Examining the Relationship between Food Environment, Food Choice, and Diet Quality in a Southeastern Metro County in the United States

by

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ABSTRACT

There has been a vast array of research examining food environment and its related influential factors. This body of research encompasses studies examining how individuals interact and how diet and food choice are influenced by the food environment, various methods and procedures in measuring the food environment, and its relationship with other health-related factors, among other topics.

This current study contains an integrative literature review to explore the relationship between food environment, food choice, and diet. The Torraco checklist for integrative literature reviews was followed. The search for relevant literature was conducted using the search terms food environment, food choice, diet, and other relevant terms. Articles examining food environment and food choice, food environment and diet quality, and food choice and diet quality were reviewed. The review synthesizes findings from various studies and discusses challenges and variations in methodological practices. Prior literature has failed to explore the interconnection between food environment, food choice, and diet quality; warranting further inquiry.

The third part of this study aims to further explain the relationship between food environment, food choice, and diet quality. An adapted NEMS-P and NEMS-S/CS was utilized to assess and compare individuals perceived and observed food environment, along with Steptoe's Food Choice questionnaire, and diet quality measures. A logistic regression and crosstabulation were utilized to examine the relationship between perceived food environment, food choice, and diet quality. Maps were created via

ArcGIS for the observed food environment. It was found that there is a relationship between some food environment and food choice measures and diet quality.

The relationship between workplace and home food environment is also explored in the second part of this work. A questionnaire was used to measure the perceived food environment around the workplace and home and perceived diet quality. A logistic regression and crosstabulation were used to assess the relationship of workplace and home food environment on diet quality. Results revealed mixed findings, where fast-food outlets around the home but not the workplace were related to diet quality. These topics warrant further investigation by future research to better understand the relationship between food environment and related factors.

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Chapter I: An Introduction to Food Environment, Food Choice, and Diet Quality

Food environment encompasses many factors of daily surroundings that influence people's food choices. Factors such as accessibility, availability, number of food outlets, individual experiences in food outlets, available information regarding food, social and cultural practices, and even political and economic situations are enveloped in the food environment (*General Food Environment Resources*, 2014; Kegler et al., 2014; Rideout et al., 2015; Turner et al., 2018). These factors in the food environment can impact food choice and diet quality, thus impacting overall health (Black et al., 2014; Lachat et al., 2012; Pitt et al., 2017; Rideout et al., 2015). This section serves to introduce the topics of food environment, diet quality, and food choice by providing background information consisting of definitions, descriptions, and theories used in research.

Food Environment Definitions and Types

Food environment has been defined by various entities in a multitude of ways. While these definitions vary slightly, they share many similarities. The term "food environment" encompasses several types of environments, including built, wild, (Downs et al., 2020), obesogenic, healthy, community, consumer, organizational (Rideout et al., 2015) and home food environments (Ding et al., 2012). Food deserts and food swamps are also included under the food environment umbrella (Rideout et al., 2015). Food environment has also been referred to as nutrition environment by some researchers

(Alber et al., 2018; Glanz et al., 2005; Green & Glanz, 2015; Jin & Lu, 2021; Minaker et al., 2013).

Many try to account for differing environmental factors when creating a definition for example, Rideout and colleagues (2015) defined the food environment as "human built and social environments that include the physical, social, economic, cultural, and political factors that can influence accessibility, availability, and adequacy of food in communities or regions" (p. 1). Turner and colleagues (2018) proposed a similar definition but included additional key factors, such as, vendor and product properties, promotional information, affordability, convenience and desirability. More recently, Downs et al. (2020) expanded the definition even further to include sustainability of food and beverages along with including the wild, cultivated and built food environments.

Healthy food environments are those that provide equal access to healthy foods such as fruits and vegetables or other whole foods, has healthy packaged or prepared food options, has various food outlets (especially those that offer healthy options) and offers programs and the infrastructure to support a healthy diet (Rideout et al., 2015). Unhealthy food environments are those that do not enable healthy food choices. Obesogenic food environments make it difficult to purchase or consume healthy food and higher occurrences of overweight and obesity are associated with these areas (Rideout et al., 2015). Similarly, there are food deserts and food swamps. These areas have limited or no access to healthy food, expensive or low-quality healthy food

(Cooksey-Stowers et al., 2020; Goodman et al., 2020; Yang et al., 2020), and an abundance of fast-food outlets, convenience stores, or other energy dense nutrient poor food outlets (Rideout et al., 2015; Yang et al., 2020).

Measurement in Food Environment Research

Types of measurement and instrument methodology used in food environment research have remained largely unchanged over the years, but the methods themselves have advanced. McKinnon et al. (2009) conducted a review on food environment research methods and found that the most used method was geographical analysis, followed by sales analysis, nutrient analysis, and menu analysis. Lytle & Sokol (2017) found similar results where geographical analysis, checklists, and interviews or questionnaires were the most common methods.

Geographical analysis uses geospatial data to map the location of a food outlet or other chosen location and can be used to assess density, proximity and variety of food outlets (Charreire et al., 2010; McKinnon et al., 2009). Sales analysis involves examining food consumption trends using receipts and other food service reporting, similar to this is menu analysis and nutrient analysis (McKinnon et al., 2009).

In terms of instrument methodology, the most commonly used methods are interviews or questionnaires, followed by market baskets, checklists, and inventories. Researchers may create their own questionnaire by combining different questions from existing questionnaires (Couch et al., 2014; Nackers & Appelhans, 2013) or they may use a pre-existing questionnaire, such as the Nutrition Environment Measurement Survey (NEMS) (Alber et al., 2018).

A market basket is a list of foods that represents the common diet of a population or a selected standardized diet, such as the Mediterranean diet or DASH diets (McKinnon et al., 2009). A checklist is a pre-selected list of foods that can be used to assess food availability, cost, and quality (McKinnon et al., 2009). An inventory is similar to a checklist but includes all foods rather than just pre-selected foods (McKinnon et al., 2009).

Background

Food Environment

The food environment in the United States has changed dramatically over the years. Fast-food restaurants, which were once non-existent, now exist in almost every town. The first fast-food restaurant was a White Castle that opened in 1921, then in the 1960's, they made their way into urban areas (Diamond, 2019). Currently, there are 201,865 fast-food restaurants in the United States (*Fast Food Restaurants in the US - Number of Businesses 2005-2029*, 2023). In the United States, most adults consume a significant amount of their energy from fast food, leading to a higher energy intake compared to diets consisting primarily of food made at home (Lachat et al., 2012). This increase is not limited to fast-food restaurants. Full-service restaurants, grocery stores, convenience stores, bakeries, coffee shops, and supermarkets have also seen significant growth (James et al., 2017). Large retail chains like Walmart and Dollar General have nearly doubled in the past decade (Lacko et al., 2020).

The food environment that an individual lives in can have a direct impact on their diet. Living in unhealthy food areas, such as food deserts or food swamps, has been associated with a lower diet quality and obesity (Cooksey-Stowers et al., 2017; Cooksey-Stowers et al., 2020). Past research has shown that the overall food environment, improving access to healthy options, and reducing access to unhealthy options is needed to improve health at the population level (Thornton & Kavanagh, 2012; Yang et al., 2020).

Social Determinants of Health. Food environment has been shown to differ among areas based on socioeconomic status (de Almeida et al., 2022; Moore et al., 2008; Pineda et al., 2023). Researchers have found overall that the various neighborhood socioeconomic statuses have had an increase in all food outlet types. However, the type and amount does vary, higher socioeconomic status neighborhoods related to more non-fast food and fast-food restaurants whereas lower socioeconomic areas had a higher amount of convenience stores (Richardson et al., 2014). This unequal increase in type and number of food outlets leads to differing and varying types of food environments with differing food availability and accessibility across the United States.

Low-income individuals may be particularly vulnerable to the negative effects of fast-food outlets compared to those who are higher income. Weight status has been associated with proximity and density of fast-food outlets with a stronger relationship for those who are lower income (Reitzel et. al., 2014). Similarly, income has been found to be associated with availability of healthy food (Ding et al., 2012), fruit, vegetable, and fast-food consumption (Althoff et al., 2022; Boone-Heinonen et al., 2011).

In addition to socioeconomic status, race and ethnicity can also impact access to healthy food (Hickson et al., 2011; Moore et al., 2008; Pitt et al., 2017; Ranjit et al., 2015). Black and colleagues (2014) found that areas with higher levels of deprivation and minority populations had greater access to fast-food outlets. Similarly, low-income and minority communities in the United States had fewer supermarkets with a greater travel distance compared to more affluent communities (Black et al., 2014). Other studies have found that those with higher incomes often live in areas with fewer unhealthy food outlets (Yang et al., 2020) and healthier beverage options are offered by street vendors in more affluent predominantly White neighborhoods (Lucan et al., 2020).

Education level is another social determinant of health that plays a role in food environment and related factors (Aggarwal et al., 2014; Drewnowski, 2015; Fuller et al., 2013; James et al., 2017; Glickman et al., 2021). It can be a protective factor against exposure to unhealthy food environments. Vogel and colleagues (2017) found that mothers with a higher education level had a better diet quality compared to mothers with a lower education level, even when both groups had activity areas considered unhealthy food environments.

Spatial distance, travel distance, or time to grocery stores can impact food choice and diet quality (Almeida et al., 2020; Ambikapathi et al., 2021; Jago et al., 2007; Sharkey et al., 2011). A recent study by Glickman and colleagues (2021) found that most participants shopped about one mile from their home and that access to a personal vehicle was not an important factor in food access. The authors also found that a higher quality proximate food retail environment and shopping close to home lead to a better overall diet quality than those who shopped further from home. Similarly, Janda and colleagues (2022) found that for minorities urbanicity and income level related to distance traveled to their primary supermarket.

These findings suggest that the surrounding food environment of a person's home is important to their diet quality, if it is the food environment they shop in. A person's food environment is not always limited to their immediate neighborhood. Goodman and colleagues (2020) found that majority of their participants shopped at a grocery store farther from their home. Similarly, Janda and colleagues (2022) found that those who used SNAP or WIC, lived in per-urban or rural areas, or were Hispanic or Black traveled further to the grocery store. Those of a lower socioeconomic status tend to make food purchases that are closer to home compared to those of a higher socioeconomic status (Thornton et al., 2017). Traveling further to the grocery store has been found to be linked to consuming fewer fruits and vegetables when controlling for price (Pitts et al., 2018). These results suggest that social determinants of health are important factors to consider when researching food environment.

Covid-19 Pandemic. The recent events of the Covid-19 pandemic had a profound impact on the food environment and how people purchased food. Grocery stores and other food outlets had to modify how they sold food, such as online shopping, curbside pickup, and delivery services. The percentage of people reporting shopping online increased from 39% to 79% during the pandemic (Leone et al., 2020). Online food shopping spending reached 5.3 billion dollars in April 2020, a 37% increase compared to the previous month (Khandpur et al., 2020).

As the food environment continues to adapt to the digital era, new methods of food purchase are emerging (Granheim et al., 2021). Online food shopping is projected to grow substantially, reaching 70% of shoppers in the United States by 2025 (Khandpur et al., 2020). This increase can be expected to be seen in those who are of a higher socioeconomic status, are younger, live in urban areas, have reliable internet, and have credit cards (Leone et al., 2020).

Food habit changes that occurred during the pandemic might have a lasting impact. During the pandemic, more people cooked and ate at home, followed a diet, snacked, and consumed plant-based foods (Leone et al., 2020). Restaurant closures resulting from the pandemic may have impacted the food environment in some areas, potentially leading to fewer food options for certain populations currently and in the future (Leone et al., 2020). All of this can lead to major changes in the food environment and impact food choice and diet quality.

Food Choice

Food choice is a complex phenomenon influenced by a myriad of factors including biological, psychological, and societal and cultural factors (Vabo & Hansen, 2014). These factors can be collapsed into specific influences such as taste, convenience, cost, health, knowledge and beliefs, perceived time, and consumption context (Darmon & Drewnowski, 2015; Kaya, 2016; Vilaro et al., 2016). Food choice happens in a complex environment where there is an abundance of food in various settings, coupled with advertisements, new types of foods and flavors, various brands, and promotions (Dawson, 2013; Guine et al., 2020). Food choice decisions can vary based on the group of people or environmental context.

A close proximity of a fast-food outlet has been found to increase the odds of consuming a high energy snack, whereas a close proximity of a supermarket increases the odds of consuming a low energy snack (Elliston et al., 2016). Similarly, Ruff and colleagues (2016) found that the likelihood of purchasing sugar sweetened beverages increased when there were fewer varieties of fruits and vegetables at the front of the store.

Chen and Yang (2014) conducted a study where they examined the food environments influence on food choice using tweets. They found that healthy tweets were more common in areas with more fast-food outlets, which suggests that the food environment may not directly affect or explain a person's food choice. The authors also found that people still consumed fast food even when there was a low number of fast-food outlets around, indicating that people will travel to acquire it.

We live in a food environment with highly palatable and energy-dense foods that are highly available and accessible majority of the time, which can lead to people frequently thinking about and wanting these foods (Espel-Huynh et al., 2018). Taste and hedonic hunger are major factors in food choice, taste can be an enabler or barrier to consuming healthy food (Perez-Cueto, 2019). Lowe and Butryn (2007) discussed how not only changes in the food environment and physical availability of food but the social acceptance and normalization of the ability to have food whenever one wants has led to widespread hedonic hunger.

Ruff and colleagues (2016) conducted a study examining food purchases and found that 13% of participants' purchases were impulse buys. These impulse buys comprised sugar-sweetened beverages and sweet and salty snacks. Almost half of the impulse buys for sweets were located near the point of purchase, suggesting that food choice is influenced by the food environment and hedonic hunger. Other research has demonstrated that people often still purchase and consume fast food even when they intend to eat healthy (Santoso et al., 2019).

Another examination of food purchases by Lacko and colleagues (2020) found that most people purchase their food at grocery stores, followed by mass merchandisers (Walmart, Target, etc.), club stores (Costco, Sam's Club, etc.), convenience and drug stores, dollar stores, and online shopping. Regardless of store type, the top food groups based on percentage of total calories for these purchases were grains, salty snacks, desserts, mixed dishes, and fats and oils in 2010. However, the top purchases for store type did vary slightly with candy being on the list for mass merchandisers and dollar stores, and at club stores nuts made the list. For drinks, sugar sweetened beverages, milk, and alcohol were the top three purchases with sugar sweetened beverages being the top of the list at all stores except for other stores, where alcohol was the top purchase for both years. Fruit and vegetable purchases made up a small percentage of food purchases.

Cruwys and colleagues (2015) found that food choice can be influenced by the people around us, particularly when it comes to highly palatable foods. This is because people are certain about their likes and dislikes of food but when it comes to the amount of food to consume people can be uncertain. As a result, they look to others for social cues on how much to consume (Cruwys et al., 2015). Similarly, Elliston and colleagues (2016) found that when people are alone, they are more likely to decide to have a low energy snack whereas the presence of others eating they are more likely to decide to have a meal.

In college students in New Zealand cost, healthfulness, and taste determined food choice. Frequently consumed foods on campus included hot foods like French fries, baked goods like cookies, candy, and savory snacks. While healthier options like nuts or fruit were consumed less frequently. Majority of students stated they wanted more fresh fruit available, less expensive food, incentives for purchasing healthy options, and visual guides for heathier choices (Roy et al., 2019). Menu labeling has been shown to influence food choice by increasing thoughts on natural content of the food and weight and health concern which can be a mechanism for menu labeling to encourage healthier food choices (Reale & Flint, 2016).

Among women, three main influential factors of food choice emerged in research by Dressler and Smith (2013). These were emotional eating, food cravings, and overeating behavior, with taste, cost, and health as subthemes. Most women reported that cost and preference were the main factors influencing grocery shopping and food consumption habits. Health was an influential factor mainly among lean/normal weight women, while overweight/obese women commonly used food as a coping mechanism for emotions like stress, depression, and boredom. Both groups of women mentioned similar cravings for types and flavors of food. Overweight/obese women mentioned overeating where lean/normal mentioned stopping with satiety cues. In another study of women, it was found that family history, health, convenience, taste and cost were highly influential factors of food choice (Vilaro et al., 2016). Cost has been found to be a particularly influential factor of food choice for those of a lower socioeconomic status (Darmon & Drewnowski, 2015).

Diet Quality

Diet is a crucial aspect of overall health. The global food supply is becoming dominated by ultra-processed foods. Since these ultra-processed foods have become available and more popular there have been increases in obesity and related chronic noncommunicable diseases such as diabetes (Monterio et al., 2013), metabolic syndrome, higher total and LDL cholesterol, lower HDL cholesterol, risk of developing high blood pressure, and an increase in fasting plasma glucose (Poti et al., 2017). The "Western diet" is now recognized as a significant cause of chronic illness and even death (Echouffo-Tcheugui & Rexford, 2019), having been linked to 11 million deaths and 255 million disability adjusted life years (Echouffo-Tcheugui & Rexford, 2019). This is no longer only true in the United States, with many other countries having a decline in overall diet quality (Crino et al., 2015).

Ultra-processed foods are those made from refined ingredients derived from whole foods (Monterio et al., 2013) or industrially prepared foods that require little to no preparation at home besides reheating or cooking (Poti et al., 2017). These are foods such as chips, sugar sweetened beverages, confectionary, pizza, and nuggets and sticks (Monterio et al., 2013). These foods are typically low in fiber, vitamins and minerals, protein and high in fat, sugar and salt (Crino et al., 2015; Monterio et al., 2013; Moubarac et al., 2017; Poti et al., 2017). When these ultra-processed foods are consumed along with fruits, vegetables, and other whole foods in a balanced diet they do not pose a risk to health (Monterio et al., 2013), this is no longer the case.

Diets that used to primarily consist of whole or minimally processed foods and home-cooked foods now primarily comprise processed and prepared foods (Poti et al., 2017). A recent study found that about 70% of the calories consumed in the United States comes from packaged foods, which are often ultra-processed (Lacko et al., 2020).

A similar study found that found that most Americans consume more calories, saturated fats, salt, and added sugar than recommended and do not consume enough fruits and vegetables or whole grains (Dietary Guidelines Advisory Committee, 2020). Consumption of ultra-processed foods is related to poorer diet quality and increased weight (Lacko et al., 2020).

In the United States, a healthier diet has been associated with higher cost and higher socioeconomic status, whereas high-energy foods are associated with lower cost and higher consumption of added sugars and saturated and trans fats (Darmon & Drewnowski, 2015). The cost of high energy food and sugar sweetened beverages have declined over the years, the cost of fruits and vegetables has increased (Darmon & Drewnowski, 2015). Individuals of a lower socioeconomic status can be more adversely impacted by food costs. Higher prices of both healthy and unhealthy food can lead to a decrease in consumption of both types of food for those of a lower socioeconomic status. For those with a lower socioeconomic status, unhealthier in-store grocery store environments, poorer food environments, greater number of convenience stores, and shopping at supercenters or convenience stores are associated with a lower diet quality, but not for those of a higher socioeconomic status (Mackenbach, Nelissen, et al., 2019).

A study comparing food purchases and diet quality found that food purchases are a good representation of overall dietary quality. The authors found that participants purchased 66.2% of food from grocery stores, 19.4% from fast food or carryout food outlets, 11.3% from restaurants or similar food outlets, and the rest from other types of food outlets (Appelhans et al., 2017). Consuming take-out or foods that are not prepared at home is associated with a higher total calorie and fat intake, lower intake of vitamins and minerals (Lachat et al., 2012) and overall poor diet quality (Saksena et al., 2018). In the United States, many adults obtain about a quarter of their calories from fast food (Lachat et al., 2012).

Theory

Food Environment

Food environment research often utilizes a social ecological model or framework (Downs et al., 2020; Dubowitz et al., 2012; Glanz et al., 2005; Turner et al., 2018). The Social Ecological model initially was developed by Urie Bronfenbrenner and includes individual and environmental factors that affect behavior. This model consists of the microsystem (face-to-face influences/social interactions), the mesosystem (system of microsystems), the exosystem (larger social system), and the macrosystem (cultural beliefs and values) (McLeroy et al., 1988). This model has since been adapted to fit various fields and topics. A model specifically for health promotion was developed, which consists of intrapersonal factors (knowledge, attitudes, skills, etc.), interpersonal factors (formal and informal social groups), institutional factors (rules, regulations, policies, etc.), community factors (organizations, institutions, informal networks, etc.), and public policy (state, local, and national) (McLeroy et al., 1988).

Recently, Downs and colleagues (2020) created a specialized social ecological framework for food environment based on previous social ecological models. This model includes six factors: ecosystems (climate, natural resources, topography, etc.), socio-cultural and political environment (religion, culture, national income, policies, etc.), sectors of influence (labor, distribution, technology, agriculture, etc.), food environments (wild, built, and cultivated), individual factors (health, knowledge, income, preferences, etc.), and diets. In this framework ecosystems, socio-cultural and political environment and sectors of influence all influence the food environment and the food environment influences individual factors and diets.

In earlier work, Glanz and colleagues (2005) developed a Model of Community Nutrition Environments based on an ecological model of health behavior. This model comprised four main factors: policy variables, environmental variables, individual variables, and behavior. Policy variables include government and industry polices. This expanded model is the Nutrition Environment Measures Survey-Perceived (NEMS-P) conceptual model. It consists of psychosocial factors, the community nutrition environment, the consumer nutrition environment, perceived nutrition environment, observed nutrition environment, home food environment, shopping behaviors, eating behaviors, and background characteristics (Green & Glanz, 2015), see Figure 1 for full model.

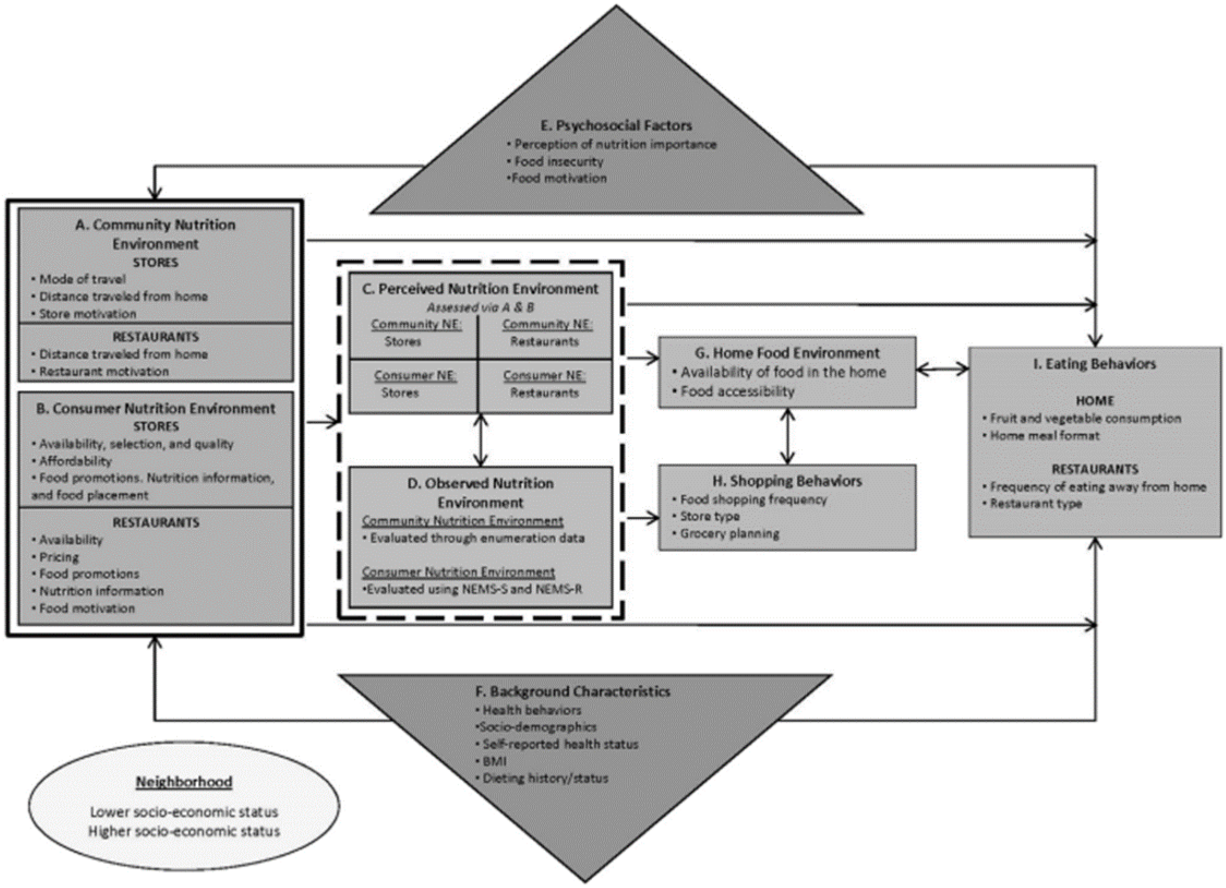


Figure 1 *Nutrition Environment Measures Survey-Perceived (NEMS-P) Conceptual Model*

The Zipf's Principle of Least Effort has also been applied in food environment research, where is has been used to explain behavior based on the interaction with the environment and the proximity of food items (Glanz et al., 2005). However, the adapted social ecological models from Glanz and colleagues (2005) and Downs and colleagues

(2020) go beyond the Zipf's principle and incorporate important influences from public health, health psychology, consumer psychology, and urban planning. These models provide a more comprehensive understanding of the factors that shape the food environment, which may be overlooked by the exclusive use of the Zipf's Principle of Least effort.

Food Choice

Food choice research has been guided by various theoretical frameworks, including the Social Ecological Model. Ziegler and colleagues (2021) discussed using this model in combination with other theories such as the Social Cognitive Theory. Since a single theory cannot fully explain the complex process of food choice.

To develop a better understanding of food choice, researchers have created their own theories. One of which is the Food Choice Process Model. Furst and colleagues (1996) conducted a study examining food choice processes and identified three main factors that influence food choice: life course, influences, and personal system. Life course includes personal roles along with social-cultural and physical environments. Influences include a person's ideals, resources, their foods roles (cooking, shopping, etc.), and food availability. Personal system refers to the mental processes when making decisions about food, such as value negotiations and unconscious strategies.

Since the development of the Food Choice Process Model, other researchers have utilized or adapted the model to their research (Connors et al., 2001; Sobal &

Bisogni, 2009). These adaptations can lead to researchers gaining a more comprehensive understanding of the complex process of food choice. Alternatively, others have taken a different approach using pre-established health theories. Shepherd (1999) proposed using the Theory of Planned Behavior or the Theory of Reasoned action to explain food choice, stating that “beliefs about the nutritional quality and health effects of a food may be more important than the actual nutritional quality and health consequences in determining an individual's choice” (Shepherd, 1999, p. 808). This may be true, but use of this theory does not consider environmental or social and cultural factors that can influence food choice. Hardcastle and colleagues (2015) also discussed the use of the Theory of Planned Behavior, whereas Cruwys and colleagues (2015) used social modeling to examine social influences on food intake and food choice.

Conclusion

Food environment, food choice, and diet quality are interconnected, and numerous factors influence each of these. Social determinants of health, including individual and neighborhood socioeconomic status, education, and race/ethnicity are among the factors that impact the quality of the food environment, food choice and diet quality.

While past research has examined food environment and food choice or food environment and diet quality. Little attention has been paid to the relationship of all three and it warrants further inquiry. Janda and colleagues (2022) suggested that future food environment research should focus on the temporality of the food environment by combining geographical analysis and behavioral data, focus on areas beyond a person's neighborhood, and focus on understanding how people interact with the food environment.

Project Purpose

The purpose of this research is to assess and explain the relationship between food environment, food choice, and diet quality. This will be done via an integrative literature review examining past research on food environment, food choice and diet quality, followed by two research studies. This first research study will examine the food environment around the workplace and home and the association with diet quality. The second will examine the relationship between food environment, food choice, and diet quality.

Chapter 2: An Integrative Review of the Food Environment, Food Choice, and Diet Quality Literature

Introduction

There has been a vast array of research examining food environment and its related influential factors. This body of research encompasses studies examining how individuals interact with the food environment (Cruwys et al., 2015; Elliston et al., 2016; Kegler et al., 2014; Thornton et al., 2017), how diet is influenced by it (Couch et al., 2014; Echouffo-Tcheugui & Rexford, 2019; Mackenbach, Nelissen, et al., 2019; Pitt et al., 2017), various methods and procedures in measuring and assessing the food environment (Bader et al., 2010; Bivoltsis et al., 2018; Glanz, 2009; Green & Glanz, 2015; Kelly et al., 2011; Lytle, 2009; Turner et al., 2018), and its relationship with other health-related factors (Dubowitz et al., 2012; Minaker et al., 2013; Nackers & Appelhans, 2013; Vandevijvere et al., 2015), among other topics.

Numerous aspects of the food environment have been shown to influence diet, including perceptions (Caspi, et al., 2012; Martin & McCormack, 2024; Williams et al., 2010), accessibility (Althoff et al., 2022; Black et al., 2014; Mensah & Oyebode, 2022), availability (Duran et al., 2016; Elliston et al., 2016; Ruff et al., 2016), and the type of food environment (Ding et al., 2012; Downs et al., 2020; Rideout et al., 2015) among others. Diet is intricately linked to food choice, as the foods individuals choose to consume constitute their diet. Factors influencing food choice include taste, convenience, cost, health considerations, knowledge and beliefs, perceived time, and consumption context (Darmon & Drewnowski, 2015; Kaya, 2016; Vilaro et al., 2016). Of which convenience, consumption context, and cost directly relate to the food environment factors of accessibility, availability, and the type of food environment.

Research examining food purchases and diet quality revealed that food purchases serve as a reliable representation of overall diet quality (Appelhans et al., 2017). In the United States, about 70% of consumed calories originate from packaged foods, which are often ultra-processed foods (Lacko et al., 2020). A trend supported by findings from Poti et al., (2017), where diets primarily consist of processed and prepared foods. This underscores the influence of the food environment on food purchases and, consequently, consumption (Gustafson et al., 2011; Hattori et al., 2013; Timperio et al., 2018).

The increase in availability of food away from home due to fast-food outlets (Saksena et al., 2018) has been shown to increase consumption of this type of food. A healthier food environment has been associated with less purchases of fast food compared to unhealthier food environments (Thornton & Kavanagh, 2012), fruit and vegetable consumption, and weight status (Cooksey-Stowers et al., 2017; Kruger et al., 2014; Menezes et al., 2017). Dubowitz et al. (2012) findings support this, where higher numbers of grocery stores and supermarkets close to the home related to a slight decrease in weight status and a higher number of fast-food outlets close to the home related to a slight increase in weight status. Others have found that access to supermarkets or other food outlets that sell fruits and vegetables and perceptions of healthier options has been associated with a healthier diet (Black et al., 2014; Caspi, Sorensen, et al., 2012; Pitt et al., 2017; Rideout et al., 2015).

The home food environment also plays an important role in food choice and dietary habits. The availability of unhealthy food has been associated with lower fruit and vegetable consumption and higher consumption of high calorie beverages (Couch et al., 2014). Furthermore, the availability and accessibility of fruit and vegetables in the home is significantly associated with fruit and vegetable consumption (Alber et al., 2018; Ding et al., 2012). Kegler and colleagues (2014) found that a higher number of fruits and vegetables in the home predicted higher fruit and vegetable intake and that unhealthy food items were associated with fat intake.

The consensus of this literature suggests a relationship between the food environment and diet quality or food behaviors, such as food choice. Various reviews have assessed the consensus of the food environment literature at various points in time and examined specific aspects of the topic. For instance, Caspi et al., (2012) broadly examined the literature of the local food environment and diet, while Charreire et al., (2010) examined measuring the food environment using geographical information systems. Xin and colleagues (2021) specifically examined the literature on the association of access to convenience stores and childhood obesity, where Madlala et al., (2023) researched food choices, the local food environment, and food access in resource poor communities, and Caruso et al., (2023) examined the campus food environment and diet of postsecondary students.

While numerous reviews have addressed the separate topics of food environment and diet, food environment and food choice, or food choice and diet. None have examined all three of these topics together to begin to explore their relationship in the literature to better understand how these factors influence one another. This review aims to address this gap by examining all three topics to answer the question: What does the previous literature say about the relationship between food environment, food choice, and diet quality?

Methods

An integrative literature review was conducted to review, critique, and synthesize the current literature on food environment, food choice, and diet quality. Using an integrative literature review allows for a broad examination of the literature to ensure inclusion of appropriate topics and include various research methods to form an all-encompassing consensus of the literature. The Torraco (2016) checklist for integrative literature reviews was used as a guide for this integrative review. The checklist consists of 11 questions to be asked when writing with three overarching categories (before writing an integrative literature review, organizing an integrative literature review, and writing an integrative literature review), see Appendix A: Torraco Checklist for Integrative Literature Review for more information. An electronic search of the literature published from January 2003 to 2023 was performed using Google Scholar, PubMed, Medline, Health and Wellness (GALE), ScienceDirect, General Science, Social Sciences, and SAGE Research Methods. The key search terms were ‘food environment', 'nutrition environment', 'food choice', 'eating behaviors', 'food behaviors', 'diet', 'diet quality', and 'nutrition'.

Articles and reviews were first selected by title and keywords. All articles were put into an Excel spreadsheet, information included title, author, year, and DOI or website address. Articles were sorted alphabetically and duplicate articles were deleted. Once all articles were found the abstracts of the articles were assessed to see which papers matched the inclusion criteria of discussing the topics of food environment, food choice, and diet quality. Articles that included two or more topics (food environment, food choice, or diet quality) were included. For example, an article had to examine, explain, or discuss the impact of food environment on diet. If the article did not include in the results an explanation of the relationship between food environment factors and dietary factors it was not included in the final list.

From the articles selected, the references of those papers were reviewed to seek additional papers following the same process as the initial article selection. Any articles where the full article was not available to the researcher or the article was not available in English were removed from the final list. The final list of articles to be reviewed was created in Excel where articles were color coded to be kept for final review by meeting the inclusion criteria or to be excluded for not being accessible or not fitting the inclusion criteria. Once the list of articles was finalized all articles were reviewed and synthesized.

Articles were synthesized by reviewing the full article and sorting articles into separate word documents based on the topic of focus (food environment and diet, food environment and food choice, or food choice and diet). From each article a summary of the methods and results was collected along with other information like location and year. Within the Word document(s) the articles were organized into those that found significant results, mixed results, and no association. There was no need for IRB approval of this study.

Results

The initial search resulted in 1,376 articles. After removing duplicates there were 885 articles. Reviewing references from articles resulted in an additional 31 articles being added to the review list. After the initial review, 308 articles were kept for the final literature review. Of these 308 articles, 247 articles investigated food environment and diet, 40 articles researched food environment and food choice, and 21 articles examined food choice and diet. Of the 308 articles reviewed one was completed in 2003, three in 2004, four in 2005, two in 2007, five in 2008, 14 in 2009, 11 in 2010, 14 in 2011, 18 in 2012, 16 in 2013, 18 in 2014, 21 in 2015, 21 in 2016, 22 in 2017, 22 in 2018, 22 in 2019, 28 in 2020, 25 in 2021, 24 in 2022, and 18 in 2023.

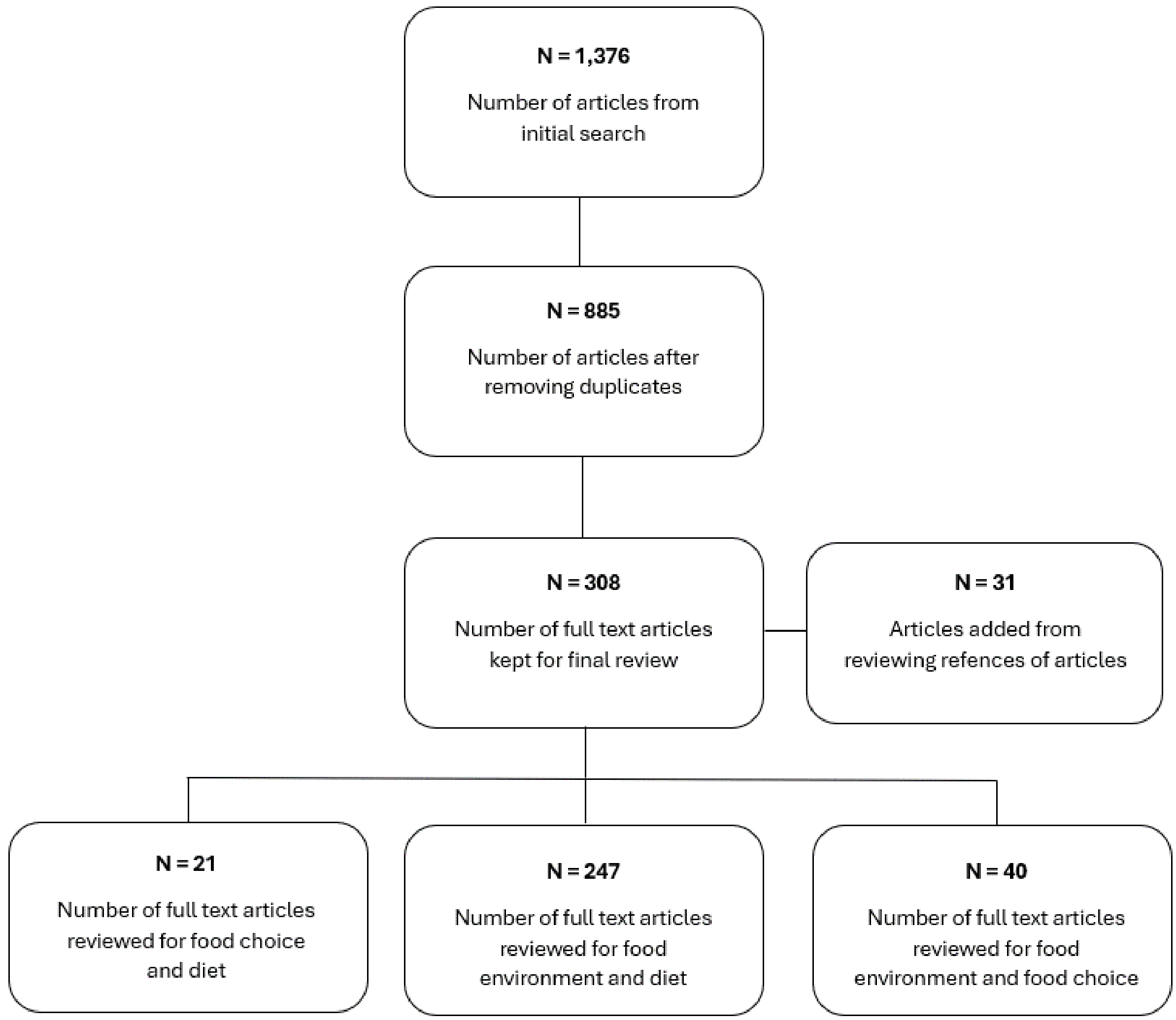


Figure 1 *Article selection flow chart*

Food Environment and Diet

There was a total of 247 surveys that directly examined the relationship between food environment and diet, 190 of which utilized surveys or questionnaires as their primary method of data collection, 18 used interviews, and 10 used secondary data sources. Many used mapping (96) and other methods like dietary recalls (29), interviews (18), photovoice (2), environmental assessment methods (32), and 5 utilized GPS or phone collected data. Eleven used some form of NEMS, including the NEMS-S and NEMS-P. Fourteen of these were literature reviews. Twelve were interventions. Many of the articles used a combination of these methods, for example (Dubowitz, Zenk, et al., 2015; Laska et al., 2010) used mapping, dietary recalls, and a survey. Hawkesworth et al., (2017) used a survey and assessed neighborhood food environments. Whereas de Deus Mendonca et al., (2019) used mapping, interviews, a questionnaire, and assessed food outlets. (de Almeida et al., 2023) used interviews, a food frequency questionnaire, and the NEMS-S.

Authors used varying methods for measuring the food environment geographically. Algur et al., (2023) used street network buffers of 1, 2, 6, and 10 miles for a density measurement, where Gustafson et al., (2013) also used street network buffers but used 0.5 and 1 mile, and Bivoltsis et al., (2020) used 0.8, 1.6, and 5 kilometer road network distances. Ambikapathi et al., (2021) used buffers ranging from 100 to 1000 meters of the home, Boone-Heinonen et al., (2011) used Euclidean buffers of 1, 1-2.99, 3-4.99, and 5-8.05 kilometers, and Hickson et al., (2011) used circular buffers of

0.5, 1, 2, and 5 miles. Some used radial buffers (Ollberding et al., 2012), nearest network distance to store (Macdonald et al., 2011), where others simply used neighborhoods (Ball et al., 2005; Cummins et al., 2014).

The majority of studies were conducted in the United States (117), 21 were conducted in Brazil, 14 in Australia, 5 in New Zealand, 3 in Japan, 10 in the Netherlands, 9 in the United Kingdom, 16 in Canada, 3 in Mexico, 3 in various countries, 7 in China, 2 in Ireland, Vietnam, England, and Finland, and one in Tanzania, Ethiopia, Chile, Ecuador, France, Belgium, Scotland, England, Latin America, Africa, Ghana, Solomon Islands, Norway, Malaysia, Italy, Minas Gerais, Thailand, Kenya, Zambia, and Demark.

Those that were reviews consistently concluded that there is an association between food environment and diet, 12 of the 14 studies found an association (Caruso et al., 2023; Chavez et al., 2020; Engler-Stringer et al., 2014; Osei-Kwasi et al., 2020; Perez-Ferrer et al., 2019; Rahmanian et al., 2014; Shaw et al., 2023; haw et al., 2020; Turner et al., 2021; Westbury et al., 2021). The one that concluded that there was little evidence of a relationship between food environment and diet was a review solely looking at research that was conducted in Canada (Stevenson et al., 2019). Although, there were other reviews that solely looked at a single area. Perez-Ferrer et al., (2019) examined studies solely conducted in Latin America, Osei-Kwasi et al., (2020) examined studies in Africa, Larson et al., (2009) solely United States studies, and Chavez et al., (2020) just Mexico studies, these reviews all came to the consensus that food environment does impact diet. Some did find mixed results (Caruso et al., 2023; Cullen

& Dave, 2017; Engler-Stringer et al., 2014; Hollis-Hansen et al., 2019; Larson et al., 2009; S. Shaw et al., 2020).

Food Environment. The consensus of the literature is that there is a relationship between food environment and diet (Chege et al., 2021; Choi et al., 2022; de Menezes et al., 2018; Gomes et al., 2022; Jennings et al., 2011; Moayyed et al., 2017; Pemjean et al., 2023; Richard et al., 2016; Saelens et al., 2018; Seto et al., 2016; Smith et al., 2013; Stowers et al., 2020). However, the significance of this relationship and its driving factors vary across studies. For instance, residing in a food swamp or food desert was associated with consuming snacks and desserts for girls (Hager et al., 2017). In the opposite, Timperio et al., (2018) discovered that individuals living in areas with fewer varieties of food outlets had a healthier dietary pattern. Moreover, poorer food environments were associated with better diet quality among mothers with degrees (Vogel et al., 2017). Additionally, some researchers found that the influence of the food environment on diet is contingent on actual usage, with this association being particularly notable within a 3-mile area (Glickman et al., 2021; McGuirt et al., 2018).

Built Food Environment. The primary food environment that individuals interact with on a daily basis is the built food environment, consisting of food outlets and food shopping outlets. In general, the literature has found a relationship between food outlets, food shopping outlets, and diet (Clary et al., 2016; Kegler et al., 2021; Timperio et al., 2008). Increased access to food stores, particularly those offering a diverse range of fruits and vegetables, has been linked to higher consumption of these healthy options

(Bonanno et al., 2017; Curioni et al., 2020; Izumi et al., 2011). Conversely, Khonje et al., (2020) found that modern food retailers were associated with ultra processed food consumption, yet they led to an increase in healthy eating index due to dairy and protein consumption. Also, Barrett et al., (2017) found that children living in areas with increasing amounts of specialty food stores, supermarkets, fast-food outlets, and total number of retail outlets tended to have better diet scores. Supporting these findings, Deierlein et al., (2014) discovered that a greater variety of food outlets led to an increase in frequency of consumption from these outlets.

Overall, proximity to food shopping outlets like supermarkets or grocery stores is related to better dietary quality. Gustafson and colleagues (2011) reported that those residing near supercenters or convenience stores tended to consume fewer fruits and vegetables. Additionally, supermarkets within a 1.5 to 3-mile buffer were associated with less frequent consumption of sugar-sweetened beverages, while fast food restaurants in a 3-mile buffer were associated with consumption of fast food and a reduced consumption of fruits and vegetables (Hattori et al., 2013). Timperio and colleagues (2008) found similar results where more fast-food outlets or convenience stores close to home the lower the likelihood of consuming fruit or vegetables. Others have found similar trends, where the number of fast-food outlets has a negative impact on diet (LeDoux & Vojnovic, 2014; Longacre et al., 2012) and as distance to supermarket increases their impact on diet lessens (LeDoux & Vojnovic, 2014). Food destination has also been positively associated with healthy eating index (McInerney et al., 2016), while higher consumption of meals outside of home or school correlated with unhealthy diet patterns (Vepsalainen et al., 2015).

Food Shopping Outlets. There are various aspects that make up the entirety of the food environment, this is evidenced by existing literature. A main component is the primary source of food for many: supermarkets and grocery stores. Various studies have examined food shopping outlets and found that the type of food shopping outlet an individual shops at can significantly impact their diet. Shopping at supercenters, for instance, has been associated with reduced consumption of sugar sweetened beverages (Gustafson, Christian, et al., 2013). Aggarwal and colleagues (2014) discovered that fruit and vegetable consumption was higher for those who shopped at higher-cost stores compared to those who shopped at lower-cost stores. Other aspects like shopping frequency and convenient access were related to higher fruit and vegetable consumption (Blitstein et al., 2012).

Households that primarily purchased food from supermarkets, specialty stores, or farmers markets consumed more fruits and vegetables (Almeida et al., 2020; Gustafson et al., 2013; Jaime et al., 2011; Lo et al., 2019; Martin et al., 2011; Rose & Richards, 2004; Zenk et al., 2005; Zhang et al., 2022). The variety of produce available in supermarkets has also been associated with a lower ultra-processed food consumption (Vedovato et al., 2015). This could be attributed to factors such as selection, variety, and greater shelf space of fruits and vegetables in these stores (Blitstein et al., 2012; Bodor et al., 2008; Izumi et al., 2011; Sharkey et al., 2010; Zenk et al., 2005). Similarly, Dhakal and Khadka, (2021) and Lo and colleagues (2019) found that frequenting convenience stores and fast-food restaurants was linked to a reduction in diet quality. Nicholas et al., (2023) found that convenience stores within 0.25-miles were associated with sugary drink consumption, while no food outlets were associated with fruit and vegetable consumption and the odds of having an unhealthy diet increased with density of convenience stores (Lind et al., 2016).

