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Examining the Influence of Healthy Eating Identity on Shopping Behaviors

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ABSTRACT

Eating identity is shown to be a promising measure capable of enhancing our understanding of nutrition behavior. Persons with healthy eating identities are less likely to consume the typical American diet and report healthier diets in general. While there are several studies linking healthy eating identity and diet, there is currently no research examining healthy eating identity in relation to food shopping behavior, an important aspect of nutritional intake. The purpose of this study was to examine the influence of healthy eating identity on shopping behaviors including supermarket utilization, supercenter utilization, likelihood of shopping at the nearest store, distance to the primary store, distance between nearest and utilized store, shopping frequency, and shopping miles. A cross-sectional telephone survey of 780 household food shoppers from an eight-county region in South Carolina ascertained information on Eating Identity Type Inventory (EITI), food shopping behaviors, and demographic factors. Geographic Information Systems (GIS) were used to generate shopping distance measures. Four general model structures were considered for linear and logistic regression analyses of each of the outcome variables. The unstandardized regression coefficient for healthy eating identity was reported for linear models, and odds ratios were reported for logistic models. There was no evidence of a significant association between healthy eating identity and the shopping behaviors of interest at the 0.05 alpha level. Though not significant, associations were positive for supermarket utilization, distance between nearest and utilized store, and shopping miles and negative for supercenter utilization and likelihood of shopping at the nearest store as expected. Findings suggest a modifying effect of urbanicity on the relationship between healthy eating identity and likelihood of shopping at the nearest store as well as distance to the primary store. The results imply that healthy eating identity may exert more of an influence on shopping behaviors in urban participants compared to non-urban participants. Studying urban and non-urban areas separately is advisable for future studies to determine whether healthy eating identity exerts a significant influence on food shopping behaviors in either of these environments.

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CHAPTER 1

INTRODUCTION

Diet-related chronic diseases currently represent the largest cause of morbidity and mortality in the United States (Kant, Leitzmann, Park, Hollenbeck, & Schatzkin, 2009; Murphy, Xu, & Kochanek, 2013; Ogden, Carroll, Kit, & Flegal, 2012). This is largely attributable to the Standard American Diet (SAD) which has contributed to health challenges experienced in the United States over the past several decades (Grotto & Zied, 2010). The SAD generally refers to a dietary pattern that includes increased consumption of calories from refined carbohydrates, fatty meats, and added fats and a deficit of nutrients found in whole grains, fruits, and vegetables (Grotto & Zied, 2010). While there is substantial evidence that eating a healthy balanced diet can reduce mortality as well as the risk of contracting illness, the dietary intake of American adults continues to run contrary to the dietary guidelines for the prevention of disease.

According to national data, most American adults do not meet recommendations of food based dietary guidelines (Kirkpatrick, Dodd, Reedy, & Krebs-Smith, 2012) and less than 10% of adults meet recommended intake of fruit and vegetables (Kimmons, Gillespie, Seymour, Serdula, & Blanck, 2009). To combat this trend, we must expand our understanding of the factors that influence eating behavior in order to better inform behavior change strategies (Paquette, 2005). Finding effective ways to help adults meet national dietary guidelines by consuming healthier diets could reduce rates of diet-related chronic diseases in the coming years (Watts, Hager, Toner, & Weber, 2011).

Research in the field of behavioral nutrition utilizes behavioral science theories and psychosocial variables to understand dietary behavior and why people eat the foods they eat. Findings are used to develop and implement dietary change programs and interventions to promote beneficial dietary changes (Baranowski, Cullen, & Baranowski, 1999; Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003). Several psychosocial measures of dietary intake including self-efficacy, knowledge and skills, and social support have been investigated in the past, but are viewed as not being adequate predictors of eating behavior (Baranowski et al., 1999; Guillaumie, Godin, & Vézina-Im, 2010; Shaikh, Yaroch, Nebeling, Yeh, & Resnicow, 2008) Conversely, self-identity is a promising determinant of behavior that has been studied in relation to a range of health-related activities such as exercising and dieting (Estabrooks & Courneya, 1997; Kendzierski & Whitaker, 1997; Kendzierski, 1990; Kendzierski, 1988; Yin & Boyd, 2000).

Self-identity is a self-definition based on past experience which focuses on an aspect of the self that is very important to an individual (Markus, 1977). In particular, self-identity related to diet, or eating identity, is evidenced as being an important dynamic that could improve our knowledge about the factors influencing nutrition behavior (Allom & Mullan, 2012; Bisogni, Connors, Devine, & Sobal, 2002; Blake & Bisogni, 2003; Devine, Sobal, Bisogni, & Connors, 1999; Fischler, 1988; Hopkins, Burrows, Bowen, & Tinker, 2001; Kendzierski & Costello, 2004; Kendzierski, 2007; Strachan & Brawley, 2009). Previous research has demonstrated that those with a healthy eating identity are more likely to report healthy dietary behaviors and are more receptive to nutrition interventions compared to those who do not describe themselves as healthy eaters (Bisogni et al., 2002; Devine et al., 1999; Kendzierski & Costello, 2004; Kendzierski, 2007; Strachan & Brawley, 2009).

Healthy eating is referred to as a 'costly health behavior' (Kendzierski & Whitaker, 1997) which requires significant dedication and effort to maintain. While there are many external factors that influence eating behavior, shopping for nutritious foods is an important facet of a person's ability to eat healthy. For instance, primary food store choice, shopping frequency, and travel distance to food store have been associated with healthy dietary consumption (Cade, Upmeier, Calvert, & Greenwood, 1999; Gustafson, Christian, Lewis, Moore, & Jilcott, 2013; Hillier et al., 2011; Pitts, McGuirt, Carr, Wu, & Keyserling, 2012; Zenk et al., 2005). Although healthy eating identity coincides with healthy dietary intake and intake depends in part on shopping behavior, there is no research which examines a relationship between healthy eating identity and shopping behavior.

The purpose of this study was to examine the influence of healthy eating identity on shopping behaviors including supermarket utilization, supercenter utilization, likelihood of shopping at the nearest store, distance to the primary store, distance between nearest and utilized store, shopping frequency, and shopping miles. Better understanding the relationship between healthy eating identity, an important psychosocial predictor of diet, and food shopping may give us a clearer overall picture of the mechanisms affecting nutrition behavior. This information will also be valuable for informing future behavioral change interventions and policies aimed towards improving dietary intake.

CHAPTER 2

LITERATURE REVIEW

2.1 EATING IDENTITY

2.1.1 PSYCHOSOCIAL MEASURES IN EATING

Previous research studies have used a variety of different psychosocial measures to explain eating behaviors including self-efficacy, knowledge and skills, and social support. Self-efficacy, or the degree to which one believes in one's own ability to complete tasks, has been related to fruit and vegetable consumption in several cases (Ling & Horwath, 1999; Mainvil, Lawson, Horwath, McKenzie, & Reeder, 2009; Strachan & Brawley, 2009). A study examining the factors affecting fruit and vegetable consumption found that self-efficacy, in particular remembering to include fruits and vegetables in dietary intake, was positively associated with consumption (Ling & Horwath, 1999). A similar study found that self-efficacy to eat fruit was positively correlated with fruit intake, self-efficacy to eat vegetables was strongly associated with vegetable intake, and self-efficacy to eat both fruit and vegetables was associated with vegetable intake but not fruit intake (Mainvil et al., 2009). In another instance, self-efficacy made a significant contribution to the prediction of fruit and vegetable consumption after taking other psychosocial measures into account (Strachan & Brawley, 2009). Other research has linked self-efficacy to eating a low-fat diet (Chang, Nitzke, Brown, Baumann, & Oakley,

2003) and reducing salt, fat, and calorie intake (Sallis, Pinski, Grossman, Patterson, & Nader, 1988).

The role of knowledge and skills in predicting dietary behavior has been observed as well. Nutrition knowledge is shown to affect the variation of dietary intake, and those with increased knowledge are more likely to meet recommendations for fruit, vegetable, and fat intake (Wardle, Parmenter, & Waller, 2000). Additionally, individuals with skills in food preparation report less frequent fast-food consumption and are more likely to meet dietary objectives for fat, calcium, fruit, vegetable, and whole grain consumption (Larson, Perry, Story, & Neumark-Sztainer, 2006). Likewise, social support can influence dietary behavior as family members exert social support for or against purchased foods (Baranowski et al., 2006, 2008). Social support for purchasing fruits and vegetables has been significantly related to the availability of fruit, 100% juice, and vegetables in the home (Baranowski et al., 2006, 2008) and has also been linked to a reduced intake of dietary fat (Hagler et al., 2007).

Although findings point to an association between psychosocial measures and diet, these existing measures collectively explain only a very small percentage of the variation in dietary intake (Baranowski et al., 1999; Guillaumie et al., 2010; Shaikh et al., 2008). The lack of measures that can effectively identify the determinants of dietary intake highlights the need for new measures to better explain eating behavior. Self-identity, which is emerging as a promising predictor of health behaviors, may be one such measure.

