limiting evaluations to a cross-sectional rather than longitudinal design.

Individual and household attitudes and needs may also influence a shopper's receptivity to various in-store interventions designed to increase LCF purchases. Tailoring in-store interventions to these characteristics may improve their effectiveness for subgroups of shoppers. This study suggests that nutrition-consciousness, deal-consciousness, and using a shopping list may increase purchases of certain LCF and/or HCF items. The size of trip in terms of expenditures also mattered, with smaller trips more likely to include HCF items, consistent with other research that found individuals who made fewer smaller trips had healthier purchasing overall (Pechey and Monsivais, 2015). Finally, our finding that lower-income households spent more on food per person may reflect other research suggesting that poor individuals often pay more for household items, including food, as a result of constrained travel, time, and money (Jaravel, 2016; Rogus, 2015). Another interpretation of these findings could be that higher-income shoppers spend more on prepared foods (e.g., take-out or delivery) or restaurants, which were not included in this study.

This study is strengthened by its in-depth examination of

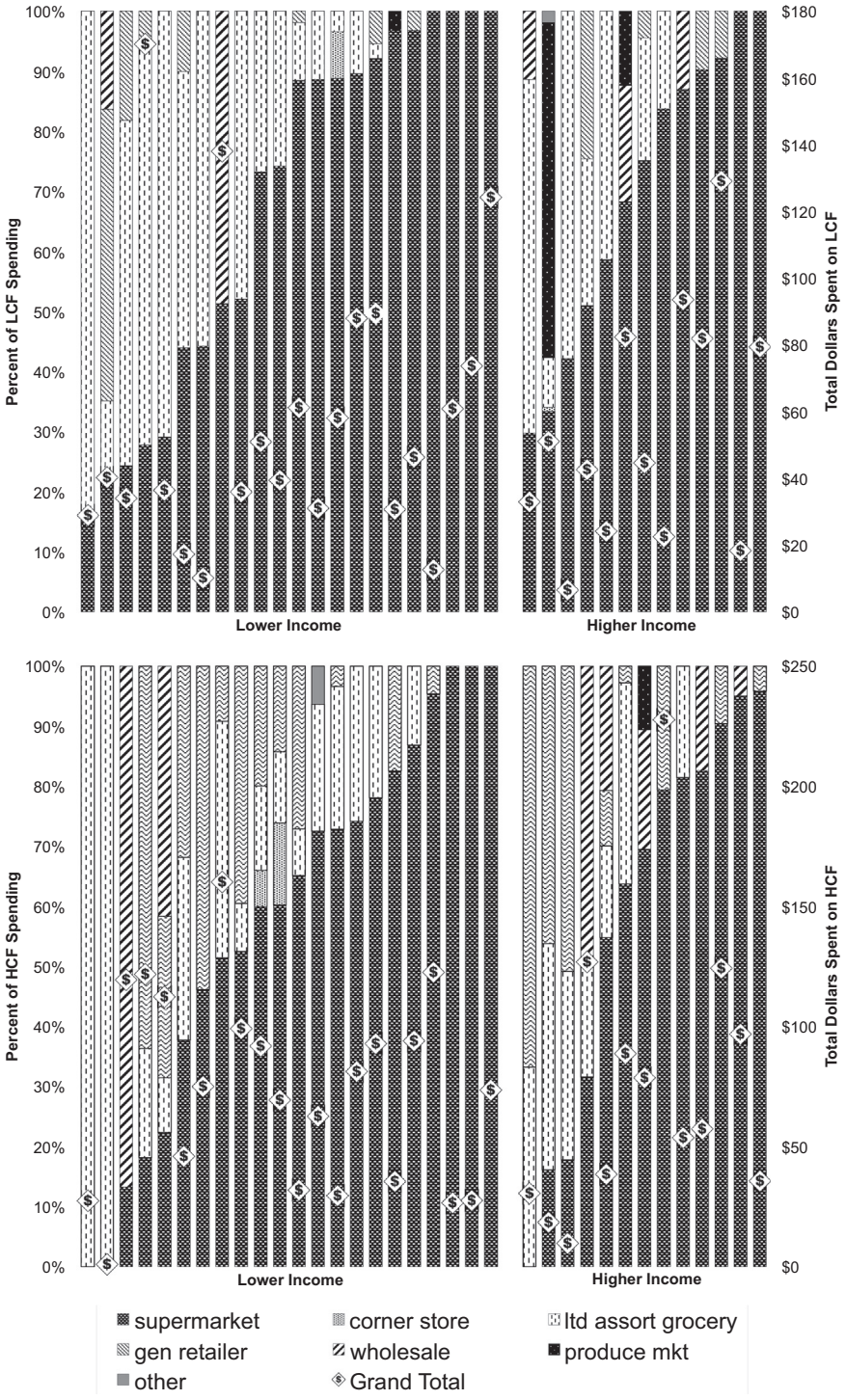

Fig. 3. Each bar represents one participant's percentage breakdown of LCF (above) or HCF (below) expenditures by store type (left axis) over the four-week period. The dollar sign icon signifies an individual's overall LCF or HCF expenditure in dollars over this period (right axis).