These findings align with findings from Vogel et al., (2016) and Zenk et al., (2009), where dietary quality and store healthfulness were associated, convenience stores were associated with less fruit and vegetable consumption, and grocery stores were associated with more. Conversely, Mathieu and colleagues (2022) found density and proximity of convenience stores were associated with fruit and vegetable consumption, where those living in areas with higher densities had a higher fruit and vegetable consumption.

Fast Food Outlets. The literature extensively explores the influence of fast-food outlets on dietary habits, like food shopping outlets access and proximity play an important role in the relationship. Access to fast food within 500m from home has been associated with decreased consumption of fruits and vegetables among children (Dunaway et al., 2017) and distance to fast food was negatively associated with high fat vegetable consumption (Jago et al., 2007). Higher exposure to fast food can lead to a higher consumption of fast food, consequently leading to a poorer diet (Algur et al., 2023; Burgoine et al., 2014; Liu et al., 2020; Moore et al., 2009; Rummo et al., 2017;

Thornton et al., 2009). Working in fast food enabled adolescents to eat foods higher in refined grains, sugar, and saturated fat (Harper et al., 2022) and restaurant environments were associated with reduced children's diet quality (Robson et al., 2020).

The presence of convenience stores and fast-food outlets near residential areas is linked to a more likely consumption of high fat foods, junk foods, and soft drinks, where restaurants led to a reduced fruit and vegetable intake (Ho et al., 2010). Surprisingly, some found that higher counts of fast-food outlets in the combined home and work environment were associated with lower odds of consuming fast food and a higher diet quality (Mackenbach et al., 2023). Greater distances to fast-food outlets and greater variety was associated with less frequent consumption of fast food meals (Sharkey et al., 2011). This is supported by others findings where living further away from a fast-food outlet was associated with a lower fast food score (de Almeida Alves et al., 2019). Similarly, Timperio and colleagues (2009) found an association between having fast food outlets close to home were less likely to consume such foods.

Home Food Environment. The built food environment is not the only food environment that can impact people's diets, the home food environment is also an essential factor. Perceived healthfulness of the home food environment is associated with better diet quality (Avelino et al., 2023). Similarly, Atoloye and Durward, (2019) demonstrated that a motivation towards health is associated with a healthier home food environment, characterized by a higher accessibility and availability of healthy food in the home. Children living in homes with higher home food environment scores exhibit higher healthy eating index scores (Benjamin-Neelon et al., 2018), and improvements in the home food environment led to a positive influence on dietary habits (Adams et al., 2022; Marshall et al., 2020).

In general, the foods that are available in the home are what is mostly consumed. Ding and colleagues (2012) found that fruit and vegetable intake was significantly associated with home food environment, but not with the community food environment. Similarly, studies by Downs et al., (2009), Hanson et al., (2005), Leme & Philippi, (2017), Serasinghe et al., (2023), Shanks et al., (2020), Trofholz et al., (2016), van Ansem et al., (2013), Watts et al., (2018), and Wyse et al., (2011) highlight the importance of fruit, vegetable, and junk food availability and accessibility within the home environment on diet quality and consumption. Likewise, a better home food environment was related to a lower intake of added sugar and higher fruit and vegetable intake (Jackson et al., 2015).

The impact of the home food environment on dietary habits may vary depending on the individuals in the household. For instance, Rex and colleagues (2021) found that while the presence of fruits and vegetables in the home was associated with intake among mothers, it did not significantly affect children's intake. Conversely, energy-dense snack foods and sugar-sweetened beverages in the home were not linked to intake in either mothers or children. Ranjit and colleagues (2015) found that not only does the physical aspect of the home food environment have a relationship with diet but so do the social aspects.

Various studies emphasize the significant role of the home food environment in determining diet and diet quality (Grant et al., 2017; Qiu et al., 2021; Trubswasser et al., 2022; Vepsalainen et al., 2018; Vereecken et al., 2010; Zhang et al., 2020). Time may play a role in the home food environment and diet relationship. More time spent at home led to a reduction in purchasing take out or fast food during the COVID-19 pandemic (Barr et al., 2021). For those who spent more time at home the food environment around the home played a role in diet, when time at home was not factored in there was no association (Chum et al., 2015).

The home food environment can be influenced by the surrounding built food environment. Fruit and vegetable availability in the neighborhood was positively associated with household fruit and vegetable availability, which was related to children's fruit and vegetable intake (Moffat et al., 2021). The nutritional quality of food purchases was positively associated with the number of greengrocers around the home but negatively associated with the number of markets around the home (Recchia et al., 2020). Having more healthy foods available in the home and having a supermarket within 800m of the home were associated with a healthy eating score whereas unhealthy food availability was associated with a less healthy diet score (Trapp et al., 2015). Households that were further from grocery stores reported a large number of unhealthy items at home and a lower healthy to unhealthy food ratio (Ohri-Vachaspati & Berry, 2012). Adolescents reported convenience as a factor that leads to fast food consumption in the home food environment (Riggsbee et al., 2019).

School Food Environment. Another crucial food environment outside of the built environment, particularly significant for children, is the school food environment. Research indicates that attending a school without stores or snack bars selling foods or beverages led to a reduced sugar sweetened beverage intake, while schools that offered fresh fruit or raw vegetables led to consuming less energy dense foods (Briefel et al., 2009). These findings are supported by work from Carter and Swinburn, (2004), Kubik et al., (2003), Terry-McElrath et al., (2014), Masse et al., (2014), and Rocha et al., (2021). Conversely, schools that have vending machines tend to lead to a higher consumption of snack foods, soda, or chocolate (Neumark-Sztainer et al., 2005; Thompson et al., 2010). Notably, environmental nutrition interventions have been shown to decrease daily fat intake, cake and sweets consumption, and increased fiber intake (Lassen et al., 2011). The home food environment can supplement the school food environment, Weigel and Armijos, (2022) found that students who packed food from home had a higher fruit and vegetable intake.

Not only the immediate school environment matters but also the other accessible food environment outside of the school premise. Although school availability of snacks and soda was not associated with intake, the number of full-service restaurants within 5km of the school was positively associated with fruit and vegetable intake. Similarly, fast food outlets within 1 km and 5km of schools lessened the positive association with school fruit and vegetable availability and student fruit and vegetable intake (Betts et al., 2022).

He and colleagues (2012) found that students attending schools with convenience stores or multiple fast-food outlets within 1km of school had lower diet scores. Heroux and colleagues (2012) and Tester et al., (2010) provide supporting evidence where the availability of such food outlets influences students' utilization. Kelly et al., (2019) and Sim et al., (2021) both demonstrate that schools with a surrounding area that contains unhealthy food outlets is associated with an unhealthier diet. On the way home from school students may consume food from fast-food and other food outlets such as chips, sugar-sweetened beverages, and candy (McKerchar et al., 2022).

Other Aspects of the Food Environment. Other aspects of the food environment such as utilization of the natural or wild food environment have been associated with a better diet quality (Ahmed et al., 2022; Bogard et al., 2021). Additionally, the frequency of shopping was also something that was shown to be associated with diet. Gustafson and colleagues (2017) found that frequently shopping at convenience stores or fast-food restaurants was related to a higher sugar consumption and Minaker et al., (2016) found that frequently shopping at convenience stores was associated with consuming fruit and vegetables less often. Where frequently shopping at supermarkets, specialty stores, farmers markets, and food co-ops was related to eating more fruits and vegetables (Minaker et al., 2016).

Social dynamics also play a critical role, shown by Santiago-Torres et al., (2014) where parents eating a healthy diet was associated with children's diet. Similarly, Harper and colleagues (2022) found that adolescents were influenced by their parents'eating behaviors. Closeness of food can impact consumption too, Privitera and Zuraikat (2014) found that when food was placed closer to a participant, they ate the closer food whether it was a preferred food or not. This is supported by Arcan and colleagues (2019) who found that serving fruits and vegetables at mealtime was associated with children's fruit and vegetable consumption.

Distance. Distance to food shopping outlets has also been shown to influence diet quality. Supermarkets closer to home tend to result in a healthier diet compared to those with supermarkets residing further away, within a range of one-half mile up to five miles (Lorts et al., 2019; Moore et al., 2008; Rose & Richards, 2004). Likewise, Jago and colleagues (2007), Dean and Sharkey, (2011), Lamichhane et al., (2012), and Wedick et al., (2015) found that distance to the nearest food shopping outlet was associated with fruit, vegetable, and juice consumption. Whereas distance to food outlets that sell primarily unprocessed or minimally processed foods was associated with lower fruit and vegetable consumption (Almeida et al., 2020). Living closer to any food retailer has been associated with a lower consumption of ultra processed foods (Pinho et al., 2021). Additional studies have also reported a relationship between distance to food shopping outlets and dietary pattern (Gomi et al., 2022; van der Horst et al., 2008; Vuong et al., 2023).

Accessibility and Availability. Accessibility and availability were also shown to be an important factor in the literature. Higher grocery store access and lower fast-food access had been independently associated with higher consumption of fruit and vegetables and lower consumption of fast food (Althoff et al., 2022). Spatial accessibility has been identified as a determinant in food outlet selection (Mensah & Oyebode, 2022). Lower densities of supermarkets and fresh produce stands, availability of fruits and vegetables, and distance to a supermarket were associated with lower fruit and vegetable consumption (Duran et al., 2016). Additionally, density of vegetable vendors was associated with intake (Ambikapathi et al., 2021), while the number café type restaurants and convenience stores around the home was associated with unhealthy diet (Bivoltsis et al., 2020). Higher fruit and vegetable intake was associated with higher density of healthy food outlets (Pessoa et al., 2015), and an increase in healthy food outlets around the home and increase in road network distance was associated with healthy diet scores (Bivoltsis et al., 2020).

A higher count of food stores and supermarkets or density of fruit and vegetable stores was associated with a higher diet quality (Rodriguez-Guerra et al., 2022; Siddiqui et al., 2023; Thornton et al., 2012). Access to fruits, vegetables, and fast food was associated with intake of these foods (Thornton et al., 2010). Fruit and vegetable intake was greater in areas with better access to healthy foods (de Menezes et al., 2018), whereas areas with poor fruit and vegetable consumption tended to have the most stores with poor access to healthy foods (Menezes et al., 2017).

Availability of healthy foods had been positively associated with diet score and sweet and savory snacking (Couch et al., 2014). While produce availability was associated with organic fruit and vegetable consumption, density was not associated with organic fruit and vegetable consumption (Curl et al., 2013). Lower availability of fruit and vegetable stores was associated with unhealthier dietary patterns, whereas higher restaurant density was linked with consumption of carbohydrates and drinks (Pineda et al., 2023). Greater availability of neighborhood convenience stores was associated with lower diet quality for those of a lower income (Rummo et al., 2015). Additionally, the availability of fruits and vegetables was positively associated with a health-conscious diet pattern and inversely associated with a sweets and treats diet pattern (Vepsalainen et al., 2018).

Perceptions. Perceived ease of purchasing fruits and vegetables and signage encouraging healthy eating has been associated with increased consumption of fruit and vegetables (Martin & McCormack, 2024). Women's perception of availability of healthy foods in their neighborhood was related to fruit and vegetable intake (Williams et al., 2010). Moreover, greater perceived access to fruit and vegetables, increased availability, and having more than one grocery store in the community are associated with higher increases in fruit and vegetable consumption (Caldwell et al., 2009).

Perceived availability was associated with consuming more fruits and vegetables (Chor et al., 2016) and perceived neighborhood food environment is related to diet quality (Majid et al., 2021). Similarly, a better perceived food environment was linked to a better diet quality (Gao et al., 2022; Gase et al., 2014; Gupta & Freedman, 2021).

Food Environment Interventions. A few studies have highlighted the potential for modifying the food environment to positively impact dietary habits. For instance, Evans et al., (2012) observed that the introduction of farm stands increased fruit and vegetable consumption. Similarly, when a full-service supermarket was opened, there was a decline in added sugar intake and percentage of total calories from solid fats (Cantor et al., 2020). Furthermore, while certain aspects of the neighborhood food environment, such as sugar-sweetened beverage intake, were associated with dietary habits, others, like fruit and vegetable intake and purchases from convenience stores and fast-food outlets, did not show significant associations (Laska et al., 2010). Conversely, others found that new additions of food shopping outlets did not elicit change in diet (Dubowitz, Ghosh-Dastidar, et al., 2015).

Mixed Findings. Some studies have reported clear findings, while others have presented mixed results. Some factors of the food environment have been associated with diet quality whereas others have not, depending on the buffers utilized or the store type (Gustafson, Lewis, et al., 2013). For instance, Laraia et al., (2004) found no association between food environment and diet for individuals with middle and higher diet scores, but living further away from a grocery store, 4 miles or more, increased the odds of being in the lowest diet score. Similarly, Ollberding and colleagues (2012), discovered that beyond a buffer of 0.5km, there was no difference in fruit and vegetable intake based on proximity to healthy, unhealthy, or total food outlets. A street market in a buffer of 500m was associated with higher fruit and vegetable consumption, but buffers of 1000m and 1500m were not (Nogueira et al., 2018).

Greater fast food outlet availability was associated with a higher energy intake, whereas other dietary outcomes like total fat, percent of carbs, and fruit and vegetables had no significant associations (Hickson et al., 2011). Another study found that supermarket distance was not associated with consumption of fruit and vegetables, but perceived access to supermarket was (Caspi, et al., 2012). Regarding perception, de Almeida Alves and colleagues (2019) found that higher perceived time to restaurants was associated with lower intake of restaurant foods.

Mejia and colleagues (2015) found mixed results regarding the impact of grocery store density on diet, where density was not associated with diet overall, but the number of midsize grocery stores within 0.25 miles did affect diet, with this relationship varying by income. Reitzel and colleagues (2016) found that greater density of fast-food outlets and convenience stores within 2 miles was associated with fruit and vegetable, fiber, and fat consumption, although fat consumption was no longer associated with fast-food outlets at 5 miles.

Murakami and colleagues (2009) found that there was no association between neighborhood food store availability and meat, fish, or fruit and vegetable consumption. However, there was an association between availability and confectionaries and bread intake. Pearce et al., (2008) also reported mixed results, where fruit intake was not associated with access to supermarkets or convenience stores, vegetable intake was not associated with supermarkets, but it was associated with convenience stores. In another study by Pearce and colleagues (2009) similar results where fast food access was not associated with fruit intake, but vegetable intake was associated with such access. Similarly, food store type was not associated with diet, however the home food environment and eating at fast food outlets was associated with diet in children (Shier et al., 2016).

Zhao and colleagues (2020) noted that healthy food marketing led to higher vegetable intake, but there was not an associated with food environment and fruit intake. Paquet and colleagues (2017) reported that healthy food consumption was positively associated with vegetable displays and negatively associated with the display and variety of soft drinks. However, no association was found for unhealthy food consumption, nor were there associations observed for main effects of food environment indicators on food consumption. Additionally, shopping at farmers markets was associated with increased fruit and vegetable consumption, while shopping at a healthy food store was associated with lower odds of consuming sweetened beverages. With no association between diet measures and traveling in a less healthy food environment (Gustafsonet al., 2013).

Hulst and colleagues (2012) reported that access to supermarkets was not associated with children's diet, whereas access to fast food and convenience stores was. Ren et al., (2022) found that while supermarket availability and accessibility were not associated with nutritional outcomes, the variety of supermarkets improved dietary quality. Zhang and Huang, (2018) discovered that density of grocery or convenience stores was not associated with fruit and vegetable consumption, but a high retail food environment index score was associated with infrequent fruit and vegetable consumption. Similarly, density of stores but not proximity of stores was associated with ultra processed drink consumption (de Menezes et al., 2022).

No Association. While many studies have identified associations between aspects of the food environment and dietary outcomes, various studies have found no such association. For instance, Boutte et al., 2021, Hawkesworth et al., (2017) and Jack et al., (2013) reported that healthy food outlet density is not associated with diet quality or fruit and vegetable consumption. Similarly, fast food availability was not associated with reported fast-food consumption or diet in studies by Harbers et al., (2021) and Richardson et al., (2011). Others found there was not a relationship with food shopping outlets distance to home, availability, or access and diet quality (Bodor et al., 2008; Boone-Heinonen et al., 2011; Dubowitz et al., 2015; Dunaway et al., 2017; Fuller et al., 2013).

Contrasting to findings of some studies where additions to the food environment resulted in improvements in diet quality, Cummins and colleagues (2014) found that the introduction of a new grocery store did not improve perceptions of fruit and vegetable access or daily fruit and vegetable intake. Similarly, perceived food environment was not associated with dietary outcomes in studies by Gustafson et al., (2011) and Lucan et al., (2014). Furthermore, Alston et al., (2019) and Gebremariam et al., (2012) found no association between school food environment and diet, while Charoenbut and colleagues (2018) did not find an association between workplace food environment and diet quality or food choice. Additionally, various other researchers found no association between food environment measures were not found to be associated with diet (Aggarwal et al., 2014; An & Sturm, 2012; Ball et al., 2005; Boone-Heinonen et al., 2011; Carbonneau et al., 2019; Chan et al., 2023; Colabianchi et al., 2021; Drewnowski et al., 2016; Figueroa et al., 2022; Flint et al., 2013; Franco et al., 2009; Freedman et al., 2021; Gao et al., 2022; Gase et al., 2014, 2016; Gilham et al., 2020; Gordon-Larsen et al., 2017; Hobbs et al., 2019; Keane et al., 2016; Kibe et al., 2023; Mackenbach et al., 2019; Macdonald et al., 2011; Madrigal et al., 2020; Mathieu et al., 2016; Murakami et al., 2010; Nash et al., 2013; Perez et al., 2019; Pitts et al., 2017; Polsky & Garriguet, 2023; Raskind et al., 2020; Rongen et al., 2020; Sexton-Dhamu et al., 2021; Shareck et al., 2018; Spoer et al., 2018; Tabak et al., 2016; van der Velde et al., 2020; Vogel et al., 2019; Wertheim-Heck & Raneri, 2019; Zuccolotto et al., 2015).

Food Environment and Food Choice

A total of 40 articles were identified that examined the topic of food environment and food choice. Of those directly 22 examined the relationship between food choice and food environment, while 11 investigated food environment and food behaviors. Additionally, five delved into the food environment and food purchasing relationship. Finally, one specifically examined the food environment and feeding practices. The majority of studies were conducted in the United States (13), followed by Australia (7), three in Canada and mixed areas, two in the United Kingdom, and one in Germany, England, Thailand, Netherlands, Denmark, Africa, and South Korea.

Among these 40 studies, 14 utilized surveys as their primary data collection method. Most researchers constructed their own survey by creating questions or adapting questions from other surveys. Whereas others used already established surveys such as NEMS (Alber et al., 2018) or a food frequency questionnaire along with their own survey (Campbell et al., 2007). Qualitative methods, including interviews, focus groups, and photovoice, either individually or in combination, were utilized in 15 articles. Of these, four studies combined photovoice and interviews or focus groups (Belon et al., 2016; Bibeau et al., 2012; Caswell & Hanning, 2018; Pradeilles et al., 2021), while one solely used photovoice methods (Isaacs et al., 2022). Additionally, three articles were literature reviews (Madlala et al., 2023; Pacific et al., 2020; Pitt et al., 2017) and two were experimental studies (Pechey & Marteau, 2018; Pitts et al., 2018).

Geographical measures were used in eight of the studies. These measurement methods varied across studies, all used GIS mapping but distances and methods differed. For instance, Thornton and Kavanagh (2012) used 2km Euclidean distance buffer whereas Kalbus and colleagues (2023) used a 1 km network buffer, Park et al. (2013) used a 500m radius, Thornton et al. (2013) used 2km of road network distance and a store count within 0.8km from participants home and workplace, and Trapp et al. (2021) used varying distances for radial zones, including: 400m, 800m, and 1km. Furthermore, Kalbus and colleagues (2023) incorporated density and proximity measurements where others solely mapped food outlets (Downs et al., 2022). Where others examined food purchases in combination with other methods like mapping (Chrisinger et al., 2018; Kalbus et al., 2023).

Four studies employed store assessment methods, with Caspi and colleagues (2017) using customer receipt interviews in combination with store assessments. One study used a food log that assessed food environment and food intake (Elliston et al., 2016).

The review articles all focused on the specific topic of food environment and food choice, highlighting mixed findings. However, more studies showed an association between the food environment and food choice. Madlala and colleagues (2023) observed a predominantly positive association between healthy food environments and healthy food choices, while some showed an association between unhealthy food environments and unhealthy food choices, and others found no association. Pacific and colleagues (2020) found that the perception of availability of healthy foods in both the home and school food environment can relate to children's food choices. Where unhealthy foods in these environments led to consumption of these unhealthy foods by children. Pitt et al. (2017) identified that availability, accessibility, and affordability were consistently identified factors in the literature as key determinants of store choice, significantly influencing food purchases and therefore food choices.

Interview-based studies identified various factors influencing food choice in relation to the food environment, including food accessibility (Brown et al., 2019; Devine et al., 2023; Dhillon et al., 2019; Pradeilles et al., 2021), food availability (Bibeau et al., 2012; Blake et al., 2023; Caswell & Hanning, 2018; Chalermsri et al., 2020; Devine et al., 2023; Pradeilles et al., 2021), food preferences (Bibeau et al., 2012; Blake et al., 2023; Brown et al., 2019; Devine et al., 2023; Downs et al., 2022; Thompson et al., 2013), traditional food practices (Blake et al., 2023), cost (Belon et al., 2016; Bibeau et al., 2012; Brown et al., 2019; Devine et al., 2023; Dhillon et al., 2019; Downs et al., 2022; Kelly et al., 2021; Pradeilles et al., 2021), convenience (Bibeau et al., 2012; Devine et al., 2023; Downs et al., 2022; Kelly et al., 2021; Pradeilles et al., 2021), social aspects (Caswell & Hanning, 2018; Devine et al., 2023; Jilcott et al., 2009; Kelly et al., 2021), health concerns (Caswell & Hanning, 2018; Devine et al., 2023; Jilcott et al., 2009; Kelly et al., 2021; Thompson et al., 2013), time (Downs et al., 2022), and quality (Dhillon et al., 2019).

Similarly, survey-based studies found that availability (Alber et al., 2018; Campbell et al., 2007; He et al., 2012; Kegler et al., 2014), social aspects (Campbell et al., 2007), time (Hearst et al., 2012), food preference (Bauer et al., 2022), and health (Bauer et al., 2022) as influential factors in the food environment that can influence food choice. Similar to the collective results of the survey and interview article the sole photovoice study found that factors like social aspects, cost, health, and convenience have an influence on food environment and food choice (Isaacs et al., 2022).

Cost emerged as a strong factor in most studies, where fast food was of a lower cost (Belon et al., 2016; Bibeau et al., 2012) and healthy food was more expensive (Belon et al., 2016) leading to influencing choices and purchases for those who are cost conscious. Moreover, the food environment played a crucial role in influencing food choices through various avenues such as school food availability and food advertisements, where available food at school and food advertisements were shown to impact purchases (Bibeau et al., 2012). Participants in studies conducted by Belon et al., (2016) expressed concerns regarding the access and availability of healthy food options, particularly in fast-food restaurants with limited or no healthy options and restricted access to healthy food outlets due to operating hours.

Several articles directly investigated the home food environment and food choice. Alber and colleagues (2018) found that higher perceived availability and accessibility of fruits and vegetables in the home was associated with a higher fruit and vegetable consumption. Conversely, Adams and colleagues (2020) noted that an increased presence of high-calorie snack foods, desserts/sweets, and processed foods in the home correlated with higher consumption of these less healthy options. Additionally, Kegler and colleagues (2014) reported that having fruits and vegetables readily available at home was predictive of higher fruit and vegetable intake, whereas the presence of unhealthy foods was associated with increased fat intake, but there was not an association between food placement, unhealthy food and drink, and fruit and vegetable intake.

External aspects not directly related to the food environment, such as smartphones, have also been found to influence food choices via access to social media. This is due to the marketing and posting of food, exposure to these food related posts and reviews can influence choosing lesser-known food outlets or types of food (Allman-Farinelli et al., 2019). Other social aspects like relationships have also been found to impact food choice in the food environment, demonstrated by Campbell et al. (2007), where savory snack and take-out food consumption in mothers was associated with consumption in their sons.

The momentary food environment can influence meals and snacking, with a higher likelihood of consuming high-energy food when near fast-food and a higher likelihood of consuming low-energy food near supermarkets (Elliston et al., 2016). Grocery stores are a momentary food environment that impacts food choice. Grocery store type can influence purchases, where shopping at a natural grocery store was associated with higher healthy eating scores compared to other retailer types (Chrisinger et al., 2018). Stores offering greater variety and quantity of fruits and vegetables tend to lead customers to purchasing more fruits and vegetables (Caspi et al., 2017). In an experiment conducted by Pechey and Marteau (2018), participants were offered more healthy food options vs less healthy food options healthy options were selected more.

While there were shared findings for many of the studies, some researchers did find conflicting results. Park et al. (2013) found no association between the food environment and healthy food choice. Similarly, He and colleagues (2012) found no association between proximity of fast-food outlets or convenience stores and food choice. Thornton and colleagues (2016) observed that an addition of a new fast-food outlet did not increase fast-food consumption overtime. Pitts and colleagues (2018) found no significant differences in fruit and vegetable and sugary beverage intake between stores with an improved food environment and control stores. Likewise, an overtime change to the food environment did not change purchases in Laska and colleagues (2019) work.

Overall aspects of the food environment did influence food choice (Chen & Yang, 2014; Folkvord et al., 2020). Although some findings were mixed, with Trapp et al. (2021) finding no association between the number of food outlets within 400m, 800m, and 1km of secondary schools and discretionary food purchasing and Kalbus et al. (2023) finding no consistent relationship between food environment and diet. Thornton and colleagues (2013) found some mixed results, with no association between fast food intake and the food environment but there was an association between the food environment and fruit and vegetable intake. This association varied based on buffer distance, location work vs home, and food outlet type. Exposure to better quality food environments also yielded mixed results; where Thornton and Kavanagh, (2012) found those living in a higher unhealthy food environment score than a healthy food environment score were more likely to purchase fast food infrequently but there was no association with frequent purchasing.

Food Choice and Diet

Of the 21 articles that examined the topic of food choice and diet, 10 specifically explored food choice and diet, eight investigated food/eating behavior and diet, and four explored food choice and eating/food behavior or food preferences. These studies were conducted across the world with four occurring the in the United States, two in Canada and Australia, and one in Uruguay, Greece, Indonesia, Brazil, Ireland, Poland, United Kingdom, South Korea, France, and Switzerland, and one assessing multiple countries.

The majority (14) of these articles used an online or paper survey or questionnaire as their primary method of data collection. Among these, three studies supplemented a survey with other methods. Blake and colleagues (2011) utilized interviews and 24-hour dietary recalls along with their questionnaire. Hoenink and colleagues (2023) used mapping in conjunction with their questionnaire to measure exposure to takeaway food outlets in neighborhoods. Similarly, Drisdelle and colleagues (2020) mapped road network buffers to assess the food environment. Those that did not rely primarily on surveys for data collection utilized interviews (5). Four of the articles used a food frequency questionnaire or a dietary recall. One article was a review where Hardcastle and colleagues (2015) synthesized literature on food choice and diet, concluding that intentions, perceived behavioral control, and confidence were predictors of healthy eating.

Interview-based studies predominately focused on food choice and diet. Two studies conducted in the United States by Banks et al. (2020) and Blake et al. (2011), Bargiota et al. (2013) carried out their study in Greece, Colozza (2022) performed theirs in Indonesia and Ares and colleagues (2017) conducted theirs in Uruguay. Of the other studies, two were conducted in Australia, two in the United States, one in Brazil, one in Ireland, one in various countries, two in Canada, one in Poland, one in South Korea, one in the United Kingdom, one in France, and one in Switzerland.

These articles examined food choice and diet in various ways, all reaching the consensus that food choice has an impact on diet. Factors such as cost (Ares et al., 2017; da Silva et al., 2023; Glabska et al., 2021; Livingstone et al., 2021; Vilaro et al., 2018), mood (da Silva et al., 2023; Glabska et al., 2021; Marty et al., 2021), attitudes towards eating (Sob et al., 2023), food enjoyment (Dubois et al., 2022), familiarity of foods (Kim, 2016), sensory appeal (Daly et al., 2023; Glabska et al., 2021), influence of relationships or others (Baldwin et al., 2022; Bargiota et al., 2013; Blake et al., 2011; Bruening et al., 2012; Colozza, 2022), health concerns (Colozza, 2022; da Silva et al., 2023; Glabska et al., 2021; Tam et al., 2017), convenience (Colozza, 2022) and self-regulation (de Wit et al., 2015; Hoenink et al., 2023) were identified.

Individuals with lower incomes often base their food choices on factors such as cost and satiety (Ares et al., 2017). Cost has been identified as a determinant leading to reduced fruit and vegetable consumption and increased intake of sugar-sweetened beverages (Vilaro et al., 2018). Interestingly, the frequency of grocery shopping has shown a positive correlation with higher fruit and vegetable consumption compared to less frequent shoppers (Banks et al., 2020), although Drisdelle and colleagues (2020) found no association between shopping frequency and higher fruit and vegetable intake.

Social situations can have a notable influence on adolescents' food choices. When out with friends they tended to select fast food outlets, although this behavior remained consistent when alone (Bargiota et al., 2013). Likewise, Bruening and colleagues (2012) found that adolescents friends positively influenced fruit and vegetable and whole grain intake. Family members' requests or preference for foods, specifically foods high in unhealthy fats, salt, and sugar, can influence other family members' consumption of such foods (Colozza, 2022). Baldwin and colleagues (2022) reported a positive relationship between higher scores on a social eating scale, indicating greater social influence, and better diet quality. Others found in certain situations the social aspect did not influence eating, where the frequency of family meals wasn't associated with unhealthy eating (de Wit et al., 2015).

Aspects like enjoyment of food, sensory appeal, familiarity of foods, mood, and attitudes towards eating or health concerns can influence healthy or unhealthy food choices, ultimately shaping diet. Health considerations may motivate individuals to opt for healthier foods and limit the consumption of ultra-processed foods (Colozza, 2022; Daly et al., 2023; Kim, 2016). Tam and colleagues (2017) found that university students sometimes chose off-campus dining due to concerns about the healthfulness of university-provided food, and similarly, preferred foods were often not available on campus. Kim (2016) noted that older adults who prioritize healthiness tend to maintain a high-quality diet. Mood was found to be associated with emotional eating, where food choice based on health was not a factor based on mood (da Silva et al., 2023) and eating based on mood was associated with decreased nutritional quality (Marty et al., 2021). Conversely, Dubois and colleagues (2022) found a positive association food enjoyment and a healthy diet pattern and a protein rich diet pattern.

The factor of convenience can impact all other aspects of food choice and therefore diet. When time is limited or alternative foods are not available, individuals are more likely to opt for convenient foods, regardless of healthfulness (Colozza, 2022). These convenient foods could be from home though (Bibeau et al., 2012). Similarly, self-regulation can facilitate making healthier food choices (de Wit et al., 2015) to an extent, at a certain point of exposure to certain foods there is no longer an association (Hoenink et al., 2023).

Discussion

This integrative literature review explored previous research concerning the relationship between the food environment, diet quality, and food choice. While some studies indicated no association between the food environment and diet measures, the majority demonstrated an association or some level of association with specific aspects of the food environment and diet. For instance, Hulst and colleagues (2012) reported that access to supermarkets was not associated with children's diet, but noted an association with access to fast food and convenience stores. Where, de Menezes and colleagues (2022) found that density of stores, but not proximity, was associated with ultra-processed drink consumption. These findings align with other reviews in the literature, which provide evidence of a relationship between the food environment and diet, albeit with mixed results (Engler-Stringer et al., 2014; Rahmanian et al., 2014).

Similar findings emerged regarding the relationship between the food environment and food choice, with most studies showing an association and some reporting mixed results. For example, Kalbus and colleagues (2023) found no consistent relationship between food environment and diet, while Thornton and colleagues (2013) found no association between fast food intake and the food environment, but did find an association between the food environment and fruit and vegetable intake. Regarding the relationship between food choice and diet, the literature consistently demonstrates a clear connection. Similarly, the research showed a relationship between food choice and diet. Factors of food choice such as cost, sensory appeal, health concerns, convenience and other factors were associated with diet (Colozza, 2022; Daly et al., 2023; Glabska et al., 2021; Vilaro et al., 2018).

While no research was conducted on these three topics together, these topics can be related to one another. This can be seen with the impact that the food environment has on food choice and diet and the relation between food choice and diet. The food environment impacts food choice by what is available, accessible, convenient, the cost of items, and various other factors. The foods that are chosen for consumption make up a person's diet. While this connection needs to be studied for a concrete association one can presume that there is some relationship between these three factors. This link is shown in the NEMS-P conceptual model where the food environment (community nutrition environment, consumer nutrition environment, etc.), food choice (eating behaviors), and background characteristics (diet history/status) are intricately connected within the model, see Appendix B: Nutrition Environment Measures Survey-Perceived (NEMS-P): Conceptual Model.

There are aspects of the reviewed research articles that warrant critique. Many of the studies employed diverse measures for assessing the food environment. These variations include differences in distances measured and measurement methods utilized. Researchers utilized Euclidean buffers, radial buffers, road network distance, or simply defined neighborhoods as a specific distance or area. This variation in measurement methods poses challenges for comparing results across studies, as definitions of neighborhoods differ. For example, Cummins et al., (2014) defined neighborhoods as 3 square miles, Franco et al., (2009) used census tracts, Pearce et al., (2008) used a weighted population centroid, and Ball et al., (2005) defined a neighborhood as “the geographical area within approximately 30 km of the central business district” (pg 624).

Along with these varying neighborhood definitions, there were various buffer distances used across studies. An and Sturm, (2012) used circular buffers of 0.1, 0.5, 1, and 1.5 miles centered around students schools and home. Bivoltsis et al., (2020) used a 1.6-kilometer road network buffer around the home. Burgoine et al., 2014 and Menezes et al., (2017) used a 1 mile buffer, Hattori et al., 2013 and Mejia et al., (2015) used 0.25, 0.5, 1, 1.5, and 3 miles circular buffers, Mackenbach et al., (2019) used buffers of 400, 800, 1,600 meters to measure density of fast food restaurants, Nogueira et al., (2018) 500, 1,000, and 1,500 meters buffers, Thornton et al., (2012) used 0.4, 1, 2, 3, 4 and 5 kilometers Euclidean and road network buffers, along with a Kernel density of 0.4, 1, 2, 3, 4 and 5 kilometers. Where others used a distance based on mode of travel, Zhang et al., (2022) used walking distance 250, 500, 800, and 1,000 meters. Some also used varying distances based on the store type Richardson et al., (2015) used 3-kilometer Euclidean distance buffers for restaurants and 8-kilometer buffer for food stores.

Thornton and colleagues (2017) discussed how there is not a common and agreed-upon buffer distance to use. They conducted a study examining the distance between purchases at food outlets and the home. It was found that the median distance was 3.6 km (2.24 miles) from participants' homes, but this distance went as high as 16.8 km (10.44 miles) from the participants' homes. In another similar study the authors found that participants lived 1.66 miles (2.67 km) away from the closest supermarket but traveled on average 5.26 miles (8.47 km) to get to their preferred supermarket (Janda et al., 2022). Both of these distances are outside the realm of what is often used by researchers (Chen & Yang, 2014; Rummo et al., 2021; Yang et al., 2020).

The distance or size of the buffer is not the only issue that arises. The location or space that the buffer surrounds should be considered as well. There is an argument for assessing other locations or spaces beyond peoples' neighborhoods or homes. People consistently move around and are exposed to other areas besides their own neighborhood in their daily lives (Zhao et al., 2018).

Yang, Wanh, and Qiu (2020) tried to account for this by adding in a 10 km (6.21 miles) buffer area outside of the city boundary to account for people traveling outside of the area to acquire food. Zhao and colleagues (2018) also recognized that people are consistently on the move, and that it is inadequate to assess and describe the built environment and its relationship with health factors based on a single location. They used seven methods of measuring the neighborhood, including a buffer around the home, workplace, and fitness center, using two different deviational ellipse methods, a convex polygon method, and road network buffer of 1 km (0.62 miles) along with a survey. Their findings suggest that using a buffer around the home may not accurately assess the impact of the built environment on obesity, because it does not consider all the environmental variables. They also found that the type of space (home, work, fitness center, etc.) used changes the relationship between environmental variables and obesity. For example, fast food restaurant density impacted BMI for home buffers, but not for other types of spaces.

Some studies used count or density of food outlets within the given area, whereas others used proximity or distance to a food outlet. Laraia and colleagues (2004) used a proximity and density measure to food outlets, such as grocery stores and convenience stores, whereas Murakami and colleagues (2009) used the number of food outlets in a 1-kilometer mesh block of the residence. Others used self-reported measures of perceptions of the food environment, Williams et al., (2010) used perceptions of availability of healthy foods in participants neighborhoods, and Caldwell et al., (2009) used perceived access to fruits and vegetables as a measure.

Many used a questionnaire to assess diet or aspects of the food environment, most of which were created by the researchers. Whereas others used a more standardized measure to assess the food environment of stores. Gustafson et al., (2013) used NEMS-S to measure food shopping outlet environments, coupled with a GPS tracker to accurately assess the food environment that a person interacted with. Others that used a form of the NEMS include de Almeida et al., (2023) who used it to assess food shopping outlets in Brazil, Mathieu et al., (2016) who used the NEMS-S and Robson et al., (2020) who used NEMS-R.

Others used the NEMS-P to measure people's perceptions of the food environment, such as Avelino et al., (2023), Majid et al., (2021), and Martin and McCormack, (2024), rather than creating their own survey. The NEMS is an index that gives a composite score for food stores based on the availability, quality, and cost of healthy options (Kelly et al., 2011). Lytle (2009) also recommended using NEMS but specifically the Nutrition Environment Measurement Survey Stores (NEMS-S) and the Nutrition Environment Measurement Survey Restaurants (NEMS-R), as well as the School Health Policy and Practices Survey (Lytle, 2009). Utilization of these more standardized measures rather than creating a new survey measurement tool adds a level of strength to the research, where study results can be more easily compared to one another.

Similar issues arise with using varying measures of diet. Some used a Food Frequency Questionnaire (FFQ) where a diet score was calculated or specific type of food consumption was assessed (Burgoine et al., 2014; Fuller et al., 2013; Hanson et al., 2005; Marshall et al., 2020; Moore et al., 2008; van Ansem et al., 2013), whereas others used fruit and vegetable intake measured from created surveys (Curioni et al., 2020; Curl et al., 2013; de Menezes et al., 2018; Nicholas et al., 2023), and some used dietary recalls (Arcan et al., 2019; Dubowitz, Zenk, et al., 2015; Kubik et al., 2003; Rocha et al., 2021; Saelens et al., 2018).

These differing forms of dietary measurement make it difficult to compare results. For example, fruit and vegetable consumption may be used as a measure diet quality, but how fruit and vegetable consumption is measured can vary from study to study. The measure may be a daily or weekly count, ask about specific types of fruits and vegetables, or ask about cups or servings eaten. These differing forms of measurement can influence significance as well as comparability across studies. Utilization of a more standardized diet measure such as a Healthy Eating Index (HEI) score would make results across studies more comparable. Some researchers used an HEI, Arcan et al., (2019), Avelino et al., (2023), Boutte et al., (2021), Dhakal and Khadka, (2021), Gupta and Freedman, (2021), and Moore et al., (2008), some used an FFQ to calculate HEI whereas others used a dietary recall.

These variations of measurement methods and instruments used make it difficult to compare and synthesize the literature. Also, a study may have a significant result or a nonsignificant result simply due to the measurement methods used. These critiques are supported by Bivoltsis and colleagues (2018) where they stated that significant results of studies varied by the method used, food outlet type measured, and the dietary outcome measured that was utilized. Lytle, (2009) also expressed concern where many have not tested the psychometric properties of the food environment measurement or instrument used.

Other authors have expressed concerns regarding the reliability, validity, and the lack of psychometric testing of instruments to assess food environment (Glanz, 2009; Kelly et al., 2011; Lytle, 2009). They argue for more standardized instruments such as the NEMS to be used by researchers. This sentiment of issues with utilization of various methods of measurement and instruments is shared by others that have conducted reviews (Rahmanian et al., 2014; Shaw et al., 2020).

This review revealed that there has not been any previous research that examines the relationship between the factors of food environment, diet quality, and food choice. Previous literature established a clear relationship between the food environment and diet as well as food environment and food choice. However, this leaves a gap in the research where the intertwining relationship of the food environment, diet quality, and food choice can be examined. Future research should examine this relationship by combining food environment, food choice, and diet measures. This can be done by creating questionnaires, combining questionnaires, or by using already established questionnaires such as the NEMS-P. Use of standardized measures like the NEMS-P is recommended.

REFERENCES

Adams, E. L., Caccavale, L. J., Smith, D., & Bean, M. K. (2020). Food insecurity, the home food environment, and parent feeding practices in the era of COVID-19. *Obesity*, *28*, 2056–2063.

Aggarwal, A., Cook, A. J., Jiao, J., Seguin, R. A., Moudon, A. V., Hurvitz, P. M., & Drewnowski, A. (2014). Access to supermarkets and fruit and vegetable consumption. *American Journal of Public Health*, *105*(5), 917–923.

Ahmed, S., Warne, T., Stewart, A., Shanks, C. B., & Dupuis, V. (2022). Role of wild food environments for cultural identity, food security, and dietary quality in a rural American state. *Frontiers in Sustainable Food Systems*, *6*. https://doi.org/10.3389/fsufs.2022.774701

Alber, J. M., Green, S. H., & Glanz, K. (2018). Perceived and observed food environments, eating behaviors, and BMI. *American Journal of Preventive Medicine*, *54*(3), 423–429. https://doi.org/10.1016/j.amepre.2017.10.024

Algur, Y., Rummo, P. E., McAlexander, T. P., de Silva, S. S. A., Lovasi, G. S., Judd, S. E., Ryan, V., Malla, G., Koyama, A. K., Lee, D. C., Thorpe, L. E., & McClure, L. A. (2023). Assessing the association between food environment and dietary inflammation by community type: A cross-sectional REGARDS study. *International Journal of Health Geographics*, *22*. https://link.springer.com/article/10.1186/s12942-023-00345-4

Allman-Farinelli, M., Rahman, H., Nour, M., Wellard-Cole, L., & Watson, W. L. (2019). The role of supportive food environments to enable healthier choices when eating meals prepared outside the home: Findings from focus groups of 18 to 30 year olds. *Nutrients*, *11*. https://doi.org/10.3390/nu11092217

Almeida, L. F. F., Novaes, T. G., Pessoa, M. C., do Carmo, A. S., Mendes, L. L., & Ribeiro, A. Q. (2020). Fruit and vegetable consumption among older adults: Influence of urban food environments in a medium-sized Brazilian city. *Public Health Nutrition*, *24*(15), 4878–4887. https://doi.org/10.1017/S136898002000467X

Alston, L., Crooks, N., Strugnell, C., Orellana, L., Allender, S., Rennie, C., & Nichols, M. (2019). Associations between school food environments, body mass index and dietary intakes among regional school students in Victoria, Australia: A cross-sectional study. *International Journal of Environmental Research and Public Health*, *16*(16). https://doi.org/10.3390/ijerph16162916

Althoff, T., Nilforoshan, H., Hua, J., & Leskovec, J. (2022). Large-scale diet tracking data reveal disparate associations between food environment and diet. *Nature Communications*, *13*. https://doi.org/10.1101/2020.09.29.20204099

Ambikapathi, R., Shively, G., Leyna, G., Mosha, D., Mangara, A., Patil, C. L., Boncyk, M., Froese, S. L., Verissimo, C. K., Kazonda, P., Mwanyika-Sando, M., Killewo, J., & Gunaratna, N. S. (2021). Informal food environment is associated with household vegetable purchase patterns and dietary intake in the DECIDE study: Empirical evidence from food vendor mapping in peri-urban Dar es Salaam, Tanzania. *Global Food Security*, *28*. https://doi.org/10.1016/j.gfs.2020.100474

An, R., & Sturm, R. (2012). School and residential neighborhood food environment and dietary intake among California children and adolescents. *American Journal of*

Preventive Medicine, *42*(2), 129–135. https://doi.org/10.1016/j.amepre.2011.10.012

Appelhans, B. M., French, S. A., Tangney, C. C., Powell, L. M., & Wang, Y. (2017). To what extent do food purchases reflect shoppers' diet quality and nutrition intake? *International Journal of Behavioral Nutrition and Physical Activity*, *14*(46). https://doi.org/DOI 10.1186/s12966-017-0502-2

Arcan, C., Friend, S., Flattum, C. F., Story, M., & Fulkerson, J. A. (2019). Fill "half your child's plate with fruits and vegetables": Correlations with food-related practices and the home food environment. *Appetite*, *133*, 77–82. https://doi.org/10.1016/j.appet.2018.10.017

Ares, G., Machin, L., Girona, A., Curutchet, M. R., & Gimenez, A. (2017). Comparison of motives underlying food choice and barriers to healthy eating among low medium income consumers in Uruguay. *Cad Saude Publica*, *33*(4). https://doi.org/10.1590/0102-311X00213315

Atoloye, A. T., & Durward, C. (2019). Being motivated by nutrition is associated with healthy home food environment of Supplemental Nutrition Assistance Program (SNAP) recipients. *Journal of Nutrition Education and Behavior*, *51*(1), 101–106. https://doi.org/10.1016/j.jneb.2018.07.013

Avelino, D. C., Duffy, V. B., Puglisi, M., Ray, S., Lituma-Solis, B., Nosal, B. M., Madore, M., & Chun, O. K. (2023). Can ordering groceries online support diet quality in adults who live in low food access and low-income environments? *Nutrients*, *15*(4). https://doi.org/10.3390/nu15040862

Bader, M. D. M., Alishire, J. A., Morenoff, J. D., & House, J. S. (2010). Measurement of the local food environment: A comparison of existing data sources. *American Journal of Epidemiology*, *171*(5), 609–617. https://doi.org/DOI: 10.1093/aje/kwp419

Baldwin, J. N., Haslam, R. L., Clarke, E., Attia, J., Hutchesson, H. J., Rollo, M. E., Callister, R., Burrows, T., Truby, H., McCaffrey, T. A., Hides, Bonevski, B., & Collins, C. E. (2022). Eating behaviors and diet quality: A national survey of Australian young adults. *Journal of Nutrition Education and Behavior*, *54*(5), 397–405. https://doi.org/10.1016/j.jneb.2021.12.001

Ball, K., Crawford, D., & Mishra, G. (2005). Socio-economic inequalities in women's fruit and vegetable intakes: A multilevel study of individual, social and environmental mediators. *Public Health Nutrition*, *9*(5), 623–630. https://doi.org/10.1079/PHN2005897

Banks, J., Fitzgibbon, M. L., Schiffer, L. A., Campbell, R. T., Antonic, M. A., Braunschweig, C. L., Odoms-Young, A. M., & Kong, A. (2020). Relationship between grocery shopping frequency and home and individual level diet quality among low income racial/ethnic minority households with preschool-age children. *Journal of the Academy of Nutrition and Dietetics*, *120*(10), 1706–1714. https://doi.org/10.1016/j.jand.2020.06.017

Bargiota, A., Delizona, M., Tsitouras, A., & Koukoulis, G. N. (2013). Eating habits and factors affecting food choice of adolescents living in rural areas. *Hormones*, *12*(2), 246–253. https://doi.org/10.14310/horm.2002.1408

Barr, M. L., Martin, C., & Cardarelli, K. (2021). Losses, gains, and changes to the food environment in a Kentucky county during the COVID-19 pandemic. *Nutrients*, *13*. https://doi.org/10.3390/nu13113929

Barrett, M., Crozier, S., Lewis, D., Godfrey, K., Robinson, S., Cooper, C., Inskip, H., Baird, J., & Vogel, C. (2017). Greater access to healthy food outlets in the home and school environment is associated with better dietary quality in young children. *Public Health Nutrition*, *20*(18). https://doi.org/10.1017/S1368980017002075

Bauer, J. M., Nielsen, K. S., Hofmann, W., & Reisch, L. A. (2022). Healthy eating in the wild: An experience-sampling study of how food environments and situational factors shape out-of-home dietary success. *Social Science & Medicine*, *299*. https://doi-org.ezproxy.mtsu.edu/10.1016/j.socscimed.2022.114869

Belon, A. P., Nieuwendyk, L. M., Vallianatos, H., & Nykiforuk, C. I. J. (2016). Perceived community environmental influences on eating behaviors: A photovoice analysis. *Social Science & Medicine*, *171*, 18–29. https://doi.org/10.1016/j.socscimed.2016.11.004

Benjamin-Neelon, S. E., Vaughn, A. E., Tovar, A., Ostbye, T., Mazzucca, S., & Ward, D. S. (2018). The family child care home environment and children's diet quality. *Appetite*, *126*, 108–113. https://doi.org/10.1016/j.appet.2018.03.024

Betts, G. M., Schwedhelm, C., Lipsky, L. M., Haynie, D. L., & Nansel, T. R. (2022). Impact of the external school food environment on the associations of internal school food environment with high schoolers' diet and BMI. *Public Health Nutrition*, *25*(11), 3086–3095. https://doi.org/10.1017/S1368980022000994

Bibeau, W. S., Saksvig, B. I., Gittelsohn, J., Williams, S., Jones, L., & Young, D. R. (2012). Perceptions of the food marketing environment among African American teen girls and adults. *Appetite*, *58*, 396–399. http://dx.doi.org/10.1016/j.appet.2011.11.004

Bivoltsis, A., Cervigni, E., Trapp, G., Knuiman, M., Hooper, P., & Ambrosini, G. L. (2018). Food environments and dietary intakes among adults: Does the type of spatial exposure measurement matter? A systematic review. *International Journal of Health Geographics*, *17*(19). https://doi.org/10.1186/s12942-018-0139-7

Bivoltsis, A., Trapp, G., Knuiman, M., Hooper, P., & Ambrosini, G. L. (2020b). The influence of the local food environment on diet following residential relocation: Longitudinal results from RESIDential Environments (RESIDE). *Public Health Nutrition*, *23*(12), 2132–2144. https://doi.org/10.1017/S1368980019005111

Bivoltsis, A., Trapp, G., Knuiman, M., Hooper, P., & Ambrosini, G. L. (2020a). Do changes in the local food environment within new residential developments influence the diets of residents? Longitudinal results from RESIDE. *International Journal of Environmental Research and Public Health*, *17*(18). https://doi.org/10.3390%2Fijerph17186778

Black, C., Moon, G., & Baird, J. (2014). Dietary inequalities: What is the evidence for the effect of the neighbourhood food environment? *Health Place*, *27*, 229–242. https://doi.org/doi:10.1016/j.healthplace.2013.09.015

Blake, C. E., Monterrosa, E. C., Rampalli, K. K., Khan, A. N. S., Reyes, L. I., Drew, S. D., Dominguez-Salas, P., Bukachi, S. A., Ngutu, M., Frongillo, E. A., Iruhiriye, E., &

Girard, A. W. (2023). Basic human values drive food choice decision-making in different food environments of Kenya and Tanzania. *Appetite*, *188*. https://doi.org/10.1016/j.appet.2023.106620

Blake, C. E., Wethington, E., Farrell, T. J., Bisogni, C. A., & Devine, C. M. (2011). Behavioral contexts, food-choice coping strategies, and dietary quality of a multiethnic sample of employed parents. *Journal of American Dietetic Association*, *111*(3), 401–407. https://doi.org/10.1016/j.jada.2010.11.012

Blitstein, J. L., Snider, J., & Evans, W. D. (2012). Perceptions of the food shopping environment are associated with greater consumption of fruits and vegetables. *Public Health Nutrition*, *15*(6), 1124–1129.