2.1.2 Self-Identity

Self-knowledge, or the awareness of one's thoughts, desires, and behaviors, has been identified as an important regulator of behavior (Markus, 1977). Self-schema, or self-identity, is made up of a combination of self-knowledge cognitions specific to a certain domain which aid in making inferences, judgments, and decisions related to the self (Allom & Mullan, 2012). Self-identity acts as a mediator between decision making, or forming an intention to do something, and decision implementation, or actually doing it (Kendzierski & Whitaker, 1997). Although the link between intention and behavior is not straightforward, research shows that the relationship is stronger for schematics (individuals who possess a particular schema) than non-schematics (Kendzierski & Costello, 2004).

Initial research of health-related self-schemas demonstrated evidence of this with exercising and dieting in which schematics were found to perform relevant behaviors more frequently and consistently than non-schematics (Estabrooks & Courneya, 1997; Kendzierski & Whitaker, 1997; Kendzierski, 1990; Kendzierski, 1988; Yin & Boyd, 2000). For example, those who see themselves as exercisers are more likely to initiate an exercise program (Kendzierski, 1990), act on their exercise intentions (Estabrooks & Courneya, 1997), exercise more frequently, and participate in more exercise-related activities compared to those who do not identify as being exercisers (Kendzierski, 1988; Yin & Boyd, 2000). Similarly, those with dieter self-schemas engage in significantly more stable dieting behavior over an eight-week period than non-schematics (Kendzierski & Whitaker, 1997). These results align with the belief that possessing a self-identity provides behavioral standards which encourage actions that are congruent with the identity (Stryker & Burke, 2000). Likewise, those who adopt a particular identity are motivated to verify this identity through reinforcing behaviors (Stets & Burke, 2003). It is also important to point out that the strength of a given identity can vary for different individuals and may influence the probability of identity-congruent behavior (Ryan & Deci, 2003).

Food and eating are central to individual identity because our diet shapes us biologically, psychologically, and socially (Fischler, 1988). Individuals assign identities to themselves based on what they consider edible, the types of foods they like or dislike, and the methods they use in food preparation (Fischler, 1988). Self-identity, in terms of eating, is evidenced as being an evolving determinant of nutrition that could improve our understanding of motivators and predictors of dietary behavior (Allom & Mullan, 2012; Bisogni et al., 2002; Blake & Bisogni, 2003; Devine et al., 1999; Fischler, 1988; Hopkins et al., 2001; Kendzierski & Costello, 2004; Kendzierski, 2007; Strachan & Brawley, 2009). Studies using the theory of planned behavior have found a relationship between intention to eat a healthy diet and healthy eating behavior (Armitage & Conner, 1999b; Conner, Norman, & Bell, 2002). Furthermore, individuals who believe in the importance and benefit of healthy eating have a higher predisposition to eating a healthy diet (Kristal et al., 1995). Research on the association between self-identities and dietary behavior have shown a link between healthy eating schema and intentions to eat a low-fat diet (Armitage & Conner, 1999a; Kendzierski & Whitaker, 1997; Sparks & Guthrie, 1998) and to consume more fruits and vegetables (Allom & Mullan, 2012). This research implies that possessing a self-schema can aid people in acting on their intentions with regards to healthy eating.

2.1.3 Healthy Eating Identity

Healthy eating has been termed a ‘costly health behavior’ (Kendzierski & Whitaker, 1997) because of the time and effort required to carry out intentions along with having to repetitively engage in the behavior to garner health benefits. For example, healthy eating involves shopping for healthy foods, cooking healthy meals, and avoiding fast food and convenience store foods that are low in nutrition (Kendzierski & Costello, 2004). Adherence to beneficial health behavior regimens is often challenging and requires consistently following intention with behavior. Possessing a healthy eating identity most likely lends a person the motivation to devote the time and effort to engage in the ‘costly health behavior’ and promotes behavior that corresponds to eating healthy (Kendzierski & Whitaker, 1997).

Healthy eating identity is a domain-specific self-definition originating from past healthy eating behavior, which is an aspect of the self that the individual values (Kendzierski & Costello, 2004). For someone to regard themselves as having a healthy eating identity, that person must consider healthy eating to be very self-descriptive and central to their lifestyle and self-image (Kendzierski, 2007). However, healthy eating may not always hold the same meaning for different individuals as it can be viewed in a variety of different ways (Paquette, 2005). It may be seen as the quantity a person consumes, the nutritional content of various food types, following recommendations suggested by national guidelines, restricting intake to a certain number of daily calories, or limiting certain categories of foods (Paquette, 2005; Ronteltap, Sijtsema, Dagevos, & de Winter, 2012). What one considers healthy eating can relate to vegetarianism, or adopting a vegetarian diet (Fox & Ward, 2008), as well as consuming fruits and vegetables, eating from all four food groups, and avoiding foods of low nutritional value (Strachan & Brawley, 2009).

Seeing as individuals can view healthy eating in a variety of ways and given its qualitative nature, healthy eating identity can be difficult to assess. To measure healthy eating identity in a quantitative manner, Kendzierski and Costello (2004) developed the healthy-eater self-schema scale using three statements related to healthy eating. The statements included are: 'I am a healthy eater', 'I eat in a nutritious manner', and 'I am careful about what I eat'. An individual rates these statements on a scale from 1 to 11 based on the self-descriptiveness (1= not at all descriptive, 1= very descriptive) and the importance (1 = not at all important, 11 = very important) of each statement to that particular individual. If the individual rates at least two of three items between 8 and 11 for both self-descriptiveness and importance then they are considered a healthy-eater schematic. Otherwise, they are considered a non-schematic. Multiple studies have based their assessment of healthy eating identity on this instrument (Allom & Mullan, 2012; Blake, Bell, Freedman, Colabianchi, & Liese, 2013; Noureddine & Stein, 2009).

It has been shown that individuals with healthy eating identities are less likely to consume the typical American diet (Noureddine & Stein, 2009) and report healthier diets compared to non-healthy eating identity types (Allom & Mullan, 2012; Kendzierski & Costello, 2004; Noureddine & Stein, 2009; Strachan & Brawley, 2009). One study found that those who saw themselves as healthy eaters consumed more fiber and less total fat than those without a self-schema, and a higher percentage of healthy eaters met the dietary guidelines for fiber, total fat, and dietary cholesterol as well (Kendzierski & Costello, 2004). Another study found that healthy-eater schematics had lower cholesterol intakes and higher complex carbohydrate intakes compared with the non-schematics (Noureddine & Stein, 2009). In addition, research shows that those who regard themselves as healthy eaters are more likely to consume fruits and vegetables (Allom & Mullan, 2012; Strachan & Brawley, 2009) and less likely to consume foods of low nutritional value compared to those without healthy eating identities (Strachan & Brawley, 2009). These results are in contrast to the present-day Standard American Diet that includes excess calories from refined carbohydrates, fatty meats, and added fats and is deficient in many nutrients found in whole grains, fruits, and vegetables (Grotto & Zied, 2010). Furthermore, those who report a healthy eating identity are discovered to be more open to nutritional interventions approaches and more receptive to nutrition intervention messages (Harmon, Blake, Armstead, & Hébert, 2013; Kendzierski & Costello, 2004; Strachan & Brawley, 2008, 2009).

2.1.4 Other Eating Identities

Recent studies have recognized several other eating identities, in addition to healthy eating identity, that influence dietary behavior (Bisogni et al., 2002; Blake & Bisogni, 2003; Blake, Jones, Pringle-Washington, & Ellison, 2010; Devine et al., 1999; Fox & Ward, 2008; Harmon et al., 2013). A qualitative study involving ethnic groups found that ethnic identities, in conjunction with other identities such as family, regional, and class influenced food choice (Devine et al., 1999). Another qualitative study of identities in food choice revealed many different eating identities related to eating practices, personal characteristics, and social categories. The identities related to eating practices corresponded with range of foods, such as being a “picky eater,” types of foods, such as being a “meat and potatoes guy,” types of meal patterns, quantity of food eaten, and consistency of food practices (Bisogni et al., 2002). Additionally, schemas related to food choice (dieter, health fanatic, picky eater, nonrestrictive eater, inconsistent eater) and schemas related to family food choice (peacekeeper, healthy provider, struggler, partnership) were identified by a similar study (Blake & Bisogni, 2003). An analysis of identities in African American pastors found that they describe themselves in terms of eating (healthy, picky, meat, over-eater) as well as church-related identities (Harmon et al., 2013). Pastors with healthier eating identities were more likely to see themselves as role models and showed greater support for health programming compared to unhealthy, picky, and over-eaters (Harmon et al., 2013). Research into vegetarians has determined that vegetarianism is not only a diet and bodily practice but also an identity based on both health and ethical grounds (Fox & Ward, 2008).