supermarket purchases, contextualized within overall food shopping patterns. Additionally, the study included both low and higher income participants in a racial/ethnic population at high risk for diet-related chronic diseases, and on food categories (e.g., fruits, vegetables, SSBs, snack foods) that are targets for public policy in the US and globally (Galizzi, 2014; Jou and Techakehakij, 2012; Young et al., 2013). Although high, the proportions of obese (54%) and overweight (28%) were similar to those for black women in the US population in 2011–12 (57% and 25%, respectively) (Ogden et al., 2014).

Limitations for this study include a small sample size comprised of black women in an urban setting, challenging the broader generalizability of our findings. This may be mitigated somewhat by a subsequent, larger study with primarily black participants residing in a food desert, which had similar findings regarding the role of supermarkets in acquiring healthy and unhealthy foods (Vaughan et al., 2016). Also, while the coding system includes commonly purchased foods and those that have been the focus of policies (e.g., taxation), we were unable to systematically code meat products as HCF/LCF because food preparation can greatly impact its caloric content.

Another related limitation is the possible influence of different foods

Table 4
Results of adjusted multivariate GEE models[a] assessing predictors of amount spent[b] on LCF and HCF items.

	LCFs						HCFs							
	Fruit		Vegetable		Low-fat dairy		Sweet snack		Salty snack		Grain-based snack		SSB	
	% diff	p	% diff	p	% diff	p	% diff	p	% diff	p	% diff	p	% diff	p
Shopping for larger household	1.9	0.32	**−3.5**	**0.10**	−0.3	0.39	−1.5	0.85	−2.1	0.14	0.4	0.77	1.5	0.28
Shopping at fewer stores (< 7)	−1.8	0.63	−1.5	0.56	0.1	0.92	−1.2	0.64	**−3.7**	**0.01**	−1.1	0.40	3.1	0.13
Low income	1.2	0.20	−1.8	0.45	−0.4	0.56	0.0	0.90	−1.0	0.69	1.1	0.27	−2.1	0.40
Deal conscious shopper	**−4.4**	**0.02**	**5.0**	**0.02**	0.1	0.97	3.4	0.25	−1.1	0.53	0.4	0.91	−1.7	0.43
Nutrition label reader	−1.1	0.16	**−4.4**	**0.03**	0.2	0.24	1.2	0.40	−1.4	0.16	−1.4	0.21	**5.2**	**0.00**
Buys on nutrition claim	**−6.0**	**0.02**	−1.5	0.57	0.1	0.50	1.8	0.49	−1.0	0.88	−0.8	0.25	**5.0**	**0.00**
Uses written shopping list	1.5	0.45	0.7	0.77	−0.8	0.26	−0.7	0.71	**2.7**	**0.06**	1.4	0.18	−2.6	0.17

GEE = generalized estimating equations, SSBs = Sugar-sweetened.

[a] Models were run unadjusted, then adjusted for: age, obesity, and the final model adjusted for age, obesity and trip size (smaller trip < $30 spent vs. bigger trip ≥$30 spent). Only results from the final adjusted model are presented, as all significance levels remained the same after adjustment.

[b] Percent less/more spent per food category is presented, with bolded figures highlighting significance $p < 0.10$.

on feelings of hunger; for instance, LCF foods are generally less palatable, but are more satiating, while HCF foods are more palatable and less satiating (Drewnowski, 1998). Future investigations should explore how the construct of satiety relates to the broader trip and store characteristics described in this paper. Furthermore, the absence of in-store data in terms of potentially influential features, such as store layout or promotions and pricing, limits our understanding of participant decision-making, especially considering the possible effects of targeted marketing on minority populations. More research is merited in this arena, as it may elucidate a need for additional supports for these populations to select LCF items (Grier and Kumanyika, 2008).

6. Conclusion

In this study, food shopping trips to full-service supermarkets encompassed over half of participants' monthly food expenditures, and included the largest amounts spent, as well as both high- and low-calorie food items. As supermarket spending increased, so did the likelihood of an individual purchasing HCF items; thus, this study helps to build an evidence base for why interventions within supermarkets may be as important as those that increase access to these retailers in food deserts. While making the healthy choice the easy choice across all types of retailers should be a goal for public health advocates, this study provides a detailed assessment of where and how efforts to change retailing practices and consumer behavior in store environments might be focused for greater impact on diet.

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