Bodor, J. N., Rose, D., Farley, T. A., Swalm, C., & Scott, S. K. (2008). Neighbourhood fruit and vegetable availability and consumption: The role of small food stores in an urban environment. *Public Health Nutrition*, *11*(4), 413–420.

Bogard, J. R., Andrew, N. L., Farrell, P., Herrero, M., Sharp, M. K., & Tutuo, J. (2021). A typology of food environments in the Pacific Region and their relationship to diet quality in Solomon Islands. *Foods*, *10*. https://doi.org/10.3390/foods10112592

Bonanno, A., Bimbo, F., Castellari, E., & Sckokai, P. (2017). Five-a-day, fruit and vegetables portions, and the food environment: The Italian case. *Applied Economic Perspectives and Policy*, *39*(4), 682–709. https://doi.org/10.1093/aepp/ppw032

Boone-Heinonen, J., Gordon-Larsen, P., Kiefe, C. I., Shikany, J. M., Lewis, C. E., & Popkin, B. M. (2011). Fast food restaurants and food stores: Longitudinal associations with diet in young to middle-ages adults: The CARDIA study. *Archives of Internal Medicine*, *171*(13), 1162–1170. https://doi.org/10.1001/archinternmed.2011.283

Boutte, A. K., Turner-McGrievy, G. M., Eberth, J. M., Wilcox, S., Liu, J., & Kaczynski, A. T. (2021). Healthy food density is not associated with diet quality among pregnant women with overweight/obesity in South Carolina. *Journal of Nutrition Education and Behavior*, *53*(2), 120–129. https://doi.org/10.1016/j.jneb.2020.11.014

Briefel, R. R., Crepinsek, M. K., Cabili, C., Wilson, A., & Gleason, P. M. (2009). School food environments and practices affect dietary behaviors of US public school children. *Journal of the American Dietetic Association*, *109*(2), S91–S107.

Brown, M. C., Shrestha, U., Huber, C., Best, L. G., O'Leary, M., Howard, B., Beresford, S., & Fretts, A. M. (2019). Characterizing the local food environment and grocery-store among a large American Indian community in the north-central USA: qualitative results from the Healthy Foods Healthy Families Feasibility Study. *Public Health Nutrition*, *22*(14), 2653–2661. https://doi.org/10.1017/S1368980019001095

Bruening, M., Eisenberg, M., MacLehose, R., Nanney, M. S., Story, M., & Neumark-Sztainer, D. (2012). Relationship between adolescents' and their friends' eating behaviors: Breakfast, fruit, vegetable, whole-grain, and dairy intake. *Journal of the Academy of Nutrition and Dietetics*, *112*, 1608–1613. https://doi.org/10.1016/j.jand.2012.07.008

Burgoine, T., Forouhi, N. G., Griffin, S. J., Wareham, N. J., & Monsiviais, P. (2014). Associations between exposure to takeaway food outlets, takeaway food consumption, and body weight in Cambridgeshire, UK: population based, cross sectional study. *BMJ*, *348*. https://doi.org/10.1136%2Fbmj.g1464

Caldwell, E. M., Kobayashi, M. M., DuBow, W. M., & Wytinck, S. M. (2009). Perceived access to fruits and vegetables associated with increased consumption. *Public Health Nutrition*, *12*(10). https://doi.org/10.1017/S1368980008004308

Campbell, K. J., Crawford, D. A., Salmon, J., Carver, A., Garnett, S. P., & Baur, L. A. (2007). Associations between the home food environment and obesity-promoting eating behaviors in adolescence. *Obesity*, *15*(3), 719–730.

Cantor, J., Beckman, R., Collins, R. L., Dastidar, M. G., Richardson, A. S., & Dubowitz, T. (2020). SNAP participants improved food security and diet after a full service supermarket opened in an urban food desert. *Health Affairs*, *39*(8), 1386–1394. https://doi.org/10.1377/hlthaff.2019.01309

Carbonneau, E., Lamarche, B., Robitaille, J., Provencher, V., Desroches, S., Vohl, M. C., Begin, C., Belanger, M., Couillard, C., Pelletier, L., Bouchard, L., Houle, J., Langlois, M. F., Corneau, L., & Lemieux, S. (2019). Social support, but not perceived food environment, is associated with diet quality in French-Speaking Canadians from the PRESIDE study. *Nutrients*, *11*(12). https://doi.org/10.3390/nu11123030

Carter, M. A., & Swinburn, B. (2004). Measuring the "obesogenic" food environment in New Zealand primary schools. *Health Promotion International*, *19*(1), 15–20.

Caruso, O. T., Schaafsma, H. N., McEachern, L. W., & Gilliland, J. A. (2023). The campus food environment and postsecondary student diet: A systematic review. *Journal of American College Health*, 1-25. https://doi.org/10.1080/07448481.2023.2227725

Caspi, C. E., Kawachi, I., Subramanian, S. V., Adamkiewicz, G., & Sorensen, G. (2012). The relationship between diet and perceived and objective access to supermarkets among low-income housing residents. *Social Science & Medicine*, *75*(7), 1254–1262. https://doi.org/10.1016/j.socscimed.2012.05.014

Caspi, C. E., Lenk, K., Pelletier, J. E., Barnes, T. L., Harnack, L., Erickson, D. J., & Laska, M. N. (2017). Association between store food environment and customer purchases in small grocery stores, gas-marts, pharmacies and dollar stores. *International Journal of Behavioral Nutrition and Physical Activity*, *14*. https://doi.org/10.1186/s12966-017-0531-x

Caspi, C. E., Sorensen, G., Subramanian, S. V., & Ichiro, K. (2012). The local food environment and diet: A systematic review. *Health Place*, *18*(5), 1172–1187. https://doi.org/doi:10.1016/j.healthplace.2012.05.006

Caswell, M. S., & Hanning, R. M. (2018). Adolescent perspectives of the recreational ice hockey food environment and influences on eating behavior revealed through photovoice. *Public Health Nutrition*, *21*(7), 1255–1265. https://doi.org/10.1017/S1368980018000289

Chalermsri, C., Herzig van Wees, S., Ziaei, S., Ekstrom, E. C., Muangpaisan, W., & Rahman, S. M. (2020). Exploring the experience and determinants of the food choices and eating practices of elderly Thai people: A qualitative study. *Nutrients*, *12*(11). https://doi.org/10.3390/nu12113497

Chan, J. A., Koster, A., Eussen, S. J. P. M., Pinho, M. G. M., Lakerveld, J., Stehouwer, C. D. A., Dagnelie, P. C., van der Kallen, C. J., van Greevenbroek, M. M. J., Wesselius, A., & Bosma, H. (2023). The association between the food environment and adherence to healthy diet quality: The Maastricht Study. *Public Health Nutrition*, *26*(9), 1775–1783. https://doi.org/10.1017/S1368980023001180

Charoenbut, P., Klaewkla, J., Srisorrachatr, S., Arphorn, S., & Wijitwanna, S. (2018). Workplace and individual factors influence eating practices of Thai factory workers. *Malaysian Journal of Nutrition*, *24*(3), 417–426.

Charreire, H., Casey, R., Salze, P., Simon, C., Chaix, B., Banos, A., Badariotti, D., Weber, C., & Oppert, J. (2010). Measuring the food environment using geographical information systems: A methodological review. *Public Health Nutrition*, *13*(11), 1773–1785. https://doi.org/doi:10.1017/S1368980010000753

Chavez, J. B. R., Garcia, L. M., Jehn, M., Pereria, M. A., & Bruening, M. (2020). Relationship between different levels of the Mexican food environment and dietary intake: A qualitative systematic review. *Public Health Nutrition*, *23*(11), 1877–1888. https://doi.org/10.1017/S1368980019004294

Chege, C. G. K., Wanyama, R., Lundy, M., Nguru, W., & Jager, M. (2021). Does retail food diversity in urban food environments influence consumer diets? *Sustainability*, *13*(7666). https://doi.org/10.3390/su13147666

Chen, X., & Yang, X. (2014). Does food environment influence food choices? A geographical analysis through “tweets.” *Applied Geography*, *51*, 82–89. http://dx.doi.org/10.1016/j.apgeog.2014.04.003 0143-6228/

Choi, Y. J., Crimmins, E. M., & Ailshire, J. A. (2022). Food insecurity, food environments, and disparities in diet quality and obesity in a nationally representative sample of community-dwelling older Americans. *Preventive Medicine Reports*, *29*. https://doi.org/10.1016/j.pmedr.2022.101912

Chor, D., Cardoso, L. O., Nobre, A. A., Griep, R. H., Fonseca, M. J. M., Giatti, L., Bensenor, I., Molina, M. C. B., Aquino, E. M. L., Diez-Roux, A., Castiglione, D. P., & Santos, S. M. (2016). Association between perceived neighbourhood characteristics, physical activity and diet quality: Results of the Brazilian Longitudinal Study of Adults Health (ELSA-Brasil). *BMC Public Health*, *16*. https://doi.org/10.1186/s12889-016-3447-5

Chrisinger, B. W., Kallan, M. J., Whiteman, E. D., & Hillier, A. (2018). Where do U.S. households purchase healthy foods? An analysis of food-at-home purchases across different types of retailers in a nationally representative dataset. *Preventative Medicine*, *112*, 15–22. https://doi.org/10.1016/j.ypmed.2018.03.015

Chum, A., Farrell, E., Vaivada, T., Labetski, A., Bohnert, A., Selvaratnam, I., Larsen, K., Pinter, T., & O’Campo, P. (2015). The effect of food environment on fruit and vegetable intake as modified by time spent at home: A cross-sectional study. *BMJ Open*, *5*(6). https://doi.org/10.1136/bmjopen-2014-006200

Clary, C., Lewis, D. J., Flint, E., Smith, N. R., Kestens, Y., & Cummins, S. (2016). The local food environment and fruit and vegetable intake: A geographically weighted regression approach in the ORiEL study. *American Journal of Epidemiology*, *184*(11), 837–846. https://doi.org/10.1093/aje/kww073

Colozza, D. (2022). A qualitative exploration of ultra-processed foods consumption and eating out behaviors in an Indonesian urban food environment. *Nutrition and Health*. https://doi.org/10.1177/02601060221133897

Cooksey-Stowers, K., Schwartz, M. B., & Brownell, K. D. (2017). Food swamps predict obesity rates better than food deserts in the United States. *International Journal of Environmental Research and Public Health*, *14*(11). https://doi.org/10.3390/ijerph14111366

Couch, S. C., Glanz, K., Zhou, C., Sallis, J. F., & Saelens, B. E. (2014). Home food environment in relation to children's diet quality and weight status. *Journal of the Academy of Nutrition and Dietetics*, *114*, 1569–1579. http://dx.doi.org/10.1016/j.jand.2014.05.015

Cruwys, T., Bevelander, K. E., & Hermans, R. C. J. (2015). Social modeling of eating: A review of when and why social influence affects food intake and choice. *Appetite*, *86*, 3–18. http://dx.doi.org/10.1016/j.appet.2014.08.035

Cullen, K. W., & Dave, J. M. (2017). The new federal school nutrition standards and meal patterns: Early evidence examining the influence on student dietary behavior and the school food environment. *Journal of the Academy of Nutrition and Dietetics*, *117*(2), 185–191.

Cummins, S., Flint, E., & Matthews, S. A. (2014). New neighborhood grocery store increased awareness of food access but did not alter dietary habits or obesity. *Health Affairs*, *33*(2), 283–291. https://doi.org/10.1377/hlthaff.2013.0512

Curioni, C. C., Boclin, K. L. S., Silveira, I. H., Canella, D. S., Castro, I. R. R., Bezerra, F. F., Junger, W., & Faerstein, E. (2020). Neighborhood food environment and consumption of fruit and leafy vegetables: Pro-Saude Study Brazil. *Public Health*, *182*, 7–12.

Curl, A. L., Beresford, S. A. A., Hajat, A., Kaufman, J. D., Moore, K., Nettleton, J. A., & Diez-Roux, A. V. (2013). Associations of organic produce consumption with socioeconomic status and the local food environment: Multi-Ethnic Study of Atherosclerosis (MESA). *PLoS ONE*, *8*(7). https://doi.org/10.1371/journal.pone.0069778

da Silva, W. R., Ferreira, E. B., Maroco, J., da Silva Junior, S. I., Teodoro, M. A., & Campos, J. A. D. B. (2023). Relationships between three eating behaviors and nine motives for food choices among Brazilian adults: A structural equation model. *Perceptual and Motor Skills*, *130*(6), 2388–2409.

Daly, A. N., O'Sullivan, E. J., Walton, J., Kehoe, L., McNulty, B. A., Flynn, A., & Kearney, J. M. (2023). Determining the food choice motivations of Irish teens and their association with dietary intakes, using the Food Choice Questionnaire. *Appetite*, *189*. https://doi.org/10.1016/j.appet.2023.106981

Darmon, N., & Drewnowski, A. (2015). Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: A systematic review and analysis. *Nutrition Reviews*, *73*(10), 643–660. https://doi.org/doi: 10.1093/nutrit/nuv027

de Almeida Alves, M., Pinho, M. G. M., Correa, E. N., das Neves, J., & de Vasconcelos, F. A. G. (2019). Parental perceived travel time to and reported use of food retailers in association with school children's dietary patterns. *International Journal of Environmental Research and Public Health*, *16*(5). https://doi.org/10.3390/ijerph16050824

de Almeida, I. J., Garcez, A., Backes, V., de Lima Cunha, C. M., Schuch, I., & Canuto, R. (2023). Association between the community food environment and dietary patterns in residents of areas of different socio-economic levels of a southern capital city in Brazil. *British Journal of Nutrition*, *129*, 1066–1074.

de Deus Mendonca, R., Lopes, M. S., Freitas, P. P., Campos, S. F., de Menezes, M. C., & Lopes, A. C. S. (2019). Monotony in the consumption of fruits and vegetables and food environment characteristics. *Revista de Saude Publica*, *53*(63). https://doi.org/10.11606/S1518-8787.2019053000705

de Menezes, M. C., Roux, A. V. D., de Lima Costa, B. V., & Lopes, A. C. S. (2018). Individual and food environmental factors: Association with diet. *Public Health Nutrition*, *21*(15), 2782–2792. https://doi.org/10.1017/S1368980018001623

de Menezes, R. C. E., Oliveira, J. S., Almendra, R., de Lira, P. I. C., Costa, E. C., Leal, V. S., & Santana, P. (2022). Influence of food environment on ultra-processed drinks consumption among an economically vulnerable population in a metropolitan area in Brazil: A multilevel analysis. *Health & Place*, *77*. https://doi.org/10.1016/j.healthplace.2022.102869

de Wit, J. B. F., Stok, F. M., Smolenski, D. J., de Ridder, D. D. T., de Vet, E., Gaspar, T., Johnson, F., Nureeva, L., & Luszczynska, A. (2015). Food culture in the home environment: Family meal practices and values can support healthy eating and self-regulation in young people in four European countries. *Applied Psychology: Health and Well-Being*, *7*(1), 22–40. https://doi.org/doi:10.1111/aphw.12034

Dean, W. R., & Sharkey, J. R. (2011). Rural and urban differences in the associations between characteristics of the community food environment and fruit and vegetable intake. *Journal of Nutrition Education and Behavior*, *43*(6), 426–433. https://doi.org/10.1016/j.jneb.2010.07.001

Deierlein, A. L., Galvez, M. P., Yen, I. H., Pinney, S. M., Biro, F. M., Kushi, L. H., Teitelbaum, S., & Wolff, M. S. (2014). Local food environments are associated with girls' energy, sugar-sweetened beverage and snack-food intakes. *Public Health Nutrition*, *17*(10). https://www.cambridge.org/core/journals/public-health-nutrition/article/local-food-environments-are-associated-with-girls-energy-sugarsweetened-beverage-and-snackfood-intakes/B8493B700C28E87A7DA1B9106D47D887

Devine, L. D., Gallagher, A. M., Briggs, S., & Hill, A. J. (2023). Factors that influence food choices in secondary school canteens: A qualitative study of pupil and staff perspectives. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1227075

Dhakal, C. K., & Khadka, S. (2021). Heterogeneities in consumer diet quality and health outcomes of consumers by store choice and income. *Nutrients*, *13*(4). https://doi.org/10.3390/nu13041046

Dhillon, J., Rios, L. K. D., Aldaz, K. J., De La Cruz, N., Vu, E., Asghar, S. A., Kuse, Q., & Ortiz, R. M. (2019). We don't have a lot of healthy options: Food environment perceptions of first-year, minority college students attending a food desert campus. *Nutrients*, *11*(4). https://doi.org/10.3390/nu11040816

Ding, D., Sallis, J. F., Norman, G. J., Saelens, B. E., Harris, S. K., Kerr, J., Rosenberg, D., Durant, N., & Glanz, K. (2012). Community food environment, home food environment, and fruit and vegetable intake of children and adolescents. *Journal of Education and Behavior*, *44*(6), 634–638. http://dx.doi.org/10.1016/j.jneb.2010.07.003

Downs, S. M., Ahmed, S., Fanzo, J., & Herforth, A. (2020). Food environment typology: Advancing an expanded definition, framework, and methodological approach for improved characterization of wild, cultivated, and built food environments toward sustainable diets. *Foods*, *9*(4). https://doi.org/10.3390/foods9040532

Downs, S. M., Arnold, A., Marshall, D., McCargar, L. J., Raine, K. D., & Willows, N. D. (2009). Associations among the food environment, diet quality and weight status in Cree children in Quebec. *Public Health Nutrition*, *12*(9), 1504–1511. https://doi.org/10.1017/S1368980008004515

Downs, S. M., Fox, E. L., Mutuku, V., Muindi, Z., Fatima, T., Pavlovic, I., Husain, S., Sabbahi, M., Kimenju, S., & Ahmed, S. (2022). Food environments and their influence on food choices: A case study in informal settlements in Nairobi, Kenya. *Nutrients*, *14*(13). https://doi.org/10.3390/nu14132571

Drewnowski, A., Aggarwal, A., Tang, P., Hurvitz, P. M., Scully, J., Stewart, O., & Moudon, A. V. (2016). Obesity, diet quality, physical activity, and the built environment: The need for behavioral pathways. *BMC Public Health*, *16*. https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-3798-y

Drisdelle, C., Kestens, Y., Hamelin, A. M., & Mercille, G. (2020). Disparities in access to healthy diets: How food security and food shopping behaviors relate to fruit and vegetable intake. *Journal Academy of Nutrition and Dietetics*, *120*(11), 1847–1858.

Dubois, L., Bedard, B., Goulet, D., Prud'homme, D., Tremblay, R. E., & Boivin, M. (2022). Eating behaviors, dietary patterns and weight status in emerging adulthood and longitudinal associations with eating behaviors in early childhood. *International Journal of Behavioral Nutrition and Physical Activity*, *19*. https://doi.org/10.1186/s12966-022-01376-z

Dubowitz, T., Ghosh-Dastidar, B., Cohen, D. A., Beckman, R., Steiner, E. D., Hunter, G. P., Florez, K. R., Huang, C., Vaughn, C. A., Sloan, J. C., Zenk, S. N., Cummins, S., & Collins, R. L. (2015). Changes in diet after introduction of a full service supermarket in a food desert. *Health Affairs*, *34*(11), 1858–1868. https://doi.org/10.1377/hlthaff.2015.0667

Dubowitz, T., Ghosh-Dastidar, B., Cohen, D. A., Beckman, R., Steiner, E. D., Hunter, G. P., Florez, K. R., Huang, C., Vaughn, C. A., Sloan, J. C., Zenk, S. N., Cummins, S., & Collins, R. L. (2015). Changes in diet after introduction of a full service supermarket in a food desert. *Health Affairs*, *34*(11), 1858–1868. https://doi.org/10.1377/hlthaff.2015.0667

Dubowitz, T., Ghosh-Dastidar, M., Eibner, C., Slaughter, M. E., Fernandes, M., Whitsel, E. A., Bird, C. E., Jewell, A., Margolis, K. L., Li, W., Michael, Y. L., Shih, R. A., Manson, J. E., & Escarce, J. J. (2012). The Women's Health Initiative: The food environment, neighborhood socioeconomic status, BMI, and blood pressure. *Obesity*, *20*, 862–871. https://doi.org/doi:10.1038/oby.2011.141

Dubowitz, T., Zenk, S. N., Ghosh-Dastidar, B., Cohen, D. A., Beckman, R., Hunter, G., Steiner, E. D., & Collins, R. L. (2015). Healthy food access for urban food desert residents: Examination of the food environment, food purchasing practices, diet and BMI. *Public Health Nutrition*, *18*(12), 2220–2230. https://doi.org/10.1017/S1368980014002742

Dunaway, L. F., Carton, T., Ma, P., Mundorf, A. R., Keel, K., & Theall, K. P. (2017). Beyond food access: The impact of parent-, home-, and neighborhood-level factors on children's diets. *International Journal of Environmental Research and Public Health*, *14*(6). https://doi.org/10.3390/ijerph14060662

Duran, A. C., de Almeida, S. L., Latorre, Mdo. R., & Jaime, P. C. (2016). The role of the local retail food environment in fruit, vegetable and sugar-sweetened beverage consumption in Brazil. *Public Health Nutrition*, *19*(6), 1093–1102. https://doi.org/10.1017/S1368980015001524

Echouffo-Tcheugui, J., & Rexford, A. S. (2019). Does diet quality or nutrient quantity contribute more to health? *Journal of Clinical Investigation*, *129*(10), 3969–3970. https://doi.org/10.1172/JCI131449

Elliston, K. G., Ferguson, S. G., Schuz, N., & Schuz, B. (2016). Situational cues and momentary food environment predict everyday eating behavior in adults with overweight and obesity. *Health Psychology*, *36*(4), 337–345. http://dx.doi.org/10.1037/hea0000439

Engler-Stringer, R., Le, H., Gerrard, A., & Muhajarine, N. (2014). The community and consumer food environment and children's diet: A systematic review. *BMC Public Health*, *14*. https://doi.org/10.1186/1471-2458-14-522

Evans, A. E., Jennings, R., Smiley, A. W., Medina, J. L., Sharma, S. V., Rutledge, R., Stigler, M. H., & Hoelscher, D. M. (2012). Introduction of farm stands in low-income communities increases fruit and vegetable among community residents. *Health & Place*, *18*, 1137–1143. http://dx.doi.org/10.1016/j.healthplace.2012.04.007

Figueroa, R., Baker, K., Capellan, J., Pinheiro, L. C., Burd, L., Lim, J., Chiong, R., Eboh, R., & Phillips, E. (2022). Residential urban food environment profiles and diet outcomes among adults in Brooklyn, New York: A cross-sectional study. *Public Health Nutrition*, *26*(4), 877–885.

Flint, E., Cummins, S., & Matthews, S. (2013). Do perceptions of the neighbourhood food environment predict fruit and vegetable intake in low-income neighbourhoods? *Health Place*, *11*(5). https://doi.org/10.1016/j.healthplace.2013.07.005

Folkvord, F., van der Zanden, M., & Pabian, S. (2020). Taste and health information on fast food menus to encourage young adults to choose healthy food products: An experimental study. *International Journal of Environmental Research and Public Health*, *17*(19). https://doi.org/10.3390/ijerph17197139

Franco, M., Diez-Roux, A. V., Nettleton, J. A., Lazo, M., Brancati, F., Cabballero, B., Glass, T., & Moore, L. V. (2009). Availability of healthy foods and dietary patterns: The Multi-Ehnic Study of Atherosclerosis. *American Journal of Clinical Nutrition*, *89*, 987–904.

Freedman, D., Bell, B., Clark, J., Ngendahimana, D., Borawski, E., Trapl, E., Pike, S., & Sehgal, A. R. (2021). Small improvements in an urban food environment resulted in no changes in diet among residents. *Journal of Community Health*, *46*(1), 1–12. https://doi.org/10.1007/s10900-020-00805-z

Fuller, D., Cummins, S., & Matthews, S. A. (2013). Does transportation mode modify associations between distance to food store, fruit and vegetable consumption, and BMI in low-income neighborhoods? *American Journal of Clinical Nutrition*, *97*, 167–172.

Gao, X., Engeda, J., Moore, L. V., Auchincloss, A. H., Moore, K., & Mujahid, M. (2022). Longitudinal associations between objective and perceived healthy food environment and diet: The Multi-Ethnic Study of Atherosclerosis. *Social Science & Medicine*, *292*. https://doi.org/10.1016/j.socscimed.2021.114542

Gase, L. N., DeFosset, A. R., Smith, L. V., & Kup, T. (2014). The association between self-reported grocery store access, fruit and vegetable intake, sugar-sweetened beverage consumption, and obesity in a racially diverse, low-income population. *Frontiers in Public Health*, *2*. https://doi.org/10.3389/fpubh.2014.00229

Gebremariam, M. K., Andersen, L. F., Bjelland, M., Klepp, K. I., Totland, T. H., Bergh, I. H., & Lien, N. (2012). Does the school food environment influence the dietary behaviours of Norwegian 11-year-olds? The HEIA study. *Scandinavian Journal of Public Health*, *40*(5), 491–497. https://doi-org.ezproxy.mtsu.edu/10.1177/1403494812454948

Gilham, K., Gu, Q., Dummer, T. J. B., Spinelli, J. J., & Murphy, R. A. (2020). Diet quality and neighborhood environment in the Atlantic Partnership for Tomorrow's Health Project. *Nutrients*, *12*(10). https://doi.org/10.3390/nu12103217

Glabska, D., Skolmowska, D., & Guzek, D. (2021). Food preferences and food choice determinants in a Polish adolescents' COVID-19 experience (PLACE-19) study. *Nutrients*, *13*(8). https://doi.org/10.3390/nu13082491

Glanz, K. (2009). Measuring food environments a historical perspective. *American Journal of Preventive Medicine*, *36*(4S), S93–S98. https://doi.org/doi:10.1016/j.amepre.2009.01.010

Glickman, A. R., Clark, J. K., & Freedman, D. A. (2021). A relational approach to evaluate food environments finds that the proximate food environment matters for those who use it. *Health Place*, *69*. https://doi.org/doi:10.1016/j.healthplace.2021.102564

Gomes, C. S., Silveira, E. A., & Velasquez-Melendez, G. (2022). Neighborhood environment is associated with unhealthy food intake in a Brazilian urban area. *Appetite*, *172*. https://doi.org/10.1016/j.appet.2022.105972

Gordon-Larsen, P., Rummo, P. E., Guilkey, D. K., Ng, S. W., Meyer, K. A., Popkin, B. M., Reis, J. P., & Shikany, J. M. (2017). Understanding bias in relationships between the food environment and diet quality: The Coronary Artery Risk Development in Young Adults (CARDIA) study. *Journal of Epidemiology and Community Health*, *71*(12), 1185–1190. https://doi.org/10.1136/jech-2017-209158

Grant, E., Gearry, R. B., Wilson, R., Pearson, J., & Skidmore, P. M. L. (2017). Home availability of fruit and vegetables and obesogenic foods as an indicator of nutrient intake in 50 year olds from Canterbury, New Zealand. *Asia Pacific Journal of Clinical Nutrition*, *26*(3), 524–530.

Green, S. H., & Glanz, K. (2015). Development of a perceived nutrition environment measures survey. *American Journal of Preventive Medicine*, *49*(1), 50–61. http://dx.doi.org/10.1016/j.amepre.2015.02.004

Gupta, N. R., & Freedman, D. A. (2021). Food security moderates relationship between perceived food environment and diet quality among adults in communities with low access to healthy food retail. *Public Health Nutrition*, *24*(10), 2975–2986. https://doi.org/10.1017/S1368980020001317

Gustafson, A. A., Sharkey, J., Samuel-Hodge, C. D., Jones-Smith, J., Folds, M. C., Cai, J., & Ammerman, A. S. (2011). Perceived and objective measures of the food store environment and the association with weight and diet among low income women in North Carolina. *Public Health Nutrition*, *14*(6), 1032–1038. https://doi.org/10.1017/S1368980011000115

Gustafson, A., Christian, J. W., Lewis, S., Moore, K., & Jilcott, S. (2013). Food venue choice, consumer food environment, but not food venue availability within daily travel patterns are associated with dietary intake among adults, Lexington Kentucky 2011. *Nutrition Journal*, *12*. https://doi.org/10.1186/1475-2891-12-17

Gustafson, A., Lewis, S., Perkins, S., Wilson, C., Buckner, E., & Vail, A. (2013). Neighbourhood and consumer food environment is associated with dietary intake among Supplemental Nutrition Assistance Program (SNAP) participants in Fayette County, Kentucky. *Public Health Nutrition*, *16*(7), 1229–1237. https://doi.org/10.1017/S1368980013000505

Gustafson, A., Pitts, S. J., McDonald, J., Ford, H., Connelly, P., Gillespie, R., Liu, E., Bush, H., Brancato, C., Babatande, T., & Mullins, J. (2017). Direct effects of the home, school, and consumer food environments on the association between food purchasing patterns and dietary intake among rural adolescents in Kentucky and North Carolina, 2017. *International Journal of Environmental Research and Public Health*, *14*(10). https://doi.org/10.3390/ijerph14101255

Hager, E. R., Cockerham, A., O'Reilly, N., Harrignton, D., Harding, J., Hurley, K. M., & Black, M. M. (2017). Food swamps and food deserts in Baltimore City, MD, USA:

associations with dietary behaviours among urban adolescent girls. *Public Health Nutrition*, *20*(14), 2598–2607. https://doi.org/10.1017/S1368980016002123

Hanson, N. I., Neumark-Sztainer, D., Eisenberg, M. E., Story, M., & Wall, M. (2005). Associations between parental report of the home food environment and adolescent intakes of fruits, vegetables and dairy foods. *Public Health Nutrition*, *8*(1), 77–85. https://doi.org/10.1079/PHN2004661

Harbers, M. C., Beulens, J. W. J., Boer, J. M. A., Karssenberg, D., Mackenbach, J. D., Rutters, F., Vaartjes, I., Verschuren, W. M. M., & van der Schouw, Y. T. (2021). Residential exposure to fast-food restaurants and its association with diet quality, overweight and obesity in the Netherlands: A cross-sectional analysis in the EPIC-NL cohort. *Nutrition Journal*, *20*. https://doi.org/10.1186/s12937-021-00713-5

Hardcastle, S. J., Thogerson-Ntoumani, C., & Chatzisarantis, N. L. D. (2015). Food choice and nutrition: A social psychological perspective. *Nutrients*, *7*, 8712–8715. https://doi.org/doi:10.3390/nu7105424

Harper, K., Caulfield, L. E., Lu, S. V., Mmari, K., & Gross, S. M. (2022). Diet quality and contextual factors influencing food choice among adolescents with food security and food insecurity in Baltimore City. *Nutrients*, *14*(21). https://doi.org/10.3390/nu14214573

Hattori, A., An, R., & Sturm, R. (2013). Neighborhood food outlets, diet, and obesity among California adults, 2007 and 2009. *Preventing Chronic Disease*, *10*. https://doi.org/10.5888/pcd10.120123

Hawkesworth, S., Silverwood, R. J., Armstrong, B., Pilakas, T., Nanchahal, K., Sartini, C., Amuzu, A., Wannamethee, G., Atkins, J., Ramsay, S. E., Casas, J. P., Morris, R. W., Whincup, P. H., & Lock, K. (2017). Investigating the importance of the local food environment for fruit and vegetable intake in older men and women in 20 UK towns: A cross-sectional analysis of two national cohorts using novel methods. *International Journal of Behavioral Nutrition and Physical Activity*, *14*. https://doi.org/10.1186/s12966-017-0581-0

He, M., Tucker, P., Gilliland, J., Irwin, J. D., Larsen, K., & Hess, P. (2012). The influence of local food environments on adolescents' food purchasing behaviors. *International Journal of Environmental Research and Public Health*, *9*(4), 1458–1471. https://doi.org/10.3390/ijerph9041458

Hearst, M. O., Pasch, K. E., & Laska, M. N. (2012). Urban v. Suburban perceptions of the neighbourhood food environment as correlates of adolescent food purchasing. *Public Health Nutrition*, *15*(2), 299–306. https://doi.org/10.1017/S1368980011002114

Heroux, M., Iannotti, R. J., Currie, D., Pickett, W., & Janssen, I. (2012). The food retail environment in school neighborhoods and its relation to lunchtime eating behaviors in youth from three countries. *Health & Place*, *18*(6), 1240–1247.

Hickson, D. A., Diez-Roux, A. V., Smith, A. E., Tucker, K. L., Gore, L. D., Zhang, L., & Wyatt, S. B. (2011). Associations of fast food restaurant availability with dietary intake and weight among African Americans in the Jackson Heart Study, 2000-2004.

American Journal of Public Health, *101*, S301–S309. https://doi.org/10.2105/AJPH.2010.300006

Ho, S., Wong, B. Y., Lo, W., Mak, K., Thomas, G. N., & Lam, T. (2010). Neighbourhood food environment and dietary intakes in adolescents: Sex and perceived family affluence as moderators. *International Journal of Pediatric Obesity*, *5*, 420–427. https://doi.org/10.3109/17477160903505910

Hobbs, M., Green, M., Roberts, K., Griffiths, C., & McKenna, J. (2019). Reconsidering the relationship between fast-food outlets, area-level deprivation, diet quality and body mass index: An exploratory structural equation modeling approach. *Journal of Epidemiology and Community Health*, *73*(9). https://doi.org/10.1136/jech-2018-211798

Hoenink, J. C., Burgoine, T., Brage, S., Forouhi, N., Griffin, S. J., Monsivais, P., Wareham, N. J., Ahern, A., & Adams, J. (2023). The moderating role of eating behaviour traits in the association between exposure to hot food takeaway outlets and body fatness. *International Journal of Obesity*, *47*(6), 496–504. https://doi.org/10.1038/s41366-023-01290-9

Hollis-Hansen, K., Vermont, L., Zafron, M. L., Seidman, J., & Leone, L. (2019). The introduction of new food retail opportunities in lower income communities and the impact on fruit and vegetable intake: A systematic review. *Translational Behavioral Medicine*, *9*(5), 837–846.

Hulst, A. V., Barnett, T. A., Gauvin, L., Daniel, M., Kestens, Y., Bird, M., Gray-Donald, K., & Lambert, M. (2012). Associations between children’s diets and features of their residential and school neighbourhood food environments. *Canadian Journal of Public Health*, *9*. https://doi.org/10.1007/BF03403835

Isaacs, A., Spires, M., Halloran, A., & Stridsland, T. (2022). Gathering data on food environment and food practices through photo elicitation in Copenhagen, Denmark: Implications for adapting the EAT-LANCET reference diet to local circumstances. *Cities & Health*, *6*. https://doi.org/10.1080/23748834.2022.2078072

Izumi, B. T., Zenk, S. N., Schulz, A. J., Mentz, G. B., & Wilson, C. (2011). Associations between neighborhood availability and individual consumption of dark-green and orange vegetables among ethically diverse adults in Detroit. *Journal of the American Dietetics Association*, *111*(2), 274–279. https://doi.org/10.1016/j.jada.2010.10.044

Jack, D., Neckerman, K., Schwartz-Soicher, O., Lovasi, G. S., Quinn, J., Richards, C., Bader, M., Weiss, C., Konty, K., Arno, P., Viola, D., Kerker, B., & Rundle, A. (2013). Socio-economic status, neighbourhood food environments and consumption of fruits and vegetables in New York City. *Public Health Nutrition*, *16*(7), 1197–1205. https://doi.org/10.1017/S1368980012005642

Jackson, J. A., Smit, E., Manore, M. M., John, D., & Gunter, K. (2015). The family-home nutrition environment and dietary intake in rural children. *Nutrients*, *7*(12), 9707–9720. https://doi.org/10.3390/nu7125495

Jago, R., Baranowski, T., Baranowski, J. C., Cullen, K. W., & Thompson, D. (2007). Distance to food stores & adolescent male fruit and vegetable consumption:

Mediation effects. *International Journal of Behavioral Nutrition and Physical Activity*, *4*(35). https://doi.org/10.1186/1479-5868-4-35

Jaime, P. C., Duran, A. C., Sarti, F. M., & Lock, K. (2011). Investigating environmental determinants of diet, physical activity, and overweight among adults in Sao Paulo, Brazil. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, *88*(3). https://doi.org/10.1007/s11524-010-9537-2

Janda, K. M., Salvo, D., Ranjit, N., Hoelscher, D. M., Nielsen, A., Lemoine, P., Casnovsky, J., & van den Berg, A. (2022). Whop shops at their nearest grocery store? A cross-sectional exploration of disparities in geographic food access among a low-income, racially/ethnically diverse cohort in central Texas. *Journal of Hunger & Environmental Nutrition*. https://doi.org/DOI: 10.1080/19320248.2022.2128962

Jennings, A., Welch, A., Jones, A. P., Harrison, F., Bentham, G., van Sluijs, E. M. F., Griffin, S. J., & Cassidy, A. (2011). Availability of local food outlets is associated with weight status and dietary intake in 9-10 year olds. *American Journal of Preventive Medicine*, *40*(4), 405–410. https://doi.org/10.1016/j.amepre.2010.12.014

Jilcott, S. B., Laraia, B. A., Evenson, K. R., & Ammerman, A. S. (2009). Perceptions of the community food environment and related influence on food choice among midlife women residing in rural and urban areas: A qualitative analysis. *Women & Health*, *49*, 164–180. https://doi.org/10.1080/03630240902915085

Kalbus, A., Cornelsen, L., Ballatore, A., & Cummins, S. (2023). Associations between the food environment and food and drink purchasing using large-scale commercial purchasing data: A cross-sectional study. *BMC Public Health*, *23*. https://doi.org/10.1186/s12889-022-14537-3

Kaya, I. H. (2016). Motivation factors of consumers' food choice. *Food and Nutrition Sciences*, *7*(3). https://doi.org/10.4236/fns.2016.73016

Keane, E., Cullinan, J., Perry, C. P., Kearney, P. M., Harrignton, J. M., Perry, I. J., & Layte, R. (2016). Dietary quality in children and the role of the local food environment. *SSM - Population Health*, 770–777.

Kegler, M. C., Alcantara, I., Haardorfer, R., Gazmararian, J. A., Ballard, D., & Sabbs, D. (2014). The influence of home food environments on eating behaviors of overweight and obese women. *Context*, *46*(3), 188–196. https://doi.org/10.1016/j.jneb.2014.01.001

Kegler, M. C., Hermstad, A., & Haardorfer, R. (2021). Home food environment and associations with weight and diet among U.S. adults: A cross-sectional study. *BMC Public Health*, *21*. https://doi.org/10.1186/s12889-021-11102-2

Kelly, B., Flood, V. M., & Yeatman, H. (2011). Measuring local food environments: An overview of available methods and measures. *Health & Place*, *17*, 1284–1293. https://doi.org/doi:10.1016/j.healthplace.2011.08.014

Kelly, C., Callaghan, M., & Gabhainn, S. N. (2021). "It's hard to make good choices and it costs more": Adolescents perception of the external school food environment. *Nutrients*, *13*. https://doi.org/10.3390/nu13041043

Kelly, C., Callaghan, M., Molcho, M., Gabhainn, S. N., & Thomas, A. A. (2019). Food environments in and around post-primary schools in Ireland: Associations with youth dietary habits. *Appetite*, *132*, 182–189.

Khonje, M. G., Ecker, O., & Qaim, M. (2020). Effects of modern food retailers on adult and child diets and nutrition. *Nutrients*, *12*(6). https://doi.org/10.3390/nu12061714

Kibe, L. W., Schrode, K., Bazargan, M., & Shaheen, M. (2023). Impact of food insecurity and food environment on the diet quality of older African Americans during the COVID-19 pandemic. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1268961

Kim, C. (2016). Food choice patterns among frail older adults: The associations between social network, food choice values, and diet quality. *Appetite*, *96*, 116–121.

Kruger, D. J., Greenberg, E., Murphy, J. B., DiFazio, L. A., & Youra, K. R. (2014). Local concentration of fast-food outlets is associated with poor nutrition and obesity. *American Journal of Health Promotion*, *28*(5), 340–343. https://doi.org/DOI: 10.4278/ajhp.111201-QUAN-437

Kubik, M. Y., Lytle, L. A., Hannan, P. J., Perry, C. L., & Story, M. (2003). The association of the school food environment with dietary behaviors of young adolescents. *American Journal of Public Health*, *93*(7), 1168–1173.

Lacko, A., Ng, S. W., & Popkin, B. (2020). Urban vs. Rural socioeconomic differences in the nutritional quality of household packaged food purchases by store type.

International Journal of Environmental Research and Public Health, *17*. https://doi.org/doi:10.3390/ijerph17207637

Lamichhane, A. P., Mayer-Davis, E. J., Puett, R., Bottai, M., Porter, D. E., & Liese, A. D. (2012). Associations of built food environment and dietary intake among youth with diabetes. *Journal of Nutrition Education and Behavior*, *44*(3), 217–224.

Laraia, B. A., Siega-Riz, A. M., Kaufman, J. S., & Jones, S. J. (2004). Proximity of supermarkets is positively associated with diet quality index for pregnancy. *Preventative Medicine*, *39*(5), 869–875. https://doi.org/10.1016/j.ypmed.2004.03.018

Larson, N. I., Story, M. T., & Nelson, M. C. (2009). Neighborhood environments: Disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine*, *36*(1), 74–81.