To measure varied eating identity types, Blake et al. (2013) developed the Eating Identity Type Inventory (EITI). This study is the first to utilize an instrument that quantitatively assesses multiple types of eating identities simultaneously. The EITI is a questionnaire used to assess four eating identity types, including healthy, meat, picky, and emotional, and is derived from Kendzierksi's healthy-eater self-schema scale (Kendzierski & Costello, 2004) as well as qualitative research into different types of eating identities (Blake & Bisogni, 2003; Blake et al., 2010). Using the EITI, this study found that healthy eaters were less likely to identify as emotional, meat or picky eaters and higher healthy eating identity scores were associated with healthier dietary intake while picky and meat eating identities were associated with less healthy dietary intake. (Blake et al., 2013). For instance, higher healthy eating identity score, either considered alone or including scores for the three other types, was significantly associated with lower percent fat calories, higher fiber intake, and more servings of fruits and vegetables, independent of gender, race, education, age, and urban residence (Blake et al., 2013). Apart from healthy eating score, meat score explained a significant proportion of the variation in percent fat, and picky and meat scores explained a significant proportion of the variation in fiber and fruit and vegetable intake (Blake et al., 2013).

2.2 Shopping Behavior

Food shopping is a significant aspect of healthy eating as it relates to a 'costly health behavior.' Costs associated with food shopping behaviors can be both direct and indirect in order to facilitate a healthy diet. Apart from an increased monetary cost for items such as fruits and vegetables (Cade et al., 1999; Drewnowski, Darmon, & Briend, 2004; Pollard, Kirk, & Cade, 2002), those with a healthy diet have been shown to go shopping more often compared to those with an unhealthy diet (Cade et al., 1999). Since people who identify as healthy eaters consume healthier diets in general (Allom & Mullan, 2012; Blake & Bisogni, 2003; Kendzierski, 2007; Noureddine & Stein, 2009; Strachan & Brawley, 2009), characteristics of their shopping behavior and grocery acquisition most likely accommodate their nutritional intake. Shopping behavior can be viewed from the perspective of in-store food shopping characteristics, such as shopping time, style of food shopping (reactive, working around the store, item-by-item, budgeted) social presence of other shoppers, food choice, and store knowledge, (Hui, Bradlow, & Fader, 2009; Park, Iyer, & Smith, 1989; Thompson, Cummins, Brown, & Kyle, 2013). Alternatively, shopping behavior can be defined by store characteristics and quantitative variables such as primary food store type, shopping frequency, and travel distance to primary food store (Liese et al., 2013; Sohi, Bell, Liu, Battersby, & Liese, 2014), which were primarily examined in our study.

2.2.1 PRIMARY FOOD STORE

Household food shoppers choose their primary food store for a variety of different reasons. Often-times characteristics such as the availability, quality, and variety of fresh fruits, vegetables, and meats are important to shoppers (Ayala, Mueller, Lopez-Madurga, Campbell, & Elder, 2005; Krukowski, Sparks, DiCarlo, McSweeney, & West, 2013; Krukowski, McSweeney, Sparks, & West, 2012; Wang et al., 2007). Store features such as safety, cleanliness, customer service, brand availability and cost are also given as common reasons for choosing a primary food store (Ayala et al., 2005; D’Angelo, Suratkar, Song, Stauffer, & Gittelsohn, 2011; Krukowski et al., 2013, 2012). Among ethnic/racial minorities, the availability of cultural or ethnic food products is a primary motivator for shopping at a particular store (Ayala et al., 2005; Wang et al., 2007). In addition, the proximity of a food store to a person’s home or workplace and convenience play key roles in food source choice (D’Angelo et al., 2011; Krukowski et al., 2013, 2012; Wang et al., 2007).

Findings have shown that supermarkets are generally the preferred food outlet for most people (Liese et al., 2013; Moore, Diez Roux, Nettleton, & Jacobs, 2008). Based on food environment data from MESA (Multi-Ethnic Study of Atherosclerosis), ninety-five percent of participants claimed to use supermarkets for most of their household food shopping (Moore et al., 2008). In another county-based study, ninety-three percent of participants reported primarily shopping at supermarkets and large grocery stores (Liese et al., 2013). Increased access to supermarkets, which is considered a traditional food source, is shown to be inversely associated with obesity (Michimi & Wimberly, 2010; Morland, Diez Roux, & Wing, 2006), whereas increased access to supercenters and convenience stores, less traditional sources of food, has been positively associated with obesity (Courtemanche & Carden, 2011; Gustafson et al., 2011). Similarly, supermarkets offer a wider selection of healthful food items in general with more shelf space for fruits and vegetables compared to nontraditional food stores (Bustillos, Sharkey, Anding, & McIntosh, 2009; Farley et al., 2009).

Research has revealed that primary food store type can depend on demographic characteristics and other factors. A higher proportion of individuals living outside of a low-income urban area reported using supermarkets and fresh markets compared to those living inside of this area (Budzynska et al., 2013). On the other hand, convenience stores and corner stores, which are associated with obtaining less healthy food purchases, are utilized more often in urban neighborhoods (Budzynska et al., 2013; D'Angelo et al., 2011). Frequent food shoppers are more likely to prefer shopping at small grocery stores, rather than supermarkets, compared to less frequent shoppers (Yoo et al., 2006). Those with higher per capita incomes are more likely to shop at supermarkets than at other grocery stores (Zenk et al., 2005). Furthermore, individuals from higher income and education groups are more likely to shop at high price supermarkets than lower price supermarkets, which tend to draw groups of people of lower education and income levels (Drewnowski, Aggarwal, Hurvitz, Monsivais, & Moudon, 2012). One study found that women who lived in smaller households, had a smaller measured body mass, were married, and were more acculturated to the Anglo culture were more likely to shop at supermarkets compared with women who shopped at other grocery stores (Ayala et al., 2005), while another study found that single mothers and married mothers alike did the majority of their grocery shopping at supermarkets (Ahuja, Capella, & Taylor, 1998).

In relation to healthy eating, those who primarily shop at supermarkets, specialty stores, and fresh markets consume fruits and vegetables more often, and in higher quantities, than those shopping at other grocery stores (Gustafson et al., 2013; Zenk et al., 2005). Those who are classified as consuming a healthy diet are significantly more likely to shop at health food stores compared to those with an unhealthy diet as well (Cade et al., 1999).

2.2.2 Shopping Frequency

Family dynamics have been shown to have a considerable influence on food shopping frequency in past studies. First of all, family size is positively related with frequency of shopping, since larger families have greater and more diversified nutritional needs which require shopping more often (Bawa & Ghosh, 1999; Yoo et al., 2006). The number of different stores visited by a household is also positively related to shopping frequency, which may be due to greater store access (Bawa & Ghosh, 1999). Alternatively, households with working adults have a lower food shopping frequency compared to households in which no adults are working. This may be a result of having less time available to devote towards food shopping (Bawa & Ghosh, 1999). Households headed by individuals 55 years old and over tend to make more frequent trips to the grocery store (Bawa & Ghosh, 1999), and households headed by single mothers make one more trip per week on average compared to households containing married mothers (Ahuja et al., 1998).

Economic restraints placed on households have been shown to influence food shopping behavior, and strategies to overcome economic barriers such as bulk buying, couponing, and food storing might relate to shopping frequency (Darko, Eggett, & Richards, 2013). One study sought to characterize food shopping into several frequency groups including a weekly big trip with a few small trips, biweekly big trips with a few small trips, no big shopping trips, a weekly big trip without small trips, a monthly big trip, and biweekly big trips without small trips (Yoo et al., 2006). Food shopping once a week was found to be the most common pattern in low-income individuals while a weekly or biweekly big trip with a few small shopping trips was the predominant food shopping pattern in the area as a whole (Yoo et al., 2006). In the same study, African American families shopped for food least frequently, while Asian American families shopped for food most frequently compared to other racial/ethnic groups (Yoo et al., 2006).

Women living in urban areas report more frequent grocery shopping at supercenters than rural residents; however, women living in rural areas report greater supermarket, or grocery store, shopping frequency than urban residents (Jilcott, Moore, Wall-Bassett, Liu, & Saelens, 2011). Although women who report traveling more in the week, to their job or elsewhere, shop more frequently at supermarkets and supercenters (Jilcott et al., 2011), frequency of supermarket/supercenter use is inversely associated with distance from home to store (Pitts et al., 2012). In other words, those who live farther away from supercenters and supermarkets shop less frequently (Pitts et al., 2012).

A relationship between food shopping frequency and healthy food consumption has been examined by several studies. Generally, those who shop less frequently make less healthful food purchases compared to those who shop more frequently (Pitts et al., 2012), and individuals who shop more frequently at their primary grocery store report a higher intake of fruits and vegetables (Liese et al., 2013). In one study, frequency of store use was positively related to the healthfulness of food purchased for shopping at both supercenters and supermarkets (Pitts et al., 2012). Shopping at a farmers' markets and specialty stores at least once a week relates to higher odds of fruit and vegetable consumption as well (Gustafson et al., 2013).

2.2.3 Distance to Food Store

Distance to primary food store may vary for individuals based on the local food environment and socioeconomic status (D'Angelo et al., 2011; Drewnowski et al., 2012; Hillier et al., 2011; Hirsch & Hillier, 2013; LeDoux & Vojnovic, 2013; Zenk et al., 2013). Findings indicate that individuals rarely shop at the closest supermarket or food outlet (Drewnowski et al., 2012; Hillier et al., 2011; LeDoux & Vojnovic, 2013). In one city-wide study, only 1 in 7 participants across different demographic groups reported shopping at their nearest supermarket (Drewnowski et al., 2012). In a rural 'food desert' primarily composed of convenience, liquor, and dollar stores, households bypassed their neighborhood food environment in favor of independent, discount and regional supermarkets located in other parts of the city and the suburbs (LeDoux & Vojnovic, 2013). It was found that higher-income households made more trips to national supermarket chains located outside the city compared to low-income households, but low-income households made more trips to discount grocery stores, which contain many of the same food staples at comparable or cheaper prices (LeDoux & Vojnovic, 2013). Within a study involving those in The Special Supplemental Nutrition Program for

Women, Infants, and Children (WIC), individuals traveled 0.65 miles beyond the closest chain supermarket for their non-WIC shopping and 0.95 miles beyond the closest WIC store for their WIC shopping (Hillier et al., 2011).

Vehicle ownership and use play an important role in distance to food store since those who shop by car are not as limited by physical distance (Drewnowski et al., 2012). A study located in an urban environment found that walking was the most frequent form of transportation to the food store in general, but was the primary form of transportation used by almost all corner store shoppers compared with less than half of supermarket shoppers (D'Angelo et al., 2011). In a favorable food environment versus an unfavorable food environment, individuals traveled shorter distances to shop for food, and most participants in the favorable food environment reported walking for their small food trips while a majority of those in the unfavorable food environment reported driving (Hirsch & Hillier, 2013). This study concluded that for big food shopping trips, a majority of individuals drove to the store while walking was more common for small food shopping trips (Hirsch & Hillier, 2013). Also, owning more than one car per household compared to owning only one car was associated with an increased travel distance to food store (Hirsch & Hillier, 2013).

The average travelling distance to the primarily used store reported in studies often depends on the study population and the environment (urban vs. non-urban). One study based in an urban county found that participants travelled 2.53 miles on average when the nearest supermarket was a mean of 1.18 miles from home (Drewnowski et al., 2012). Families in low-income urban neighborhoods travelled 1.58 miles to do their non-WIC shopping and 1.07 miles to do their WIC shopping (Hillier et al., 2011). In an urban city setting, participants in a favorable food environment travelled 3.6 miles on average for big trips and 0.7 miles for small trips compared participants in an unfavorable food environment who travelled 2.5 miles and 1.5 miles respectively (Hirsch & Hillier, 2013). Another study found that people located outside of a city in the suburbs travelled a mean distance of 6.7 miles to shop compared to 1.7 miles for those in the city (Zenk et al., 2013). In the same study population, supermarket shoppers averaged 5.7 miles to shop compared to 1.8 miles for those shopping at another store type (Zenk et al., 2013). In a largely non-urban based study population where the majority of participants (55%) did not have a supermarket in their census tract, the average distance to the primary food store was 9.4 miles (Liese et al., 2013).

Longer distance to primary store is associated with many factors including being younger, female, higher socioeconomic status, lower satisfaction with the neighborhood food environment, being further from the nearest supermarket, and living in a neighborhood with higher poverty and without a large grocery store (Zenk et al., 2013). African Americans also travel longer distances compared with Latinos (Zenk et al., 2013). Being a student or working part-time compared to full-time and having an associate's degree or some college compared to a bachelor's degree are associated with further travel distance to store (Hirsch & Hillier, 2013). On the other hand, having a lower income or more family members is associated with decreased distance traveled to shop (Hirsch & Hillier, 2013). Distance traveled to food store has been shown to be positively associated with the variety of fresh fruits purchased within the previous month as well (Hillier et al., 2011).

2.2.4 SHOPPING BEHAVIOR AND HEALTHY EATING

As previously noted, shopping behaviors have been linked with attributes of healthy eating in previous studies. Individuals shopping at supermarkets and specialty stores consumed fruit and vegetables 1.22 and 2.37 more times daily, on average, than those shopping at independent grocery stores, adjusting for age, per capita income, years of education, store location, and ratings of selection/quality and affordability (Zenk et al., 2005). Those shopping at specialty stores or farmers' markets had higher odds of consuming fruits and vegetables at least two times per day compared to those who never shop at specialty stores or farmers' markets (Gustafson et al., 2013). Healthfulness of food purchased at supercenters was positively associated with frequency of supercenter use. Likewise, the same pattern was observed between healthfulness of food purchased at supermarkets and frequency of supermarket use (Pitts et al., 2012). Higher shopping frequency had a direct effect on higher intake of fruit and vegetables (Liese et al., 2013). Distance traveled for food shopping was also positively associated with the variety of fresh fruits purchased within the previous month (Hillier et al., 2011). Although there is evidence that shopping behavior is associated with healthy eating, the relationship between healthy eating identity and shopping behavior remains unknown. Given that data on food shopping behaviors is limited relative to our interest in eating identity, our aim in this study was to help bridge this gap in the literature.

CHAPTER 3

METHODS

3.1 AIMS AND RESEARCH QUESTIONS

The aim of this study is to explore potential differences in food shopping behaviors as a function of self-reported healthy eating identity score based on the EITI (Blake et al., 2013).

The research questions we addressed in this study included: is there an association between healthy eating identity score and various shopping behaviors, including supermarket utilization, supercenter utilization, likelihood of shopping at the nearest food store, distance to utilized shopping store, distance between nearest and utilized shopping stores, shopping frequency, and total number of shopping miles?

3.1.1 HYPOTHESES

A priori, we hypothesize that those with a higher healthy eating identity score will be more likely to utilize supermarkets as their primary food store, less likely to utilize supercenters as their primary food store, less likely to shop at the nearest food store, will travel greater distances to their primary food store, have a greater distance between nearest and utilized shopping stores, make more shopping trips per week, and accumulate more shopping miles per week. De facto, these hypotheses are treated as two-sided hypothesis tests as to not limit the analysis.

3.2 Study Population

The data are part of a larger cross-sectional study (Liese et al., 2013) of adults in an eight-county region in the Midlands of South Carolina. Data were collected through a 20-minute telephone survey ascertaining information on perceptions of the food environment, dietary intake, shopping behaviors, eating out behavior, Eating Identity Type Inventory (EITI), and other demographic factors. Survey data were also used to generate Geographic Information Systems (GIS) based availability and accessibility measures. The eight-county study area consisted of seven non-urban counties and one urban county. Participants were selected from 64 eligible zip codes in the study region using a simple random sample of landline telephone numbers. This selection method yielded 2,477 residential listed numbers. Phone surveys were carried out by the University of South Carolina Survey Research Laboratory (SRL). Study participants were considered eligible if they were at least 18 years old, the primary household food shopper, and English speaking. Of those screened, 968 individuals met the eligibility criteria and completed the interview. A total of 780 participants who provided responses to all of the eating identity, shopping, and demographic questions served as the analytic sample for statistical analysis. This study was evaluated as a secondary analysis of de-identified data and approved by the University of South Carolina's Institutional Review Board.

3.3 Definition of Variables

3.3.1 Healthy Eating Identity

Healthy eating identity was assessed using the Eating Identity Type Inventory (EITI). The EITI was developed by Blake et al. (2013) to assess four eating identity types (healthy, meat, picky, and emotional). This instrument demonstrated acceptable internal consistencies and good to acceptable test–retest reliability for the eating identity types (Blake et al., 2013). Cronbach's alphas for healthy, emotional, meat, and picky were .82, .76, .68, and .61 and Pearson's correlations were .78, .84, .66, .78 respectively. The EITI is unlike previous instruments because it takes into account different combinations of eating identity types. It is an 11-item instrument employed to construct scores for the four eating identity types using agreement on a scale from 1-5 ('strongly agree' to 'strongly disagree'). Scores are calculated by totaling the responses for the items corresponding to each type and dividing by the number of items. Prior to this, each item is rescaled so that higher values reflect a greater affinity for the eating identity type. For the main exposure, we focused on the healthy eating identity type score which is a continuous variable ranging from 1 to 5. The three items in the EITI used to assess affinity for this type include: (H1) I am a healthy eater, (H2) I am someone who eats in a nutritious manner, and (H3) I am someone who is careful about what I eat. For example, if a participant rates their level of agreement as **1** for H1, **2** for H2, and **3** for H3, they would be assigned a healthy identity type score of 4.0. Items are first rescaled (**1**=5, **2**=4, **3**=3), totaled (5+4+3=12), and divided by the number of items (12/3) to determine a final score of 4.0.