Laska, M. N., Caspi, C. E., Lenk, K., Moe, S. G., Pelletier, J. E., Harnack, L. J., & Erickson, D. J. (2019). Evaluation of the first U.S. staple foods ordinance: Impact on nutritional quality of food store offerings, customer purchases and home food environments. *International Journal of Behavioral Nutrition and Physical Activity*, *16*(1). https://doi.org/10.1186/s12966-019-0818-1

Laska, M. N., Hearst, M. O., Forsyth, A., Pasch, K. E., & Lytle, L. (2010). Neighborhood food environments: Are they associated with adolescent dietary intake, food purchases and weight status? *Public Health Nutrition*, *13*(11), 1757–1763. https://doi.org/10.1017/S1368980010001564

Lassen, A. D., Thorsen, A. V., Sommer, H. M., Fagt, S., Trolle, E., Biltoft-Jensen, A., & Tetens, I. (2011). Improving the diet of employees at blue-collar worksites: Results from the "Food at Work" intervention study. *Public Health Nutrition*, *14*(6), 965–974. https://doi.org/10.1017/S1368980010003447

LeDoux, T. F., & Vojnovic, I. (2014). Examining the role between the residential neighborhood food environment and diet among low-income households in Detroit, Michigan. *Applied Geography*, *55*, 9–18.

Lind, P. L., Jensen, P. V., Glumer, C., & Toft, U. (2016). The association between accessibility of local convenience stores and unhealthy diet. *European Journal of Public Health*, *26*(4), 634–639.

Liu, B., Widener, M., Burgoine, T., & Hammond, D. (2020). Association between time-weighted activity space-based exposures to fast food outlets and fast food consumption among young adults in urban Canada. *International Journal of Behavioral Nutrition and Physical Activity*, *17*. https://doi.org/10.1186/s12966-020-00967-y

Livingstone, K. M., Abbott, G., Lamb, K. E., Dullaghan, K., Worsley, T., & McNaughton, S. A. (2021). Understanding meal choices in young adults and interactions with demographics, diet quality, and health behaviors: A discrete choice experiment. *Journal of Nutrition*, *151*(8), 2361–2371. https://doi.org/10.1093/jn/nxab106

Lo, K. B., Megiel, S., Liu, E., Folta, S. C., Graham, M. L., & Seguin, R. A. (2019). Associations between frequency of food shopping at different sources and fruit and vegetable intake among rural residents in upstate New York, USA. *Public*

Health Nutrition, *22*(13), 2472–2478. https://doi.org/10.1017/S1368980019000843

Longacre, M. R., Drake, K. M., MacKenzie, T. A., Gibson, L., Owens, P., Titus, L. J., Beach, M. L., & Dalton, M. A. (2012). Fast-food environments and family fast-food intake in nonmetropolitan areas. *American Journal of Preventive Medicine*, *42*(6), 579–587.

Lorts, C., Tasevska, N., Adams, M. A., Yedidia, M. J., Tulloch, D., Hooker, S. P., & Ohri-Vachaspati, P. (2019). Participation in the Supplemental Nutrition Assistance Program and dietary behaviors: Role of community food environment. *Journal Academy of Nutrition and Dietetics*, *119*(6), 934–943. https://doi.org/10.1016/j.jand.2018.11.021

Lucan, S. C., Maroko, A. R., Patel, A. N., Gjonbalaj, I., Elbel, B., & Schechter, C. B. (2020). Healthful and less healthful foods and drinks from store front and non-storefront businesses: Implications for “food deserts,” “food swamps,” and food source disparities. *Public Health Nutrition*, *23*(8), 1428–1439. https://doi.org/doi:10.1017/S1368980019004427

Lytle, L. A. (2009). Measuring the food environment state of the science. *American Journal of Preventive Medicine*, *36*(4S), S134–S144. https://doi.org/doi:10.1016/j.amepre.2009.01.018

Macdonald, L., Ellaway, A., Ball, K., & Macintyre, S. (2011). Is proximity to a food retail store associated with diet and BMI in Glasgow, Scotland? *BMC Public Health*, *11*. https://doi.org/10.1186/1471-2458-11-464

Mackenbach, J. D., Lakerveld, J., Generaal, E., Gibson-Smith, D., Penninx, B. W. J. H., & Beulens, J. W. J. (2019). Local fast-food environment, diet and blood pressure: The moderating role of mastery. *European Journal of Nutrition*, *58*, 3129–3134. https://doi.org/10.1007/s00394-018-1857-0

Mackenbach, J. D., Nelissen, K. G. M., Dijkstra, C., Poelman, M. P., Daams, J. G., Leijssen, J. B., & Nicolaou, M. (2019). A systematic review on socioeconomic differences in the association between the food environment and dietary behaviors. *Nutrients*, *11*. https://doi.org/10.3390/nu11092215

Mackenbach, J. D., Widener, M. J., van der Gaag, E., & Pinho, M. G. M. (2023). Survey-derived activity space-based exposures to fast food outlets and their cross-sectional associations with use of fast food outlets, diet quality and BMI. *Health & Place*, *79*. https://doi.org/10.1016/j.healthplace.2023.102966

Madlala, S. S., Hill, J., Kunneke, E., Lopes, T., & Faber, M. (2023). Adult food choices in association with the local retail food environment and food access in resource-poor communities: A scoping review. *BMC Public Health*, *23*. https://doi.org/10.1186/s12889-023-15996-y

Madrigal, J. M., Cedillo-Couvert, E., Ricardo, A. C., Appel, L. J., Anderson, C. A. M., Deo, R., Hamm, L. L., Cornish-Zirker, D., Tan, T. C., Sha, D., Hsu, J. Y., Zenk, S. N., Saunders, M. R., Persky, V., & Lash, J. P. (2020). Neighborhood food outlet access and dietary intake among adults with chronic kidney disease: Results from the Chronic Renal Insufficiency Cohort Study. *Journal Academy of Nutrition and Dietetics*, *120*(7), 1151–1162. https://doi.org/10.1016/j.jand.2019.12.013

Majid, M. R., Lim, N. H. H., Zaman, M., & Ruslik, N. (2021). Exploring the link between BMI, perceived neighborhood environment and health behaviours in Malaysia. *Journal of Sustainability Science and Management*, *16*(7), 190–208. https://doi.org/10.46754/jssm.2021.10.015

Marshall, A. N., Markham, C., Ranjit, N., Bounds, G., Chow, J., & Sharma, S. V. (2020). Long-term impact of a school-based nutrition intervention on home nutrition intervention on home nutrition environment and family fruit and vegetable intake: A two-year follow-up study. *Preventive Medicine Reports*, *20*. https://doi.org/10.1016/j.pmedr.2020.101247

Martin, K. S., Havens, E., Boyle, K. E., Matthews, G., Schilling, E. A., Harel, O., & Ferris, A. M. (2011). If you stock it, will they buy it? Healthy food availability and customer purchasing behaviour within corner stores in Hartford, CT, USA. *Public Health Nutrition*, *15*(10). https://www.cambridge.org/core/journals/public-health-nutrition/article/if-you-stock-it-will-they-buy-it-healthy-food-availability-and-customer-purchasing-behaviour-within-corner-stores-in-hartford-ct-usa/6071D43161A9162F004B6100147A13B0

Martin, S., & McCormack, L. (2024). Eating behaviors and the perceived nutrition environment among college students. *Journal of American College Health*, *72*(3), 685–689. https://doi.org/10.1080/07448481.2022.2068019

Marty, L., de Lauzon-Guillain, B., Labesse, M., & Nicklaus, S. (2021). Food choice motives and the nutritional quality of diet during the COVID-19 lockdown in France. *Appetite*, *157*. https://doi.org/10.1016/j.appet.2020.105005

Masse, L. C., de Niet-Fitzgerald, J. E., Watts, A. W., Naylor, P. J., & Saewyc, E. M. (2014). Associations between the school food environment, student consumption and body mass index of Canadian adolescents. *International Journal of Behavioral Nutrition and Physical Activity*, *11*. https://doi.org/10.1186/1479-5868-11-29

Mathieu, A.-A., Robitaille, E., & Paquette, M.-C. (2022). Is food outlet accessibility a significant factor of fruit and vegetable intake? Evidence from a cross-sectional province-wide study in Quebec, Canada. *Obesities*, *2*(1), 35–50. https://doi.org/10.3390/obesities2010004

Mathieu, I. P., Sommer, E. C., Mitchell, S. J., & Barkin, S. L. (2016). Urban Latino families' food built environment and young children's produce consumption. *Journal of Health Care for the Poor and Underserved*, *27*(4), 1899–1908. https://doi.org/10.1353/hpu.2016.0170

McGuirt, J. T., Pitts, S. B. J., & Gustafson, A. (2018). Association between spatial access to food outlets, frequency of grocery shopping, and objectively-assessed and self-reported fruit and vegetable consumption. *Nutrients*, *10*(12). https://doi.org/10.3390/nu10121974

McInerney, M., Csizmadi, I., Friedenreich, C. M., Uribe, F. A., Nettel-Aguirre, A., McLaren, L., Potestio, M., Sandalack, B., & McCormack, G. R. (2016). Associations between the neighbourhood food environment, neighbourhood socioeconomic status, and diet quality: An observational study. *BMC Public Health*, *16*. https://doi.org/10.1186/s12889-016-3631-7

McKerchar, C., Gage, R., Smith, M., Lacey, C., Abel, G., & Mhurchu, C. N. (2022). Children's community nutrition environment, food and drink purchases and consumption on journeys between home and school: A wearable camera study. *Nutrients*, *14*(10). https://doi.org/10.3390/nu14101995

Mejia, N., Lightstone, A. S., Basurto-Davila, R., Morales, D. M., & Sturm, R. (2015). Neighborhood food environment, diet, and obesity among Los Angeles county adults, 2011. *Preventing Chronic Disease*. https://doi.org/10.5888/pcd12.150078

Menezes, M. C., Costa, B. V. L., Oliveira, C. D. L., & Lopes, A. C. S. (2017). Local food environment and fruit and vegetable consumption: An ecological study. *Preventive Medicine Reports*, *5*, 13–20. https://doi.org/ttp://dx.doi.org/10.1016/j.pmedr.2016.10.015

Menezes, M. C., Costa, B. V. L., Oliveira, C. D. L., & Lopes, A. C. S. (2017). Local food environment and fruit and vegetable consumption: An ecological study. *Preventive Medicine Reports*, *5*, 13–20. https://doi.org/ttp://dx.doi.org/10.1016/j.pmedr.2016.10.015

Mensah, D. O., & Oyebode. (2022). "We think about the quantity more": Factors influencing emerging adults' food outlet choice in a university food environment, a qualitative enquiry. *Nutrition Journal*, *21*. https://doi.org/10.1186/s12937-022-00801-0

Minaker, L. M., Olstad, D. L., Thompson, M. E., Raine, K. D., Fisher, P., & Frank, L. D. (2016). Associations between frequency of food shopping at different store types and diet and weight outcomes: Findings from the NEWPATH study. *Public Health Nutrition*, *19*(12), 2268–2277. https://doi.org/10.1017/S1368980016000355

Minaker, L. M., Raine, K. D., Wild, T. C., Kykiforuk, C. I. J., Thompson, M. E., & Frank, L. D. (2013). Objective food environments and health outcomes. *American Journal of Preventive Medicine*, *45*(3), 289–296. http://dx.doi.org/10.1016/j.amepre.2013.05.008

Moayyed, H., Kelly, B., Feng, X., & Flood, V. (2017). Is living near healthier food stores associated with better food intake in regional Australia? *International Journal of Environmental Research and Public Health*, *14*(8). https://doi.org/10.3390%2Fijerph14080884

Moffat, L. F., Ritchie, L. D., Gosliner, W., Plank, K. R., & Au, L. E. (2021). Perceived produce availability and child fruit and vegetable intake: The healthy communities study. *Nutrients*, *13*(11). https://doi.org/10.3390/nu13113681

Moore, L. V., Diez-Roux, A. V., Nettleton, J. A., Jacobs, D. R., & Franco, M. (2009). Fast food consumption, diet quality, and neighborhood exposure to fast food. *American Journal of Epidemiology*, *170*(1), 29–36. https://doi.org/10.1093/aje/kwp090

Moore, L. V., Roux, A. V. D., Nettleton, J. A., & Jacobs, D. R. (2008). Associations of the local food environment with diet quality-A comparison of assessments based on surveys and geographic information systems. *American Journal of Epidemiology*, *167*(8), 917–924. https://doi.org/10.1093/aje/kwm394

Murakami, K., Sasaki, S., Takahashi, Y., & Uenishi, K. (2009). Neighborhood food store availability in relation to food intake in young Japanese women. *Nutrition*, *25*, 640–646. https://doi.org/10.1016/j.nut.2009.01.002

Murakami, K., Sasaki, S., Takahashi, Y., & Uenishi, K. (2010). No meaningful association of neighborhood food store availability with dietary intake, body mass index, or wait circumference in young Japanese women. *Nutrition Research*, *30*, 565–573. http://dx.doi.org/10.1016/j.nutres.2010.08.002

Nackers, L. M., & Appelhans, B. M. (2013). Food insecurity is linked to a food environment promoting obesity in households with children. *Journal of Nutrition Education and Behavior*, *45*, 780–784. https://doi.org/10.1016/j.jneb.2013.08.001

Nash, D. M., Gilliland, J. A., Evers, S. E., Wilk, P., & Campbell, M. K. (2013). Determinants of diet quality in pregnancy: Sociodemographic, pregnancy-specific, and food environment influences. *Journal of Nutrition Education and Behavior*, *45*(6), 627–634. https://doi.org/10.1016/j.jneb.2013.04.268

Neumark-Sztainer, D., French, S. A., Hannan, P. J., Story, M., & Fulkerson, J. A. (2005). School lunch and snacking patterns among high school students: Associations with school food environment and policies. *International Journal of Behavioral Nutrition and Physical Activity*, *2*. https://doi.org/10.1186/1479-5868-2-14

Nicholas, K. M., Thompson, A. L., Wasser, H. M., & Bentley, M. E. (2023). Healthy home food environments of pregnant Black women are shaped by food outlet access and participation in nutrition assistance programs. *American Journal of Human Biology*, *35*(8). https://doi.org/10.1002/ajhb.23903

Nogueira, L. R., Fontanelli, M. M., Aguiar, B. S., Failla, M. A., Florindo, A. A., Barrozo, L. V., Goldbaum, M., Cesar, C. L. G., Alves, M. C. G. P., & Fisberg, R. M. (2018). Access to street markets and consumption of fruits and vegetables by adolescents living in Sao Paulo, Brazil. *International Journal of Environmental Research and Public Health*, *15*(3). https://doi.org/10.3390/ijerph15030517

Ohri-Vachaspati, P., & Berry, A. (2012). Environmental, parental, and demographic determinants of home food environment. *Journal of Nutrition Education and Behavior*, *44*(4). https://doi.org/10.1016/j.jneb.2012.03.139

Ollberding, N. J., Nigg, C. R., Geller, K. S., Horwath, C. C., Motl, R. W., & Dishman, R. K. (2012). Food outlet accessibility and fruit and vegetable consumption. *American Journal of Health Promotion*, *26*(6), 366–370. https://doi.org/10.4278/ajhp.101215-ARB-401

Osei-Kwasi, H., Mohindra, A., Booth, A., Laar, A., Wanjohi, M., Graham, F., Pradeilles, R., Cohen, E., & Holdsworth, M. (2020). Factors influencing dietary behaviours in urban food environments in Africa: A systematic mapping review. *Public Health Nutrition*, *23*(14), 2584–2601. https://doi.org/10.1017/S1368980019005305

Pacific, R., Martin, H. D., Kulwa, K., & Petrucka, P. (2020). Contribution of home and school environment in children’s food choice and overweight/obesity prevalence in African context: Evidence for creating enabling healthful food environment.

Pediatric Health, Medicine and Therapeutics, *11*, 283–295. https://doi.org/10.2147/PHMT.S257549

Paquet, C., Montigny, L., Labban, A., Buckeridge, D., Ma, Y., Arora, N., & Dube, L. (2017). The moderating role of food cue sensitivity in the behavioral response of children to their neighborhood food environment: A cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity*, *14*. https://doi.org/10.1186/s12966-017-0540-9

Park, S., Choi, B. Y., Wang, Y., Colantuoni, E., & Gittelsohn, J. (2013). School and neighborhood nutrition environment and their association with students' nutrition behaviors and weight status in Seoul, South Korea. *Journal of Adolescent Health*, *53*, 655–662. http://dx.doi.org/10.1016/j.jadohealth.2013.06.002

Pearce, J., Hiscock, R., Blakely, T., & Witten, K. (2008). The contextual effects of neighbourhood access to supermarkets and convenience stores on individual fruit and vegetable consumption. *Journal of Epidemiology and Community Health*, *62*(3), 198–201. https://doi.org/10.1136/jech.2006.059196

Pearce, J., Hiscock, R., Blakely, T., & Witten, K. (2009). A national study of the association between neighbourhood access to fast-food outlets and the diet and weight of local residents. *Health & Place*, *15*, 193–197. https://doi.org/10.1016/j.healthplace.2008.04.003

Pechey, R., & Marteau, T. M. (2018). Availability of healthier vs. Less healthy food and food choice: An online experiment. *BMC Public Health*, *18*. https://doi.org/10.1186/s12889-018-6112-3

Pemjean, I., Mediano, F., Ferrer, P., Garmendia, M. L., & Corvalan, C. (2023). Food access, domestic environments, and dietary quality of low-middle income Chilean children during the COVID-19 pandemic. *Frontiers in Public Health*. https://doi.org/10.3389/fpubh.2023.1164357

Perez, P. M. P., Castro, I. R. R., Canella, D. S., & Franco, A. S. (2019). Effect of implementation of a University restaurant on the diet of students in a Brazilian public university. *Ciência & Saúde Coletiva*, *24*(6). https://doi.org/10.1590/1413-81232018246.11562017

Perez-Ferrer, C., Auchincloss, A. H., Menezes, M. C., Kroker-Lobos, M. F., Cardoso, L. O., & Barrientos-Gutierrez, T. (2019). The food environment in Latin America: A systematic review with a focus on environments relevant to obesity and related chronic diseases. *Public Health Nutrition*, *22*(18), 3447–3464. https://doi.org/10.1017/S1368980019002891

Pessoa, M. C., Mendes, L. L., Gomes, C. S., Martins, P. A., & Velasquez-Melendez, G. (2015). Food environment and fruit and vegetable intake in a urban population: A multilevel analysis. *BMC Public Health*, *15*. https://link.springer.com/article/10.1186/s12889-015-2277-1

Pineda, E., Cunha, D. B., Sharabiani, M. T. A., & Millett, C. (2023). Association of the retail food environment, BMI, dietary patterns, and socioeconomic position in urban areas of Mexico. *PLOS Global Public Health*, *3*(2). https://doi.org/10.1371/journal.pgph.0001069

Pinho, M. G. M., Lakerveld, J., Harbers, M. C., Sluijs, I., Vermeulen, R., Huss, A., Boer, J. M. A., Verschuren, W. M. M., Brug, J., Beulens, J. W. J., & Mackenbach, J. D. (2021). Ultra-processed food consumption patterns among older adults in the Netherlands and the role of the food environment. *European Journal of Nutrition*, *60*(5), 2567–2580. https://doi.org/10.1007/s00394-020-02436-5

Pitt, E., Gallegos, D., Comans, T., Cameron, C., & Thornton, L. (2017). Exploring the influence of local food environment on food behaviours: A systematic review of qualitative literature. *Public Health Nutrition*, *20*(13), 2393–2405. https://doi.org/10.1017/S1368980017001069

Pitts, S. B. J., Wu, Q., McGuirt, J. T., Sharpe, P. A., & Rafferty, A. P. (2018). Impact on dietary choices after discount supermarket opens in low-income community. *Journal of Nutrition Education and Behavior*, *50*(7). https://doi.org/10.1016/j.jneb.2018.03.002

Pitts, S. B. J., Wu, Q., Truesdale, K. P., Haynes-Maslow, L., McGuirt, J. T., Ammerman, A., Bell, R., & Laska, M. N. (2018). One-year follow-up examination of the impact of the North Carolina healthy food small retailer program on healthy food availability, purchases, and consumption. *International Journal of Environmental Research and Public Health*, *15*(12). https://doi.org/10.3390/ijerph15122681

Pitts, S. B. J., Wu, Q., Truesdale, K. P., Laska, M. N., Grinchak, T., McGuirt, J. T., Haynes-Maslow, L., Bell, R. A., & Ammerman, A. S. (2017). Baseline assessment of a healthy corner store initiative: Associations between food store environments, shopping patterns, customer purchases, and dietary intake in Eastern North Carolina. *International Journal of Environmental Research and Public Health*, *14*(10). https://doi.org/10.3390/ijerph14101189

Polsky, J. Y., & Garriguet, D. (2023). The local restaurant environment in relation to eating out and sugary drink intake among Canadian children and youth. *Health Reports*, *34*. https://www.doi.org/10.25318/82-003-x202300800001-eng

Poti, J. M., Braga, B., & Qin, B. (2017). Ultra-processed food intake and obesity: What really matters for health—Processing or nutrient content? *Current Obesity Reports*, *6*(4), 420–431. https://doi.org/doi:10.1007/s13679-017-0285-4

Pradeilles, R., Irache, A., Wanjohi, M. N., Holdsworth, M., Laar, A., Zotor, F., Tandoh, A., Klomegah, S., Graham, F., Muthuri, S. K., Kimani-Murage, E. W., Coleman, N., Green, M. A., Osei-Kwasi, H. A., Bohr, M., Rousham, E. K., Asiki, G., Akparibo, R., Mensah, K., … Griffiths, P. (2021). Urban physical food environments drive dietary behaviours in Ghana and Kenya: A photovoice study. *Health Place*, *71*. https://doi.org/10.1016/j.healthplace.2021.102647

Privitera, G. J., & Zuraikat, F. M. (2014). Proximity of foods in a competitive food environment influences consumption of a low calorie and a high calorie food. *Appetite*, *76*, 175–179. https://doi.org/10.1016/j.appet.2014.02.004

Qiu, N., Moore, J. B., Wang, Y., Fu, J., Ding, K., & Li, R. (2021). Perceived parental attitudes are indirectly associated with consumption of junk foods and sugar-sweetened beverages among Chinese adolescents through home food environment and autonomous motivation: A path analysis. *Nutrients*, *13*. https://doi.org/10.3390/nu13103403

Rahmanian, E., Gasevic, D., Vukmirovich, I., & Lear, S. A. (2014). The association between the built environment and dietary intake—A systematic review. *Asia Pacific Journal of Clinical Nutrition*, *23*(2), 183–196. https://doi.org/10.6133/apjcn.2014.23.2.08

Rahmanian, E., Gasevic, D., Vukmirovich, I., & Lear, S. A. (2014). The association between the built environment and dietary intake—A systematic review. *Asia Pacific Journal of Clinical Nutrition*, *23*(2), 183–196. https://doi.org/10.6133/apjcn.2014.23.2.08

Ranjit, N., Evans, A. E., Springer, A. E., Hoelscher, D. M., & Kelder, S. H. (2015). Racial and ethnic differences in the home food environment explain disparities in dietary practices of middle school children in Texas. *Journal of Nutrition Education and Behavior*, *47*. http://dx.doi.org/10.1016/j.jneb.2014.09.001

Raskind, I. G., Kegler, M. C., Girard, A. W., Dunlop, A. L., & Kramer, M. R. (2020). An activity space approach to understanding how food access is associated with dietary intake and BMI among urban, low-income African American women. *Health Place*, *66*. https://doi.org/10.1016/j.healthplace.2020.102458

Recchia, D., Perignon, M., Rollet, P., Vonthron, S., Tharrey, M., Darmon, N., Feuillet, T., & Mejean, C. (2020). Associations between retail food environment and the nutritional quality of food purchases in French households: The Mont'Panier cross-sectional study. *PLoS ONE*, *17*(4). https://doi.org/10.1371/journal.pone.0267639

Reitzel, L. R., Okamoto, H., Hernandez, D. C., Regan, S. D., McNeill, L. H., & Obasi, E. M. (2016). The built food environment and dietary intake among African-American adults. *American Journal of Health Behavior*, *40*(1), 3–11. https://doi.org/10.5993/AJHB.40.1.1

Ren, Y., Zhao, J., Glauben, T., & Campos, B. C. (2022). Supermarket environment and nutrition outcomes: Evidence from rural China. *Journal of Rural Studies*, *92*, 79–92. https://doi.org/10.1016/j.jrurstud.2022.03.019

Rex, S. M., Kopetsky, A., Bodt, B., & Robson, S. M. (2021). Relationships among the physical and social home food environments, dietary intake, and diet quality in mothers and children. *Journal of the Academy of Nutrition and Dietetics*, *121*(10). https://doi.org/10.1016/j.jand.2021.03.008

Richard, R., Akhund, A., & Adjoian, T. (2016). Small convenience stores and the local food environment: An analysis of resident shopping behavior using multilevel modeling. *American Journal of Health Promotion*, *30*(3). https://doi.org/10.4278/ajhp.140326-QUAN-121

Richardson, A. S., Boone-Heinonen, J., Popkin, B. M., & Gordon-Larsen, P. (2011). Neighborhood fast food restaurants and fast food consumption: A national study. *BMC Public Health*, *11*. https://doi.org/10.1186/1471-2458-11-543

Richardson, A. S., Meyer, K. A., Howard, A. G., Boone-Heinonen, J., Popkin, B. M., Evenson, K. R., Shikany, J. M., Lewis, C. E., & Gordon-Larsen, P. (2015). Multiple pathways from the neighborhood food environment to increased body mass index through dietary behaviors: A structural equation-based analysis in the CARDIA study. *Health Place*, *36*, 74–87. https://doi.org/10.1016/j.healthplace.2015.09.003

Rideout, K., Mah, C. L., & Minaker, L. (2015). Food environments: An introduction for public health practice. *National Collaborating Centre for Environmental Health*. https://www.ncceh.ca/sites/default/files/Food_Environments_Public_Health_Practice_Dec_2015.pdf

Riggsbee, K. A., Riggsbee, J., Vilaro, M. J., Moret, L., Spence, M., Steeves, E. A., Zhou, W., Olfert, M. D., Franzen-Castle, L., Horacek, T., Hall, E., & Colby, S. (2019). More than fast food: Development of a story map to compare adolescent perceptions and observations of their food environments and related food behaviors. *International Journal of Environmental Research and Public Health*, *16*(1). https://doi.org/10.3390/ijerph16010076

Robson, S. M., Vadiveloo, M., Green, S., Couch, S. C., Sallis, J. F., Glanz, K., & Saelens, B. E. (2020). Examining the consumer restaurant environment and dietary intake in children. *Preventive Medicine Reports*, *20*. https://doi.org/10.1016/j.pmedr.2020.101274

Rocha, L. L., Pessoa, M. C., Gratao, L. H. A., Carmo, A. S., Cordeiro, N. G., Cunha, C. F., Oliveira, T. R. P. R., & Mendes, L. L. (2021). Characteristics of the school food environment affect the consumption of sugar-sweetened beverages among adolescents. *Frontiers in Nutrition*, *8*. https://doi.org/10.3389/fnut.2021.742744

Rodriguez-Guerra, A. I., Lopez-Olmedo, N., Medina, C., Hernandez-Alcaraz, C., Ortega-Avila, A. G., & Barquera, S. (2022). Association between density of convenience and small grocery stores with diet quality in adults living in Mexico City: A cross sectional study. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.857754

Rongen, S., Poelman, M. P., Thornton, L., Abbott, G., Lu, M., Kamphuis, C. B. M., Verkooijen, K., & Vet, E. (2020). Neighbourhood fast food exposure and consumption: The mediating role of neighbourhood social norms. *International Journal of Behavioral Nutrition and Physical Activity*, *17*. https://doi.org/10.1186/s12966-020-00969-w

Rose, D., & Richards, R. (2004). Food store access and household fruit and vegetable use among participants in the US food stamp program. *Public*, *7*(8), 1081–1088. https://doi.org/10.1079/PHN2004648

Ruff, R. R., Akhund, A., & Adjoian, T. (2016). Small convenience stores and the local food environment: An analysis of resident shopping behavior using multilevel modeling. *American Journal of Health Promotion*, *30*(3). https://doi.org/DOI: 10.4278/ajhp.140326-QUAN-121

Rummo, P. E., Algur, Y., McAlexander, T., Judd, S. E., Lopez, P. M., Adhikaru, S., Brown, J., Meeker, M., McClure, L. A., & Elbel, B. (2021). Comparing competing geospatial measures to capture the relationship between the neighborhood food environment and diet. *Annals of Epidemiology*, *61*. https://doi.org/10.1016/j.annepidem.2021.05.005

Rummo, P. E., Guilkey, D. K., & Ng, S. W. (2017). Understanding bias in relationships between the food environment and diet quality: The Coronary Artery Risk Development in Young Adults (CARDIA) study. *Journal of Epidemiology and Community Health*, *71*(12). https://doi.org/10.1136/jech-2017-209158

Rummo, P. E., Meyer, K. A., Boone-Heinonen, J., Jacobs, D. R., Kiefe, C. I., Lewis, C. E., Steffen, L. M., & Gordon-Larsen, P. (2015). Neighborhood availability of convenience stores and diet quality: Findings from 20 years of follow-up in the Coronary Artery Risk Development in Young Adults study. *American Journal of Public Health*, *105*(5). https://doi.org/10.2105/ AJPH.2014.302435

Saelens, B. E., Glanz, K., Frank, L. D., Couch, S. C., Zhou, C., Colburn, T., & Sallis, J. F. (2018). Two-year changes in child weight status, diet, and activity by neighborhood nutrition and physical activity environment. *Obesity*, *26*(8), 1338–1346. https://doi.org/10.1002/oby.22247

Saksena, M. J., Okrent, A. M., Anekwe, T. D., Cho, C., Dicken, C., Effland, A., Elitzak, H., Guthrie, J., Hamrick, K. S., Hyman, J., Jo, Y., Lin, B.-H., Mancino, L., McLaughlin, P. W., Rahkovsky, I., Ralston, K., Smith, T. A., Stewart, H., Todd, J., & Tuttle, C. (2018). *America's eating habits: Food away from home* (196). United States Department of Agriculture Economic Research Service.

Santiago-Torres, M., Adams, A. K., Carrel, A. L., LaRowe, T. L., & Schoeller, D. A. (2014). Home food availability, parental dietary intake, and familial eating habits influence the diet quality of urban Hispanic children. *Childhood Obesity*, *10*(5), 408–415. https://doi.org/10.1089/chi.2014.0051

Serasinghe, N., Vepsalainen, H., Lehto, R., Abdollahi, A. M., Erkkola, M., Roos, E., & Ray, C. (2023). Association between socioeconomic status, home food availability, parental role-modeling, and children's fruit and vegetable consumption: A mediation analysis. *BMC Public Health*, *23*. https://doi.org/10.1186/s12889-023-15879-2

Seto, E., Hua, J., Wu, L., Shia, V., Eom, S., Wang, M., & Li, Y. (2016). Models of individual dietary behavior based on smartphone data: The influence of routine, physical activity, emotion, and food environment. *PLoS ONE*, *11*(4). https://doi.org/10.1371/journal.pone.0153085

Sexton-Dhamu, M. J., Livingstone, K. M., Pendergast, F. J., Worsley, A., & McNaughton, S. A. (2021). Individual, social-environmental and physical-environmental correlates of diet quality in young adults aged 18-30 years. *Appetite*, *162*. https://doi.org/10.1016/j.appet.2021.105175

Shanks, C. B., Ahmed, S., Dupuis, V., Houghtaling, B., Crane, M. A. R., Tryon, M., & Pierre, M. (2020). Perceptions of food environments and nutrition among residents of the Flathead Indian Reservation. *BMC Public Health*, *20*. https://doi.org/10.1186/s12889-020-09584-7

Shareck, M., Lewis, D., Smith, N. R., Clary, C., & Cummins, S. (2018). Associations between home and school neighbourhood food environments and adolescents' fast-food and sugar-sweetened beverage intakes: Findings from the Olympic Regeneration in East London (ORiEL) study. *Public Health Nutrition*, *21*(15). https://doi.org/10.1017/S1368980018001477

Sharkey, J. R., Johnson, C. M., & Dean, W. R. (2010). Food access and perceptions of the community and household food environment as correlates of fruit and vegetable intake among rural seniors. *BMC Geriatrics*, *10*. https://bmcgeriatr.biomedcentral.com/articles/10.1186/1471-2318-10-32

Sharkey, J. R., Johnson, C. M., Dean, W. R., & Horel, S. A. (2011). Association between proximity to and coverage of traditional fast-food restaurants and non-traditional fast-food outlets and fast-food consumption among rural adults. *International Journal of Health Geographics*, *10*(37). http://www.ij-healthgeographics.com/content/10/1/37

Shaw, S. C., Ntani, G., Baird, J., & Vogel, C. A. (2020). A systematic review of the influences of food store product placement on dietary-related outcomes. *Nutrition Reviews*, *78*(12), 1030–1045. https://doi.org/10.1093/nutrit/nuaa024

Shaw, S., Barrett, M., Shand, C., Cooper, C., Crozier, S., Smith, D., Barker, M., & Vogel, C. (2023). Influences of the community and consumer nutrition environment on the food purchases and dietary behaviors of adolescents: A systematic review. *Obesity Reviews*, *24*(7). https://doi.org/10.1111/obr.13569

Shier, V., Nicosia, N., & Datar, A. (2016). Neighborhood and home food environment and children’s diet and obesity: Evidence from military personnel’s installation assignment. *Social Science & Medicine*, *158*, 122–131. https://doi.org/10.1016/j.socscimed.2016.03.043

Siddiqui, N. Z., Pinho, M. G. M., Rutters, F., Beulens, J. W. J., & Mackenbach, J. D. (2023). The interaction between the community food environment and cooking skills in association with diet-related outcomes in Dutch adults. *Public Health Nutrition*, *26*(12), 2945–2952. https://doi.org/10.1017/S1368980023002148

Sim, S., Veugelers, P. J., Prowse, R., Nykiforuk, C. I. J., & Maximova, K. (2021). Unhealthy food options in the school environment are associated with diet quality and body weights of elementary school children in Canada. *Public Health Nutrition*, *24*(14), 4572–4581. https://doi.org/10.1017/S1368980020004437

Smith, D., Cummins, S., Clark, C., & Stansfeld, S. (2013). Does the local food environment around schools affect diet? Longitudinal associations in adolescents attending secondary schools in East London. *BMC Public Health*, *70*. https://doi.org/10.1186/1471-2458-13-70

Sob, C., Siegrist, M., & Hartmann, C. (2023). The positive eating scale: Associations with eating behavior, food choice, and body mass index. *Eating Behaviors*, *48*. https://doi.org/10.1016/j.eatbeh.2023.101706

Spoer, B. R., Cantor, J. H., Rummo, P. E., & Elbel, B. D. (2018). Food environment does not predict self-reported SSB consumption in New York City: A cross sectional study. *PLoS ONE*, *13*(10). https://doi.org/10.1371/journal.pone.0196689

Stevenson, A. C., Brazeau, A. S., Dasgupta, K., & Ross, N. A. (2019). Evidence synthesis—Neighbourhood retail food outlet access, diet and body mass index in Canada: A systematic review. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy, and Practice*, *39*(10), 261–280. https://doi.org/10.24095/hpcdp.39.10.01

Stowers, K. C., Jiang, Q., Atoloye, A. T., Lucan, S., & Gans, K. (2020). Racial differences in perceived food swamp and food desert exposure and disparities in self-reported dietary habits. *International Journal of Environmental Research and Public Health*, *17*(19). https://doi.org/10.3390/ijerph17197143

Systematic reviews & other review types. (2023, February 8). Temple University University Libraries. https://guides.temple.edu/c.php?g=78618&p=4260131

Tabak, R., Hipp, J. A., Dodson, E. A., Yang, L., Adlakha, D., & Brownson, R. C. (2016). Exploring associations between perceived home and work neighborhood environments, diet behaviors, and obesity: Results from a survey of employed adults in Missouri. *Preventive Medicine Reports*, *4*, 591–596. https://doi.org/10.1016/j.pmedr.2016.10.008

Tam, R., Yassa, B., Parker, H., O'Connor, H., & Allman-Farinelli, M. (2017). University students' on-campus food purchasing behaviors, preferences, and opinions on food availability. *Nutrition*, *37*, 7–13. http://dx.doi.org/10.1016/j.nut.2016.07.007

Terry-McElrath, Y. M., O'Malley, P. M., & Johnston, L. D. (2014). Accessibility over availability: Associations between the school food environment and student fruit and green vegetable consumption. *Childhood Obesity*, *10*(3), 241–250. https://doi.org/10.1089/chi.2014.0011

Tester, J. M., Yen, I. H., & Laraia, B. (2010). Mobile food vending and the after-school food environment. *American Journal of Preventive Medicine*, *38*(1), 70–73. https://doi.org/10.1016/j.amepre.2009.09.030

Thompson, C., Cummins, S., Brown, T., & Kyle, R. (2013). Understanding interactions with the food environment: An exploration of supermarket food shopping routines in deprived neighbourhoods. *Health & Place*, *19*, 116–123.

Thompson, O. M., Yaroch, A. L., Moser, R. P., Rutten, L. J. F., & Agurs-Collins, T. (2010). School vending machine purchasing behavior: Results from the 2005 YouthStyles survey. *Journal of School Health*, *80*, 225–232. https://doi.org/10.1111/j.1746-1561.2010.00494.x

Thornton, L. E., & Kavanagh, A. (2012). Association between fast food purchasing and the local food environment. *Nutrition and Diabetes*, *2*, 1–6. https://doi.org/10.1038/nutd.2012.27

Thornton, L. E., Ball, K., Lamb, K. E., McCann, J., Parker, K., & Crawford, D. A. (2016). The impact of a new McDonald's restaurant on eating behaviours and perceptions of local residents: A natural experiment using repeated cross-sectional data. *Health & Place*, *39*, 86–91. http://dx.doi.org/10.1016/j.healthplace.2016.03.005

Thornton, L. E., Bentley, R. J., & Kavanagh, A. M. (2009). Fast food purchasing and access to fast food restaurants: A multilevel analysis of VicLANES. *International Journal of Behavioral Nutrition and Physical Activity*, *6*(28). https://doi.org/10.1186/1479-5868-6-28

Thornton, L. E., Crawford, D. A., & Ball, K. (2010). Neighbourhood-socioeconomic variation in women's diet: The role of nutrition environments. *European Journal of Clinical Nutrition*, *64*(12), 1423–1432. https://doi.org/10.1038/ejcn.2010.174

Thornton, L. E., Crawford, D. A., Lamb, K. E., & Ball, K. (2017). Where do people purchase food? A novel approach to investigating food purchasing locations. *International Journal of Health Geographics*, *16*(9). https://doi.org/OI 10.1186/s12942-017-0082-z

Thornton, L. E., Lamb, K. E., & Ball, K. (2013). Employment status, residential and workplace food environments: Associations with women's eating behaviours. *Health & Place*, *24*, 80–89. http://dx.doi.org/10.1016/j.healthplace.2013.08.006

Thornton, L. E., Pearce, J. R., Macdonald, L., Lamb, K. E., & Ellaway, A. (2012). Does the choice of neighbourhood supermarket access measure influence associations with individual-level fruit and vegetable consumption? A case study from Glasgow. *International Journal of Health Geographics*. https://doi.org/10.1186/1476-072X-11-29

Timperio, A. F., Ball, K., Roberts, R., Andrianopoulos, N., & Crawford, D. A. (2009). Children's takeaway and fast-food intakes: Associations with the neighbourhood food environment. *Public Health Nutrition*, *12*(10), 1960–1964. https://doi.org/10.1017/S1368980009004959

Timperio, A., Ball, K., Roberts, R., Campbell, K., Andrianopoulos, N., & Crawford, D. (2008). Children's fruit and vegetable intake: Associations with the neighbourhood food environment. *Preventative Medicine*, *46*(4), 331–335. https://doi.org/10.1016/j.ypmed.2007.11.011

Timperio, A., Crawford, D., Leech, R. M., Lamb, K. E., & Ball, K. (2018). Patterning of neighbourhood food outlets and longitudinal associations with children's eating behaviours. *Preventative Medicine*, *111*, 248–253. https://doi.org/10.1016/j.ypmed.2018.03.003

Torraco, R. J. (2016). Writing integrative literature reviews: Using the past and present to explore the future. *Human Resource Development Review*, *15*(4), 404–428. https://doi.org/DOI: 10.1177/1534484316671606

Trapp, G. S. A., Hickling, S., Christian, H. E., Bull, F., Timperio, A. F., Boruff, B., Shrestha, D., & Giles-Corti, B. (2015). Individual, social, and environmental correlates of healthy and unhealthy eating. *Society for Public Health Education*, *42*(6). https://doi.org/10.1177/1090198115578750

Trapp, G. S. A., Hooper, P., Thornton, L., Kennington, K., Sartori, A., Hurworth, M., & Billingham, W. (2021). Association between food-outlet availability near secondary schools and junk-food purchasing among Australian adolescents. *Nutrition*, *91*. https://doi.org/10.1016/j.nut.2021.111488

Trofholz, A. C., Tate, A. D., Draxten, M. L., Neumark-Sztainer, D., & Berge, J. M. (2016). Home food environment factors associated with presence of fruit and vegetables at dinner: A direct observational study. *Appetite*, *96*, 526–532. https://doi.org/10.1016/j.appet.2015.10.019

Trubswasser, U., Talsma, E. F., Ekubay, S., Poelman, M. P., Holdsworth, M., Feskens, E. J. M., & Baye, K. (2022). Factors influencing adolescents' dietary behaviors in the school and home environment in Addis Ababa, Ethiopia. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.861463

Turner, C., Aggarwal, A., Walls, H., Herfoth, A., Drewnowski, A., Coates, J., Kalamatianou, S., & Kadiyala, S. (2018). Concepts and critical perspectives for food environment research: A global framework with implications for action in low and middle income countries. *Global Food Security*, *18*, 93–101. https://doi.org/10.1016/j.gfs.2018.08.003

Turner, G., Green, R., Alae-Carew, C., & Dangour, A. D. (2021). The association of dimensions of fruit and vegetable access in the retail food environment with consumption: A systematic review. *Global Food Security*, *29*. https://doi.org/10.1016/j.gfs.2021.100528

van Ansem, W. J. C., Schrijvers, C. T. M., Rodenburg, G., & van de Mheen, D. (2013). Is there an association between the home food environment, the local food shopping environment and children's fruit and vegetable intake? Results from the Dutch INPACT study. *Public Health Nutrition*, *16*(7), 1206–1214. https://doi.org/10.1017/S1368980012003461

van der Horst, K., Timperio, A., Crawford, D., Roberts, R., Brug, J., & Oenema, A. (2008). The school food environment: Associations with adolescent soft drink and snack consumption. *American Journal of Preventive Medicine*, *35*(3), 217–223. https://doi.org/10.1016/j.amepre.2008.05.022

van der Velde, L. A., Zitman, F. M. P., Mackenbach, J. D., Numans, M. E., & Jong, J. C. K. (2020). The interplay between fast-food outlet exposure, household food insecurity and diet quality in disadvantaged districts. *Public Health Nutrition*, *25*(1), 105–113. https://doi.org/10.1017/S1368980020004280

Vandevijvere, S., Chow, C. C., Hall, K. D., Umali, E., & Swinburn, B. A. (2015). Increased food energy supply as a major driver of the obesity epidemic: A global analysis. *Bulletin World Health Organization*, *93*(7), 446–456.