Emotional, meat, and picky identity type scores were calculated for each participant in addition to healthy eating identity type score and treated as covariates. Items used to assess emotional type included: (E1) I am someone who eats more when sad/depressed, (E2) I am someone who eats more when stressed/anxious, and (E3) I am an overeater. Items used to assess meat type included: (M1) I am a meat eater and (M2) I am someone who likes meat with every meal. Items used to assess picky type included:

(P1) I am a picky eater, (P2) I am someone who likes to try new foods, and (P3) I am someone who likes to eat a lot of different things. Scores for these identity types were determined using the same calculations as healthy eating type except that P2 and P3 were not recoded because they were reversed in the way that they were phrased.

3.3.2 FOOD SHOPPING BEHAVIOR

Food shopping behavior was assessed by asking participants to name their primary food store (dollar, drug/pharmacy, small grocery, specialty, supercenter, supermarket, warehouse club, or other) and their frequency of shopping at that particular store (times per week). Supermarket utilization was coded as 1 (supermarket) or 0 (other store). Supercenter utilization was coded as 1 (supercenter) or 0 (other store). Participants' addresses, obtained from the survey, were linked to an existing, validated geospatial database containing the exact locations of 2,208 retail food outlets in the eight county study area using ArcGIS 10.0 (Liese et al., 2010). Based on this database, the nearest food store to each participant's address, of the same type as their self-reported primary food store, was identified in the study area. Likelihood of shopping at the nearest store was coded as 1(yes), meaning they shopped at the nearest store, or 0 (no), meaning that they did not shop at the nearest store. The primary food store addresses were matched to the food environment database and geocoded. Distances from each participant's residence to their primary food store and nearest food store were calculated using the shortest street network distance in miles based on the TIGER 2008 road network (U.S. Census TIGER/Line, 2008). The distance between the nearest and utilized food stores was then computed by taking the difference between these two values. In the case that participants' nearest store was also their primary shopping store, the distance was zero. Shopping miles per week were calculated by multiplying shopping frequency by twice the distance to the primarily utilized food store to account for travel distance to and from the store. This calculation was made under the assumption that participants departed from home.

3.3.3 COVARIATES

Several demographic characteristics assessed in the survey were included in the analysis to control for potential confounding. Specifically, these consisted of age (years), race (non-Hispanic white/other), gender (female/male), education level (high school diploma or less/one year of college or more), and urbanicity (urban/non-urban). We considered including income as a covariate based on the literature, but did not include this variable in the analysis seeing as it would limit our sample size considerably. Other characteristics suspected of being confounders such as household size, employment status (retired, unemployed, employed), body mass index (BMI), diabetes (yes/no), and fast food consumption (FFC; times per week) were considered in the analysis as well.

In addition to considering urbanicity as a potential confounder, we treated this covariate as a potential effect modifier as well. This consideration was based on assumptions derived from the literature suggesting that the relationship between healthy eating and shopping behavior may be altered depending on urban or non-urban residence (Budzynska et al., 2013; D'Angelo et al., 2011; Jilcott et al., 2011; Pitts et al., 2012). Table 3.1 provides a list of all variables considered in the analyses including exposure, shopping behaviors, and covariates.

3.4 Statistical Analyses

After individuals with missing data on any study variables were removed, a final sample size of 780 participants remained. Descriptive statistics were examined for all study variables. Distribution values including mean, median, standard deviation, skewness, and kurtosis were examined for all continuous variables and frequency distributions were examined for all categorical variables. Continuous outcomes including distance to primary food store, distance between nearest and utilized store, shopping frequency, and shopping miles were winsorized at the 95th percentile to address extreme outliers, skewness, and kurtosis. Ordinary least squares (OLS) regression was used to analyze continuous outcomes and provided estimates for unstandardized regression coefficients, *p*-values, and overall model R^2. Logistic regression was used to analyze dichotomous outcomes including supermarket utilization, supercenter utilization, and likelihood of shopping at the nearest food store providing unstandardized regression coefficients, *p*-values, odds ratios and corresponding 95% confidence intervals. All statistical analyses were conducted using SAS (Version 9.3, Cary, NC).

We considered four general model structures for linear and logistic regression analyses of each of the outcome variables. Model 1 included only the primary exposure of interest, healthy eating identity score, and corresponding scores for the other eating identity types. Model 2 expanded upon Model 1 by including several demographic variables that have been related to shopping behaviors based on previous literature. Model 3 expanded upon Model 2 by including other suspected confounding variables and diet-related characteristics that possibly influence the relationship between healthy eating identity and shopping behaviors. Lastly, Model 4 was used to assess effect modification and expanded upon Model 3 with an interaction term involving healthy eating identity and urbanicity. Equations for each of the four models are presented below:

Model 1: Outcome = $\beta_0 + \beta_1$(Healthy) + β_2(Emotional) + β_3(Meat) + β_3(Picky)

Model 2: Outcome = $\beta_0 + \beta_1$(Healthy) + β_2(Emotional) + β_3(Meat) + β_3(Picky) + β_4(Age) + β_5(Race) + β_6(Gender) + β_7(Education) + β_8(Urbanicity)

Model 3: Outcome = $\beta_0 + \beta_1$(Healthy) + β_2(Emotional) + β_3(Meat) + β_3(Picky) + β_4(Age) + β_5(Race) + β_6(Gender) + β_7(Education) + β_8(Urbanicity) + β_9(HouseholdSize) + β_{10}(Employment) + β_{11}(BMI) + β_{12}(Diabetes) + β_{13}(FFC)

Model 4: Outcome = $\beta_0 + \beta_1$(Healthy) + β_2(Emotional) + β_3(Meat) + β_3(Picky) + β_4(Age) + β_5(Race) + β_6(Gender) + β_7(Education) + β_8(Urbanicity) + β_9(HouseholdSize) + β_{10}(Employment) + β_{11}(BMI) + β_{12}(Diabetes) + β_{13}(FFC) + β_{14}(Healthy*Urbanicity)

We used an a priori modeling strategy, based on previous findings in this population (Liese et al., 2013; Sohi et al., 2014), in which variables were not removed from the models. Building the models in this sequential manner allowed nested models to be compared using a Likelihood-ratio test. Linear models were compared via changes in R^2 and logistic models were compared using the Hosmer-Lemeshow goodness of fit test. For OLS models, we checked the linearity assumption as well as violations of homoscedasticity using a plot of residuals versus predicted values. Violations of independence were examined with an autocorrelation plot of the residual values. Multicolinearity was checked in linear regression models using the variance inflation factor (VIF) and checked in logistic models via running the model as if it were an OLS model and examining collinearity diagnostics. The normality assumption in OLS models was tested by using probability plots for normally distributed errors and checking diagnostics of influential outliers and measures of skewness and kurtosis.

T-tests were used to assess the significance of coefficients for continuous outcome variables and the Wald statistic was used to assess the significance of coefficients for dichotomous outcome variables. Interpretation of results from OLS models focused on the unstandardized regression coefficient (*b*) for healthy eating identity. For example, in a linear model predicting distance to the primary food store, the *b* for healthy eating identity indicates the predicted change in distance in miles per one unit change in healthy eating identity score holding other variables constant. Interpretation of results from the logistic models focused on the odds ratio for healthy eating identity. For instance, in a logistic model predicting supermarket utilization, the odds ratio for healthy eating identity compares the odds of supermarket utilization for a one unit change in healthy eating identity score holding other variables constant. All analyses of main effects used an alpha level of 0.05 and effect modification analyses used an alpha level of 0.20. Due to our small sample size, especially those living in urban areas, we chose a more lenient alpha level to consider effect modification.