Vedovato, G. M., Trude, A. C. B., Kharmats, A. Y., & Martins, P. A. (2015). Degree of food processing of household acquisition patterns in a Brazilian urban area is related to food buying preferences and perceived food environment. *Appetite*, *87*, 296–302. https://doi.org/10.1016/j.appet.2014.12.229

Vepsalainen, H., Korkalo, L., Mikkila, V., Lehto, R., Ray, C., Nissinen, K., Skaffari, E., Fogelholm, M., Koivusilta, L., Roos, E., & Erkkola, M. (2018). Dietary patterns and their associations with home food availability among Finnish pre-school children: A cross-sectional study. *Public Health Nutrition*, *21*(7), 1232–1242. https://doi.org/10.1017/S1368980017003871

Vepsalainen, H., Mikkila, V., Erkkola, M., Broyles, S. T., Chaput, J. P., Hu, G., Kuriyan, R., Kurpad, A., Lambert, E. V., Maher, C., Maia, J., Matsudo, V., Olds, T., Onywera, V., Sarmiento, O. L., Standage, M., Tremblay, M. S., Tudor-Locke, C., Zhao, P., … Fogelholm, M. (2015). Association between home and school food environments and dietary patterns among 9-11-year old children in 12 countries. *International Journal of Obesity Supplements*, *5*. https://www.nature.com/articles/ijosup201522

Vereecken, C., Haerens, L., Bourdeaudhuij, I. D., & Maes, L. (2010). The relationship between children’s home food environment and dietary patterns in childhood and adolescence. *Public Health Nutrition*, *13*, 1729–1735. https://doi.org/10.1017/S1368980010002296

Vilaro, M. J., Barnett, T. E., Mathews, A., Pomeranz, J., & Curbow, B. (2016). Income differences in social control of eating behaviors and food choice priorities among Southern rural women in the US: a qualitative study. *Appetite*, *107*, 604–612. https://doi.org/10.1016/j.appet.2016.09.003

Vilaro, M. J., Colby, S. E., Riggsbee, K., Zhou, W., Byrd-Bredbenner, C., Olfert, M. D., Barnett, T. E., Horacek, T., Sowers, M., & Mathews, A. E. (2018). Food choice priorities change over time and predict dietary intake at the end of the first year of college among students in the US. *Nutrients*, *10*(9). https://doi.org/10.3390/nu10091296

Vogel, C., Abbott, G., Ntani, G., Barker, M., Cooper, C., Moon, G., Ball, K., & Baird, J. (2019). Examination of how food environment and psychological factors interact in their relationship with dietary behaviours: Test of a cross-sectional model. *International Journal of Behavioral Nutrition and Physical Activity*, *16*. https://doi.org/10.1186/s12966-019-0772-y

Vogel, C., Lewis, D., Ntani, G., Cummins, S., Cooper, C., Moon, G., & Baird, J. (2017). The relationship between dietary quality and the local food environment differs according to level of educational attainment: A cross-sectional study. *PLoS One*, *12*(8). https://doi.org/10.1371/journal.pone.0183700

Vogel, C., Ntani, G., Inskip, H., Barker, M., Cummins, S., Cooper, C., Moon, G., & Baird, J. (2016). Education moderates the association between supermarket environment and diet. *American Journal of Preventive Medicine*, *51*(2), e27–e34. https://doi.org/10.1016/j.amepre.2016.02.030

Watts, A. W., Barr, S. I., Hanning, R. M., Lovato, C. Y., & Masse, L. C. (2018). The home food environment and associations with dietary intake among adolescents presenting for a lifestyle modification intervention. *BMC Nutrition*, *4*. https://doi.org/10.1186/s40795-018-0210-6

Wedick, N. M., Ma, Y., Olendzki, B. C., Procter-Gray, E., Cheng, J., Kane, K. J., Ockene, I. S., Pagoto, S. L., Land, T. G., & Li, W. (2015). Access to healthy food stores modifies effect of a dietary intervention. *American Journal of Preventive Medicine*, *48*(3), 309–317. https://doi.org/10.1016/j.amepre.2014.08.020

Weigel, M. M., & Armijos, R. X. (2022). The Ecuadorian school food environment: Association with healthy and unhealthy food and beverage consumption and BMI. *Food and Nutrition Bulletin*, *43*(4), 439–464. https://doi.org/10.1177/03795721221116447

Wertheim-Heck, S. C. O., & Raneri, J. E. (2019). A cross-disciplinary mixed-method approach to understand how food retail environment transformations influence food choice and intake among the urban poor: Experiences from Vietnam. *Appetite*, *142*. https://doi.org/10.1016/j.appet.2019.104370

Westbury, S., Ghosh, I., Jones, H. M., Mensah, D., Samuel, F., Irache, A., Azhar, N., Al-Khudairy, L., Iqbal, R., & Oyebode, O. (2021). The influence of the urban food environment on diet, nutrition and health outcomes in low-income and middle-income countries: A systematic review. *BMJ Global Health*, *6*(10). https://doi.org/10.1136/bmjgh-2021-006358

Williams, L., Ball, K., & Crawford, D. (2010). Why do some socioeconomically disadvantaged women eat better than others? An investigation of the personal, social and environmental correlates of fruit and vegetable consumption. *Appetite*, *55*(3), 441–446. https://doi.org/10.1016/j.appet.2010.08.004

Wyse, R., Campbell, E., Nathan, N., & Wolfenden, L. (2011). Associations between characteristics of the home food environment and fruit and vegetable intake in preschool children: A cross-sectional study. *BMC Public Health*, *16*. https://doi.org/10.1186/1471-2458-11-938

Xin, J., Zhao, L., Wu, T., Zhang, L., Li, Y., Xue, H., Xiao, Q., Wang, R., Xu, P., Visscher, T., Ma, X., & Jia, P. (2021). Association between access to convenience stores and childhood obesity: A systematic review. *Obesity Reviews*, *22*(S1). https://doi.org/10.1111/obr.12908

Yang, M., Wang, H., & Qiu, F. (2020). Neighbourhood food environments revisited: When food deserts meet food swamps. *The Canadian Geographer*, *64*(1), 135–154. https://doi.org/DOI: 10.1111/cag.12570

Zenk, S. N., Lachance, L. L., Schulz, A. J., Mentz, G., Kannan, S., & Ridella, W. (2009). Neighborhood retail food environment and fruit and vegetable intake in a multiethnic urban population. *American Journal of Health Promotion*, *23*(4), 255–265. https://doi.org/10.4278/ajhp.071204127

Zenk, S. N., Schulz, A. J., Hollis-Neely, T., Watkins, G., Nwankwo, R., & Odoms-Young, A. (2005). Fruit and vegetable intake in African Americans income and store characteristics. *American Journal of Preventive Medicine*, *29*(1). https://doi.org/10.1016/j.amepre.2005.03.002

Zhang, M., Zhang, N., Zhou, M., & Ma, G. (2022.). Association between neighborhood food environment and dietary diversity score among older people in Beijing, China: A cross-sectional study. *Frontiers in Nutrition*, *9*. https://doi.org/10.3389/fnut.2022.903214

Zhang, R., Yu, X., Yu, Y., Guo, D., He, H., Zhao, Y., & Zhu, W. (2020). Family food environments and their association with primary and secondary students' food consumption in Beijing, China: A cross-sectional study. *Nutrients*, *14*. https://doi.org/10.3390/nu14091970

Zhang, T., & Huang, B. (2018). Local retail food environment and consumption of fruit and vegetable among adults in Hong Kong. *International Journal of Environmental Research and Public Health*, *15*(10). https://doi.org/10.3390/ijerph15102247

Zhao, A. W., McGowan, C. C., Zenk, S. N., & Kershaw, K. N. (2020). Associations of the consumer food environment with eating behaviours and BMI. *Public Health Nutrition*, *23*(17), 3197–3203. https://doi.org/10.1017/S1368980020002633

Zhao, P., Kwan, M., & Zhou, S. (2018). The uncertain geographic context problem in the analysis of the relationship between obesity and the built environment in

Guangzhou. *International Journal of Environmental Research and Public Health*, *15*. https://doi.org/doi:10.3390/ijerph15020308

Zuccolotto, D. C. C., Barbieri, P., & Sartorelli, D. S. (2015). Food environment and family support in relation to fruit and vegetable intake in pregnant women. *Archivos Latinoamericanos de Nutrición*, *65*(4). https://ve.scielo.org/scielo.php?pid=S0004-06222015000400002&script=sci_arttext

APPENDICES

Appendix A: Torraco Checklist for Integrative Literature Reviews

Table 2. A Checklist for Writing an Integrative Literature Review.

A. Before Writing an Integrative Literature Review

1. What will the integrative literature review address (i.e., review of a new topic? a mature topic?). Is the topic of the review clearly defined? Are the scope and boundaries of the review demarcated to show the bodies of literature that will and will not be reviewed?
2. Is there a *need* for the integrative literature review? Is an integrative literature review the most appropriate form of research to address the problem? Will the review article make a significant, value-added contribution to new thinking in the field?
3. Is the perspective taken by the author on the literature review explained to readers (e.g., neutral representation vs. taking a position or point of view)? Are the assumptions of the author regarding the literature review stated?

B. Organizing an Integrative Literature Review

4. Is the integrative literature review organized effectively?
   - (a) Is the literature review organized for logical flow of ideas, organization, and readability?
   - (b) Is the literature review organized around a coherent structure for clarity about what is being reviewed and how the main concepts or themes of the topic come together as a unified idea (e.g., temporal, methodological, or conceptual structure)?
   - (c) Should diagrams or other visual representations be used to show how the literature review is structured and to enhance the reader's understanding of how the topic is addressed in the literature?
5. Are the methods for conducting the integrative literature review sufficiently described?
   - (a) How was the literature for the review selected? What key subject terms (or keywords) were used to search the literature? What databases were used to search the literature?
   - (b) Is a table or matrix used to track which keywords and databases led to relevant literature and which did not? If so, is the use of the table mentioned in the review for readers?
   - (c) Are the criteria stated for retaining or discarding the literature retrieved?
   - (d) Is there a discussion of how each piece of literature was reviewed (e.g., complete reading of each literature source, reading of abstracts only, a staged review)?
   - (e) Is there a discussion of how the main ideas and themes from the literature were identified and analyzed?
   - (f) Is the description of the methods for searching, analyzing, and interpreting the literature as transparent as possible for the reader? Is the description of the literature review methodology written so that if other researchers attempted to replicate the integrative literature review, sufficient information would be available to do so?

C. Writing an Integrative Literature Review

6. Does the review critically analyze existing literature on the topic (i.e., is a critique provided)?
   - (a) Does the critical analysis describe both the strengths and weaknesses of the literature?
   - (b) Does the critical analysis identify literature deficiencies, omissions, inaccuracies, conflicting perspectives and inconsistencies, and aspects of the topic or phenomenon that are missing, incomplete, or poorly represented in the literature?

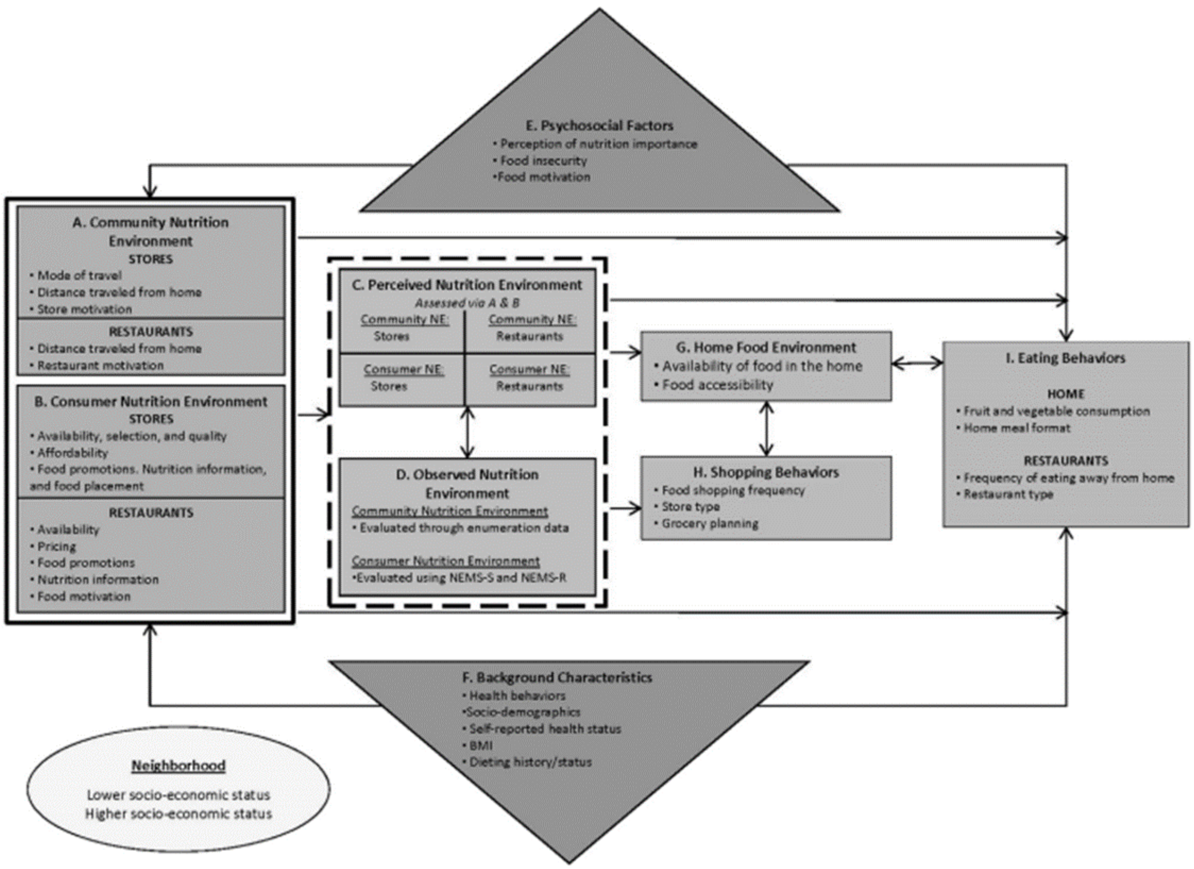
(continued)

Table 2. (continued)

	(c) Would it be beneficial for the review to include a concept map, analysis matrix, or other visual representation of the main ideas and conceptual relationships of a topic to enhance the reader's understanding of the critical analysis of the literature?
7.	Does the integrative literature review synthesize knowledge from the literature into a significant, value-added contribution to new knowledge on the topic? (See Table 1 for five forms of synthesis.)
8.	Does the integrative literature review lay the foundation for future research by formulating questions for further research on the topic?
9.	Does the integrative literature review describe the logic and conceptual reasoning used by the author to synthesize the model or framework from the review and critique of the literature?
10.	Does the integrative literature review explore the future of the topic or field? Does the review identify factors that are shaping the future of the topic, discuss pending developments in the field, and assess the direction for future events and trends?
11.	Has the integrative literature review been examined and revised for clear, concise, understandable writing?

Appendix B: Nutrition Environment Measures Survey-Perceived (NEMS-P): Conceptual

Model



Chapter 3: Food Environment and Diet Quality of a Southeastern Metro County in the United States: Home, Work, and Dietary Habits

Introduction

The food environment plays a crucial role in dietary decision-making. It encompasses various factors such as distance, availability, access to food outlets (*General Food Environment Resources*, 2014), experiences, available information, social and cultural practices, and political and economic influences (Rideout et al., 2015). These factors involve the neighborhood that a person resides in as well as the food outlets from which they purchase food (Kegler et al., 2014; Turner et al., 2018). Food environments can be categorized as falling under the umbrella of the built or the natural food environment. While most people procure food from their built food environment, consisting of supermarkets, farmers markets, and other food retailers and outlets. Some food is procured from the natural food environment which consists of wild food sources, such as forests, rivers, and jungles, and farmed food, such as gardens, fields, and orchards (Downs et al., 2020).

The food environment surrounding an individual's home and place of work impacts the available choices for purchase and, ultimately, the nutritional profile of their chosen diet (Pitt et al., 2017; Rideout et al., 2015; Sharkey et al., 2010; Timperio et al., 2018). Availability of fruits and vegetables via access to supermarkets or other grocery outlets that sell produce has been linked to an overall healthier diet (Ambikapathi et al., 2021; Black et al., 2014; Caldwell et al., 2009; Thornton et al., 2012). However, in the

United States it has been shown that the majority of adults consume most of their energy from fast food, which leads to a higher energy intake compared to diets consisting of home-prepared foods (Lachat et al., 2012).

Research on food environments around both the home and workplace is limited. Burgoine and colleagues (2014) examined both the home and workplace in their research and found that there was more food outlet availability at work than at home, and exposure to takeaway food outlets was positively associated with intake of that food whether it was at home or work. In contrast, Mackenbach et al., (2023) found that higher counts of fast-food outlets in the combined home and work location were associated with a lower odds of consumption and a higher diet quality.

James and colleagues (2017) examined the food environment around the workplace and home over time and found that overtime, densities of all food outlet types (fast-food restaurants, convenience stores, grocery stores, etc.) increased around the home and distance to establishments also decreased around both the home and workplace. Zhao and colleagues (2018) expansively examined the food environment by including the home, workplace, and place of fitness. These authors concluded that the relationship between food environment and obesity varies based on the environmental measure. Similarly, Thornton and colleagues (2013) found mixed associations with the food environment around the workplace and home, varying based on the buffer used, and Tabak et al., (2016) found that workplace food environment variables were not associated with dietary behaviors, nor was the home food environment.

Studies that solely examined food environments at work have yielded varied results. Charoenbut and colleagues (2018) found no impact of the work food environment on diet, while Lassen and colleagues (2011) found that a food environment intervention at the workplace led to a decrease in daily fat intake, cake and sweets, and an increase in fiber. Working at fast-food outlets allowed for easier access for adolescents to have meals at work, and if they didn't eat at their workplace, they often ate at a similar outlet nearby (Harper et al., 2022). Jilcott and colleagues (2009) found that workplace food choices were impacted by the social environment, personal health concerns, and the food environment. The little amount of research that has been conducted on both the food environment workplace and home leaves room for further investigation.

This study aims to answer the following questions: First, when controlling for sex, education, household income, marital status, race, and household size, what is the relationship between perception of the local food environment and perceived diet quality? Second, when controlling for sex, education, household income, marital status, race, and household size, what is the relationship between the food environment measures of availability, cost, selection, and accessibility and perceived diet quality?

For the first question the researcher hypothesizes that when controlling for sex, education, household income, marital status, race, and household size, an unhealthy local food environment will be associated with a lower perceived diet quality. For the second question the researcher hypothesizes that when controlling for sex, education, household income, marital status, race, and household size, a lower rating for availability, cost, selection, and accessibility will be associated with a lower perceived diet quality.

Methods

Participants and Procedure

Participants (*N* = 126) were recruited using a snowball sampling method where participants were asked to share the survey with others. Participants were emailed directly using direct contacts and recruited online via social media. The participants were 18 years or older and resided in the study area of Rutherford County, Tennessee. This was a two part study the pilot study (*N* = 52) was used to test the questionnaire and study two (*N* = 74)was used to improve the questionnaire. The pilot study was administered March-April of 2020 and the updated questionnaire was administered March-April of 2021. The questionnaire was administered using Qualtrics via an anonymous link. The participants were informed that they could stop at any time and informed consent was obtained. This study received Institutional Review Board approval from Middle Tennessee State University, see Appendix B: for IRB approval.

Materials

The questionnaire for this study was created through consultation with a survey methodologist and through extensive literature review. The items in the questionnaire were created based on previous studies and designed to measure perceived food environment and diet quality. See Appendix A: Survey for more information on the questionnaire. Study one served as a pilot to test and improve upon the new survey tool, while in study two the questionnaire was edited by improving upon the collected demographic and diet quality items. In study two questions regarding consumption of types of foods (fried foods and turkey) and zip code were added, see Appendix A for the full questionnaire.

Measures

Local food Environment*.* Local food environment was measured by the number of grocery stores and fast-food restaurants within a 15-minute drive from the person's home and the number of fast-food restaurants within a 15-minute drive of the person's work. The rating of availability, cost, selection, and accessibility (poor to excellent) of fruits and vegetables in home and work areas were used to create a fruit and vegetable scale score. The scale score was created by adding the variable options together, poor was rated as 1 and excellent as 4. The highest score possible was 16 and the lowest score possible was 4. These scores were then split into groups of poor/fair and good/excellent. These groups were created by finding the middle score and splitting the groups in half.

Diet Quality*.* Perceived diet quality was measured using a self-rating of overall diet quality (not healthy at all to very healthy), combined into not healthy/somewhat and healthy/very healthy.

Demographics*.* Demographics were measured using questions asking about age, race/ethnicity, sex, education level, household income, marital status, and employment status.

Data Analysis

SPSS version 29 was used to run a logistic regression and chi-square to assess the relationship between the perception of the local food environment and perceived diet quality and the relationship between the food environment measures of availability, cost, selection, and accessibility and perceived diet quality. Frequencies, descriptive statistics, and cross-tabulations were run using SPSS version 29. A post hoc power analysis (linear regression) was conducted in SPSS version 29 to assess the power of the attained sample size(s) to ensure that an adequate sample size was attained to test the study hypotheses. The post hoc power analysis showed that the obtained sample size of $N = 126$ was sufficient for meeting a power value of 1.0 where a medium effect size of 0.5 and a significance level of $p = 0.05$.

Data cleaning included deleting invalid surveys and ensuring responses were valid. Deletion of invalid surveys included deleting those who did not live in the study area, did not consent to taking the survey, and answered less than 25% of the survey questions. Ensuring responses were valid consisted of the researcher assessing response time and testing for outliers. If the response time was under 8 minutes, the entry was deleted. Missing responses to questions were treated as missing in the dataset.

Results

Demographics and Descriptives

For the 126 participants, 31.2 years old (SD = 10.95) was the average age with a range from 19 to 62. Majority of the participants were females 96 (76.2%), had some college education or an associated degree 52 (41.3%), had a household income of $60,000 or higher 62 (49.2%), were not married 77 (61.1%), White 89 (70.6%), non-Hispanic 115 (91.3%), and had 3-4 people in the household 56 (44.4%), see Table 1. Demographics for full demographic information.

Table 1
Demographics

	N	%
Sex		
Male	30	23.8
Female	96	76.2
Education		
High school or equivalent	13	10.3
Some college or associates degree	52	41.3
Bachelor’s degree	34	27.4
Post bachelor’s degree	27	21.4
Income		
Less than $20,000	29	23.0
$21,000 to $59,999	34	27.0
$60,000+	62	49.2
Marital Status		
Not married	77	61.1
Married or domestic partnership	49	38.9
Race		
White	89	70.6
Black	27	21.4
Other including Asian	10	7.9
Ethnicity		
Non-Hispanic	115	91.3
Hispanic	11	8.7
Household size		
1 to 2	50	39.7
3 to 4	56	44.4
5+	19	15.1

Of the 126 participants, 18 (14.3%) stated that they had a diet quality of not healthy at all and 12 (9.5%) a diet quality of very healthy. These groups were combined into groups of not healthy 74 (58.7%) and healthy 48 (38.1%) for the logistic regression. None of the participants reported having five or more grocery stores within a 15-minute drive of where they live or work. Ten of the participants reported not having a grocery store and none reported having zero fast food restaurants within a 15-minute drive of their home. The majority of participants reported having eight or more fast food restaurants and three to four grocery stores within a 15-minute drive of their home or work. For more details on food environment and diet quality variable statistics see tables 2 and 3.

Table 2

Food Environment and Diet Quality Measures

	N	%
Diet Quality		
Not healthy at all	18	14.3
Somewhat healthy	56	44.4
Healthy	36	28.6
Very healthy	12	9.5
Local Food Environment		
Fast food restaurants - Home		
0	0	0.0
1 to 7	38	30.2
8+	84	66.7
Fast food restaurants - Work		
0	3	2.4
1 to 7	48	38.1
8+	68	54.0
Grocery stores - Home		
0	10	7.9
1 to 2	22	17.5
3 to 4	89	70.6
5 to 6	0	0.0
6+	0	0.0
Grocery stores - Work		
0	4	3.2
1 to 2	30	23.8
3 to 4	86	68.3
5 to 6	0	0.0
6+	0	0.0
Fruit and Vegetable Score		
Home		
Poor/fair	24	19.0
Good/excellent	96	76.2
Work		
Poor/fair	40	31.7
Good/excellent	77	61.1
Combined		
Poor/fair	51	40.5
Good/excellent	69	54.8

Table 3

Fruit and Vegetable Score Variables

	Work		Home	
	N	%	N	%
Availability				
Poor	12	9.5	3	2.4
Fair	32	25.4	17	13.5
Good	34	27.0	42	33.3
Excellent	39	31.0	58	46.0
Cost				
Poor	15	11.9	12	9.5
Fair	47	37.3	44	34.9
Good	43	34.1	51	40.5
Excellent	11	8.7	12	9.5
Selection				
Poor	9	7.1	4	3.2
Fair	30	23.8	22	17.5
Good	40	31.7	47	37.3
Excellent	38	30.2	47	37.3
Accessibility				
Poor	19	15.1	11	8.7
Fair	32	25.1	22	17.5
Good	43	34.1	49	38.9
Excellent	23	18.3	38	30.2

Local Food Environment and Diet Quality

A chi-square test of independence was conducted to examine the relationship between diet quality and sex, education, income, marital status, race, household size, and the number of grocery and fast-food outlets within a 15-minute drive of home or work. The relationship between diet quality and education was significant, X^2 (3, N =

126) = 15.16, *p* = .002. Those who had some college education or an associate's degree (78.4%) were more likely to have a diet quality of not healthy at all/somewhat healthy. The relationship between diet quality and the number of fast-food outlets within a 15-mintute drive of home was significant, X^2 (1, N = 126) = 4.60, *p* = .032. Those with 1 to 7 fast food outlets within a 15-minute drive of their home (68.4%) were more likely to have a diet quality of not healthy at all or somewhat healthy. All other relationships were not significant, for crosstabulation statistics see table 4.

Table 4

Crosstabulations for Diet Quality and Other Variables

Diet Quality	Not Healthy/Somewhat Healthy	Healthy/Very Healthy
Sex		
Male	15 (53.6%)	13 (46.4%)
Female	59 (62.8%)	35 (37.2%)
Education		
High school or equivalent	6 (50%)	6 (50%)
Some college or associates	40 (78.4%)	11 (21.6%)
Bachelor's degree	18 (54.5%)	15 (45.5%)
Post bachelor's degree	10 (38.5%)	61.5%)
Income		
Less than $20,000	20 (71.4%)	8 (28.6%)
$21,000 to $59,999	20 (60.6%)	13 (39.4%)
$60,000	34 (55.7%)	27 (44.3%)
Marital Status		
Not married	47 (62.7%)	28 (37.3%)
Married or domestic partnership	27 (57.4%)	20 (42.6%)
Race		
White	52 (60.5%)	34 (39.5%)
Black	16 (61.5%)	10 (38.5%)
Other	6 (60.0%)	4 (40.0%)

Household size		
1 to 2	25 (52.1%)	23 (47.9%)
3 to 4	34 (61.8%)	21 (38.2%)
5+	14 (77.8%)	4 (22.2%)
Local Food Environment		
Fast food restaurants - Home		
0	0	0
1 to 7	26 (68.4%)	12 (31.6%)
8+	48 (57.1%)	36 (42.9%)
Fast food restaurants - Work		
0	2 (66.7%)	1 (33.3%)
1 to 7	31 (64.6%)	17 (35.4%)
8+	39 (57.4%)	29 (42.6%)
Grocery stores - Home		
0	4 (40.0%)	6 (60.0%)
1 to 2	15 (68.2%)	7 (31.8%)
3 to 4	55 (61.8%)	34 (38.2%)
5 to 6	0	0
6+	0	0
Grocery stores - Work		
0	2 (50.0%)	2 (50.0%)
1 to 2	17 (56.7%)	13 (43.3%)
3 to 4	55 (64.0%)	31 (36.0%)
5 to 6	0	0
6+	0	0
Fruit and Vegetable Score - Work		
Poor/Fair	33 (82.5%)	7 (17.5%)
Good/Excellent	39 (50.36%)	38 (49.4%)
Fruit and Vegetable Score - Home		
Poor/Fair	22 (91.7%)	2 (8.3%)
Good/Excellent	52 (54.2%)	44 (45.8%)
Fruit and Vegetable Score - Overall		
Poor/Fair	40 (78.4%)	11 (21.6%)
Good/Excellent	34 (49.3%)	35 (50.7%)

The logistic regression revealed that those who have some college education or an associate's degree (78.4%) were 14.38 times more likely [*95% CI* = 3.12, 66.21] to have a diet quality of not healthy at all/somewhat healthy when compared to those with a post bachelor's degree. Those who had 1 to 7 fast food outlets within a 15-minute drive of their home (68.4%) were 3.82 times more likely [*95% CI* = 1.07, 13.65] to have a diet quality of not healthy at all/somewhat healthy compared to those with 8 or more fast food outlets within a 15-minute drive of their home.

The relationship between diet quality and household size for those with 1 to 2 people in the household was close to significant, $p = .069$. Where those with 1 to 2 people in the household were 0.25 times less likely [*95% CI* = 0.05, 1.11] to have a not at all healthy/somewhat healthy diet quality compared to those with 5 or more people in the household. Similarly, the relationship between diet quality and those with zero grocery stores within a 15-minute drive of their home, $p = .064$. Where those with zero grocery stores within a 15-minute drive of their home were 0.13 times less likely [*95% CI* = 0.02, 1.13] to have a diet quality of not healthy at all/somewhat healthy compared to those with 3 to 4 grocery stores within a 15-minute drive of their home. All other relationships were not significant or close to significant, for logistic regression statistics see table 5.

Table 5
Parameter Estimates and Odds Ratios for Diet Quality and Work and Home Food Environment Measures

	Not Healthy at All/Somewhat Healthy		
Independent Variables	*B*	*S.E.*	*OR (95%CI)*
Sex			
Male	0.03	0.58	1.03 (0.33-3.21)
Female	.	.	.
Education			
High school or equivalent	0.62	0.84	1.86 (0.36-9.66)
Some college or associates degree	2.67	0.78	14.38 (3.12-66.21)*
Bachelor's degree	1.01	0.62	2.74 (0.82-9.15)
Post bachelor's degree	.	.	.
Income			
Less than $20,000	0.38	0.78	1.46 (0.32-6.74)
$21,000 to $59,999	0.09	0.67	1.09 (0.30-4.02)
$60,000+	.	.	.
Marital Status			
Not married	-0.27	0.63	0.76 (0.22-2.60)
Married or domestic partnership	.	.	.
Race			
Other including Asian	-1.49	0.97	0.23 (0.03-1.50)
Black	-1.11	0.68	0.33 (0.09-1.26)
White	.	.	.
Household size			
1 to 2	-1.49	0.97	0.23 (0.03-1.50)
3 to 4	-1.11	0.68	0.33 (0.09-1.26)
5+	.	.	.
Local Food Environment			
Fast food restaurants - Home			
0			
1 to 7	1.34	0.65	3.82 (1.07-13.65)*
8+	.	.	.
Fast food restaurants - Work			
0	-0.81	1.41	0.45 (0.23-7.05)
1 to 7	-0.2	0.54	0.82 (028-2.36)
8+	.	.	.
Grocery stores - Home			
0	-2.03	1.1	0.13 (0.01-1.13)
1 to 2	-0.36	0.73	0.70 (0.17-2.91)
3 to 4	.	.	.
Grocery stores - Work			
0	1.88	1.62	6.5 (0.27-155.56)
1 to 2	-0.01	0.6	0.99 (0.31-3.20)
3 to 4	.	.	.

*Note: B= Parameter Estimate, S.E.= Standard Error, OR= Odds Ratio 95%, CI= 95% Confidence Interval, *= p=≤ .05*

Availability, Cost, Selection, and Accessibility and Diet Quality

A chi-square test of independence was conducted to examine the relationship between diet quality and sex, education, income, marital status, race, household size, fruit and vegetable score – work, fruit and vegetable score – home, and fruit and vegetable score – overall. The relationship between diet quality and education was significant, X^2 (3, N = 126) = 11.81, *p* = .008. Those who had some college education or an associate's degree (78.4%) were more likely to have a diet quality of not healthy at all/somewhat healthy. The relationship between diet quality and fruit and vegetable score – work was significant, X^2 (1, N = 126) = 5.07, *p* = .024. Those who had a fruit and vegetable score – work of poor/fair (82.5%) were more likely to have a diet quality of not at all healthy/somewhat healthy. Other relationships were not significant, see table 4 for statistics of crosstabulations.

The logistic regression revealed that those who had some college education or an associate's degree (78.4%) were 7.97 times more likely [*95% CI* = 1.74, 36.56] to have a diet quality of not healthy at all/somewhat healthy, compared to those with a post bachelor's degree. Those who had a fruit and vegetable score – work of poor/fair (82.5%) were 5.31 times more likely [*95% CI* = 1.18, 23.93] to have a diet quality of not at all healthy/somewhat healthy, compared to those who had a fruit and vegetable score or good/excellent. The relationship between diet quality and household size was not significant for the chi-square test but it was significant in the logistic regression model. Those with a household size of 1 to 2 were 0.2 times less likely [*95% CI* = 0.45, 0.94] to have a diet quality of not at all healthy/somewhat healthy compared to those with five or more in the household. All other relationships were not significant, see table 6 for logistic regression statistics.

Table 6

Parameter Estimates and Odds Ratios for Diet Quality and Fruit and Vegetable Score Measures

	Not Healthy at All/Somewhat Healthy		
Independent Variables	*B*	*S.E.*	*OR (95%CI)*
Sex			
Male	0.15	0.60	1.16(0.37-3.68)
Female	.	.	.
Education			
High school or equivalent	-0.57	0.93	0.56 (0.91-3.51)
Some college or associates degree	2.08	0.78	1.89 (0.56-6.41)*
Bachelor's degree	0.63	0.62	1.89 (0.56-6.41)
Post bachelor's degree	.	.	.
Income			
Less than $20,000	0.48	0.85	1.62 (0.31-8.48)
$21,000 to $59,999	0.15	0.73	1.16 (0.28-4.86)
$60,000+	.	.	.
Marital Status			
Not married	-0.72	0.68	0.49 (0.13-1.84)
Married or domestic partnership	.	.	.
Race			
Other including Asian	-1.04	0.98	0.36 (0.05-2.40)
Black	-0.50	0.65	0.61 (0.17-2.15)
White	.	.	.
Household size			
1 to 2	-1.60	0.78	0.20 (0.04-0.94)*
3 to 4	-1.31	0.77	0.27 (0.06-1.23)
5+	.	.	.
Fruit and Vegetable Score - Work			
Poor/Fair	1.67	0.77	5.31 (1.18-23.53)*
Good/Excellent	.	.	.
Fruit and Vegetable Score - Home			
Poor/Fair	1.50	0.99	4.47 (0.64-31.19)
Good/Excellent	.	.	.
Fruit and Vegetable Score - Overall			
Poor/Fair	-0.05	0.77	0.95 (0.21-4.30)
Good/Excellent	.	.	.

*Note: B= Parameter Estimate, S.E.= Standard Error, OR= Odds Ratio 95%, CI= 95% Confidence Interval, *= p=≤ .05*

Discussion

This study aimed to investigate the relationship between diet quality and the food environment measures of the number of fast-food outlets and grocery stores within a 15-minute drive of home and work and availability, cost, selection, and accessibility of fruits and vegetables. It was found that a work area fruit and vegetable score of poor/fair was related with a poorer diet quality, compared to those with a rating of good/excellent. Similarly, individuals who had 1 to 7 fast food outlets within a 15-minute drive of their home were more likely to have a poorer diet quality, compared to those with 8 or more fast food outlets. Which is an interesting finding because other researchers have found that greater exposure relates to a lower diet quality (Algur et al., 2023; Burgoine et al., 2014; Liu et al., 2020; Thornton et al., 2009). No other food environment measures showed significant relationships with diet quality, whereas demographic factors such as education level and household size did.

Specifically, individuals with some college education or an associate’s degree were more likely to report poorer diet quality compared to those with post-bachelor's degree education. This finding aligns with Vogel and colleagues (2017) who found higher education to be a protective factor in poorer food environments. Individuals with a household size of 1 to 2 were less likely to have a poorer diet quality when compared to those with a household size of 5 or more. While other variables were not statistically significant there are some results that warrant discussion.

Examining the relationship between the number of grocery stores within a 15-minute drive of home, it was observed that the absence of grocery stores nearly reached statistical significance. This would mean that those with zero grocery stores within a 15-minute drive of home were less likely to have a diet quality of poor/fair compared to those with 3 to 4 grocery stores. Other authors have found similar results, where some people may travel further to a grocery store or go outside of their neighborhood (Goodman et al., 2020; Janda et al., 2022) and this may be associated with higher fruit and vegetable consumption (Pitts et al., 2018).

Interestingly, none of the participants reported having more than 5 grocery stores within a 15-minute drive of their home or work and no participants had zero fast food outlets near their home. When comparing diet quality ratings there was not a reportable difference between those who rated their diet quality as not healthy/somewhat healthy and healthy/very healthy for good/excellent fruit and vegetable scores for home and work. This suggests that how individuals utilize the food environment may be more influential on diet quality than the availability of healthy options.

Some researchers have found that the influence of the food environment on diet is contingent on actual usage, with this association being particularly notable within a 3-mile area (Glickman et al., 2021; McGuirt et al., 2018). Chen and Yang (2014) found that similar results, where areas with more fast-foods outlets had more healthy tweets. Alternatively, they also found that even when there was a low number of fast-food outlets around people still consumed fast food. These findings suggest that individual intentions and food choices may play a significant role in dietary outcomes rather than the sole influence of the food environment.

This work found that many of the measures were not significantly related to diet quality. This is similar to work by Heet al., (2012), Park et al., (2013), and Pitts et al., (2018) where food environment measures were not significantly related to diet. The findings of this study regarding fast-food outlet access being associated with diet quality is reflected by findings from other authors where higher exposure or accessibility to fast-food outlets is associated with a lower diet quality either due to a higher consumption of fast-food (Algur et al., 2023; Burgoine et al., 2014; Liu et al., 2020; Moore et al., 2009; Rummo et al., 2015; Thornton et al., 2009) or due to a lower consumption of fruit and vegetables (Dunaway et al., 2017). Although there have been mixed results where higher counts of fast-food outlets were associated with a higher diet quality (Mackenbach et al., 2023).

This study did not find an association between grocery store availability and diet quality measures. Contrary to findings by other researchers where higher grocery store access was associated with higher fruit and vegetable consumption (Althoff et al., 2022) and lower densities of supermarkets and fresh produce stands, availability of fruits and vegetables, and distance to a supermarket were associated with lower fruit and vegetable consumption (Duran et al., 2016).

This study found work area fruit and vegetable score and the number of fast-food restaurants in a 15-minute drive of the home were significantly related to diet, while all other variables were non-significant. This provides further evidence that the food environment around the workplace and home impact an individual's diet. This information can be used to assist in creation of healthier food environments. Such that fast-food outlets are further from residential areas and grocery stores or other food retail outlets offering fruits and vegetables are accessible in residential and commercial areas.

Strengths of this study include its comprehensive examination of the food environment surrounding both home and workplace in relation to diet quality. The workplace food environment, often overlooked, is crucial given the amount of time individuals spend there during the week. Additionally, this study being completed in two parts allowed for the survey to be updated for better readability by participants and improvement of questions. This study was limited in variation of participants with data collection being limited due to the COVID-19 pandemic. The data collection period being during the beginning of COVID-19 lockdowns and after lockdowns may not give an accurate representation of the relationship of the food environment around the workplace and home and diet.

REFERENCES

Algur, Y., Rummo, P. E., McAlexander, T. P., de Silva, S. S. A., Lovasi, G. S., Judd, S. E., Ryan, V., Malla, G., Koyama, A. K., Lee, D. C., Thorpe, L. E., & McClure, L. A. (2023). Assessing the association between food environment and dietary inflammation by community type: A cross-sectional REGARDS study. *International Journal of Health Geographics*, *22*. https://link.springer.com/article/10.1186/s12942-023-00345-4

Althoff, T., Nilforoshan, H., Hua, J., & Leskovec, J. (2022). Large-scale diet tracking data reveal disparate associations between food environment and diet. *Nature Communications*, *13*. https://doi.org/10.1101/2020.09.29.20204099

Ambikapathi, R., Shively, G., Leyna, G., Mosha, D., Mangara, A., Patil, C. L., Boncyk, M., Froese, S. L., Verissimo, C. K., Kazonda, P., Mwanyika-Sando, M., Killewo, J., & Gunaratna, N. S. (2021). Informal food environment is associated with household vegetable purchase patterns and dietary intake in the DECIDE study: Empirical evidence from food vendor mapping in peri-urban Dar es Salaam, Tanzania. *Global Food Security*, *28*. https://doi.org/10.1016/j.gfs.2020.100474

Black, C., Moon, G., & Baird, J. (2014). Dietary inequalities: What is the evidence for the effect of the neighbourhood food environment? *Health Place*, *27*, 229–242. https://doi.org/doi:10.1016/j.healthplace.2013.09.015

Burgoine, T., Forouhi, N. G., Griffin, S. J., Wareham, N. J., & Monsiviais, P. (2014). Associations between exposure to takeaway food outlets, takeaway food consumption, and body weight in Cambridgeshire, UK: population based, cross sectional study. *BMJ*, *348*. https://doi.org/10.1136%2Fbmj.g1464

Caldwell, E. M., Kobayashi, M. M., DuBow, W. M., & Wytinck, S. M. (2009). Perceived access to fruits and vegetables associated with increased consumption. *Public Health Nutrition*, *12*(10). https://doi.org/10.1017/S1368980008004308

Charoenbut, P., Klaewkla, J., Srisorrachatr, S., Arphorn, S., & Wijitwanna, S. (2018). Workplace and individual factors influence eating practices of Thai factory workers. *Malaysian Journal of Nutrition*, *24*(3), 417–426.

Chen, X., & Yang, X. (2014). Does food environment influence food choices? A geographical analysis through “tweets.” *Applied Geography*, *51*, 82–89. http://dx.doi.org/10.1016/j.apgeog.2014.04.003 0143-6228/

Downs, S. M., Ahmed, S., Fanzo, J., & Herforth, A. (2020). Food environment typology: Advancing an expanded definition, framework, and methodological approach for improved characterization of wild, cultivated, and built food environments toward sustainable diets. *Foods*, *9*(4). https://doi.org/10.3390/foods9040532

Dunaway, L. F., Carton, T., Ma, P., Mundorf, A. R., Keel, K., & Theall, K. P. (2017). Beyond food access: The impact of parent-, home-, and neighborhood-level factors on children’s diets. *International Journal of Environmental Research and Public Health*, *14*(6). https://doi.org/10.3390/ijerph14060662

Duran, A. C., de Almeida, S. L., Latorre, Mdo. R., & Jaime, P. C. (2016). The role of the local retail food environment in fruit, vegetable and sugar-sweetened beverage consumption in Brazil. *Public Health Nutrition*, *19*(6), 1093–1102. https://doi.org/10.1017/S1368980015001524

General food environment resources. (2014). Centers for Disease Control and Prevention. https://www.cdc.gov/healthyplaces/healthtopics/healthyfood/general.htm

Glickman, A. R., Clark, J. K., & Freedman, D. A. (2021). A relational approach to evaluate food environments finds that the proximate food environment matters for those who use it. *Health Place*, *69*. https://doi.org/doi:10.1016/j.healthplace.2021.102564

Goodman, M., Thomson, J., & Landry, A. (2020). Food environment in the Lower Mississippi Delta: Food deserts, food swamps and hot spots. *International Journal of Environmental Research and Public Health*, *17*. https://doi.org/doi:10.3390/ijerph17103354

Harper, K., Caulfield, L. E., Lu, S. V., Mmari, K., & Gross, S. M. (2022). Diet quality and contextual factors influencing food choice among adolescents with food security and food insecurity in Baltimore City. *Nutrients*, *14*(21). https://doi.org/10.3390/nu14214573

He, M., Tucker, P., Gilliland, J., Irwin, J. D., Larsen, K., & Hess, P. (2012). The influence of local food environments on adolescents' food purchasing behaviors. *International Journal of Environmental Research and Public Health*, *9*(4), 1458–1471. https://doi.org/10.3390/ijerph9041458

He, M., Tucker, P., Irwin, J. D., Gilliland, J., Larsen, K., & Hess, P. (2012). Obesogenic neighborhoods: The impact of neighbourhood restaurants and convenience stores on adolescents' food consumption behaviours. *Public Health Nutrition*, *15*(12). https://doi.org/10.1017/S1368980012000584

James, P., Seward, M. W., O'Malley, A. J., Subramanian, S., & Block, J. P. (2017). Changes in the food environment over time: Examining 40 years of data in the Framingham Heart Study. *International Journal of Behavioral Nutrition and Physical Activity*, *14*. https://doi.org/10.1186/s12966-017-0537-4

Janda, K. M., Salvo, D., Ranjit, N., Hoelscher, D. M., Nielsen, A., Lemoine, P., Casnovsky, J., & van den Berg, A. (2022). Who shops at their nearest grocery store? A cross-sectional exploration of disparities in geographic food access among a low-income, racially/ethnically diverse cohort in central Texas. *Journal of Hunger & Environmental Nutrition*. https://doi.org/DOI: 10.1080/19320248.2022.2128962

Jilcott, S. B., Laraia, B. A., Evenson, K. R., & Ammerman, A. S. (2009). Perceptions of the community food environment and related influence on food choice among midlife women residing in rural and urban areas: A qualitative analysis. *Women & Health*, *49*, 164–180. https://doi.org/10.1080/03630240902915085

Kegler, M. C., Alcantara, I., Haardorfer, R., Gazmararian, J. A., Ballard, D., & Sabbs, D. (2014). The influence of home food environments on eating behaviors of overweight and obese women. *Context*, *46*(3), 188–196. https://doi.org/10.1016/j.jneb.2014.01.001

Lachat, C., Nago, E., Verstraeten, R., Roberfroid, D., Van Camp, J., & Kolsteren, P. (2012). Eating out of home and its association with dietary intake: A systematic review of the evidence. *Obesity Reviews*, *13*, 329–346. https://doi.org/doi: 10.1111/j.1467-789X.2011.00953.x

Lassen, A. D., Thorsen, A. V., Sommer, H. M., Fagt, S., Trolle, E., Biltoft-Jensen, A., & Tetens, I. (2011). Improving the diet of employees at blue-collar worksites: Results from the "Food at Work" intervention study. *Public Health Nutrition*, *14*(6), 965–974. https://doi.org/10.1017/S1368980010003447

Liu, B., Widener, M., Burgoine, T., & Hammond, D. (2020). Association between time-weighted activity space-based exposures to fast food outlets and fast food consumption among young adults in urban Canada. *International Journal of Behavioral Nutrition and Physical Activity*, *17*. https://doi.org/10.1186/s12966-020-00967-y

Mackenbach, J. D., Widener, M. J., van der Gaag, E., & Pinho, M. G. M. (2023). Survey-derived activity space-based exposures to fast food outlets and their cross-sectional associations with use of fast food outlets, diet quality and BMI. *Health & Place*, *79*. https://doi.org/10.1016/j.healthplace.2023.102966

McGuirt, J. T., Pitts, S. B. J., & Gustafson, A. (2018). Association between spatial access to food outlets, frequency of grocery shopping, and objectively-assessed and self-reported fruit and vegetable consumption. *Nutrients*, *10*(12). https://doi.org/10.3390/nu10121974

Moore, L. V., Diez-Roux, A. V., Nettleton, J. A., Jacobs, D. R., & Franco, M. (2009). Fast food consumption, diet quality, and neighborhood exposure to fast food. *American Journal of Epidemiology*, *170*(1), 29–36. https://doi.org/10.1093/aje/kwp090

Park, S., Choi, B. Y., Wang, Y., Colantuoni, E., & Gittelsohn, J. (2013). School and neighborhood nutrition environment and their association with students' nutrition behaviors and weight status in Seoul, South Korea. *Journal of Adolescent Health*, *53*, 655–662. http://dx.doi.org/10.1016/j.jadohealth.2013.06.002

Pitt, E., Gallegos, D., Comans, T., Cameron, C., & Thornton, L. (2017). Exploring the influence of local food environment on food behaviours: A systematic review of qualitative literature. *Public Health Nutrition*, *20*(13), 2393–2405. https://doi.org/10.1017/S1368980017001069

Pitts, S. B. J., Wu, Q., McGuirt, J. T., Sharpe, P. A., & Rafferty, A. P. (2018). Impact on dietary choices after discount supermarket opens in low-income community. *Journal of Nutrition Education and Behavior*, *50*(7). https://doi.org/10.1016/j.jneb.2018.03.002

Pitts, S. B. J., Wu, Q., Truesdale, K. P., Haynes-Maslow, L., McGuirt, J. T., Ammerman, A., Bell, R., & Laska, M. N. (2018). One-year follow-up examination of the impact of the North Carolina healthy food small retailer program on healthy food availability, purchases, and consumption. *International Journal of Environmental Research and Public Health*, *15*(12). https://doi.org/10.3390/ijerph15122681

Rideout, K., Mah, C. L., & Minaker, L. (2015). Food environments: An introduction for public health practice. *National Collaborating Centre for Environmental Health*. https://www.ncceh.ca/sites/default/files/Food_Environments_Public_Health_Practice_Dec_2015.pdf

Rummo, P. E., Meyer, K. A., Boone-Heinonen, J., Jacobs, D. R., Kiefe, C. I., Lewis, C. E., Steffen, L. M., & Gordon-Larsen, P. (2015). Neighborhood availability of convenience stores and diet quality: Findings from 20 years of follow-up in the Coronary Artery Risk Development in Young Adults study. *American Journal of Public Health*, *105*(5). https://doi.org/10.2105/ AJPH.2014.302435

Sharkey, J. R., Johnson, C. M., & Dean, W. R. (2010). Food access and perceptions of the community and household food environment as correlates of fruit and vegetable intake among rural seniors. *BMC Geriatrics*, *10*. https://bmcgeriatr.biomedcentral.com/articles/10.1186/1471-2318-10-32

Tabak, R., Hipp, J. A., Dodson, E. A., Yang, L., Adlakha, D., & Brownson, R. C. (2016). Exploring associations between perceived home and work neighborhood environments, diet behaviors, and obesity: Results from a survey of employed adults in Missouri. *Preventive Medicine Reports*, *4*, 591–596. https://doi.org/10.1016/j.pmedr.2016.10.008

Thornton, L. E., & Kavanagh, A. (2012). Association between fast food purchasing and the local food environment. *Nutrition and Diabetes*, *2*, 1–6. https://doi.org/10.1038/nutd.2012.27

Thornton, L. E., Bentley, R. J., & Kavanagh, A. M. (2009). Fast food purchasing and access to fast food restaurants: A multilevel analysis of VicLANES. *International Journal of Behavioral Nutrition and Physical Activity*, *6*(28). https://doi.org/10.1186/1479-5868-6-28

Thornton, L. E., Lamb, K. E., & Ball, K. (2013). Employment status, residential and workplace food environments: Associations with women's eating behaviours. *Health & Place*, *24*, 80–89. http://dx.doi.org/10.1016/j.healthplace.2013.08.006

Thornton, L. E., Pearce, J. R., Macdonald, L., Lamb, K. E., & Ellaway, A. (2012). Does the choice of neighbourhood supermarket access measure influence associations with individual-level fruit and vegetable consumption? A case study from Glasgow. *International Journal of Health Geographics*. https://doi.org/10.1186/1476-072X-11-29

Timperio, A., Crawford, D., Leech, R. M., Lamb, K. E., & Ball, K. (2018). Patterning of neighbourhood food outlets and longitudinal associations with children's eating behaviours. *Preventative Medicine*, *111*, 248–253. https://doi.org/10.1016/j.ypmed.2018.03.003

Turner, C., Aggarwal, A., Walls, H., Herforth, A., Drewnowski, A., Coates, J., Kalamatianou, S., & Kadiyala, S. (2018). Concepts and critical perspectives for food environment research: A global framework with implications for action in low and middle income countries. *Global Food Security*, *18*, 93–101. https://doi.org/10.1016/j.gfs.2018.08.003

Vogel, C., Lewis, D., Ntani, G., Cummins, S., Cooper, C., Moon, G., & Baird, J. (2017). The relationship between dietary quality and the local food environment differs according to level of educational attainment: A cross-sectional study. *PLoS One*, *12*(8). https://doi.org/10.1371/journal.pone.0183700

Zhao, P., Kwan, M., & Zhou, S. (2018). The uncertain geographic context problem in the analysis of the relationship between obesity and the built environment in Guangzhou. *International Journal of Environmental Research and Public Health*, *15*. https://doi.org/doi:10.3390/ijerph15020308

APPENDICES

Appendix A: Survey

<u>Information and Disclosure Section</u>

1. **Purpose**: This research project is designed to help us evaluate the relationship between perceived food environment and diet quality.

2. **Description**: This survey asks questions about perceived food environment and diet quality. The study is focused on those who live in Rutherford county and will take about 15-20 minutes.

3. **Duration**: The whole activity should take about __15-20__ minutes. The participants will not be compensated. The subjects must take at least __15-20___ minutes to complete the study.

Here are your rights as a participant:
Your participation in this research is voluntary. You may skip any item that you don't want to answer, and you may stop the experiment at any time (but see the note below) If you leave an item blank by either not clicking or entering a response, you may be warned that you missed one, just in case it was an accident. But you can continue the study without entering a response if you didn't want to answer any questions. Some items may require a response to accurately present the survey.

4. **Risks & Discomforts:** There will be no risks beyond that of normal daily life.

5. **Benefits:** The participant will learn about research through participation.

6. Identifiable Information: You will NOT be asked to provide identifiable personal information.

7. **Compensation: There is no compensation for participating in this study**

8. Confidentiality. All efforts, within reason, will be made to keep your personal information private but total privacy cannot be promised. Your information may be shared with MTSU or the government, such as the Middle Tennessee State University Institutional Review Board, Federal Government Office for Human Research Protections, *if* you or someone else is in danger or if we are required to do so by law.

9. **Contact Information.** If you should have any questions about this research study or possibly injury, please feel free to contact Nickie Detomasi by telephone 775-217-3993 or by email nd3n@mtmail.mtsu.edu OR my faculty advisor, Angela Bowman, at angie.bowman@mtsu.edu. You can also contact the MTSU Office of compliance via telephone (615 494 8918) or by email (compliance@mtsu.edu). This contact information will be presented again at the end of the experiment.
STATEMENT BY PERSON AGREEING TO PARTCIPATE IN THIS STUDY I have read the above informed consent document pertaining to the above identified research. The research procedures are clear to me. I confirm I am 18 years or older. I am aware of the potential risks of the study. I affirm that I freely and voluntarily choose to participate in

this study. I understand I can withdraw from this study at any time without facing any consequences.

Yes, I consent

No, I do not consent

1. Do you live in the middle Tennessee area? This includes Stewart, Montgomery, Robertson, Sumner, Macon, Clay, Houston, Dickson, Cheatham, Davidson, Wilson, Trousdale, Smith, Jackson, Overton, Putnam, DeKalb, Cannon, Rutherford, Williamson, Hickman, Humphreys, Warren, Van Buren, White, Grundy, Coffee, Bedford, Marshall, Maury, Lewis, Perry, Wayne, Lawrence, Giles, Lincoln, Moore, and Franklin counties?
    a. Yes
    b. No
2. What is your age? (drop down in Qualtrics)
3. What is your sex?
    a. Male
    b. Female
    c. Intersex
4. What is your marital status?
    a. Single (never married)
    b. Married or in a domestic partnership
    c. Widowed
    d. Separated
    e. Divorced
5. What is your race?
    a. White
    b. Black or African American
    c. Asian
    d. Other not listed
6. Are you of Hispanic decent?
    a. Yes
    b. No
7. What is the highest level of school you have completed?
    a. Less than high school
    b. High school or equivalent
    c. Some college (no degree) or Associates degree
    d. Bachelor's degree
    e. Post bachelor's degree (e.g. graduate or professional school)
8. What is your current employment status?
    a. Employed
    b. Unemployed
    c. Student
    d. Retired
9. What is your weight in pounds? (drop down in Qualtrics)
10. What is your height in feet and inches? (drop down in Qualtrics)
11. What is your current household income level?
    a. Less than $20,000

b. $21,000 to $39,999
c. $40,000 to $59,999
d. $60,000 to $79,999
e. $80,000 to $100,999
f. $101,000 to $120,999
g. Over $121,000

12. How many people currently live in your household?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5
    f. 6 or more
13. What is your home zip code? (Fill in)
14. What is your work zip code? (Fill in)
15. How healthy do you considered your overall diet to be?
    a. Not healthy at all
    b. Somewhat healthy
    c. Healthy
    d. Very healthy
16. On average how many meals a day do you eat vegetables? (e.g. leafy greens, broccoli, tomatoes, squash etc.)
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4 or more
17. On average how many meals a day do you eat fruit? (e.g. apples, orange, berries, bananas etc.)
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4 or more
18. How many meals a week do you normally eat chicken?
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
19. How many meals a week do you normally eat turkey?
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6

    e. 7-8
    f. More than 8

20. How many meals a week do you normally eat beef?
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
21. How many meals a week do you normally eat pork?
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
22. How many meals a week do you normally eat fish?
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
23. How many meals a week do you normally eat a plant source for your protein? (e.g. soy products, plant-based protein powders, beans etc.)
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
24. How many meals a week do you normally eat processed meats? (e.g. lunch meats, hot dogs, bacon, cured meats etc.)
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
25. How many meals a week do you normally eat dairy products? (cheese, milk, butter etc.)
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8

26. How many meals a week do you normally eat eggs?
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
27. How many meals (including snacks) a week do you normally eat processed snack foods? (e.g. chips, snack cakes, crackers etc.)
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
28. How many times per week do you eat baked goods? (including bread, cake, muffins etc.)
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
29. How many meals a week do you normally eat fried foods? (e.g. fried chicken, okra, French fries etc.)
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
30. How many meals a week do you normally eat out? (e.g. at a fast food or sit down restaurant, not including eating a homemade meals at a friends or family members house)
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. 7-8
    f. More than 8
31. How many times a day do you normally eat home-cooked meals?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4 or more

32. How many times a day do you normally eat pre-made meals? (e.g. to go meals from a grocery store or purchased meal prep, not including leftovers or meal prep made at home)
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4 or more
33. When you eat out is it more often while you are at work or home?
    a. Work
    b. Home
34. When eating out is eating fruits or vegetables a priority?
    a. Rarely
    b. Sometimes
    c. Most of the time
    d. Almost always
35. When eating out how much do you usually spend on a meal? (Only including yourself)
    a. Less than $5.00
    b. $5.01 to $9.99
    c. $10.00 to $14.99
    d. $15.00 to $19.99
    e. Over $20.00
36. How easy is it to purchase fruits and vegetables when eating out?
    a. Very difficult
    b. Difficult
    c. Easy
    d. Very easy
37. What do you think about the number of restaurants within 15 minute drive of your home? (including fast food and sit down)
    a. There's too many
    b. There's not enough
    c. There's the right amount
38. What do you think about the number of grocery stores within 15 minute drive of your home? (This does not include convenience stores)
    a. There's too many
    b. There's not enough
    c. There's the right amount
39. How many grocery stores are about 15 minutes driving from your home? This does not include convenience stores.)
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. More than 6
40. How many fast-food restaurants are about 15 minute drive from your home?
    a. 0

b. 1-3
c. 4-7
d. 8-10
e. More than 10

41. What do you think about the number of restaurants within 15 minutes driving of your work? (Both fast food and sit down.)
    a. There's too many
    b. There's not enough
    c. There's the right amount
42. What do you think about the number of grocery stores within 15 minutes driving of your work? (This does not include convenience stores.)
    a. There's too many
    b. There's not enough
    c. There's the right amount
43. How many grocery stores are about 15 minutes driving from your work?
    a. 0
    b. 1-2
    c. 3-4
    d. 5-6
    e. More than 6
44. How many fast food restaurants are about 15 minute drive from your work?
    a. 0
    b. 1-3
    c. 4-7
    d. 8-10
    e. More than 10
45. Do you do most of your grocery shopping closer to your work or home? (skip if C)
    a. Home
    b. Work
    c. I don't do the grocery shopping
46. What's the main reason you choose to shop at your primary grocery store?
    a. Good prices
    b. Close to home
    c. Close to work
    d. Good selection of foods
47. Is where you shop the most and where you buy the most food the same place?
    a. Yes
    b. No
    c. I'm not sure
48. How much do you usually spend at the grocery store for the entire household on a normal grocery trip?
    a. Less than $50.00
    b. $50.01 to $75.00
    c. $75.01 to $125.00
    d. $125.01 to $175.00
    e. $175.01 to $225.00

f. Over $230.00

49. When grocery shopping, is buying fruits or vegetables a priority?
    a. Rarely
    b. Sometimes
    c. Most of the time
    d. Almost always
50. How long does it take you to get to your regular grocery store?
    a. Less than 10 minutes
    b. 11 to 15 minutes
    c. 16 to 20 minutes
    d. 21 to 25 minutes
    e. 26 to 30 minutes
    f. More than 30 minutes
51. Do you do most of the grocery shopping for your household?
    a. Yes
    b. No
52. Do you ever order your groceries online to pick up?
    a. Yes
    b. No
53. Do you ever have your groceries delivered?
    a. Yes
    b. No
54. How often do you buy groceries from a convenience store or gas station?
    a. Rarely
    b. Sometimes
    c. Most of the time
    d. Almost always
55. How easy is it to purchase fruits and vegetables when grocery shopping?
    a. Very difficult
    b. Difficult
    c. Easy
    d. Very easy

Please answer the following questions.

	Excellent	Good	Fair	Poor
55.How would you rate the availability of fruits and vegetables in your household?				
56.How would you rate the availability of fruits and vegetables in the area that you live? (area is 1 mile walking distance or about a 15 minute drive)				
57.How would you rate the availability of fruits and vegetables in the area that you work? (area is 1 mile walking distance or about a 15 minute drive)				
62.How would you rate the selection of fruits and vegetables in the area that you live?				

63.How would you rate the selection of fruits and vegetables in the area that you work?				
64.How would you rate the selection of fruits and vegetables when eating at a fast food restaurant?				
65.How would you rate the selection of fruits and vegetables when eating as a sit-down restaurant?				
66.How would you rate the prices of fruits and vegetables in the area that you live?				
67.How would you rate the prices of fruits and vegetables in the area that you work?				
68.How would you rate the accessibility of fresh food in the area that you live? (e.g. fresh fruits, fresh vegetables, fresh meats, or fresh baked goods etc.)				
69.How would you rate the accessibility of fresh food in the area that you work?				
70.How would you rate the grocery selection in the area that you live?				
71.How would you rate the grocery store selection in the area that you work?				

Appendix B: IRB Approval

IRB

INSTITUTIONAL REVIEW BOARD

Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129
FWA: 00005331/IRB Regn.. 0003571

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN007 – EXEMPTION DETERMINATION NOTICE

Thursday, March 11, 2021

Protocol Title	***Perceptions of food environment and diet quality in middle Tennessee***
Protocol ID	**21-1127 2q**
Principal Investigator	**Nickie Brillon** (Student)
Faculty Advisor	Angela Bowman
Co-Investigators	NONE
Investigator Email(s)	*ncf3n@mtmail.mtsu.edu; angela.bowman@mtsu.edu*
Department/Affiliation	Health and Human Performance

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category ***(2) Educational Tests, surveys, interviews or observations of public behavior*** *(Qualtrics Surveys)*. A summary of the IRB action and other particulars of this protocol are shown below:

IRB Action	**EXEMPT from further IRB Review** Exempt from further continuing review but other oversight requirements apply
Date of Expiration	6/30/2022 *Date of Approval:* **3/11/21** *Recent Amendment:* none
Sample Size	One thousand (1,000)
Participant Pool	**Healthy adults (18 or older) - Living in Middle Tennessee**
Exceptions	Online consent followed by internet-based survey using Qualtrics is permitted (Qualtrics links on file).
Type of Interaction	☐ Non-interventional or Data Analysis ☒ Virtual/Remote/Online Interview/survey ☐ In person or physical– Mandatory COVID-19 Management (refer next page)
Mandatory Restrictions	**1. All restrictions for exemption apply.** **2. The participants must be 18 years or older.** **3. Mandatory ACTIVE informed consent. Identifiable information including, names, addresses, voice/video data, must not be obtained.** **4. NOT approved for in-person data collection.**
Approved IRB Templates	*IRB Templates:* Recruitment Email and Online Informed Consent *Non-MTSU Templates:* NONE
Research Inducement	NONE
Comments	NONE

Chapter 4: Comparing the Perceived and Observed Food Environment of a Southeastern Metro Area

Introduction

The food environment can have a significant impact on people's food choices and purchases by offering healthy or unhealthy food (Pitt et al., 2017; Rideout et al., 2015), thus impacting diet quality. Over the years, the food environment in the United States has undergone significant changes. With there being 201,865 fast-food restaurants and a continuous increase in full-service restaurants, grocery stores, convenience stores, and other food outlets (*Fast Food Restaurants in the US - Number of Businesses 2005-2029*, 2023; James et al., 2017) the food environment is ever changing and food is highly accessible.

This increase in highly accessible food is mostly ultra processed foods such as chips, sugar-sweetened beverages, confectionary, nuggets, and sticks (Monterio et al., 2013). These foods are often low in fiber, vitamins and minerals, but high in fat, sugar, and salt (Crino et al., 2015; Monterio et al., 2013; Moubarac et al., 2017; Poti et al., 2017). This increase in availability of food away from home leads to an increase in consumption of these foods, primarily fast-food (Saksena et al., 2018) which U.S. adults get about one quarter of their calories from (Lachat et al., 2012). In the United States, about 70% of the calories that are consumed come from packaged foods, which are often ultra processed. Consumption of these foods is related to a poorer diet quality and increased weight (Lacko et al., 2020).

This general abundance of food in various settings coupled with advertisements, promotions and new types of foods within the food environment add a certain complexity to food choice (Dawson, 2013; Guine et al., 2020). Food choice is influenced by convenience, cost, health, taste, time, consumption context, and knowledge and beliefs surrounding food (Darmon & Drewnowski, 2015; Kaya, 2016; Vilaro et al., 2016). A closer proximity of fast-food outlets has been found to increase high energy snack intake whereas a closer proximity to a supermarket leads to an increase of low energy snacks. The inside of a store can influence purchases, impulse buys occurring at point of purchase primarily consist of sugar-sweetened beverages, sweets, and salty snacks (Ruff et al., 2016). Having these easy access points to certain foods is a clear influence on consumption.

The consensus of the food environment literature is that it has an impact on diet and food choice. The impact that it can have can vary depending on various factors such as education. Poorer food environments have been associated with a better diet quality among mothers with degrees (Vogel et al., 2017). Sex has been found to be a factor in areas like food swamps and food deserts where consuming snacks and desserts was more likely for girls (Hager et al., 2017). Other aspects such as social dynamics (Harper et al., 2022; Santiago-Torres et al., 2014), distance (Jago et al., 2007; Lamichhane et al., 2012; Lorts et al., 2019; Sharkey et al., 2011; Wedick et al., 2015), accessibility and availability (Althoff et al., 2022; Duran et al., 2016; Pessoa et al., 2015; Siddiqui et al., 2023), and perceptions (Chor et al., 2016; Gao et al., 2022; Martin & McCormack, 2024;

Williams et al., 2010) are all ways the food environment can impact diet. The food environment impacts food choice in similar ways to diet. Things such as accessibility and availability of food (Bibeau et al., 2012; Dhillon et al., 2019; Pradeilles et al., 2021), food preferences (Blake et al., 2023; Devine et al., 2023; Downs et al., 2022), food practices (Blake et al., 2023), cost (Belon et al., 2016; Brown et al., 2019; Kelly et al., 2021), convenience (Bibeau et al., 2012; Devine et al., 2023; Pradeilles et al., 2021), and other aspects.

There is a clear link between food environment and food choice and food environment and diet quality which has been shown by past research. The relationship between food environment, food choice, and diet quality has yet to be examined though. This article will examine the relationship between all three of these factors and aim to answer the research questions of: When controlling for sex, education, household income, marital status, race, household size, sedentary activity, and nicotine use what is the relationship between the perceived food environment, individual food choice, and perceived diet quality? and How does the perceived food environment compare to the observed food environment?

The researcher hypothesize that when controlling for sex, education, household income, marital status, race, household size, sedentary activity, and nicotine use a perceived food environment that is healthier will be associated with food choices driven by ease of access to healthy food and a healthier diet quality and that the perceived food environment will be healthier than the observed food environment.

For this research, the Nutrition Environment Measures Survey-Perceived (NEMS-P): Conceptual Model will be used. This model includes different food environments and their interdependent influences, as well as the effects of these food environments on shopping behavior and the home food environment. This model also considers how eating behaviors are impacted by all those other factors. Other researchers have used this model with the NEMS-P survey (Alber et al., 2018; Martinez-Garcia et al., 2020). Food choice will be assessed within this model (i.e. food choice influences related to shopping and eating behaviors).

Methods

Participants

This study used a convenience sample, *N* = 308. Participants in this study were those that resided in the study area and were 18 years or older. Participants were recruited online via social media, email, and in-person. Those that participated in the survey were asked to pass it along to others. Participants were eligible to be entered into a drawing for one out of ten 20-dollar visa gift cards.

Materials

The questionnaire for this study was created using an adapted version of the Nutrition Environment Measurement Survey-Perceived (NEMS-P) (Green & Glanz, 2015; *Nutritional Environment Measures Survey*, n.d.), Food Choice Questionnaire (FCQ) (Steptoe et al., 1995), and adapted questions from the Palatable Eating Motives Scale (Boggiano, 2016). The NEMS-P measures the community nutrition environment, consumer nutrition environment, eating behaviors, the home food environment, shopping behaviors, psychosocial factors, background characteristics, and the perceived nutrition environment (Green & Glanz, 2015). The FCQ measures factors that influence food choice (Steptoe et al., 1995). The Palatable Eating Motives Scale measures reasons that people may consume highly palatable foods (Boggiano, 2016).

Adaptation of the NEMS-P consisted of modifying the directions and format to match administration of the survey via Qualtrics, “neighborhood near where you live” (defined as area within a 20-minute walk or 10-15 minute drive from your home) was removed because people often shop outside of this boundary (Janda et al., 2022; Sohi et al., 2014; Thornton et al., 2017) instead wording of “when food shopping is used”, questions 1, 8, 24, and 25 were removed, questions question 30b (4b) was modified to match the language of the rest of the survey (from “the fresh produce in my neighborhood is of high quality” to “the fresh fruits and vegetables that are available when food shopping is of high quality”), the wording of questions 35, 42, and 43 (9, 16, and 17) were changed to reflect main mode of transportation rather than walk time because people often do not walk to these locations (Yang et al., 2020), a question was added to number 40 (14) “I use nutrition labels or nutrition information to make food purchase”, for Likert scales that had a neutral option this option was removed (e.g. neither disagree or agree), added to question 55 (29) “non-peeled non-deep fried potatoes” and other food frequency measures, “background questions” and “general household questions” were added to the demographics section or removed.

The Palatable eating Motives Scale created by Boggiano (2016) consists of 20 items representing four motives of eating: coping, reward enhancement, social, and conformity. A question was created based on each question type from the scale measuring the four motives to assess that motive. Steptoe and colleagues (1995) FCQ was used in its entirety with no changes besides adaption to be taken via Qualtrics.

An adapted version of the Nutrition Environment Measurement Survey-Store (NEMS-S) (Glanz et al., 2007; *Nutritional Environment Measures Survey*, n.d.) was used for assessing the in store food environment. This version was adapted by the adding frozen and canned fruit and vegetable measurements from the Nutrition Environment Measurement Survey-Corner Store (NEMS-CS) (Cavanaugh et al., 2013; *Nutritional Environment Measures Survey*, n.d.). Specific brands of juice beverages were added, and the canned and frozen fruit and vegetable section was expanded to include more items. This survey was adapted so that it could be completed via Qualtrics by the researcher. See Appendix A: Participant Survey and Appendix B: In-Store Assessment for full surveys.

Measures

Perceived food environment. Was measured by time it takes to get to primary grocery store and restaurant (fast-food and sit-down), availability, selection, quality, and cost of fruit and vegetables, ease of getting types of foods (fruits and vegetables, lean meats, regular soda, candy and snack chips, and low-fat products), and ease, cost, and labeling of primary restaurant. These variables, except for time to grocery store and restaurant, were turned into scores and these scores were put into categories based on the Likert scale the original question was asked in. For the restaurant score a lower score equates to a healthier food environment. For the fruit and vegetable score and ease of purchasing healthy food score a higher score equates to a healthier food environment. For ease of purchasing unhealthy foods a lower score equates to a healthier food environment. All scores were created by adding up Likert scale scores of the questions and splitting the scores into categories based on possible scores and labeled based on the Likert responses of the questions. For the fruit and vegetable score, cost was reverse scored to reflect a positive rating of cost.

Diet quality. Was measured by a food frequency questionnaire score and perceived overall health of the diet. A higher FFQ score equates to a healthier diet. The FFQ diet score was created by adding together ratings on frequency of consumption of food items. Healthy items (fruit, green salad, nuts/seeds, etc.) were reversed scored to create the score. This was done so that unhealthy items would score negatively.

Food choice. Was measured by Steptoe's Factors that Influence Food Choice questionnaire. A score was created based on Steptoe's scoring method, Steptoe et al., (1995). A higher score in each of the categories indicates a higher propensity to choose foods based on that category.

Observed food environment. Was measured using the adapted NEMS-S and by GIS mapping of the food outlets in Rutherford County.

Store Types. Grocery stores or supermarkets were stores that provide fresh produce, meat, and other food products (Li et al., 2019). These were stores like Kroger, Publix, and Walmart (including Marketplaces). Convenience stores, general stores, and corner stores were those that provide everyday items including groceries like snack foods, confectionary, and soft drinks, along with other products like toiletries, over the counter drugs, magazines, or tobacco products (Xin et al., 2021). These were stores like Dollar General or 7 Eleven.

Store Selection

Grocery stores, convenience stores, and corner stores were selected by a stratified random sampling technique. A list of all grocery stores, convenience stores, and corner stores in Rutherford County was created using Rutherford County Chamber of Commerce data. This list includes the store name, location and an identification number that was used on the store adapted NEMS-S. Stores that were surveyed were selected by assigning them a random number and then randomly sorted in Microsoft Excel. The first 12 randomly sampled stores were selected from each store type category (grocery store, convenience/general store, and gas station/corner store) to be surveyed. The zip codes of the selected stores were examined to assure that Rutherford County was equally represented. To best assess the store environment the store categories were split into grocery stores, convenience/general stores (Dollar General or Dollar Tree), and gas station/corner stores. This was done because many of the corner stores are directed towards beverage or smoking products making them most similar to gas stations.

Procedure

Potential participants were informed of the survey topic food environment, food choice, and diet quality in Rutherford County Tennessee and asked to participate. Participants were given informed consent that followed Middle Tennessee State Universities Institutional Review Board guidelines. If the participants did not consent or did not live in Rutherford County Tennessee, the survey ended, and they were thanked for their time. If they were ineligible (did not consent or did not live in Rutherford County Tennessee) to take the survey, they were not eligible for the drawing. At the end of the survey the participants were able to enter their first name and primary mailing address to be entered into the 20-dollar visa gift card drawing. This was not required. All highly identifiable information was removed from the dataset for analysis.

Food stores were found using Rutherford County Chamber of Commerce data and food restaurants were found using Rutherford County Health Department list of restaurants inspections. Addresses for food outlets were confirmed via a Google search. These addresses were used to create maps to help assess the observed food environment of Rutherford County.

Data Analysis

IBM's SPSS version 29 was used to analyze the data. A logistic regression and chi-square were used to examine the relationship of perceived and observed food environment and individual food choices on diet quality. Descriptive statistics, frequencies, and cross-tabulations were also conducted. Mapping of the grocery store, corner store, convenience store, fast food and sit-down restaurant locations was done via ArcGIS. The address of all food outlets and stores were geocoded and mapped. An a priori power analysis (linear regression) was conducted in SPSS version 29 to assess the needed sample size to ensure that a medium effect size was met. An effect size of 0.5, a significance level of p=0.05 and a power value of 0.8 were used. The analysis resulted in a needed sample size of 67, the obtained sample size of N = 308 was adequate for testing the hypotheses of this study.

Data cleaning included deleting invalid surveys, removing identifiable information, and ensuring responses were valid. Deletion of invalid surveys included deleting those who did not live in the study area, did not consent to taking the survey, and answered less than 25% of the survey questions. Identifiable information such as address and first name were removed, this information was used for distribution of the Visa gift cards. Ensuring responses were valid consisted of the researcher assessing response time and testing for outliers. If the response time was under 8 minutes, the entry was deleted. Missing responses to questions were treated as missing in the dataset.

Results

Demographics

This sample consisted of 308 participants. The average age of participants was 28.1 years old (SD=12.94) with a minimum age of 18 years old and a maximum age of 77 years old. The majority of participants had an education level of some college or an associate's degree 45.4% (138), a household size of 3 to 4 43.8% (131), an income of $34,999 or below 43.2% (127), were White 77.6% (236), female 75.8% (229), sedentary 6 to 9 hours of the day 37.4% (111), never used nicotine 76.5% (231), and never married or single 40.6% (123). For full demographics see Table 1.

Table 1

Demographics

	N	%
Education		
High school equivalent or less	50	16.2
Some college, associates, or 4-year	191	62.0
Graduate or professional degree	63	20.5
Household Size		
1	64	20.8
2	73	23.7
3 to 4	131	42.5
5+	31	10.1
Income		
$34,999 and below	127	41.2
$35,000 to $64,999	51	16.6
$65,000 to $99,999	42	13.6
$100,000+	73	23.7
Race		
Other	44	14.3
Black	24	7.8
White	236	76.6
Sex		
Male	73	23.7
Female	229	74.4
Sedentary hours a day		
0 to 2	40	13.0
3 to 5	97	31.5
6 to 9	111	36.0
10 to 12	34	11.0
13+	15	4.9
Nicotine Use		
Currently uses or has used	71	23.1
Never used	231	75.0
Marital Status		
Not married	214	69.5
Married or living with long term partner	89	28.9

Perceived Food Environment

FFQ diet measure. A chi-square test of independence was performed to examine the relationship between food environment, food choice, and diet quality variables. The relationship between food choice-convenience and diet quality was significant, X^2 (2, N = 308) = 12.05, p = .002. The relationship between food choice-natural content and diet quality was significant, X^2 (2, N = 308) = 22.60, p = < .001. The relationship between food choice-familiarity and diet quality was significant, X^2 (2, N = 308) = 9, p = .011. The relationship between fruit and vegetable score and diet quality was significant, X^2 (4, N = 308) = 9.47, p = .050. The relationship between time to primary sit-down restaurant and diet quality was significant, X^2 (6, N = 308) = 12.97, p = .044. The relationship between education and diet quality was significant, X^2 (4, N = 308) = 9.62, p = .047. The relationship between household size and diet quality was significant, X^2 (2, N = 308) = 12.05, p = .002. The relationship between hours of sedentary activity a day and diet quality was significant, X^2 (8, N = 308) = 17.48, p = .026.

The regression showed that the food choices of convenience and familiarity, fruit and vegetable score, time to primary grocery store, time to primary sit-down restaurant, and marital status were related to diet quality. Those who rated the food choice of familiarity as not at all important/a little important (11.2%) were 0.14 times less likely [*95% CI* = 0.03, 0.63] compared to people who had a rating of moderately important/very important (25.8%) to have a diet quality of poor/fair. Compared to those who had a fruit and vegetable score of very good (6.7%), those with a score of good

(23.6%) were 6.38 times [*95% CI* = 1.53, 26.59] more likely to have a diet quality of poor/fair, and those with a score of not good (28.6%) were 14.43 times [*95% CI* = 1.49, 139.51] more likely to have a diet quality of poor/fair. Those who had a travel time of 10 minutes or less to their primary grocery store (15.6%) were 0.11 times [*95% CI* = 0.01, 0.87] less likely to have a poor/fair diet quality compared to those who were 21 or more minutes away from their primary grocery store (25%). Compared to those who were married or living with a long-term partner (7.7%), those who were single/never married (21.1%) were 9.15 [*95% CI* = 1.24, 67.32] times more likely to have a diet quality of poor/fair.

Those with a food choice-convenience rating of not at all important/a little important (38%) were 6.28 times [*95% CI* = 2.11, 18.65] more likely to have a diet quality score of very good/excellent compared to those who had a rating of important/very important (19.9%). Those with a food choice-natural content rating of not at all important/a little important (16.3%) were 0.13 times [*95% CI* = 1.49, 139.51] less likely to have a diet quality of very good/excellent compared to those who had a rating of moderately important/very important (41.3%). Compared to those who do not eat at sit-down restaurants (47.1%), those whose primary sit-down restaurant was 10 minutes or less away (23.9%) were 0.04 times [*95% CI* = 0.004, 0.47] less likely to have a diet quality of good/excellent, and those whose primary sit-down restaurant was 11 to 20 minutes away (21.4%) were 0.05 times [*95% CI* = 0.01, 0.53] less likely to have a diet quality of good/excellent. For full FFQ regression results see Table 3 and for crosstabulation results see Table 2.

Table 2
Crosstabulations for FFQ Diet Quality Measure and Other Variables

Diet Quality	Poor/Fair	Good	Very Good/Excellent
Food choice			
Convenience			
Not at all important/a little important	9(11.4%)	40(50.6%)	30(38.0%)
Moderately important/very important	32(19.3%)	101(60.8%)	33(19.9%)
Natural content			
Not at all important/a little important	36(23.5%)	92(60.1%)	25(16.3%)
Moderately important/very important	5(5.4%)	49(53.3%)	38(41.3%)
Weight control			
Not at all important/a little important	29(20.3%)	80(55.9%)	34(23.8%)
Moderately important/very important	12(11.8%)	61(59.8%)	29(28.4%)
Sensory appeal			
Not at all important/a little important	11(12.9%)	48(56.5%)	26(30.6%)
Moderately important/very important	30(18.8%)	93(58.1%)	37(23.1%)
Cost			
Not at all important/a little important	2(6.3%)	17(53.1%)	13(40.6%)
Moderately important/very important	39(18.3%)	124(58.2%)	50(23.5%)
Familiarity			
Not at all important/a little important	17(11.2%)	92(60.5%)	43(28.3%)
Moderately important/very important	24(25.8%)	49(52.7%)	20(21.5%)
Ethical Concern			

Not at all important/a little important	36(16.7%)	128(59.5%)	51(23.7%)
Moderately important/very important	5(16.7%)	13(43.3%)	12(40.0%)
Mood			
Not at all important/a little important	16(13.8%)	65(56.0%)	35(30.2%)
Moderately important/very important	25(19.4%)	76(58.9%)	28(21.7%)
Health			
Not at all important/a little important	18(32.1%)	32(57.1%)	6(10.7%)
Moderately important/very important	23(12.2%)	109(57.7%)	57(30.2%)
Restaurant Score			
Healthy	7(15.6%)	24(53.3%)	14(31.1%)
Somewhat healthy	20(14.9%)	85(63.4%)	29(21.6%)
Not healthy	13(20.6%)	31(49.2%)	19(30.2%)
Ease of purchasing food-Healthy			
Not easy	3(15.0%)	11(55.0%)	6(30.0%)
Easy	38(17.2%)	128(57.9%)	55(24.9%)
Ease of purchasing food- Not healthy			
Not easy	1(14.3%)	2(28.6%)	4(57.1%)
Easy	40(17.2%)	135(57.9%)	58(24.9%)
Fruit and vegetable score			
Not good	4(28.6%)	9(64.3%)	1(7.1%)
Good	30(23.6%)	66(52.0%)	31(24.4%)
Very good	7(6.7%)	66(63.5%)	31(29.8%)
Time to primary fast food			
10 minutes or less	30(19.2%)	92(59.0%)	34(21.8%)
11 to 20 minutes	10(15.9%)	37(58.7%)	16(25.4%)
21+ minutes	1(4.0%)	11(44.0%)	13(52.0%)
I do not eat fast food	0	0	0
Time to primary sit down			
10 minutes or less	18(20.5%)	49(55.7%)	21(23.9%)
11 to 20 minutes	18(15.4%)	74(63.2%)	25(21.4%)
21+ minutes	2(8.7%)	12(52.2%)	9(39.1%)
I do not eat sit down	3(17.6%)	6(35.3%)	8(47.1%)
Time to primary grocery store			
10 minutes or less	25(15.6%)	94(58.8%)	41(25.6%)
11 to 20 minutes	12(17.4%)	41(59.4%)	16(23.2%)
21+ minutes	4(25.0%)	6(37.5%)	6(37.5%)
Education			
High school equivalent or less	4(11.4%)	25(71.4%)	6(17.1%)
Some college, associates, or 4-year	31(20.0%)	83(53.5%)	41(26.5%)
Graduate or professional degree	10.9%)	33(60.0%)	16(29.1%)
Household Size			
1	9(18.4%)	30(61.2%)	10(20.4%)
2	11(17.7%)	30(48.4%)	21(33.9%)

3 to 4	17(15.9%)	67(62.6%)	23(21.5%)
5+	2(9.1%)	13(59.1%)	7(31.8%)
Income			
$34,999 and below	18(18.0%)	62(62.0%)	20(20.0%)
$35,000 to $64,999	8(18.6%)	24(55.8%)	11(25.6%)
$65,000 to $99,999	7(21.9%)	16(50.0%)	9(28.1%)
$100,000+	5(8.3%)	36(60.0%)	19(31.7%)
Race			
Other	6(16.7%)	21(58.3%)	9(25.0%)
Black	2(12.5%)	8(50.0%)	6(37.5%)
White	33(17.1%)	112(58.0%)	48(24.9%)
Sex			
Male	7(11.7%)	39(65.0%)	14(23.3%)
Female	33(18.0%)	101(55.2%)	49(26.8%)
Sedentary hours a day			
0 to 2	2(5.9%)	18(52.9%)	14(41.2%)
3 to 5	13(16.7%)	50(64.1%)	15(19.2%)
6 to 9	14(15.7%)	55(61.8%)	20(22.5%)
10 to 12	10(37.0%)	8(29.6%)	9(33.3%)
13+	2(16.7%)	8(66.7%)	2(16.7%)
Nicotine Use			
Currently uses or has used	8(16.7%)	31(64.6%)	9(18.8%)
Never used	33(16.8%)	110(56.1%)	53(27.0%)
Marital Status			
Not married	35(21.1%)	94(56.6%)	37(22.3%)
Married or living with long term partner	6(7.7%)	47(60.3%)	25(32.1%)

Table 3

Parameter Estimates and Odds Ratios for FFQ Diet Quality Measure and Other Variables

Diet Quality	Poor/Fair			Very Good/Excellent		
Independent Variables	*B*	*S.E.*	*OR (95%CI)*	*B*	*S.E.*	*OR (95%CI)*
Food choice						
Convenience						
Not at all important/a little important	0.22	0.79	1.24(0.26-5.89)	1.84	0.56	6.28(2.11-18.65)*
Moderately important/very important	.	.	.	.	.	.
Natural content						
Not at all important/a little important	1.42	0.75	4.16(0.95-18.10)	-2.06	0.58	0.13(0.04-0.40)*
Moderately important/very important	.	.	.	.	.	.
Weight control						
Not at all important/a little important	-0.31	0.74	0.74(0.17-3.15)	-0.81	0.5	0.45(0.17-1.18)
Moderately important/very important	.	.	.	.	.	.
Sensory appeal						
Not at all important/a little important	-1.15	0.86	0.32(0.06-1.7)	0.44	0.53	1.54(0.55-4.38)
Moderately important/very important	.	.	.	.	.	.
Cost						
Not at all important/a little important	-2.09	1.43	0.12(0.01-2.03)	-0.44	0.68	0.64(0.17-2.45)
Moderately important/very important	.	.	.	.	.	.
Familiarity						
Not at all important/a little important	-1.95	0.75	0.14(0.03-0.63)*	0.18	0.55	1.19(0.41-3.49)
Moderately important/very important	.	.	.	.	.	.
Ethical Concern						
Not at all important/a little important	-0.95	0.94	0.39(0.06-2.43)	-0.55	0.74	0.58(0.14-2.45)
Moderately important/very important	.	.	.	.	.	.
Mood						
Not at all important/a little important	0.44	0.73	1.55(0.37-6.48)	0.79	0.56	2.21(0.74-6.66)

Moderately important/very important				.	.	.
Health						
Not at all important/a little important	0.21	0.73	1.24(0.30-5.21)	-1.08	0.83	0.34(0.07-1.73)
Moderately important/very important				.	.	.
Restaurant Score						
Healthy	-0.5	0.95	0.61(0.09-3.91)	0.02	0.66	1.02(0.28-3.76)
Somewhat healthy	-1.11	0.68	0.33(0.09-1.24)	-0.53	0.55	0.59(0.20-1.72)
Not healthy	.	.	.	.	.	.
Ease of purchasing food-Healthy						
Not easy	-0.45	1.29	0.64(0.05-8.09)	-0.05	0.91	0.95(0.16-5.64)
Easy	.	.	.	.	.	.
Ease of purchasing food- Not healthy						
Not easy	-0.73	2.08	0.48(0.01-27.95)	-0.2	1.28	0.82(0.07-10.11)
Easy	.	.	.	.	.	.
Fruit and vegetable score						
Not good	2.67	1.16	14.43(1.49-139.51)*	1.02	1.42	2.77(0.17-44.73)
Good	1.85	0.73	6.38(1.53-26.89)*	0.21	0.52	1.23(0.45-3.39)
Very good	.	.	.	.	.	.
Time to primary fast food						
10 minutes or less	0.9	1.96	2.45(0.05-114.56)	0.02	0.84	1.02(0.20-5.26)
11 to 20 minutes	0.84	1.86	2.32(0.06-89.09)	0.34	0.87	1.42(0.26-7.77)
21+ minutes	.	.	.	.	.	.
I do not eat fast food	0	0	0	0	0	0
Time to primary sit down						
10 minutes or less	-0.2	1.25	0.82(0.07-9.44)	-3.19	1.25	0.04(0.004-0.47)*
11 to 20 minutes	-1.61	1.19	0.20(0.02-2.07)	-2.99	1.21	0.50(0.005-0.53)*
21+ minutes	-2.23	1.62	0.11(0.004-2.58	-2.21	1.21	0.11(0.01-1.16)
I do not eat sit down	.	.	.	.	.	.
Time to primary grocery store						
10 minutes or less	-2.22	1.06	0.11(0.01-0.86)*	-0.65	0.99	0.52(0.08-3.61)
11 to 20 minutes	-1.38	1.07	0.25(0.03-2.06)	-1.09	1.04	0.34(0.04-2.57)
21+ minutes	.	.	.	.	.	.
Education						
High school equivalent or less	-1.76	1.27	0.17(0.01-2.06)	-1.77	1.04	0.17(0.02-1.32)
Some college, associates, or 4-year	0.24	0.88	1.27(0.23-7.07)	0.2	0.61	0.34(0.04-2.57)
Graduate or professional degree	.	.	.	.	.	.
Household Size						
1	1.88	1.57	6.56(0.30-141.96)	-1.62	1.01	0.20(0.03-1.43)
2	2.85	1.57	17.35(0.81-372.55)	0.37	0.82	1.44(0.29-7.23)
3 to 4	1.21	1.54	3.34(0.16-68.53)	-0.54	0.75	0.58(0.13-2.52)
5+	.	.	.	.	.	.
Income						
$34,999 and below	-1.93	1.13	0.15(0.02-1.32)	-0.59	0.78	0.55(0.12-2.57)

$35,000 to $64,999	-1.58	1.18	0.21(0.02-2.08)	-0.15	0.77	0.86(0.19-3.92)
$65,000 to $99,999	-0.05	1.06	0.96(0.12-7.66)	0.06	0.78	1.06(0.23-4.88)
$100,000+	.	.	.	.	.	.
Race						
Other	0.86	1.13	0.15(0.02-1.32)	-0.26	0.69	0.77(0.20-2.98)
Black	-0.81	1.18	0.21(.02-2.08)	0.79	0.89	2.21(0.39-12.62)
White	.	.	.	.	.	.
Sex						
Male	0.18	0.91	1.20(0.20-1.18)	-0.53	0.54	0.59(0.21-1.71)
Female	.	.	.	.	.	.
Sedentary hours a day						
0 to 2	-1.85	1.63	0.16(0.01-3.81)	1.18	1.2	3.24(0.31-34.21)
3 to 5	-0.87	1.28	0.42(0.03-5.15)	-0.35	1.17	0.70(0.07-6.93)
6 to 9	-0.85	1.22	0.43(0.04-4.68)	0.07	1.14	1.07(0.12-10.02)
10 to 12	1	1.46	2.72(0.16-47.53)	2.05	1.32	7.74(0.58-103.00)
13+	.	.	.	.	.	.
Nicotine Use						
Currently uses or has used	-0.73	0.92	0.48(0.08-2.91)	-0.7	0.62	0.50(0.14-1.68)
Never used	.	.	.	.	.	.
Marital Status						
Not married	2.21	1.02	9.15(1.24-67.32)*	0.42	0.67	1.53(0.41-5.71)
Married or living with long term partner	.	.	.	.	.	.

*Note: B= Parameter Estimate, S.E.= Standard Error, OR= Odds Ratio 95%, CI= 95% Confidence Interval, *= p=≤ .05*

Perceived diet quality measure. A chi-square test of independence was performed to examine the relationship between food environment, food choice, and diet quality variables. The relationship between food choice-natural content and diet quality was significant X^2 (2, N = 308) = 19.92, *p* = < .001. The relationship between food choice-health and diet quality was significant X^2 (2, N = 308) = 14.24, *p* = < .001. The relationship between fruit and vegetable score and diet quality was significant X^2 (4, N =

308) = 10.62, *p* = .031. The relationship between household size and diet quality was significant X^2 (6, N = 308) = 15.30, *p* = .018. The relationship between hours of sedentary activity and diet quality was borderline significant X^2 (8, N = 308) = 15.45, *p* = .051.

The regression results showed that compared to those who had a fruit and vegetable score rating of very good (25%) those with a rating of not good were 18.85 times [*95% CI* = 1.49, 237.95] more likely to have a diet quality of poor/fair (73.7%) and those with a rating of good were 2.83 times [*95% CI* = 1.18, 6.78] more likely to have a diet quality of poor/fair (50%). Compared to those who did not eat at sit-down restaurants (31.6%) those who lived less than 10 minutes away from their primary sit-down restaurant (42.4%) were 6.78 times [*95% CI* = 1.01, 45.33] more likely to have a diet quality of poor/fair and those who lived 21 or more minutes away from their primary sit-down restaurant (43.5%) were 8.96 times [*95% CI* = 1.03, 78.30] more likely to have a diet quality of poor/fair.

Those who lived in a single person household (50%) were 8.19 times [*95% CI* = 1.22, 54.87] more likely to have a diet quality of poor/fair compared to those living in a household with 5 or more (32.1%). Compared to those who were sedentary for 13 or more hours a day (61.5%), those who were sedentary for 6 to 9 hours a day (43.5%), 3 to 5 hours a day (40.2%), or 0 to 2 hours a day (30.8%) were less likely to have a diet quality of poor/fair. Those who had a not at all important/a little important rating for food choice-natural content (10.4%) were 0.13 times [*95% CI* = 0.4, 0.45] less likely than those who had a rating of moderately important/important (36.5%) to have a diet quality of very good/excellent. No other relationships were significant, see Table 5 for full perceived diet quality regression results and Table 4 for crosstabulation results.