Table 3.1 List of Variables

Category	Name	Type	Referent Group
Exposure			
	Healthy Eating Identity Score	Continuous	–
Shopping Behaviors			
	Supermarket Utilization	Dichotomous	Other store
	Supercenter Utilization	Dichotomous	Other store
	Likelihood of Shopping at Nearest Food Store	Dichotomous	No
	Distance to Primary Food Store	Continuous	–
	Distance Between Nearest and Utilized Food Store	Continuous	–
	Shopping Frequency	Continuous	–
	Shopping Miles per Week	Continuous	–
Covariates			
	Emotional Eating Identity Score	Continuous	–
	Meat Eating Identity Score	Continuous	–
	Picky Eating Identity Score	Continuous	–
	Age	Continuous	–
	Race	Dichotomous	Non-Hispanic white
	Gender	Dichotomous	Male
	Education Level	Categorical	One year of college or more
	Urbanicity*	Dichotomous	Non-urban
	Household Size	Continuous	–
	Employment Status	Categorical	Employed
	BMI	Continuous	–
	Diabetes	Dichotomous	No
	FFC	Categorical	None

*Additionally treated as an effect modifier

CHAPTER 4

RESULTS

Descriptive characteristics of the study sample are presented in Table 4.1. The final sample size (n=780) consisted of study participants who were predominantly middle-aged or older (average age 57 years) and female (78.9%) which most likely stems from the use of landline numbers for data collection and the prevailing culture of women being the primary household shopper. A large portion of participants were Non-Hispanic white (66.8%) and approximately half of participants had previously attended college for at least one year or more (53.3%). About 18% of the sample lived in areas considered urban. Participants reported an average household size of 2.4 individuals, and only 42.4% were employed, with the majority being either unemployed (22.8%) or retired (34.8%). Mean BMI, based on self-reported height and weight, was 28.5 kg/m^2. Persons with diabetes made up 16.2% of the study sample whereas average fast food consumption was 1.1 times per week.

Mean score (ranging from 1 to 5) for healthy eating identity type was 3.7. Scores for the other three eating identity types (emotional, meat, and picky) were 2.5, 3.1, and 2.5 respectively. The majority of participants reported primarily shopping at supermarkets (62.8 %) and 27.6% shopped at supercenters. Almost half (43.2%) of participants shopped at the nearest food store to their residence. Based on GIS analysis, the average distance to the primarily utilized food store was 9.6 miles, and those who did not shop at their nearest store traveled a mean distance of 3.8 miles further to do their primary shopping. On average, shopping frequency at the primary store was 1.7 times per week and total shopping miles were determined to be 28.6 miles per week.

We first examined the association of healthy eating identity with dichotomous shopping behaviors using logistic regression models and focused largely on odds ratios (Table 4.2). Persons with a higher healthy eating identity score were more likely to utilize supermarkets as their primary food store, with results being relatively consistent with increasing levels of adjustment. Model 1 included eating identity types only (OR=1.17; 95% CI 0.97-1.41), Model 2 adjusted for age, race, gender, education, and urbanicity (OR=1.13; 95% CI 0.93-1.36), and Model 3 additionally adjusted for household size, employment, body mass index, diabetes, and fast food consumption (OR=1.14; 95% CI 0.93-1.38). Statistical significance at the alpha .05 level was not reached in these models. Persons with a higher healthy eating identity score were less likely to utilize supercenters as their primary food store in Model 1 (OR=0.84; 95% CI 0.68-1.02), Model 2 (OR=0.86; 95% CI 0.70-1.05), and Model 3 (OR=0.87; 95% CI 0.70-1.07); however, statistical significance was again not reached. For likelihood of shopping at the nearest store, persons with a higher healthy eating identity score were less likely to shop at the nearest store across Model 1 (OR=0.85; 95% CI 0.70-1.02), Model 2 (OR=0.85; 95% CI 0.70-1.02), and Model 3 (OR=0.85; 95% CI 0.70-1.03), although the association was not significant.

Subsequently, we examined the association of healthy eating identity with continuous shopping behaviors using linear regression models and focused largely on unstandardized regression coefficients (Table 4.2). Persons with a higher healthy eating identity score were predicted to travel somewhat shorter distances to their primary store based on Model 1 (b = -0.55, p = 0.08), but this association was attenuated as covariates were considered in Model 2 (b = -0.23, p = 0.43) and Model 3 (b = -0.20, p = 0.49). There was no association between healthy eating identity score and distance between the nearest and utilized food store in Model 1 (b = 0.01, p = 0.96). Model 2 (b = 0.18, p = 0.49) and Model 3 (b = 0.18, p = 0.52). However, this indicates that persons with a higher healthy eating identity score who did not shop at their nearest preferred store type were predicted to travel further distances past the nearest store to do their food shopping. This association was not considered statistically significant. Results for shopping frequency were altogether null across Model 1 (b = 0.01, p = 0.89), Model 2 (b = 0.02, p = 0.78), and Model 3 (b = 0.03, p = 0.65). Regarding shopping miles, we initially found that persons with a higher healthy eating identity score accumulated less weekly shopping miles in Model 1 (b = -1.02, p = 0.40). Interestingly, the association changed directions with control for confounding in Model 2 (b = 0.14, p = 0.91) and was strengthened in Model 3 (b = 0.55, p = 0.64), though it was not statistically significant. According to these models, persons with a higher healthy eating identity score are predicted to accumulate more total shopping miles per week.

Lastly, we examined potential effect modification between healthy eating identity score, urbanicity, and the shopping behaviors. All interaction analyses were conducted using Model 4. We considered an interaction term with a more lenient alpha level of 0.20 to be suggestive of effect modification, given our limited sample size.

The interaction term between healthy eating identity score and urbanicity yielded p = .13 in the model predicting likelihood of shopping at the nearest store (Table 4.3). Figure 4.1 displays predicted probabilities of utilizing the nearest food store as a function of healthy eating identity score for urban and non-urban participants separately. Based on the interaction plot, there is a disordinal interaction between healthy eating identity, likelihood of shopping at the nearest store, and urbanicity. When healthy eating identity score was low, urban residents had a higher probability of shopping at their nearest store compared to non-urban residents. On the contrary, when healthy eating identity score was high, urban residents had a lower probability of shopping at their nearest store compared to non-urban residents.

In the model predicting distance to primary store, the interaction term yielded $p = 0.10$ (Table 4.3). In this instance, the associations were in opposite directions depending on urbanicity. We observed a positive association between healthy eating identity score and distance to primary store for those living in urban areas and a slight negative association for those living in non-urban areas. This relationship is portrayed by Figure 4.2, which shows mean miles to the primary shopping store at each level of healthy eating identity score for urban and non-urban participants separately. Based on the interaction plot, there is an ordinal interaction between healthy eating identity, distance to primary store, and urbanicity. Whereas there is a clear linear trend between healthy eating identity and travel distance for urban residents, the relationship among non-urban residents is much weaker. We found no evidence of effect modification between healthy eating identity score, urbanicity, and any of the remaining shopping outcomes.

Table 4.1 Descriptive Characteristics of the Study Sample (n=780)

	Mean (SD) or Percentage of Study Sample*
Demographic Characteristics	
Age	57.4 (14.5)
Non-Hispanic White	66.8
Female	78.9
One Year College or More	53.3
Urban	18.0
Household Size	2.4 (1.3)
Employment Status	
Employed	42.4
Unemployed	22.8
Retired	34.8
Dietary Characteristics	
BMI	28.5 (6.3)
Diabetes	16.2
Fast Food Consumption (times per week)	1.1 (1.7)
Eating Identity Score	
Healthy (Range: 1-5)	3.7 (0.8)
Emotional (Range: 1-5)	2.5 (0.9)
Meat (Range: 1-5)	3.1 (1.0)
Picky (Range: 1-5)	2.5 (0.9)
Shopping Behaviors	
Supermarket Utilization	62.8
Supercenter Utilization	27.6
Shop at Nearest Store	43.2
Distance to Primary Store (miles)	9.6 (6.7)
Distance between Nearest and Utilized Store[a] (miles)	3.8 (5.8)
Shopping Frequency[b] (times per week)	1.7 (1.3)
Shopping Miles[c] (per week)	28.6 (25.8)

*Mean (SD) listed for continuous variables. Percentages listed for categorical variables.
[a] Based on participants who did not shop at their nearest store.
[b] Times per week shopping at the primary food store.
[c] Calculated by multiplying shopping frequency by twice the distance to the primary food store assuming they leave from home.
BMI, Body Mass Index; SD, Standard Deviation.