Table 4
Crosstabulations for Perceived Diet Quality Measure and Other Variables

Diet Quality	Poor/Fair	Good	Very Good/Excellent
Food choice			
Convenience			
Not at all important/a little important	29(32.2%)	38(42.2%)	23(25.6%)
Moderately important/very important	86(46.0%)	68(36.4%)	33(17.6%)
Natural content			
Not at all important/a little important	87(50.3%)	68(39.3%)	18(10.4%)
Moderately important/very important	28(26.9%)	38(36.5%)	38(36.5%)
Weight control			
Not at all important/a little important	70(43.8%)	55(34.4%)	35(21.9%)
Moderately important/very important	45(38.5%)	51(43.6%)	21(17.9%)
Sensory appeal			
Not at all important/a little important	36(36.7%)	35(35.7%)	27(27.6%)
Moderately important/very important	79(44.1%)	71(39.7%)	29(16.2%)
Cost			
Not at all important/a little important	8(22.9%)	12(34.3%)	15(42.9%)
Moderately important/very important	107(44.2%)	94(38.8%)	41(16.9%)
Familiarity			
Not at all important/a little important	63(36.6%)	71(41.3%)	38(22.1%)
Moderately important/very important	52(49.5%)	35(33.3%)	18(17.1%)
Ethical Concern			
Not at all important/a little important	97(40.6%)	96(40.2%)	46(19.2%)
Moderately important/very important	18(50.0%)	9(25.0%)	9(25.0%)
Mood			
Not at all important/a little important	44(33.8%)	54(41.5%)	32(24.6%)
Moderately important/very important	71(48.6%)	52(35.6%)	23(15.8%)
Health			
Not at all important/a little important	43(69.4%)	15(24.2%)	4(6.5%)
Moderately important/very important	72(33.6%)	91(42.5%)	51(23.8%)
Restaurant Score			
Healthy	14(30.4%)	20(43.5%)	12(26.1%)
Somewhat healthy	57(40.7%)	57(40.7%)	26(18.6%)
Not healthy	28(44.4%)	24(38.1%)	11(17.5%)
Ease of purchasing food-Healthy			

Not easy	14(63.6%)	6(27.3%)	2(9.1%)
Easy	95(39.4%)	96(39.8%)	50(20.7%)
Ease of purchasing food- Not healthy			
Not easy	3(37.5%)	1(12.5%)	4(50.0%)
Easy	105(41.5%)	100(39.5%)	48(19.0%)
Fruit and vegetable score			
Not good	14(73.7%)	3(15.8%)	2(10.5%)
Good	70(50.0%0	43(30.7%)	27(19.3%)
Very good	28(25.0%)	58(51.8%)	26(23.2%)
Time to primary fast food			
10 minutes or less	69(42.1%)	73(44.5%)	22(13.4%)
11 to 20 minutes	25(39.1%)	24(37.5%)	15(23.4%)
21+ minutes	6(24.0%)	5(20.0%)	14(56.0%)
I do not eat fast food	0	0	0
Time to primary sit down			
10 minutes or less	39(42.4%	40(43.5%)	13(14.1%)
11 to 20 minutes	46(38.3%)	49(40.8%)	25(20.8%)
21+ minutes	10(43.5%)	5(21.7%)	8(34.8%)
I do not eat sit down	6(31.6%)	8(42.1%)	5(26.3%)
Time to primary grocery store			
10 minutes or less	66(38.6%)	72(42.1%)	33(19.3%)
11 to 20 minutes	35(44.3%)	28(35.4%)	16(20.3%)
21+ minutes	11(57.9%)	3(15.8%)	5(26.3%)
Education			
High school equivalent or less	24(51.1%)	16(34.0%)	7(14.9%)
Some college, associates, or 4-year	86(47.0%)	64(35.0%)	33(18.0%)
Graduate or professional degree	14(23.0%)	29(47.5%)	58(19.9%)
Household Size			
1	31(50.0%)	21(33.9%)	10(16.1%)
2	24(35.3%)	27(39.7%)	17(25.0%)
3 to 4	59(46.1%)	44(34.4%)	25(19.5%)
5+	9(32.1%)	15(53.6%)	4(14.3%)
Income			
$34,999 and below	56(46.3%)	44(36.4%)	21(17.4%)
$35,000 to $64,999	25(50.0%)	15(30.0%)	10(20.0%)
$65,000 to $99,999	18(46.2%)	14(35.9%)	7(17.9%)
$100,000+	21(30.0%)	30(42.9%)	19(27.1%)
Race			
Other	17(41.5%)	13(31.7%)	11(26.8%)
Black	11(50.0%)	6(27.3%)	5(22.7%)
White	96(42.1%)	90(39.5%)	42(18.4%)
Sex			
Male	30(42.3%)	26(36.6%)	15(21.1%)
Female	93(42.7%)	82(37.6%)	43(19.7%)
Sedentary hours a day			
0 to 2	12(30.8%)	14(35.9%)	13(33.3%)
3 to 5	37(40.2%)	39(42.4%)	16(17.4%)
6 to 9	47(43.5%)	40(37.0%)	21(19.4%)

10 to 12	16(50.0%	12(37.5%)	4(12.5%)
13+	8(61.5%)	3(23.1%)	2(15.4%)
Nicotine Use			
Currently uses or has used	35(51.5%)	22(32.4%)	11(16.2%)
Never used	89(40.1%)	87(39.2%)	46(20.7%)
Marital Status			
Not married	94(46.3%)	73(36.0%)	36(17.7%)
Married or living with long term partner	30(34.5%)	36(41.4%)	21(24.1%)

Table 5

Parameter Estimates and Odds Ratios for Perceived Diet Quality Measure and Other Variables

Diet Quality	Poor/Fair			Very Good/Excellent		
Independent Variables	*B*	*S.E.*	*OR (95%CI)*	*B*	*S.E.*	*OR (95%CI)*
Food choice						
Convenience						
Not at all important/a little important	-0.41	0.49	0.67(0.25-1.75)	0.41	0.60	1.50(0.47-4.83)
Moderately important/very important	.	.	.	.	.	.
Natural content						
Not at all important/a little important	0.71	0.46	2.04(0.82-5.06)	-2.02	0.62	0.13(0.04-0.45)*
Moderately important/very important	.	.	.	.	.	.
Weight control						
Not at all important/a little important	0.12	0.45	1.13(0.47-2.70)	0.54	0.55	1.71(0.58-4.99)
Moderately important/very important	.	.	.	.	.	.
Sensory appeal						
Not at all important/a little important	0.59	0.51	1.80(0.67-4.83)	0.89	0.60	2.44(0.80-7.86)
Moderately important/very important	.	.	.	.	.	.
Cost						
Not at all important/a little important	-0.76	0.88	0.47(0.08-2.62)	0.19	0.71	1.21(0.30-4.89)
Moderately important/very important	.	.	.	.	.	.
Familiarity						
Not at all important/a little important	-0.49	0.45	0.62(0.26-1.47)	-0.61	0.58	0.54(0.18-1.67)
Moderately important/very important	.	.	.	.	.	.
Ethical Concern						
Not at all important/a little important	0.01	0.65	1.01(0.28-3.62)	0.23	0.84	1.25(0.24-6.44)
Moderately important/very important	.	.	.	.	.	.
Mood						

Not at all important/a little important	-0.57	0.48	0.57(0.22-1.14)	0.53	0.59	1.69(0.53-5.39)
Moderately important/very important	.	.	.	.	.	.
Health						
Not at all important/a little important	1.89	0.58	6.64(2.14-20.58)*	-0.14	1.00	0.87(0.12-6.18)
Moderately important/very important	.	.	.	.	.	.
Restaurant Score						
Healthy	-0.32	0.61	0.73(0.22-2.41)	1.08	0.78	2.95(0.65-13.37)
Somewhat healthy	-0.18	0.48	0.84(0.33-2.12)	0.58	0.67	1.79(0.49-6.60)
Not healthy	.	.	.	.	.	.
Ease of purchasing food-Healthy						
Not easy	0.00	0.084	1.00(0.19-5.16)	-1.43	1.22	0.24(0.02-2.58)
Easy	.	.	.	.	.	.
Ease of purchasing food- Not healthy						
Not easy	0.28	1.65	1.33(0.05-33.33)	0.54	1.72	1.72(0.06-49.55)
Easy	.	.	.	.	.	.
Fruit and vegetable score						
Not good	2.94	1.29	18.85(1.49-237.95)*	2.40	1.83	11.01(0.31-397.74)
Good	1.04	0.45	2.83(1.18-6.78)*	0.74	0.54	2.09(0.72-6.05)
Very good	.	.	.	.	.	.
Time to primary fast food						
10 minutes or less	-0.73	1.02	0.48(0.07-3.58)	-2.01	1.05	0.14(0.02-1.05)
11 to 20 minutes	-0.56	1.03	0.57(0.08-4.31)	-0.74	1.07	0.47(0.06-3.79)
21+ minutes	.	.	.	.	.	.
I do not eat fast food	0	0	0	0	0	0
Time to primary sit down						
10 minutes or less	1.91	0.97	6.78(1.01-45.33)*	-1.22	1.35	0.30(0.02-4.19)
11 to 20 minutes	1.46	0.93	4.30(0.69-26.68)	-0.63	1.22	0.53(0.05-5.85)
21+ minutes	2.19	1.11	8.9(1.03-78.30)*	-0.28	1.35	0.76(0.05-10.64)
I do not eat sit down	.	.	.	.	.	.
Time to primary grocery store						
10 minutes or less	-1.15	0.92	0.32(0.05-1.93)	-0.14	1.31	0.87(0.07-11.33)
11 to 20 minutes	-0.93	0.98	0.39(0.06-2.66)	-0.43	1.34	0.65(0.05-9.09)
21+ minutes	.	.	.	.	.	.
Education						

High school equivalent or less	0.94	0.81	2.57(0.53-12.54)	-0.76	1.06	0.47(0.06-3.76)
Some college, associates, or 4 -year	1.02	0.59	2.76(0.86-8.84)	-0.92	0.70	0.40(0.10-1.57)
Graduate or professional degree	.	.	.	.	.	.
Household Size						
1	2.10	0.97	8.19(1.22-54.87)*	0.27	1.19	1.01(0.13-13.52)
2	0.84	0.95	2.32(0.36-15.07)	1.35	1.06	3.87(0.49-30.84)
3 to 4	2.10	0.89	8.12(1.42-46.57)*	1.64	0.98	5.14(0.75-35.05)
5+	.	.	.	.	.	.
Income						
$34,999 and below	0.77	0.76	2.16(0.49-9.46)	0.01	0.87	1.01(0.18-5.60)
$35,000 to $64,999	0.83	0.77	2.28(0.50-10.39)	0.30	0.87	1.03(0.19-5.64)
$65,000 to $99,999	0.06	0.80	1.06(0.22-5.04)	-0.82	0.95	0.44(0.07-2.85)
$100,000+	.	.	.	.	.	.
Race						
Other	0.41	0.63	1.50(0.43-5.20)	0.91	0.76	2.48(0.56-10.92)
Black	0.40	0.86	1.49(0.28-8.02)	0.12	1.08	1.12(0.13-9.26)
White	.	.	.	.	.	.
Sex						
Male	0.26	0.51	1.30(0.47-3.55)	0.77	0.58	2.16(0.69-6.71)
Female	.	.	.	.	.	.
Sedentary hours a day						
0 to 2	-3.23	1.17	0.04(0.004-0.40)*	-1.17	1.43	0.31(0.02-5.04)
3 to 5	-2.38	1.04	0.09(0.01-0.71)*	-2.09	1.36	0.12(0.01-1.79)
6 to 9	-2.25	1.01	0.11(0.02-0.76)*	-2.22	1.34	0.11(0.01-1.50)
10 to 12	-1.73	1.18	0.18(0.02-1.80)	-3.01	1.77	0.05(0.002-1.59)
13+	.	.	.	.	.	.
Nicotine Use						
Currently uses or has used	-0.19	0.52	0.82(0.30-2.27)	-1.48	0.82	0.23(0.05-1.12)
Never used	.	.	.	.	.	.
Marital Status						
Not married	-1.14	0.67	0.32(0.08-1.19)	-0.54	0.79	0.58(0.12-2.77)
Married or living with long term partner	.	.	.			

*Note: B= Parameter Estimate, S.E.= Standard Error, OR= Odds Ratio 95%, CI= 95% Confidence Interval, *= p=≤ .05*

Observed Food Environment

At the time of creating the store assessment and restaurant/food vendor lists there were 48 grocery stores, 129 gas stations/corner stores, 36 general stores (Dollar General/Dollar Tree), 263 full service restaurants, 24 nutrition specific restaurants (Jamba Juice, Clean Eatz, Corelife Eatery, etc.), 71 sweet/coffee focused restaurants, 331 limited service restaurants (Taco Bell, Zaxby's, Chipotle, McAlister's Deli, etc.), and 112 mobile food vendors. Most of these food outlets are in and around the main cities in the county (Murfreesboro and Smyrna). Outside of the cities food outlets primarily consisted of gas stations/corner stores and general stores. There were some restaurants outside of the cities, but the majority resided inside or on the outskirts of the cities.

The store assessment showed that all standard grocery stores (Kroger, Publix, Walmart, Aldi) had all the types of food items (fresh fruits and vegetables, cereal, meats, etc.) that were assessed by the researchers. Some items did vary based on seasonality (watermelon or corn) or varied based on the size or specialty of the store. Discount grocery stores like Save A Lot or Aldi were more limited in variety compared to more standard grocery stores like Publix. For example, Save A Lot had lettuce, but Iceberg lettuce was the only option. This store also did not have green beans, broccoli, or pears which majority of other grocery stores did have. Aldi was limited in items such as frozen dinners, did not have all of the frozen fruit or vegetables measured available, and did not have any limited options for bread and drinks. It was observed by the researchers that this may be due to branding of the products where certain brands do not offer some of the measured food items.

Availability of food items varied for convenience stores and gas stations. Researchers found that all stores sold drinks such as soda, water, or other carbonated beverages. Not all stores sold milk, this was more common among corner stores than gas stations. Stores that did sell milk typically offered a smaller drinking size of a pint of whole milk or chocolate milk. All stores also had some type of chips or other salty snack foods. Many did not offer whole wheat bread, and some did not have a standard bread option, but had hot dog or hamburger buns. For more information on foods offered in gas stations/corner stores see Table 6.

Table 6
Food Retailer Types and Items Sold

Store Type	Grocery Store		Convenience Store/Gas Stations		Super Center	
	No	Yes	No	Yes	No	Yes
Milk	0	9(100%)	9(37.5%)	15(62.5%)	0	3(100%)
1%	0	9(100%)	22(91.47%)	2(8.3%)	0	3(100%)
2%	0	9(100%)	11(45.8%)	13(54.2%)	0	3(100%)
Whole	0	9(100%)	9(34.5%)	15(62.5%%)	0	3(100%)
Fruit	0	9(100%)	19(79.2%)	5(20.8%)	0	3(100%)
Bananas	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Apples	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Oranges	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Grapes	1(11.1%)	8(88.9%)	19(79.2%)	5(20.8%)	0	3(100%)
Cantaloupe	3(33.3%)	6(66.7%)	24(100%)	0	0	3(100%)
Peaches	6(66.7%)	3(3.33%)	24(100%)	0	0	3(100%)
Strawberries	0	9(100%)	22(91.7%)	2(8.3%)	0	3(100%)

Honeydew	4(44.4%)	5(55.6%)	24(100%)	0	1(33.3%)	2(66.7%)
Watermelon	3(33.3%)	6(66.7%)	22(91.7%)	2(8.3%)	0	3(100%)
Pears	2(22.2%)	7(77.8%)	24(100%)	0	0	3(100%)
Vegetables	0	9(100%)	19(79.2%)	5(20.8%)	0	3(100%)
Carrots	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Tomatoes	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Sweet peppers	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Broccoli	1(11.1%)	8(88.9%)	23(95.8%)	1(4.2%)	0	3(100%)
Lettuce	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Corn	4(44.4%)	5(55.6%)	24(100%)	0	2(66.7%)	1(33.3%)
Celery	1(11.1%)	8(88.9%)	20(83.3%)	4(16.7%)	0	3(100%)
Cucumbers	1(11.1%)	8(88.9%)	21(87.5%)	3(12.5%)	0	3(100%)
Cabbage	1(11.1%)	8(88.9%)	21(87.5%)	3(12.5%)	0	3(100%)
Cauliflower	1(11.1%)	8(88.9%)	23(95.8%)	1(4.2%)	0	3(100%)
Green beans	1(11.1%)	8(88.9%)	24(100%)	0	0	3(100%)
Beef	0	9(100%)	22(91.7%)	2(8.3%)	0	3(100%)
90% lean	4(44.4%)	5(55.6%)	24(100%)	0	0	3(100%)
<10% fat	2(22.2%)	7(77.8%)	24(100%)	0	0	3(100%)
Ground turkey	2(22.2%)	7(77.8%)	24(100%)	0	2(66.7%	1(33.33%)
80/20	1(11.1%)	8(88.9%)	24(100%)	0	0	3(100%)
Hotdog	0	9(100%)	13(54.2%)	11(45.8%)	0	3(100%)
Frozen Dinner	0	9(100%)	13(54.2%)	11(45.8%)	0	3(100%)
Frozen Fruit	1(11.1%)	8(88.9%)	24(100%)	0	0	3(100%)
Strawberries	1(11.1%)	8(88.9%)	24(100%)	0	0	3(100%)
Mixed berries	2(22.2%)	7(77.8%)	24(100%)	0	0	3(100%)
Mango	2(22.2%)	7(77.8%)	24(100%)	0	0	3(100%)
Pineapple	3(33.3%)	6(66.7%)	24(100%)	0	0	3(100%)
Peaches	4(44.4%)	5(55.6%)	24(100%)	0	0	3(100%)
Cherries	3(33.3%)	6(66.7%)	24(100%)	0	0	3(100%)
Blueberries	0	9(100%)	17(81.0%)	4(19.0%)	0	3(100%)
Frozen Vegetables	0	9(100%)	17(70.8%)	7(29.2%)	0	3(100%)
Carrots	3(33.3%)	6(66.7%)	24(100%)	0	2(66.7%)	1(33.3%)
Broccoli	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Corn	1(11.1%)	8(88.9%)	22(91.7%)	2(8.3%)	0	3(100%)
Green beans	0	9(100%)	20(83.3%)	4(16.7%)	0	3(100%)
Cauliflower	4(44.4%)	5(55.6%)	24(100%)	0	0	3(100%)
Peas	2(22.2%)	7(77.8%)	22(91.7%)	2(8.3%)	0	3(100%)
Sweet peppers	4(44.4%)	5(55.6%)	24(100%)	0	1(33.3%)	2(66.7%)
Spinach	0	9(100%)	24(100%)	0	0	3(100%)
Baked Goods	0	9(100%)	10(41.7%)	14(58.3%)	0	3(100%)
Nature's Own Whole Wheat	3(33.3%)	6(66.7%)	18(75.0%	6(25.0%)	0	3(100%)
Sara Lee Whole Wheat	2(22.2%)	7(77.8%)	24(100%)	0	0	3(100%)
Beverages	0	9(100%)	0	24(100%)	0	3(100%)
Soda	0	9(100%)	0	24(100%)	0	3(100%)
Orange juice	0	9(100%)	0	24(100%)	0	3(100%)
Water	0	9(100%)	0	24(100%)	0	3(100%)
Other non-carbonated beverages low-calorie beverages	0	9(100%)	0	24(100%)	0	3(100%)
Chips	0	9(100%)	0	24(100%)	0	3(100%)
Cereal	0	9(100%)	12(50%)	12(50%)	0	3(100%)

Canned Vegetables	0	9(100%)	11(45.8%)	13(54.2%)	0	3(100%)
Corn	0	9(100%)	15(62.5%)	9(37.5%)	0	3(100%)
Green beans	0	9(100%)	14(58.3%)	10(47.6%)	0	3(100%)
Peas	0	9(100%)	15(62.5%)	9(37.5%)	0	3(100%)
Carrots	1(11.1%)	8(88.9%)	17(70.8%)	7(29.2%)	0	3(100%)
Tomatoes	1(11.1%)	8(88.9%)	15(62.5%)	9(37.5%)	0	3(100%)
Canned Fruit	0	9(100%)	13(54.2%)	11(45.8%)	0	3(100%)
Pineapple-no added sugar	0	9(100%)	17(70.8%)	7(29.2%)	0	3(100%)
Peaches-no added sugar	1(11.1%0	8(88.9%)	24(100%)	0	0	3(100%)
Pears-no added sugar	2(22.2%)	7(77.8%)	24(100%)	0	1(33.3%)	2(66.7%)
Mandarins-no added sugar	3(33.3%)	6(66.7%)	24(100%)	0	1(33.3%)	2(66.7%)

The quality of produce was relatively similar across stores and was of a high quality. There were some Dollar General locations that did not have a high quality of some produce items. For example, cucumbers were soft and beginning to mold or strawberries had spots that were beginning to mold or were moldy.

The store assessments revealed that the same types of stores in different locations had different prices for the same items. This was seen in Dollar General locations where milk differed in price for the same type and size of milk. This was seen with gallons for 2% and whole milk, a gallon for each of these had prices of $3.65, $3.80, and $4.45. At other stores prices did not vary between stores in differing locations, only between different food outlet retailers (e.g. Kroger, Publix, Walmart). Prices did vary between different food outlet retailers for fresh items such as milk or produce. The price of milk ranged from $3.14 (Walmart) to 6.99 (Sprouts) with an average price of

$3.98 for a gallon of whole milk. Prices were similar for a 2% gallon of milk. Apples ranged from $1.06lb (Dollar General) to $4.89lb (Jr's Food Land) with the average price being $1.93lb. Overall, prices for fresh food items are similar across different food outlet retailers, particularly for standard grocery stores (Kroger or Publix). Some items were cheaper at discount type stores (Aldi, Save A Lot, Dollar General, etc.) but other items may be more expensive than standard grocery stores (Publix, Kroger, etc.). For example, grapes at some Dollar General locations were $4.95lb and $3.69lb at Save A Lot whereas at Publix grapes were $2.59lb and $2.49lb at Kroger.

The researchers did observe a change occurring in the food environment where certain Dollar General locations were adding sections for fresh fruits and vegetables. These locations were not labeled as Dollar General Markets where fresh fruits, vegetables, and meat are sold, but regular Dollar General locations. These prices were comparable to those of a standard grocery store for some items. For example, tomatoes were $2.95lb and $3.50lb at Dollar General locations and varied from $1.99lb to $3.99lb at other food outlet retailers. Similarly, oranges were $1.65lb at Dollar General and varied from $0.99lb to $1.99lb at other food outlet retailers.

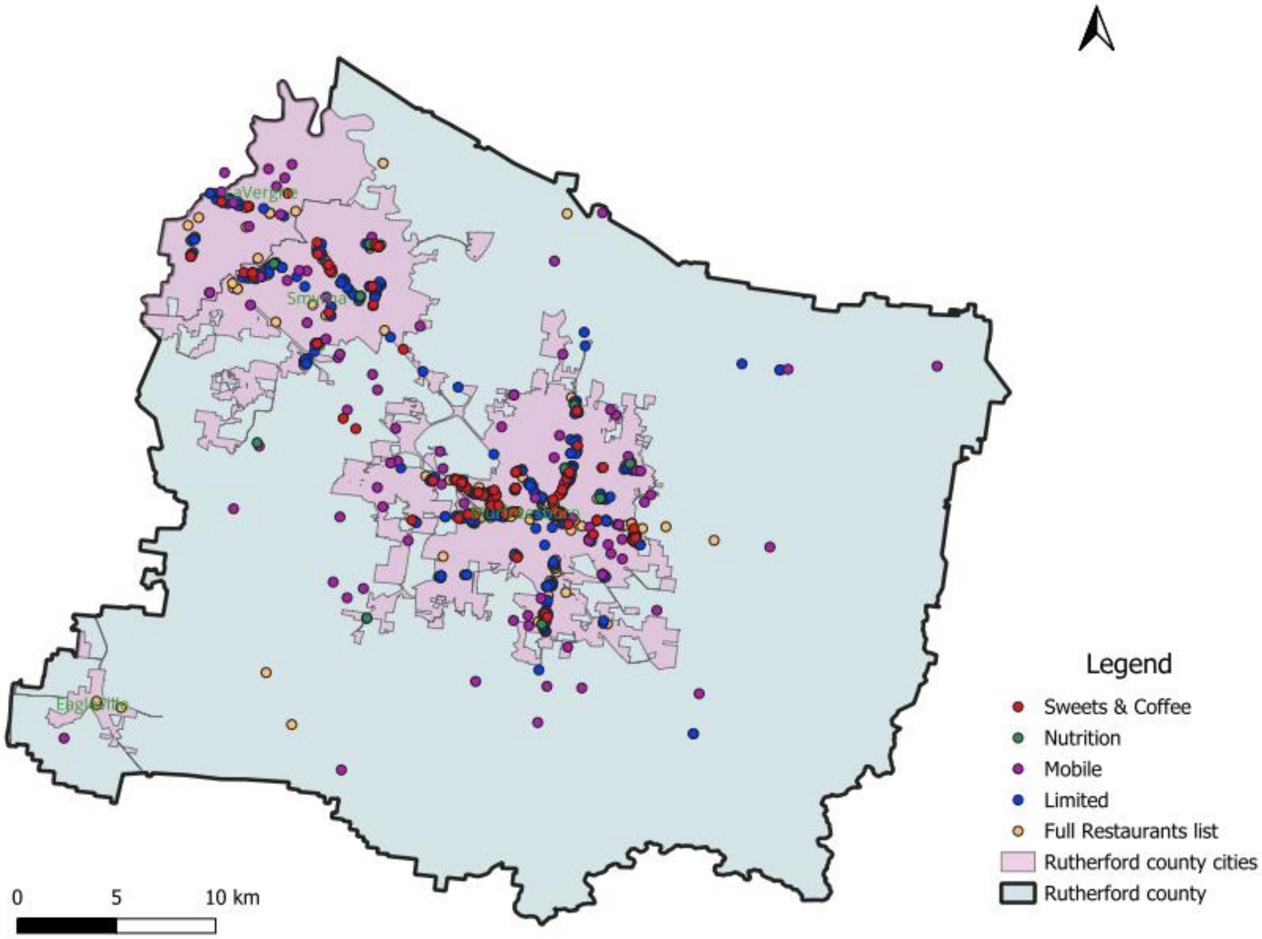


Figure 1 *Restaurants in Rutherford County*

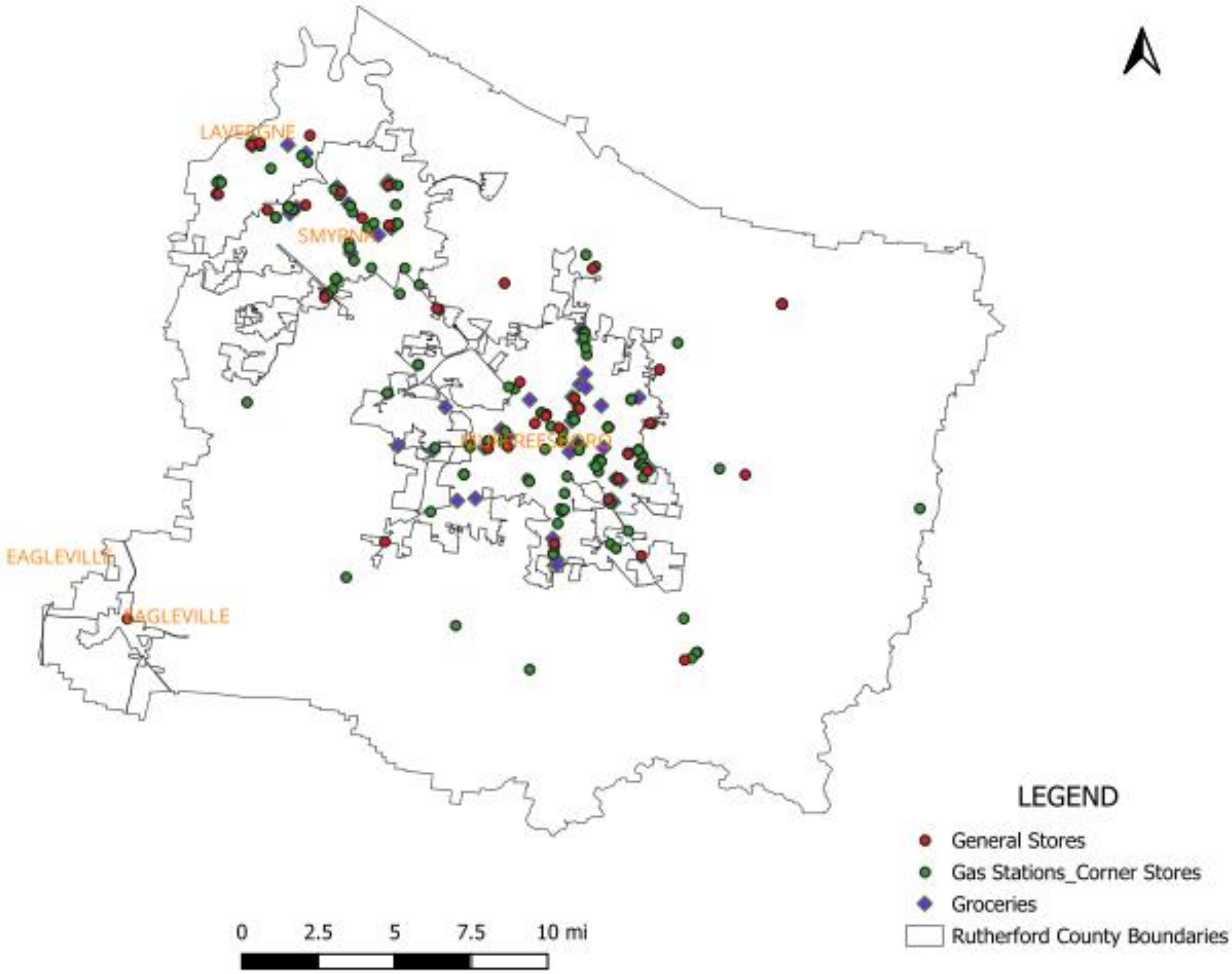


Figure 2 *Food Stores in Rutherford County*

Discussion

This research aimed to address the gap in understanding the relationship between the food environment, food choice, and diet quality. Overall, the results indicate a relationship between some perceived food environment measures, food choice categories, and diet quality. This relationship varied depending on the measure of diet quality used (e.g., FFQ vs perceived diet quality), echoing concerns raised by other researchers (Bivoltsis et al., 2018). The results of this study show a relationship between the food choice category of natural content and diet quality, where those who rated a higher importance for natural content of their food are more likely to have a better quality. Additionally, a higher fruit and vegetable score-created by cost, ease of purchasing, quality, and selection of fruit and vegetables-was consistently associated with better diet quality across both models. This underscores the pivotal role of the food environment, particularly in the availability and accessibility of fruits and vegetables, in influencing diet quality.

Similar findings have been reported where cost, availability, quality and selection of fruits and vegetables in the food environment relates to diet quality. Moffat and colleagues, (2021) demonstrated that greater availability of fruits and vegetables in the food environment was associated with increased household availability and consumption. Similarly, Pessoa and colleagues (2015) found that higher density of healthy food outlets was associated with fruit and vegetable intake. In the opposite, lower availability of fruit and vegetable stores has been associated with unhealthier dietary patterns (Pineda et al., 2023). These findings support the impact of the community nutrition and consumer nutrition environments on eating behaviors reflected by the NEMS-P: Conceptual Model where access, availability, cost, and quality are related to consumption.

Like earlier work, this study resulted in mixed results. While some relationships were significant in chi-square tests of independence, they did not hold in regression models. Most of the food choice categories were not significantly related to diet quality, contrasting with findings from other studies. For example, cost was found to be significant by Belon et al., (2016) and Bibeau et al., (2012) but it was not significant for this study. These mixed results are shared by Park and colleagues (2013) where they found no association. With the food choice of natural content being significant, participants of this study may be less concerned about cost of food items and more focused on choosing those with a higher natural content.

The results of the perceived food environment measures where participants reported a high number of fast-food outlets and other restaurants near their home and a moderate to low number of grocery stores around their home overlaps with the results of the observed food environment assessment. As an example, throughout the county, primarily within city limits, there are many fast-food outlets which was mimicked in the participants data. Which shows that individuals may be reliable sources of food environment assessment. The observed food environment assessment revealed widespread access to various types of food outlets throughout the county, primarily within Murfreesboro and Smyrna city limits. Access to grocery stores varied across the county, with better access reported within city limits. In areas lacking grocery stores, general stores like Dollar General are beginning to introduce fresh fruits and vegetables, which shows promise for improving food access in underserved areas.

For residents concerned about grocery costs may find it beneficial to compare prices across stores. However, after including the cost of gas and time of traveling to multiple locations this may not be the most fiscally appropriate choice depending on where they reside in the county. For quick shopping needs, especially in areas with limited access to fresh produce, Dollar General's initiative to stock fresh fruits and vegetables could be advantageous.

This study used the Nutrition Environment Measures Survey-Perceived (NEMS-P): Conceptual Model. Within this model food environment, food choice, and diet quality relate to one another. This research found that the perceived nutrition environment, the observed nutrition environment, the community nutrition environment, and consumer nutrition environment related to each other. This was shown through the NEMS-P results reflecting those of the observed food environment results. Most participants reported that it was easy to purchase healthy foods like fruits and vegetables and low-fat meats. This aligned with the results of the observed food environment survey where most of the stores had these types of foods. Majority of the participants reported a fruit and vegetable score of good or very good, which is reflected by the observed food environment results. Particularly by the change that the researchers observed where Dollar General stores are expanding their grocery selection to include fresh produce.

A strength of this study is that it used a standardized measurement to assess perceived food environment (NEMS-P) and the observed food environment (NEMS-S/CS). Use of non-standardized measures has been a concern expressed by other researchers (Lytle, 2009). This study also used two methods of assessing diet quality, which can enhance comparability to other studies. In comparing the perceived and observed food environment there was a challenge due to the inability to merge datasets. To combat this, future studies may collect the zip code or address of all participants to be mapped along with the locations of grocery stores. Alternatively, the name and location of the primary grocery store may be collected. For the observed food environment, it was difficult to ensure that the food outlets were up to date, mainly for Murfreesboro. Murfreesboro is an area that is continuously being developed and sees restaurants open and close often. Due to the nature of collecting addresses for these locations some restaurants that were open at the time of assessment may not have been included and ones that were closed were included.

REFERENCES

Althoff, T., Nilforoshan, H., Hua, J., & Leskovec, J. (2022). Large-scale diet tracking data reveal disparate associations between food environment and diet. *Nature Communications*, *13*. https://doi.org/10.1101/2020.09.29.20204099

Belon, A. P., Nieuwendyk, L. M., Vallianatos, H., & Nykiforuk, C. I. J. (2016). Perceived community environmental influences on eating behaviors: A photovoice analysis. *Social Science & Medicine*, *171*, 18–29. https://doi.org/10.1016/j.socscimed.2016.11.004

Bibeau, W. S., Saksvig, B. I., Gittelsohn, J., Williams, S., Jones, L., & Young, D. R. (2012). Perceptions of the food marketing environment among African American teen girls and adults. *Appetite*, *58*, 396–399. http://dx.doi.org/10.1016/j.appet.2011.11.004

Bivoltsis, A., Cervigni, E., Trapp, G., Knuiman, M., Hooper, P., & Ambrosini, G. L. (2018). Food environments and dietary intakes among adults: Does the type of spatial exposure measurement matter? A systematic review. *International Journal of Health Geographics*, *17*(19). https://doi.org/10.1186/s12942-018-0139-7

Blake, C. E., Monterrosa, E. C., Rampalli, K. K., Khan, A. N. S., Reyes, L. I., Drew, S. D., Dominguez-Salas, P., Bukachi, S. A., Ngutu, M., Frongillo, E. A., Iruhiriye, E., & Girard, A. W. (2023). Basic human values drive food choice decision-making in different food environments of Kenya and Tanzania. *Appetite*, *188*. https://doi.org/10.1016/j.appet.2023.106620

Brown, M. C., Shrestha, U., Huber, C., Best, L. G., O'Leary, M., Howard, B., Beresford, S., & Fretts, A. M. (2019). Characterizing the local food environment and grocery-store among a large American Indian community in the north-central USA: qualitative results from the Healthy Foods Healthy Families Feasibility Study. *Public Health Nutrition*, *22*(14), 2653–2661. https://doi.org/10.1017/S1368980019001095

Chor, D., Cardoso, L. O., Nobre, A. A., Griep, R. H., Fonseca, M. J. M., Giatti, L., Bensenor, I., Molina, M. C. B., Aquino, E. M. L., Diez-Roux, A., Castiglione, D. P., & Santos, S. M. (2016). Association between perceived neighbourhood characteristics, physical activity and diet quality: Results of the Brazilian Longitudinal Study of Adults Health (ELSA-Brazil). *BMC Public Health*, *16*. https://doi.org/10.1186/s12889-016-3447-5

Crino, M., Sacks, G., Vandevijvere, S., Swinburn, B., & Neal, B. (2015). The influence on population weight gain and obesity of the macronutrient composition and energy density of the food supply. *Current Obesity Reports*, *4*(1). https://doi.org/DOI 10.1007/s13679-014-0134-7

Darmon, N., & Drewnowski, A. (2015). Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: A systematic review and analysis. *Nutrition Reviews*, *73*(10), 643–660. https://doi.org/doi: 10.1093/nutrit/nuv027

Dawson, J. (2013). Retailer activity in shaping food choice. *Food Quality and Preference*, *28*(1), 399–347. https://doi.org/10.1016/j.foodqual.2012.09.012

Devine, L. D., Gallagher, A. M., Briggs, S., & Hill, A. J. (2023). Factors that influence food choices in secondary school canteens: A qualitative study of pupil and staff perspectives. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1227075

Dhillon, J., Rios, L. K. D., Aldaz, K. J., De La Cruz, N., Vu, E., Asghar, S. A., Kuse, Q., & Ortiz, R. M. (2019). We don't have a lot of healthy options: Food environment perceptions of first-year, minority college students attending a food desert campus. *Nutrients*, *11*(4). https://doi.org/10.3390/nu11040816

Downs, S. M., Fox, E. L., Mutuku, V., Muindi, Z., Fatima, T., Pavlovic, I., Husain, S., Sabbahi, M., Kimenju, S., & Ahmed, S. (2022). Food environments and their influence on food choices: A case study in informal settlements in Nairobi, Kenya. *Nutrients*, *14*(13). https://doi.org/10.3390/nu14132571

Duran, A. C., de Almeida, S. L., Latorre, Mdo. R., & Jaime, P. C. (2016). The role of the local retail food environment in fruit, vegetable and sugar-sweetened beverage consumption in Brazil. *Public Health Nutrition*, *19*(6), 1093–1102. https://doi.org/10.1017/S1368980015001524

Fast food restaurants in the US - number of businesses 2005-2029. (2023, January 12). IBISWorld. https://www.ibisworld.com/industry-statistics/number-of-businesses/fast-food-restaurants-united-states/#:~:text=How%20many%20businesses%20are%20there,increase%20of%200.9%25%20from%202022.

Gao, X., Engeda, J., Moore, L. V., Auchincloss, A. H., Moore, K., & Mujahid, M. (2022). Longitudinal associations between objective and perceived healthy food environment and diet: The Multi-Ethnic Study of Atherosclerosis. *Social Science & Medicine*, *292*. https://doi.org/10.1016/j.socscimed.2021.114542

Guine, R. P. F., Bartkiene, E., Szucs, V., Tarcea, M., Ljubicic, M., Cernelic-Bizjak, M., Isoldi, K., EL-Kenawy, A., Ferreira, V., Straumite, E., Korzeniowska, M., Vittadini, E., Leal, M., Frez-Munoz, L., Papageorgiou, M., Djekic, I., Ferreira, M., Correia, P., Cardoso, A. P., & Duarte, J. (2020). Study about food choice determinants according to six types of conditioning motivations in a sample of 11,960 participants. *Foods*, *9*(7). https://doi.org/10.3390/foods9070888

Harper, K., Caulfield, L. E., Lu, S. V., Mmari, K., & Gross, S. M. (2022). Diet quality and contextual factors influencing food choice among adolescents with food security and food insecurity in Baltimore City. *Nutrients*, *14*(21). https://doi.org/10.3390/nu14214573

Jago, R., Baranowski, T., Baranowski, J. C., Cullen, K. W., & Thompson, D. (2007). Distance to food stores & adolescent male fruit and vegetable consumption: Mediation effects. *International Journal of Behavioral Nutrition and Physical Activity*, *4*(35). https://doi.org/10.1186/1479-5868-4-35

Kaya, I. H. (2016). Motivation factors of consumers’ food choice. *Food and Nutrition Sciences*, *7*(3). https://doi.org/10.4236/fns.2016.73016

Kelly, C., Callaghan, M., & Gabhainn, S. N. (2021). “It’s hard to make good choices and it costs more”: Adolescents perception of the external school food environment. *Nutrients*, *13*. https://doi.org/10.3390/nu13041043

Lachat, C., Nago, E., Verstraeten, R., Roberfroid, D., Van Camp, J., & Kolsteren, P. (2012). Eating out of home and its association with dietary intake: A systematic review of the evidence. *Obesity Reviews*, *13*, 329–346. https://doi.org/doi: 10.1111/j.1467-789X.2011.00953.x

Lacko, A., Ng, S. W., & Popkin, B. (2020). Urban vs. Rural socioeconomic differences in the nutritional quality of household packaged food purchases by store type. *International Journal of Environmental Research and Public Health*, *17*. https://doi.org/doi:10.3390/ijerph17207637

Lamichhane, A. P., Mayer-Davis, E. J., Puett, R., Bottai, M., Porter, D. E., & Liese, A. D. (2012). Associations of built food environment and dietary intake among youth with diabetes. *Journal of Nutrition Education and Behavior*, *44*(3), 217–224.

Lorts, C., Tasevska, N., Adams, M. A., Yedidia, M. J., Tulloch, D., Hooker, S. P., & Ohri-Vachaspati, P. (2019). Participation in the Supplemental Nutrition Assistance Program and dietary behaviors: Role of community food environment. *Journal Academy of Nutrition and Dietetics*, *119*(6), 934–943. https://doi.org/10.1016/j.jand.2018.11.021

Lowe, M. R., & Butryn, M. L. (2007). Hedonic hunger: A new dimensions of appetite? *Physiology & Behavior*, *91*(4), 432–439. https://doi.org/10.1016/j.physbeh.2007.04.006

Lytle, L. A. (2009). Measuring the food environment state of the science. *American Journal of Preventive Medicine*, *36*(4S), S134–S144. https://doi.org/doi:10.1016/j.amepre.2009.01.018

Martin, S., & McCormack, L. (2024). Eating behaviors and the perceived nutrition environment among college students. *Journal of American College Health*, *72*(3), 685–689. https://doi.org/10.1080/07448481.2022.2068019

Moffat, L. F., Ritchie, L. D., Gosliner, W., Plank, K. R., & Au, L. E. (2021). Perceived produce availability and child fruit and vegetable intake: The healthy communities study. *Nutrients*, *13*(11). https://doi.org/10.3390/nu13113681

Monterio, C. A., Moubarac, J.-C., Cannon, G., Ng, S. W., & Popkin, B. (2013). Ultra-processed products are becoming dominant in the global food system. *Obesity Reviews*, *14*, 21–28. https://doi.org/doi: 10.1111/obr.12107

Moubarac, J.-C., Batal, M., Louzada, M. L., Steele, E. M., & Monterio, C. A. (2017). Consumption of ultra-processed foods predicts diet quality in Canada. *Appetite*, *108*, 512–520. http://dx.doi.org/10.1016/j.appet.2016.11.006

Park, S., Choi, B. Y., Wang, Y., Colantuoni, E., & Gittelsohn, J. (2013). School and neighborhood nutrition environment and their association with students' nutrition behaviors and weight status in Seoul, South Korea. *Journal of Adolescent Health*, *53*, 655–662. http://dx.doi.org/10.1016/j.jadohealth.2013.06.002

Pessoa, M. C., Mendes, L. L., Gomes, C. S., Martins, P. A., & Velasquez-Melendez, G. (2015). Food environment and fruit and vegetable intake in a urban population:

A multilevel analysis. *BMC Public Health*, *15*. https://link.springer.com/article/10.1186/s12889-015-2277-1

Pineda, E., Cunha, D. B., Sharabiani, M. T. A., & Millett, C. (2023). Association of the retail food environment, BMI, dietary patterns, and socioeconomic position in urban areas of Mexico. *PLOS Global Public Health*, *3*(2). https://doi.org/10.1371/journal.pgph.0001069

Pitt, E., Gallegos, D., Comans, T., Cameron, C., & Thornton, L. (2017). Exploring the influence of local food environment on food behaviours: A systematic review of qualitative literature. *Public Health Nutrition*, *20*(13), 2393–2405. https://doi.org/10.1017/S1368980017001069

Poti, J. M., Braga, B., & Qin, B. (2017). Ultra-processed food intake and obesity: What really matters for health—Processing or nutrient content? *Current Obesity Reports*, *6*(4), 420–431. https://doi.org/doi:10.1007/s13679-017-0285-4

Pradeilles, R., Irache, A., Wanjohi, M. N., Holdsworth, M., Laar, A., Zotor, F., Tandoh, A., Klomegah, S., Graham, F., Muthuri, S. K., Kimani-Murage, E. W., Coleman, N., Green, M. A., Osei-Kwasi, H. A., Bohr, M., Rousham, E. K., Asiki, G., Akparibo, R., Mensah, K., … Griffiths, P. (2021). Urban physical food environments drive dietary behaviours in Ghana and Kenya: A photovoice study. *Health Place*, *71*. https://doi.org/10.1016/j.healthplace.2021.102647

Rideout, K., Mah, C. L., & Minaker, L. (2015). Food environments: An introduction for public health practice. *National Collaborating Centre for Environmental Health*.

https://www.ncceh.ca/sites/default/files/Food_Environments_Public_Health_Practice_Dec_2015.pdf

Ruff, R. R., Akhund, A., & Adjoian, T. (2016). Small convenience stores and the local food environment: An analysis of resident shopping behavior using multilevel modeling. *American Journal of Health Promotion*, *30*(3). https://doi.org/DOI: 10.4278/ajhp.140326-QUAN-121

Saksena, M. J., Okrent, A. M., Anekwe, T. D., Cho, C., Dicken, C., Effland, A., Elitzak, H., Guthrie, J., Hamrick, K. S., Hyman, J., Jo, Y., Lin, B.-H., Mancino, L., McLaughlin, P. W., Rahkovsky, I., Ralston, K., Smith, T. A., Stewart, H., Todd, J., & Tuttle, C. (2018). *America's eating habits: Food away from home* (196). United States Department of Agriculture Economic Research Service.