Table 4.2 The Influence of Self-Reported Healthy Eating Identity Score on Food Shopping Behaviors (n= 780)

Shopping Outcomes	**Healthy Eating Identity**		
	Model Parameters		
Supermarket Utilization[*]	**OR (95% CI)**		
Model 1[a]	1.17 (0.97, 1.41)		
Model 2[b]	1.13 (0.93, 1.36)		
Model 3[c]	1.14 (0.93, 1.38)		
Supercenter Utilization[*]			
Model 1	0.84 (0.68, 1.02)		
Model 2	0.86 (0.70, 1.05)		
Model 3	0.87 (0.70, 1.07)		
Likelihood of Shopping at Nearest Store[*]			
Model 1	0.85 (0.70, 1.02)		
Model 2	0.85 (0.70, 1.02)		
Model 3	0.85 (0.70, 1.03)		
Distance to Primary Store (miles)[-]		***b* (SE)**	***p***
Model 1		-0.55 (0.31)	0.076
Model 2		-0.23 (0.29)	0.426
Model 3		-0.20 (0.29)	0.490
Distance between Nearest and Utilized Store (miles)[-]			
Model 1		0.01 (0.27)	0.957
Model 2		0.18 (0.27)	0.493
Model 3		0.18 (0.27)	0.515
Shopping Frequency (times per week)[-]			
Model 1		0.01 (0.06)	0.885
Model 2		0.02 (0.06)	0.780
Model 3		0.03 (0.06)	0.645
Shopping Miles (per week)[-]			
Model 1		-1.02 (1.20)	0.396
Model 2		0.14 (1.16)	0.908
Model 3		0.55 (1.17)	0.638

[*] Parameters derived from logistic regression models.
[-] Parameters derived from OLS models.
[a] Model 1 includes eating identity types only
[b] Model 2 includes eating identity types, age, race, gender, education, and urbanicity
[c] Model 3 includes eating identity types, age, race, gender, education, urbanicity, household size, employment, body mass index, diabetes, and fast food consumption

Table 4.3 Analysis of Effect Modification between Healthy Eating Identity, Urbanicity, and Shopping Behaviors (n=780)

Shopping Behaviors	**Interaction Term**[a]
	p[b]
Supermarket Utilization	0.209
Supercenter Utilization	0.550
Likelihood of Shopping at Nearest Store	0.125*
Distance to Primary Store (miles)	0.097*
Distance between Nearest and Utilized Store (miles)	0.541
Shopping Frequency (times per week)	0.554
Shopping Miles (per week)	0.365

[a] Healthy Eating Identity*Urbanicity
[b] Based on Model 4 including eating identity types, age, race, gender, education, urbanicity, household size, employment, body mass index, diabetes, fast food consumption and healthy eating identity*urbanicity.
*p < .20

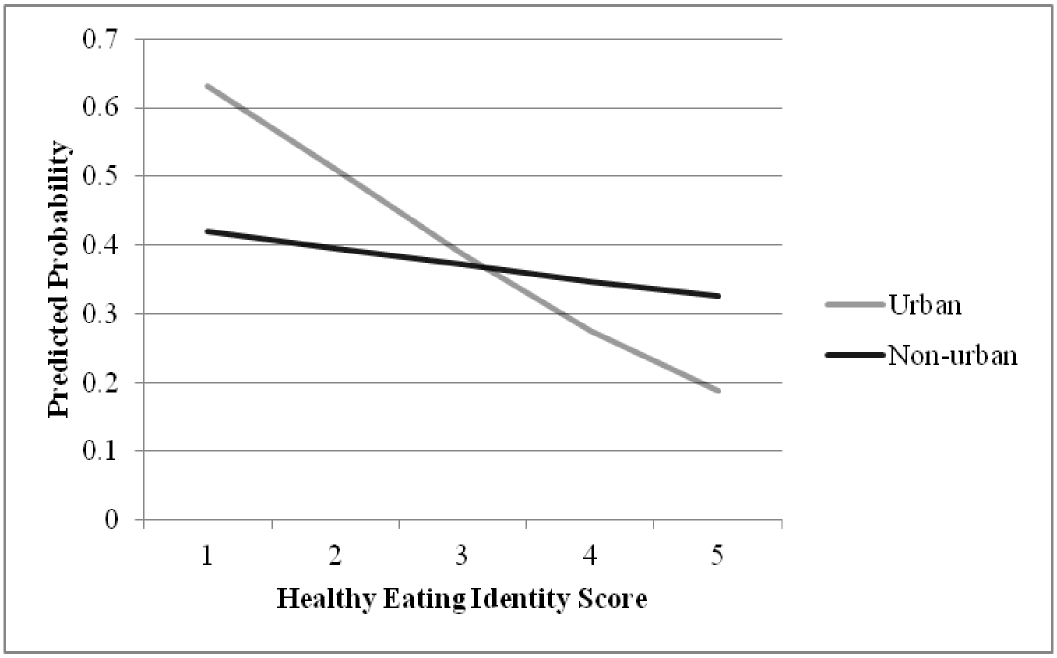

Figure 4.1 Probability of Shopping at the Nearest Food Store by Healthy Eating Identity Score for Urban and Non-urban Participants

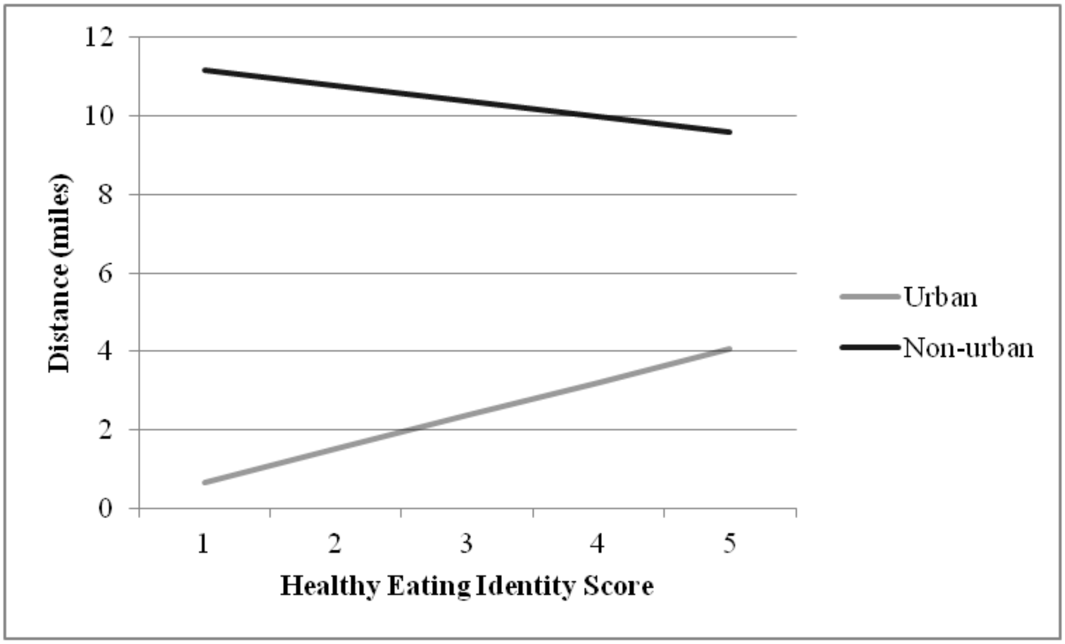

Figure 4.2 Distance to Primary Food Store by Healthy Eating Identity Score for Urban and Non-urban Participants

CHAPTER 5

DISCUSSION

Our study is the first, to our knowledge, to explore shopping behaviors in relation to healthy eating identity. In this study sample, our results were collectively null, as there was no evidence of an association between healthy eating identity score and the shopping behaviors of interest. However, our findings were suggestive of effect modification indicating a possible modifying effect of urbanicity on the relationship between healthy eating identity score and certain food shopping outcomes.

Supermarkets were the preferred food store, which is in line with previous literature (Moore et al., 2008), as sixty-three percent of participants claimed to use these for most of their food shopping. Though not significant, we found a positive association between healthy eating identity and supermarket utilization in accordance with our hypothesis. There is evidence that those who shop primarily at supermarkets consume fruits and vegetables more often and in higher quantities (Gustafson et al., 2013; Zenk et al., 2005), which may explain why those with a higher healthy eating identity score were more likely to utilize supermarkets as their primary food store in this study. Supermarkets have also been revealed to offer more healthy choices compared to other stores and make fruits and vegetables more readily available (Bustillos et al., 2009; Farley et al., 2009), which probably attracts those with higher eating identity scores.

Concerning supercenter utilization, our findings were in the same direction as our hypothesis, but we cannot state with confidence that those with a higher healthy eating identity score are less likely to utilize supercenters. Research has shown an inverse association between obesity and access to supermarkets, a traditional food outlet (Michimi & Wimberly, 2010; Morland et al., 2006), and a positive association between obesity and access to supercenters, a less traditional food outlet (Courtemanche & Carden, 2011; Gustafson et al., 2011). One could infer that increased use of supermarkets, which offer more healthy options (Bustillos et al., 2009; Farley et al., 2009) is associated with healthier eating (i.e. higher healthy eating identity score) and thus lower BMI, whereas increased use of supercenters, which may offer a lower variety of healthy options, is associated with less healthy eating (i.e. lower healthy eating identity score) and higher BMI. This is purely speculation, however, as there is no evidence in the literature linking healthy eating identity and obesity.

Contrary to general findings, approximately 43% of participants shopped at the nearest food store of their preferred type. Research suggests that individuals rarely shop at the nearest supermarket or food outlet (Drewnowski et al., 2012; Hillier et al., 2011; LeDoux & Vojnovic, 2013), but this discrepancy may stem from the largely non-urban study area and considering the preferred store type in this study. Our results suggest a negative association between healthy eating identity score and likelihood of shopping at the nearest store, which is consistent with our hypothesis. Although the association was not significant, participants with higher healthy eating identity scores were less likely to shop at their nearest preferred store. Also, the results pointed to suggestive effect modification showing that when healthy eating identity score was low, urban residents had a higher probability of shopping at their nearest store compared to non-urban residents, but when healthy eating identity score was high, urban residents had a lower probability of shopping at their nearest store. In fact, running an analysis between healthy eating identity score and likelihood of shopping at the nearest store in strictly the urban sample yielded a significant positive association (OR=0.58; 95% CI 0.34-0.99). This result is likely a product of the food environment given that urban residents commonly have a more diverse selection of shopping outlets and thus more shopping choices to express their healthy eating identity. Even if higher healthy eating score plays a role in whether one shops at the nearest food store, some individuals living in non-urban locations may not have sensible alternatives.

It is important to note that vehicle ownership can significantly impact the distance that one travels to shop (Drewnowski et al., 2012; Hirsch & Hillier, 2013), but we did not take this into account in our study because almost all participants owned a motor vehicle. Since the study area was largely centered around non-urban areas, the average distance to the primary store (9.6 miles) was higher compared to similar studies examining distance to shop (Drewnowski et al., 2012; Hillier et al., 2011; Hirsch & Hillier, 2013; Zenk et al., 2013). Based on the results, we were incorrect in assuming that distance to the primary store would increase with healthy eating identity score. On the contrary, those with higher healthy eating identity scores travelled somewhat shorter distances to shop overall. We sensed that this outcome was better explained by checking for effect modification. Our findings indicated that urbanicity was a possible effect modifier between healthy eating identity and distance to the primary food store. For non-urban residents, the association was also slightly negative, but among urban residents, participants travelled 0.72 miles further to their primary food store for every one unit increase in healthy eating identity score. This is consistent with our hypothesis, and it makes sense that urban residents with higher healthy eating identity scores would travel further in areas with greater access to a number of food stores.

We found a positive association between healthy eating identity score and distance between the nearest and utilized food stores which was expected. Past studies have discovered that individuals will often bypass their nearest supermarket or food outlet to shop, even in non-urban areas (Drewnowski et al., 2012; Hillier et al., 2011; LeDoux & Vojnovic, 2013). In our study population, 62.9% of urban participants and 55.5% of non-urban participants travelled further than their nearest store. In other words, these individuals did not shop at the nearest store. Of this group, it seems as if those with higher healthy eating identity scores travelled a short distance further from their nearest store to shop. Again, similarly to why they are less likely to utilize the nearest store, healthy eating identity types are potentially more selective in their food store choice choosing stores which offer more nutritious options.

It was unexpected that we found a null association between healthy eating identity score and shopping frequency with all three models. In prior research using the same study population, shopping frequency at the primary store was the only direct predictor of fruit and vegetable intake (Liese et al., 2013). Likewise, frequency of shopping at both supermarkets and supercenters has been positively related to healthfulness of purchased food (Pitts et al., 2012). In the present study, we found no relationship between healthy eating identity and shopping frequency at the primary store. This contradicts our hypothesis based on the concept that those with higher eating identities would consume fruits and vegetables in higher quantities and, therefore, need to shop more often to acquire such perishable foods.

Our hypothesis pertaining to shopping miles was rooted in the assumption that those with a higher healthy eating identity score would both travel further to obtain healthy food choices and shop more frequently to maintain a stock of healthful foods. Though not significant, we did observe a positive association between healthy eating identity and total shopping miles per week using our most conservative model. Nonetheless, this finding is bit a perplexing since the association between healthy eating identity score and distance to primary store was negative, and the association with shopping frequency was effectively null.

There are several limitations to our study which need to be considered. First of all, our study is cross-sectional by design, so a determination of causality cannot be established; for example, food shopping behavior might influence one's healthy eating identity or a healthy eating identity might influence one's shopping behaviors. Due to sampling via landline telephone numbers, the observed population was primarily composed of women and older adults. Therefore, results cannot be generalized to men or those of younger ages. Also, the exclusion criteria limited the study sample to English-speaking participants, which may have presented selection bias if this group was not representative of the general population. The self-reported nature of healthy eating identity may make it prone to social desirability bias, so it is possible that healthy eating identity scores may have been overestimated in some cases. Concerning the study area, food environment data, such as the location of food stores, were collected in 2009 while the study survey was implemented in 2010. It is possible that this delay resulted in a minor amount of error. Many of the measured shopping outcomes were derived from spatial information relating to only the primary food store. It is likely that participants shopped at additional stores as well, for which data was not considered. Additionally, distance outcomes were calculated assuming that participants departed from their residence, which may not be true in all circumstances.

The key strengths of this study include using ground-truthed data derived from a validated GIS database to calculate shopping distance measures, as opposed to secondary data, in addition to the EITI, which allows for the measurement of multiple eating identities simultaneously. Furthermore, the EITI produces a continuous measure of healthy eating identity compared to most previous studies which treat healthy eating identity as a dichotomous variable (Bisogni et al., 2002; Fox & Ward, 2008; Strachan & Brawley, 2009). Treating the other eating identity types as continuous measures allowed us to more effectively adjust for these in the analyses as well. Lastly, our study population consisted of individuals living in both urban and non-urban areas with diverse demographic, socioeconomic, and diet-related characteristics.

With respect to the literature, we cannot directly compare our study of shopping behaviors in the context of healthy eating to other papers since none currently exist. The limited research using measures of self-identity to date have primarily focused on exercising, dieting, and nutritional intake (Allom & Mullan, 2012; Estabrooks & Courneya, 1997; Kendzierski & Costello, 2004; Kendzierski & Whitaker, 1997; Kendzierski, 1990; Kendzierski, 1988; Noureddine & Stein, 2009; Strachan & Brawley, 2009; Yin & Boyd, 2000). Prior studies have related healthy eating identity to healthy dietary behavior and shown that healthy eating identity has the potential to be an important psychosocial predictor of dietary intake (Allom & Mullan, 2012; Bisogni et al., 2002; Blake & Bisogni, 2003; Devine et al., 1999; Fischler, 1988; Hopkins et al., 2001;

Kendzierski & Costello, 2004; Kendzierski, 2007; Strachan & Brawley, 2009). In addition, an initial use of the EITI associated higher healthy eating identity scores, both alone and accompanied by other eating identity types, with healthier food consumption including lower percent fat calories, higher fiber intake, and more servings of fruits and vegetables (Blake et al., 2013). It may be the case that measures of self-identity, in general, are better suited towards "costly health behaviors" such as dietary intake, which is directly measurable, as opposed to secondary factors such as food shopping. For example, shopping can be highly variable, and a person's shopping behavior does not necessarily dictate their eating habits. An individual who identifies as being a healthy eater may consume nutritious foods from a personal garden or local farmer's market which would eliminate the need to acquire these items from a food store. There is evidence that those who routinely shop at specialty stores or farmers' markets are more likely to consume fruits and vegetables at least two times per day compared to those who never shop at these places (Gustafson et al., 2013). Unfortunately, our study sample did not allow examining an association between healthy eating identity and farmer's market or health food store utilization. Hence, the EITI might be a tool better used to predict nutritional intake, a directly measureable health determinant, rather than shopping behaviors and other external factors. Further research in this field is required to make any judgment about the feasibility of utilizing healthy eating identity in this manner.

This is not only the first study to examine healthy eating identity and shopping behavior, but one of the first to use other eating identity type measures in conjunction with healthy eating identity. Although our study did not detect any significant direct associations between healthy eating identity and food shopping outcomes, we did identity potential trends which should be studied further. These include supermarket utilization, supercenter utilization, and likelihood of shopping at the nearest store. This might suggest that healthy eating identity has more of an influence on where people actually shop as opposed to the distance they travel or shopping frequency. Future studies might also consider the effect of healthy eating identity on in-store shopping variables, such as food choice, to determine whether stores chosen by healthy eating identity types are related to the acquisition of healthy foods.

Furthermore, it is apparent in our study that urbanicity plays an important role in the relationship between healthy eating identity and shopping behaviors. Regarding both likelihood of shopping at the nearest food store and distance to primary food store, healthy eating identity score had a considerable expected effect on urban individuals, but had little to no effect on non-urban residents. It is not surprising that choice would be limited in non-urban areas by barriers such as distance and store access and availability. Hence, healthy eating identity would have no real effect on shopping behaviors if individuals were restricted by their environment. It is very possible that healthy eating identity exerted an influence on shopping behaviors in urban participants, but since these individuals only made up a small part of the total sample, any detectable impact was probably negated. With these considerations, we recommend that future research focus on urban and non-urban environments separately. It would be worth investigating how healthy eating identity influences shopping behaviors in an urban population where identity is more likely to dictate one's behavior.

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