Santiago-Torres, M., Adams, A. K., Carrel, A. L., LaRowe, T. L., & Schoeller, D. A. (2014). Home food availability, parental dietary intake, and familial eating habits influence the diet quality of urban Hispanic children. *Childhood Obesity*, *10*(5), 408–415. https://doi.org/10.1089/chi.2014.0051

Sharkey, J. R., Johnson, C. M., Dean, W. R., & Horel, S. A. (2011). Association between proximity to and coverage of traditional fast-food restaurants and non-traditional fast-food outlets and fast-food consumption among rural adults. *International Journal of Health Geographics*, *10*(37). http://www.ij-healthgeographics.com/content/10/1/37

Siddiqui, N. Z., Pinho, M. G. M., Rutters, F., Beulens, J. W. J., & Mackenbach, J. D. (2023). The interaction between the community food environment and cooking skills in association with diet-related outcomes in Dutch adults. *Public Health Nutrition*, *26*(12), 2945–2952. https://doi.org/10.1017/S1368980023002148

Vilaro, M. J., Barnett, T. E., Mathews, A., Pomeranz, J., & Curbow, B. (2016). Income differences in social control of eating behaviors and food choice priorities among Southern rural women in the US: a qualitative study. *Appetite*, *107*, 604–612. https://doi.org/10.1016/j.appet.2016.09.003

Vogel, C., Lewis, D., Ntani, G., Cummins, S., Cooper, C., Moon, G., & Baird, J. (2017). The relationship between dietary quality and the local food environment differs according to level of educational attainment: A cross-sectional study. *PLoS One*, *12*(8). https://doi.org/10.1371/journal.pone.0183700

Wedick, N. M., Ma, Y., Olendzki, B. C., Procter-Gray, E., Cheng, J., Kane, K. J., Ockene, I. S., Pagoto, S. L., Land, T. G., & Li, W. (2015). Access to healthy food stores modifies effect of a dietary intervention. *American Journal of Preventive Medicine*, *48*(3), 309–317. https://doi.org/10.1016/j.amepre.2014.08.020

Williams, L., Ball, K., & Crawford, D. (2010). Why do some socioeconomically disadvantaged women eat better than others? An investigation of the personal, social and environmental correlates of fruit and vegetable consumption. *Appetite*, *55*(3), 441–446. https://doi.org/10.1016/j.appet.2010.08.004

APPENDICES

Appendix A: Participant Survey

Qualifying questions

1. Selecting I consent to participate indicates that you have read the above description, are 18 years or older, and understand the purpose, risks, and benefits of this research and know what will be expected to do as a study participant.
    a. Yes
    b. No (kicks them out)
2. Do you live in Rutherford County Tennessee?
    a. Yes
    b. No (kicks them out)

Demographics

3. What is your residential address? (Have as open ended)
4. What is your biological sex?
    a. Male
    b. Female
    c. Intersex
5. What is your age?
    a. Have dropdown to select age
6. Are you the primary food shopper in your household (more than 50% of the grocery shopping)?
    a. Yes
    b. No
7. How many drive-able motor vehicles (cars, trucks, and motorcycles) are there in your household?
    a. Have drop down to select answer
8. What is your main mode of transportation?
    a. Walk
    b. Bicycle
    c. Bus or other public transportation such as Uber or taxi
    d. Drive your own vehicle
    e. Get a ride (friend, family, or carpool)
    f. Other (please specify): _____
9. What best describes the area that you were primarily raised?
    a. Urban/city or town
    b. Suburban
    c. Rural or very rural
10. What is your racial background or ethnicity? (Note: answer options taken from NHANES)
    a. Mexican American
    b. Other Hispanic
    c. Non-Hispanic White

    d. Non-Hispanic Black
    e. Other _______

11. What is your current marital status?
    a. Married or living with a long term partner
    b. Separated or divorced
    c. Widowed
    d. Never been married
    e. Dating
12. What is your current employment status?
    a. Full-time
    b. Part-time
    c. Unemployed, actively seeking employment
    d. Not employed, not seeking employment (student, retired, home-maker, disabled, etc.)
13. What is your highest level of education?
    a. Less than high school
    b. High school degree or equivalent
    c. Some college or technical school or associates degree
    d. Bachelor's/4 year degree
    e. Graduate or professional degree
14. What is your yearly household income?
    a. $0 to $4,999
    b. $5,000 to $9,999
    c. $10,000 to $14,999
    d. $15,000 to $19,999
    e. $20,000 to $24,999
    f. $25,000 to $ 34,999
    g. $35,000 to $44,999
    h. $45,000 to $54,999
    i. $55,000 to $64,999
    j. $65,000 to $74,999
    k. $75,000 to $84,999
    l. $85,000 to $99,999
    m. $100,000 or more
15. How many people live in your household?
    a. Have drop down to select
16. How do you most commonly do your grocery shopping?
    a. In-store
    b. Online for pick up
    c. Online for delivery
17. Do you currently use nicotine (e.g. cigarettes, vape, chewing tobacco, cigars)?
    a. Yes, I currently smoke
    b. No, but I used to smoke and quit
    c. No, I have never smoked
18. How many hours a day are you normally sedentary? (this does not include sleeping)
    a. Have as drop down for hours sedentary per day

19. Do you currently receive any of the following? (Note: matrix; yes no)
    a. Food stamps (Supplemental Nutrition Assistance Program or SNAP benefits)
    b. WIC benefits
    c. Government cash assistance including TANF, SSI, SSDI, or GA (but not including social security benefits)
    d. Food banks (e.g. Green House Ministries, blessing boxes, etc.)
    e. Other type of food assistance (please specify): ______

Student section

20. Are you currently an MTSU student? (Have this question for display logic of next questions about food on campus)
    a. No
    b. Yes
21. Do you live on campus?
    a. No
    b. Yes
22. Do you think there are healthy food choices on campus? (Healthy food choices as in, fruits and vegetables, low-fat options, low-calories options, sugar-free beverages, etc.)
    a. Yes
    b. Sometimes
    c. No
23. How often do you eat on campus?
    a. I don't eat on campus
    b. Once a day
    c. Twice a day
    d. Three times a day
    e. Once a week
    f. 3-4 time a week
    g. 5-6 time a week
    h. More than 6 times a week
24. Please list some of the healthy food choices on campus.
    a. Have as fill in box
25. What are some healthy food choices you would like to have on campus but do not?
    a. Have has fill in box
26. What do you think about the cost of healthy food on campus?
    a. Not expensive
    b. A little expensive
    c. Expensive
    d. Very expensive
27. What do you think about the cost of food on campus? (not including healthy food)
    a. Not expensive
    b. A little expensive
    c. Expensive
    d. Very expensive

Health section

28. How would you rate your overall health?
    a. Poor
    b. Fair
    c. Good
    d. Very good
    e. Excellent
29. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
    a. Number of days (have drop down to select)
30. Now thinking about your mental health which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?
    a. Number of days (have drop down to select)
31. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities such as self-care, work, or recreation?
    a. Number of days (have drop down to select)
32. How would you rate the overall health of your diet?
    a. Poor
    b. Fair
    c. Good
    d. Very good
    e. Excellent

These next four questions are questions that I created from the Palatable Food Questionnaire:

For the next four questions think in regards to tasty foods and drinks such as: sweets (ice cream, cookies, cake, brownies, candy, etc.), snack foods (chips, crackers, trail mix, peanuts, pretzels, etc.), fast food or homemade fried foods (hamburgers, French fries, fried chicken, pizza, fried okra, fried fish, etc.), and sugary drinks (soda, sweet tea, milkshakes, juice drinks, sweetened coffees, etc.). (Note: these are adapted from the palatable eating motives scale; coping, social, reward enhancement, conformity, bullets will be used with examples to make reading easier)

33. I consume tasty foods (sweets, snack foods, fast-food or fried food, or sugary drinks) because they make me feel (less stressed, less depressed, forget about problems, etc.).
    a. Never/almost never
    b. Some of the time
    c. Half of the time
    d. Most of the time
    e. Almost always/always
34. I consume tasty foods (sweets, snack foods, fast-food or fried food, or sugary drinks) because it makes social gatherings better in some way (more fun, less awkward, more enjoyable, to be social, etc.)
    a. Never/almost never
    b. Some of the time
    c. Half of the time
    d. Most of the time
    e. Almost always/always

35. I consume tasty foods (sweets, snack foods, fast-food or fried food, or sugary drinks) because it gives me positive feelings (excitement, joy, euphoria, etc.)
    a. Never/almost never
    b. Some of the time
    c. Half of the time
    d. Most of the time
    e. Almost always/always
36. I consume tasty foods (sweets, snack foods, fast-food or fried food, or sugary drinks) because others are eating them, I don't want to feel left out, or others want me to eat these foods.
    a. Never/almost never
    b. Some of the time
    c. Half of the time
    d. Most of the time
    e. Almost always/always

Steptoe Factors That Influence Food Choice

Directions: For the items below read each item carefully and rate how important the item is to you. Select the answer option that best reflects your feelings. (Note: This will be a matrix with options of: not important at all, a little important, moderately important, and very important, this will be a 10 point scale)

37. It is important to me that the food I eat on a typical day:
    a. Is easy to prepare
    b. Contains no additives
    c. Is low in calories
    d. Tastes good
    e. Contains natural ingredients
    f. Is not expensive
    g. Is low in fat
    h. Is familiar to me
    i. Is high in fiber and roughage
    j. Is nutritious
    k. Is easily available in shops and supermarkets
    l. Is good value for money
    m. Cheers me up
    n. Smells nice
    o. Can be cooked very simply
    p. Helps me cope with stress
    q. Helps me control my weight
    r. Has a pleasant texture
    s. Is packaged in an environmentally friendly way
    t. Comes from countries I approve of politically
    u. Is like the food I ate when I was a child
    v. Contains lots of vitamins and minerals
    w. Contains no artificial ingredients
    x. Keeps me awake and alert

y. Looks nice
z. Helps me relax
aa. Is high in protein
bb. Takes no time to prepare
cc. Keeps me healthy
dd. Is good for my skin/teeth/hair/nails etc.
ee. Makes me feel good
ff. Has the country of origin clearly marked
gg. Is what I usually eat
hh. Helps me to cope with life
ii. Can be bought in shops close to there I live or work
jj. Is cheap

Perceived Food Environment Section (NEMS-P)

Directions: “We would like to find out about the way that you perceive or think about the food choices in your neighborhood. Please answer the following questions about your neighborhood, home, and yourself.”

Home Food Environment

38. Please indicate whether each of these food items were available in your home <u>in the past week</u>: (Note: This will be a yes/no matrix)
    a. Bananas
    b. Apples
    c. Grapes
    d. Candy or cookies
    e. Snack chips (potato chips, corn chips, tortilla chips, etc.)
    f. Regular whole milk
    g. Low-fat milk
    h. Regular (non-diet) soda
    i. Diet soda
    j. Carrots
    k. Tomatoes
    l. Dark leafy greens (spinach, collards, kale, etc.)
    m. Regular hot dogs
    n. Reduced-fat hot dogs
    o. White bread
    p. Whole grain bread
    q. White rice
    r. Brown rice
39. In your home how often do you…? (Note: This will be a Likert scale matrix; never or rarely, sometimes, often, almost always)
    a. Have fruits and vegetables in refrigerator
    b. Have candy or chips available to eat
    c. Have fruit available in a bowl or on the counter

d. Have ice cream, cake, pastries, or ready-to-eat sweet baked goods (cookies, brownies, etc.)

Food Shopping Questions

Directions:

40. Please rate your level of agreement with the following statements: (Note: This will be a Likert scale matrix; strongly disagree to strongly agree get rid of middle)
    a. It is easy to buy fresh fruits and vegetables when food shopping.
    b. The fresh fruits and vegetables that are available when food shopping is of high quality.
    c. There is a large selection of fresh fruits and vegetables when food shopping.
    d. It is easy to buy low-fat products, such as low-fat milk or lean meats, when food shopping.
    e. The low-fat products that are available when food shopping are of high quality.
    f. There is a large selection of low-fat products available when food shopping.
41. How often do you usually shop for food?
    a. More than once a week
    b. Once a week
    c. Once every 1-2 weeks
    d. Once a month
    e. Other (please specify): _____
42. When you shop how many stores do you usually visit?
    a. One store
    b. Two stores
    c. More than two stores
43. What type of store is the store **where you buy most of your food**? (Choose the best answer)
    a. Supermarket or grocery store (like Kroger or Publix)
    b. Small or specialty grocery store (like JRs Foodland or Sprouts)
    c. Corner store or convenience store (like Dollar General)
    d. Supercenter (like Walmart or Target)
    e. Other (please specify):_____
44. About how long does it take you to get from your home to the store **where you buy the most of your food**, with your main mode of transportation?
    a. 10 minutes
    b. 11 to 20 minutes
    c. 21 to 30 minutes
    d. More than 30 minutes
45. How important are each of the following factors in your decision to shop at the store **where you buy most of your food**? (Note: Likert scale matrix; not at all, a little, somewhat, very)
    a. Near your home
    b. Near or on the way to other places where you spend time
    c. Your friend/relatives shop at this store
    d. Selection of foods
    e. Quality of foods

    f. Prices of foods
    g. Access to public transportation
46. At the store **where you buy most of your food**, how hard or easy is it to get these types of foods? (Note: Likert scale matrix; very easy, somewhat easy, somewhat hard, very hard)
    a. Fresh fruits and vegetables
    b. Canned or frozen fruits and vegetables
    c. Lean meats
    d. Candy and snack chips
    e. Low-fat products
    f. Regular soda or other sugary drinks (sports drinks, juice drinks, etc.)
47. At the store **where you buy most of your food**, how would you rate the price of fresh fruits and vegetables?
    a. Very inexpensive
    b. Not expensive
    c. Somewhat expensive
    d. Very expensive
48. Where do you **usually** purchase fruits and vegetables? (Select all that apply)
    a. Supermarket or grocery store (like Kroger or Publix)
    b. Small or specialty grocery store (like JRs Foodland or Sprouts)
    c. Corner store or convenience store (like Dollar General)
    d. Supercenter (like Walmart or Target)
    e. Farmers market
    f. Fruit and vegetable truck
    g. Other (please specify): ______
    h. I don't buy fresh fruits and vegetables
49. Please rate your level of agreement with the following statements for the store **where you buy most of your food** and your shopping habits at that store. Questions about unhealthy foods mean those often considered to be high in sugar, salt, fat and calories, such as candy, chips, regular soda, sugary cereals, bakery desserts, and so on. (Note: Likert scale matrix; strongly disagree to strongly agree get rid of middle)
    a. I notice signs that encourage me to purchase healthy foods.
    b. I often buy food items that are located near the cash register.
    c. The unhealthy foods are usually located near the end of the aisles.
    d. I often buy items that are eye-level on the shelves.
    e. There are a lot of signs and displays encouraging me to buy unhealthy foods.
    f. I see nutrition labels or nutrition information for most packaged foods at the store.
    g. I use nutrition labels or nutrition information to make food purchases.
    h. The foods near the cash register are mostly unhealthy choices.

Restaurant/Eating Out Section

50. In an average week, how many times do you eat a meal away from home, or get take-out food, at a… (Note: this will be a drop down to select number)
    a. Fast food restaurant:____ times a week
    b. Sit down restaurant: ____ times a week

c. Other type of "restaurant" (e.g. food truck, cafeteria, etc.): _____ times a week
    i. Please specify type: ______

51. About how long would it take to get from your home to the **fast-food restaurant where you go most often** using your main mode of transportation? (Note: use display logic)
    a. 10 minutes or less
    b. 11 to 20 minutes
    c. 21 to 30 minutes
    d. More than 30 minutes
    e. I do not eat at fast-food restaurants
52. About how long would it take to get from your home to the **sit-down restaurant where you go most often** using your main mode of transportation? (Note: use display logic
    a. 10 minutes or less
    b. 11 to 20 minutes
    c. 21 to 30 minutes
    d. More than 30 minutes
    e. I do not eat at sit-down restaurants

Directions: Please check the answer that best describes the restaurant where you go most often (including getting take-out) and your opinion about that restaurant.

- Questions about healthy options mean choices that are low-fat, "heart healthy", small portions, fruits and vegetables, and so on.
- Questions about unhealthy foods mean those foods that are high in fat, sugar, salt , and calories, such as "super-sized" items, foods that are deep-fried, sweet desserts, and so on.

53. Please mark whether you agree or disagree with the following statements about the **restaurant where you go most often**: (Note: Likert scale matrix; strongly disagree to strongly agree get rid of middle option)
    a. There are many healthy menu options at the restaurant.
    b. It is hard to find a healthy fruit and vegetable choices at the restaurant.
    c. It is easy to find healthy fruit and vegetable choices at the restaurant.
    d. It is important to me to be able to make a healthy food choice when eating out.
    e. The restaurant provides nutrition information (such as calorie content) on a menu board or on the menu.
    f. It costs more to buy the healthy options.
    g. The menu or menu board highlights and promotes the healthy options at the restaurant.

Your Thoughts and Habits about Food Section

54. In the last 12 months, how often were you concerned about having enough money to eat nutritious meals?
    a. Never
    b. A few times
    c. Frequently
    d. Almost all the time
55. How concerned are you about the nutritional content of the foods you eat?
    a. Not at all concerned

b. Not too concerned
c. Somewhat concerned
d. Very concerned

56. When you shop for food, how important to you is…? (Note: Likert scale matrix; not at all important, somewhat important, very important)
    a. Taste
    b. Nutrition
    c. Cost
    d. Convenience
    e. Weight control
57. When you eat out at a restaurant or get take-out food, how important to you is…? (Note: Likert scale matrix; not at all important, somewhat important, very important)
    a. Taste
    b. Nutrition
    c. Cost
    d. Convenience
    e. Weight control
58. When you shop for groceries, how often do you use a list?
    a. Never
    b. Occasionally
    c. Sometimes
    d. Usually or always
59. How often does your family eat evening meals together?
    a. Never
    b. Occasionally
    c. Sometimes
    d. Usually or always
60. How often does your family eat meals while watching TV?
    a. Never
    b. Occasionally
    c. Sometimes
    d. Usually or always
61. How would you define a healthy diet?
    a. Have as open ended
62. How would you define being healthy?
    a. Have as open ended

Directions: The next question asks about how often you eat certain foods. Think about what you **usually** eat, including all meals, snacks, and eating out.

63. About how often do you **usually** eat or drink each of the following items? (Note: matrix; 2 or more times a DAY, once a DAY, 5-6 times per WEEK, 3-4 times per WEEK, 1-3 times per MONTH, less than once a month or never
    a. Fruit (fresh, frozen, or canned), not counting juice,
    b. Fruit juice (orange, grapefruit, or tomato)
    c. Green salad
    d. Vegetables (fresh, frozen or canned), not counting potatoes or salad

e. Non-peeled non-deep fried potatoes
f. Nuts or seeds (sunflower seeds, peanuts, cashews, pumpkin seeds, etc.)
g. Fish or shellfish
h. Red meat (beef, pork, or game)
i. White meat (chicken, turkey, etc.)
j. Sugary drinks (soda, sweetened tea, sports drinks, etc.)
k. Dairy products (milk, cheese, yogurt, or butter)
l. Processed meats (lunch meat, hot dogs, etc.)
m. Sweets (candy, baked goods, chocolate, etc.)
n. Salty snacks (chips, snack mixes, etc.)
o. Legumes (beans, peas, lentils, etc.)
p. Grains (brown rice, whole wheat, oatmeal, etc.)

Information for Drawing

Directions: This section of the survey collects information to enter you into a drawing for a gift card. 10 20-dollar visa gift cards will be drawn for at random. Please fill out this information if you wish to be entered into the drawing. This is not mandatory information it in voluntary. If you do not fill this section out you will not be entered into the drawing for the gift cards. Thank you for your time in completing this survey.

64. What is your first name.
    a. Have as fill in
65. What is your mailing address?
    a. Have as fill in

Appendix B: In-Store Assessment

ID Section

1. Rater ID: This is your first and last name initials and your birth month. (Open entry question.)
2. Store ID: This is the store name and the stores numerical address. (Open entry question.)
3. Select the primary store type.
    a. Grocery store (Kroger, Publix, etc.)
    b. Convenience store (Dollar General, Dollar Tree, etc.)
    c. Super center (Wal-Mart, Target, etc.)
4. Select the secondary store type. If a secondary store type does not apply leave blank.
    a. Ethnic food store
    b. Corner store
    c. General merchandise store (Target, Wal-Mart, etc.)
    d. Drugstore or pharmacy
    e. Gas station
5. Please enter the date of your assessment in the format of mm/dd/yyyy. (Open entry question.)
6. Please enter the time that you are starting your store assessment in the format of 00:00 am/pm.

Milk Section

7. Is there milk available in this store? (If no, section is skipped.)
    a. No
    b. Yes
8. Is low-fat (skim or 1%) milk available?
    a. No
    b. Yes
9. Is 2% milk available?
    a. No
    b. Yes
10. Is whole milk available?
    a. No
    b. Yes
11. If there is a store brand please use that as the reference brand. If not please select a comparable brand. Not a high end brand unless that is the only other option.
    a. Store brand
    b. Other brand
12. If you selected a non-store brand as the reference brand please enter the brand name.
13. This section will assess shelf space for the reference brand of milk. Please count how many rows of the product is available. (This question is in a matrix format with open entry boxes.)
    a. Skim
        i. Pint
        ii. Quart
        iii. Half gallon

iv. Gallon
b. 1%
i. Pint
ii. Quart
iii. Half gallon
iv. Gallon
c. 2%
i. Pint
ii. Quart
iii. Half gallon
iv. Gallon
d. Whole
i. Pint
ii. Quart
iii. Half gallon
iv. Gallon

14. Please record the prices for the reference brand of milk.
    a. Skim
        i. Quart
        ii. Half gallon
        iii. Gallon
    b. 1%
        i. Quart
        ii. Half gallon
        iii. Gallon
    c. 2%
        i. Quart
        ii. Half gallon
        iii. Gallon
    d. Whole
        i. Quart
        ii. Half gallon
        iii. Gallon
15. Please enter any comments you have about the milk selection at this store. (This is an open entry question.)

Fresh Fruit Section

16. Does this store have fresh fruit? (If no, section is skipped.)
    a. No
    b. Yes
17. Please assess the availability and price of fruit at this store. (This will be a matrix question with open entry boxes.)

	Type X if available	Price, $0.00	Unit for price, each or per lb	Quality rating, H=High(Fresh looking and no bad spots/blemishes) M=Medium(Somewhat fresh some

				blemishes L=Low (old looking has multiple blemishes and bad spots)
Bananas				
Apples				
Oranges				
Grapes				
Cantaloupe				
Peaches				
Strawberries				
Honeydew melon				
Watermelon				
Pears				

18. Please enter any comments about fruits at this store. (Open entry comment box.)

Fresh Vegetable Section

19. Does this store sell fresh vegetables? (If no, section is skipped.)
    a. No
    b. Yes
20. Please assess the availability and price of vegetables at this store. (This will be a matrix question with open entry boxes.)

	Type X if available	Price, $0.00	Unit for price, each or per lb	Quality rating, H=High(Fresh looking and no bad spots/blemishes) M=Medium(Somewhat fresh some blemishes L=Low (old looking has multiple blemishes and bad spots)
Carrots				
Tomatoes				
Sweet Peppers				
Broccoli				
Lettuce				
Corn				
Celery				
Cucumbers				
Cabbage				
Cauliflower				
Green Beans				

21. Please enter any comments you have about the vegetables at this store. (Open entry comment box.)

Beef Section

22. Does this store sell any beef? (If no, section is skipped.)
    a. No
    b. Yes
23. Please assess the availability and price of beef at this store.

	Type X if available	Price per lb, $0.00	Percent of fat
Lean ground beef, 90% lean 10% fat (ground sirloin)			
Lean ground beef, <10% fat			
Ground turkey			
Standard ground beef, 80% lean 20% fat			

24. Please select the number of varieties of lean ground beef.
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5
    f. 6+
25. Please enter any comments you have about the beef at this store. (Open entry comment box.)

Hot Dog Section

26. Does this store sell hot dogs? (If no, section is skipped.)
    a. No
    b. Yes
27. Please assess the availability and price of hot dogs at this store.

	Type X if available	Price per package, $0.00	Package size in ounces	Grams of fat per serving	Number of hot dogs per package
Oscar Mayer 98% fat-free					
Alternate brand less than or equal to 9 grams fat (choose brand similar to Oscar Mayer e.g. Ball Park)					
Oscar Mayer regular fat					
Alternate brand more than 9 grams fat (choose brand similar to Oscar Mayer e.g. Ball Park)					

28. Please enter the name of the alternate brand. (Open entry box.)
29. Please enter any comments you have about hot dogs at this store. (Open entry box.)

Frozen Dinner Section

30. Does this store sell frozen dinners? (If no, section is skipped.)
    a. No
    b. Yes
31. Does this store sell Stouffer's bran?
    a. No
    b. Yes
32. Please enter the name of the alternate brand of frozen dinners that is available. If there are multiple please select one that has reduced fat options or the one that is most similar to Stouffer's. (Open entry box.)
33. Are reduced fat frozen dinners available e.g. Lean Cuisine?
    a. No
    b. Yes
34. Please assess the shelf space for Stouffer's brand by entering the number of rows of frozen dinners available. (Open entry box.)
35. Please assess the shelf space for the alternate brand by entering the number of rows of frozen dinners available. (Open entry box).
36. Please assess the availability and price of frozen dinners. (All items must be the same brand.)

	Price per package, $0.00	Ounces of package	Calories per serving	Grams of fat per serving
Lean Cuisine or other reduced fat option: lasagna				
Lean Cuisine or other reduced fat option: roasted turkey breast				
Lean Cuisine or other reduced fat option: meatloaf				
Stouffer's: lasagna				
Stouffer's: roasted turkey breast				
Stouffer's: meatloaf				
Alternate: lasagna				
Alternate: roasted turkey breast				
Alternate: meatloaf				

37. Please enter any comments you have about the frozen dinner section. (Open entry box.)

Frozen Fruit Section

38. Does this store sell frozen fruit with no sugar added? (If no, section is skipped.)
    a. No

b. Yes

39. Please assess the availability and price of frozen fruit at this store. Use the same brand if possible.

	Type X if available	Price per package, $0.00	Ounces in package	Brand, use store brand if available
Strawberries				
Mixed berries				
Mango				
Pineapple				
Peaches				
Cherries				
Blueberries				

40. How many rows of frozen fruit are there? (Open entry box.)
41. Please enter any comments about the frozen fruit selection at this store. (Open entry box.)

Frozen Vegetable Section

42. Does this store sell frozen vegetables? (If no, section is skipped.)
    a. No
    b. Yes
43. Please assess the availability and price of frozen vegetables at this store. Use all the same brand if possible.

	Type X if available	Price per package, $0.00	Ounces in package	Brand, use store brand if available
Carrots				
Broccoli				
Corn				
Green beans				
Cauliflower				
Peas				
Sweet Peppers				
Spinach				

44. How many rows of frozen vegetables are there? (Open entry box.)
45. Please enter any comments you have about the frozen vegetables at this store. (Open entry box.)

Baked Goods Section

46. Does this store sell baked goods, bagels, bread, English muffins, etc.? (If no, section is skipped.)
    a. No

b. Yes

47. Please assess the availability and price of baked goods in this store.

	Type X if available	Cost of package, $0.00	Loaf size in ounces	Amount per package	Brand
Single bagel					
Package of bagels					
English muffins					
Low-fat English muffins					
Regular muffin (choose poppy seed if available or other plain flavor)					
Regular Danish					
Nature's Own 100% Whole Wheat Bread					
Sara Lee Classic 100% Whole Wheat Bread					
Alternate brand 100% whole wheat bread (choose a brand that is similar to Sara Lee or Nature's Own if these are not available)					
Nature's Own Butter Bread					
Sara Lee Classic White Bread					
Alternate brand white bread/made with refined flour (choose a brand that is similar to Sara Lee or Nature's Own if these are not available)					

48. How many variations of 100% whole wheat bread were at this store? This is all brands/versions of whole wheat bread.
    a. 1
    b. 2

c. 3
d. 4
e. 5
f. 6+

49. Please enter any comments you have about the baked goods and bread selection at this store. (Open entry box.)

Beverages Section

50. Does this store sell beverages? (If no, section is skipped.)
    a. No
    b. Yes
51. Please assess the availability and price of soda beverages at this store.

	Type X is available	Price per package, $0.00	Brand of alternate soda (if used)
Diet Coke 12oz			
Diet Coke 20oz			
Diet Coke 12 pack 12oz			
Alternate brand of diet soda 12oz			
Alternate brand of diet soda 20oz			
Regular Coke 12oz			
Regular Coke 20oz			
Regular Coke 12 pack 12oz			
Alternate brand regular soda 12 pack 12oz			
Alternate bran regular soda 12oz			
Alternate brand regular soda 20oz			

52. Please assess the availability and price of juice beverages at this store.

	Type X is available	Price per package, $0.00	Brand of alternate juice (if used)
Tropicana orange juice, 100% juice, 15.2oz			
Tropicana orange juice, 100% juice, 64oz			
Minute Maid orange juice, 100% juice, 15.2oz			
Minute Maid orange juice, 100% juice, 64oz			
Alternate brand or orange juice, 100% juice, 15.2 oz			

Alternate brand of orange juice, 100% juice, 64oz			
Tropicana Island Punch 15.2oz			
Tropicana Island Punch 64oz			
Alternate brand of punch if others not available, 15.2oz			
Alternate brand of punch if others not available, 64oz			

53. Does this store sell water?
    a. No
    b. Yes
54. Does this store sell non-carbonated, zero or low-calorie beverages?
    a. No
    b. Yes
55. Please enter any comments you have about the beverages at this store. (Open entry box.)

Chip Section

56. Does this store sell chips? (If no, section is skipped.)
    a. No
    b. Yes
57. Please assess the price and availability of chips at this store. Please select similar sizes.

	Type X is available	Size in ounces	Price, $0.00	Alternate brand name
Baked Lays potato chips				
Alternate low-fat chip, 3 grams of fat or less per 1oz serving				
Lays Classic potato chips				
Alternate brand regular potato chips				

58. How many varieties of low-fat chips of any brand are available?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4

f. 5
g. 6+

59. Does this store sell cereal? (If no, section is skipped.)
    a. No
    b. Yes
60. Please assess the price and availability of cereal at this store.

	Type X is available	Size in ounces	Price, $0.00	Alternate brand name
Plain Cheerios				
Alternate brand healthy option, less than 7 grams of sugar per serving				
Honey Nut cheerios				
Alternate brand of regular cereal				

61. How many varieties of healthy cereal are at this store?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4
    f. 5
    g. 6+
62. Please enter any comments you have about the cereal selection at this store. (Open entry box.)

Canned Vegetable Section

63. Does this store sell canned vegetables? (If no, section is skipped.)
    a. No
    b. Yes
64. Please assess the price and availability of canned vegetables at this store. Select varieties that are not in syrup, sauce, or seasoned.

	Type X is available	Price, $0.00	Ounces in can	Brand, use store brand if available
Corn, regular not cream,				
Green beans				
Peas				
Carrots				
Tomatoes				

65. Please enter any comments you have about the canned vegetable selection at this store. (Open entry box.)

Canned Fruit Section

66. Does this store sell canned fruit? (If no, section is skipped.)
    a. No
    b. Yes
67. Please assess the price and availability of canned fruit at this store.

	Type X is available	Price, $0.00	Ounces in can	Brand, use store brand if available
Pineapple, no sugar added or 100% juice				
Peaches, no sugar added or 100% juice				
Pears, no sugar added or 100% juice				
Mandarins, no sugar added or 100% juice				

68. Please enter any comments you have about the canned fruit selection at this store. (Open entry box.)

Appendix C: IRB Approval

Office of Research Compliance
2269 Middle Tennessee Blvd.
Sam H. Ingram Bldg (ING) Room 010A
Box 124
Murfreesboro, TN 37132
www.mtsu.edu/irb

Date: April 17, 2023
PI: Nickie Detomasi
Department: Middle Tennessee State University, Health and Human Performance
Re: Initial - IRB-FY2023-137
The Relationship Between Food Environment, Food Choice, and Diet Quality

The Middle Tennessee State University Institutional Review Board has rendered the decision below for The Relationship Between Food Environment, Food Choice, and Diet Quality. The approval is effective starting April 13, 2023.

Decision: Approved
Category: 7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Findings:
Research Notes:

Please note:

Any **modifications to the approved study must be submitted for review through Cayuse IRB**. Please note, as well, that according to MTSU Policy, a researcher is defined as anyone who works with data or has contact with participants. Anyone meeting this definition needs to be listed on the protocol and needs to complete the required training. If you add researchers to an approved project, please add them to the project within Cayuse IRB for approval **before** they begin to work on the project.

Any unanticipated harm to participants or adverse events must be reported to the Office of Compliance, and any subsequent changes to the protocol must be submitted to the IRB for review before implementing this change.

You must submit an end-of-project form to the Office of Compliance upon completion of your research. Completed research means that you have finished collecting data.

All research materials must be retained by the PI or faculty advisor (if the PI is a student) for at least three (3) years after study completion and then destroyed in a manner that maintains confidentiality and anonymity.

All approval letters and study documents are located within the Study Details in Cayuse IRB.

We wish you a successful research project,

Middle Tennessee State University Institutional Review Board

Chapter 5: Discussion

The food environment is continuously evolving. The first fast-food restaurant opened in 1921 (Diamond, 2019). Today, online food shopping is expected to reach 70% of U.S. shoppers by 2025 (Khandpur et al., 2020) and the number of food outlets continues to rise (James et al., 2017; Lacko et al., 2020). This dynamic food environment can influence people's food choices through factors such as proximity of food outlets (Brown et al., 2019; Dhillon et al., 2019; Elliston et al., 2016), social aspects (Caswell & Hanning, 2018; Cruwys et al., 2015; Elliston et al., 2016; C. Kelly et al., 2021), menu labeling (Reale & Flint, 2016), emotions, cravings (Dressler & Smith, 2013), convenience (Devine et al., 2023; Downs et al., 2022; Pradeilles et al., 2021), and a variety of other factors.

The food choices individuals make impacts their diet quality because their diet is fundamentally comprised of the foods they consume. Understanding how individuals make these choices is crucial for improving health. Especially given the increased availability and consumption of ultra-processed foods, which are linked to obesity, diabetes (Monterio et al., 2013), metabolic syndrome, risk of high blood pressure, and other health issues (Poti et al., 2017).

The literature widely supports a relationship between food environment and food choice (Belon et al., 2016; Dhillon et al., 2019; Kelly et al., 2021; Thompson et al., 2013), food environment and diet (Chavez et al., 2020; Osei-Kwasi et al., 2020; Rahmanian et al., 2014; Shaw et al., 2020; Westbury et al., 2021), and food choice and diet (Bruening et al., 2012; Colozza, 2022; Daly et al., 2023; Glabska et al., 2021; Hoenink et al., 2023). This work aimed to further explain the connection between these three factors. The integrative literature review further supported the connection between the variables individually, no previous research has comprehensively examined these variables together. Through the individual literature a connection can be seen between food environment, food choice, and diet with the food environment impacting both food choice and diet and food choice directly impacting diet.

Previous research on the food environment surrounding workplaces and diet has yielded mixed findings. Mackenbach and colleagues (2023) found that higher counts of fast-food outlets in the combined home and workplace food environment was associated with a higher diet quality. In the opposite, Burgoine and colleagues (2014) found that there were more fast-food outlets around the workplace and exposure to these outlets was associated with intake.

This research found that the number of fast-food outlets within a 15-minute drive of the home was associated with diet, but the number around the workplace was not. This unequal relationship could be due to the use of a 15-minute drive buffer. Previous research has shown mixed associations depending on buffer size used (Thornton et al., 2013), and variations in the relationship between food environment and obesity have been observed based on the type of area measured (work, home, or place of fitness) (Zhao et al., 2018). Despite mixed results, this study contributes to understanding the optimal buffers and measures to best assess the relationship of food environment and diet. It was also found that the fruit and vegetable score for the food environment around the workplace was significant. These findings together show that food environments around frequented locations does have an impact on diet.

Furthermore, this study aimed to enhance current knowledge by addressing the gap regarding the connections between the food environment, food choice, and diet quality. The food choice-natural content was shown to be associated with diet quality, where those rating the natural content of their food as more important have a better diet quality. This finding supports the idea that the food environment may not be the most important factor in diet but how people utilize the food environment is. Individuals with a higher fruit and vegetable score (derived from selection, cost, ease of purchasing, and quality of fruits and vegetables) were more likely to have a better diet quality, further supporting the impact of the food environment on diet quality. Together these findings emphasize the influence of both the food environment and food choices influence diet quality.

Additionally, this study revealed that perceived food environment and observed food environment do mimic each other, suggesting that either measure could be suitable for future research. Provided researchers consider how individuals interact with the food environment. Future studies should aim to continue use of standardized measures for food environment research in order to facilitate comparisons across studies. Further exploration of the relationships among the food environment, food choice, and diet quality is warranted, as this study only begins to explore these complex dynamics. Given the ever-changing nature of the food environment, continued research in this area is crucial. The findings from this collection of research supports the relationship that the NEMS-P: Conceptual Model maps out, where the consumer nutrition environment and the community nutrition environment, the perceived and observed nutrition environments, and eating behaviors (food choice and diet) are all intertwined and impacted by each other. This collection of research also supports other research that has found that availability and accessibility of foods impacts food choice and thus diet.

This research began to explain the relationship of food environment, food choice, and diet. Future research can explore this relationship further by utilizing the NEMS measurement tools in differing areas and populations. This will lead to a better understanding of the relationship which can lead to policy change and implementation to create a healthier overall food environment and improve health overall.

REFERENCES

Adams, E. L., Caccavale, L. J., Smith, D., & Bean, M. K. (2020). Food insecurity, the home food environment, and parent feeding practices in the era of COVID-19. *Obesity*, *28*, 2056–2063.

Aggarwal, A., Cook, A. J., Jiao, J., Seguin, R. A., Moudon, A. V., Hurvitz, P. M., & Drewnowski, A. (2014). Access to supermarkets and fruit and vegetable consumption. *American Journal of Public Health*, *105*(5), 917–923.

Ahmed, S., Warne, T., Stewart, A., Shanks, C. B., & Dupuis, V. (2022). Role of wild food environments for cultural identity, food security, and dietary quality in a rural American state. *Frontiers in Sustainable Food Systems*, *6*. https://doi.org/10.3389/fsufs.2022.774701

Alber, J. M., Green, S. H., & Glanz, K. (2018). Perceived and observed food environments, eating behaviors, and BMI. *American Journal of Preventive Medicine*, *54*(3), 423–429. https://doi.org/10.1016/j.amepre.2017.10.024

Algur, Y., Rummo, P. E., McAlexander, T. P., de Silva, S. S. A., Lovasi, G. S., Judd, S. E., Ryan, V., Malla, G., Koyama, A. K., Lee, D. C., Thorpe, L. E., & McClure, L. A. (2023). Assessing the association between food environment and dietary inflammation by community type: A cross-sectional REGARDS study. *International Journal of Health Geographics*, *22*. https://link.springer.com/article/10.1186/s12942-023-00345-4

Allman-Farinelli, M., Rahman, H., Nour, M., Wellard-Cole, L., & Watson, W. L. (2019). The role of supportive food environments to enable healthier choices when eating meals prepared outside the home: Findings from focus groups of 18 to 30 year olds. *Nutrients*, *11*. https://doi.org/10.3390/nu11092217

Almeida, L. F. F., Novaes, T. G., Pessoa, M. C., do Carmo, A. S., Mendes, L. L., & Ribeiro, A. Q. (2020). Fruit and vegetable consumption among older adults: Influence of urban food environments in a medium-sized Brazilian city. *Public Health Nutrition*, *24*(15), 4878–4887. https://doi.org/10.1017/S136898002000467X

Alston, L., Crooks, N., Strugnell, C., Orellana, L., Allender, S., Rennie, C., & Nichols, M. (2019). Associations between school food environments, body mass index and dietary intakes among regional school students in Victoria, Australia: A cross-sectional study. *International Journal of Environmental Research and Public Health*, *16*(16). https://doi.org/10.3390/ijerph16162916

Althoff, T., Nilforoshan, H., Hua, J., & Leskovec, J. (2022). Large-scale diet tracking data reveal disparate associations between food environment and diet. *Nature Communications*, *13*. https://doi.org/10.1101/2020.09.29.20204099

Ambikapathi, R., Shively, G., Leyna, G., Mosha, D., Mangara, A., Patil, C. L., Boncyk, M., Froese, S. L., Verissimo, C. K., Kazonda, P., Mwanyika-Sando, M., Killewo, J., & Gunaratna, N. S. (2021). Informal food environment is associated with household vegetable purchase patterns and dietary intake in the DECIDE study: Empirical evidence from food vendor mapping in peri-urban Dar es Salaam, Tanzania. *Global Food Security*, *28*. https://doi.org/10.1016/j.gfs.2020.100474

An, R., & Sturm, R. (2012). School and residential neighborhood food environment and dietary intake among California children and adolescents. *American Journal of*

Preventive Medicine, *42*(2), 129–135. https://doi.org/10.1016/j.amepre.2011.10.012

Appelhans, B. M., French, S. A., Tangney, C. C., Powell, L. M., & Wang, Y. (2017). To what extent do food purchases reflect shoppers' diet quality and nutrition intake? *International Journal of Behavioral Nutrition and Physical Activity*, *14*(46). https://doi.org/DOI 10.1186/s12966-017-0502-2

Arcan, C., Friend, S., Flattum, C. F., Story, M., & Fulkerson, J. A. (2019). Fill "half your child's plate with fruits and vegetables": Correlations with food-related practices and the home food environment. *Appetite*, *133*, 77–82. https://doi.org/10.1016/j.appet.2018.10.017

Ares, G., Machin, L., Girona, A., Curutchet, M. R., & Gimenez, A. (2017). Comparison of motives underlying food choice and barriers to healthy eating among low medium income consumers in Uruguay. *Cad Saude Publica*, *33*(4). https://doi.org/10.1590/0102-311X00213315

Atoloye, A. T., & Durward, C. (2019). Being motivated by nutrition is associated with healthy home food environment of Supplemental Nutrition Assistance Program (SNAP) recipients. *Journal of Nutrition Education and Behavior*, *51*(1), 101–106. https://doi.org/10.1016/j.jneb.2018.07.013

Avelino, D. C., Duffy, V. B., Puglisi, M., Ray, S., Lituma-Solis, B., Nosal, B. M., Madore, M., & Chun, O. K. (2023). Can ordering groceries online support diet quality in adults who live in low food access and low-income environments? *Nutrients*, *15*(4). https://doi.org/10.3390/nu15040862

Bader, M. D. M., Alishire, J. A., Morenoff, J. D., & House, J. S. (2010). Measurement of the local food environment: A comparison of existing data sources. *American Journal of Epidemiology*, *171*(5), 609–617. https://doi.org/DOI: 10.1093/aje/kwp419

Baldwin, J. N., Haslam, R. L., Clarke, E., Attia, J., Hutchesson, H. J., Rollo, M. E., Callister, R., Burrows, T., Truby, H., McCaffrey, T. A., Hides, Bonevski, B., & Collins, C. E. (2022). Eating behaviors and diet quality: A national survey of Australian young adults. *Journal of Nutrition Education and Behavior*, *54*(5), 397–405. https://doi.org/10.1016/j.jneb.2021.12.001

Ball, K., Crawford, D., & Mishra, G. (2005). Socio-economic inequalities in women's fruit and vegetable intakes: A multilevel study of individual, social and environmental mediators. *Public Health Nutrition*, *9*(5), 623–630. https://doi.org/10.1079/PHN2005897

Banks, J., Fitzgibbon, M. L., Schiffer, L. A., Campbell, R. T., Antonic, M. A., Braunschweig, C. L., Odoms-Young, A. M., & Kong, A. (2020). Relationship between grocery shopping frequency and home and individual level diet quality among low income racial/ethnic minority households with preschool-age children. *Journal of the Academy of Nutrition and Dietetics*, *120*(10), 1706–1714. https://doi.org/10.1016/j.jand.2020.06.017

Bargiota, A., Delizona, M., Tsitouras, A., & Koukoulis, G. N. (2013). Eating habits and factors affecting food choice of adolescents living in rural areas. *Hormones*, *12*(2), 246–253. https://doi.org/10.14310/horm.2002.1408

Barr, M. L., Martin, C., & Cardarelli, K. (2021). Losses, gains, and changes to the food environment in a Kentucky county during the COVID-19 pandemic. *Nutrients*, *13*. https://doi.org/10.3390/nu13113929

Barrett, M., Crozier, S., Lewis, D., Godfrey, K., Robinson, S., Cooper, C., Inskip, H., Baird, J., & Vogel, C. (2017). Greater access to healthy food outlets in the home and school environment is associated with better dietary quality in young children. *Public Health Nutrition*, *20*(18). https://doi.org/10.1017/S1368980017002075

Bauer, J. M., Nielsen, K. S., Hofmann, W., & Reisch, L. A. (2022). Healthy eating in the wild: An experience-sampling study of how food environments and situational factors shape out-of-home dietary success. *Social Science & Medicine*, *299*. https://doi-org.ezproxy.mtsu.edu/10.1016/j.socscimed.2022.114869

Belon, A. P., Nieuwendyk, L. M., Vallianatos, H., & Nykiforuk, C. I. J. (2016). Perceived community environmental influences on eating behaviors: A photovoice analysis. *Social Science & Medicine*, *171*, 18–29. https://doi.org/10.1016/j.socscimed.2016.11.004

Benjamin-Neelon, S. E., Vaughn, A. E., Tovar, A., Ostbye, T., Mazzucca, S., & Ward, D. S. (2018). The family child care home environment and children’s diet quality. *Appetite*, *126*, 108–113. https://doi.org/10.1016/j.appet.2018.03.024

Betts, G. M., Schwedhelm, C., Lipsky, L. M., Haynie, D. L., & Nansel, T. R. (2022). Impact of the external school food environment on the associations of internal school food environment with high schoolers’ diet and BMI. *Public Health Nutrition*, *25*(11), 3086–3095. https://doi.org/10.1017/S1368980022000994

Bibeau, W. S., Saksvig, B. I., Gittelsohn, J., Williams, S., Jones, L., & Young, D. R. (2012). Perceptions of the food marketing environment among African American teen girls and adults. *Appetite*, *58*, 396–399. http://dx.doi.org/10.1016/j.appet.2011.11.004

Bivoltsis, A., Cervigni, E., Trapp, G., Knuiman, M., Hooper, P., & Ambrosini, G. L. (2018). Food environments and dietary intakes among adults: Does the type of spatial exposure measurement matter? A systematic review. *International Journal of Health Geographics*, *17*(19). https://doi.org/10.1186/s12942-018-0139-7

Bivoltsis, A., Trapp, G., Knuiman, M., Hooper, P., & Ambrosini, G. L. (2020a). Do changes in the local food environment within new residential developments influence the diets of residents? Longitudinal results from RESIDE. *International Journal of Environmental Research and Public Health*, *17*(18). https://doi.org/10.3390%2Fijerph17186778

Bivoltsis, A., Trapp, G., Knuiman, M., Hooper, P., & Ambrosini, G. L. (2020b). The influence of the local food environment on diet following residential relocation: Longitudinal results from RESIDential Environments (RESIDE). *Public Health Nutrition*, *23*(12), 2132–2144. https://doi.org/10.1017/S1368980019005111

Black, C., Moon, G., & Baird, J. (2014a). Dietary inequalities: What is the evidence for the effect of the neighbourhood food environment? *Health Place*, *27*, 229–242. https://doi.org/10.1016/j.healthplace.2013.09.015

Black, C., Moon, G., & Baird, J. (2014b). Dietary inequalities: What is the evidence for the effect of the neighbourhood food environment? *Health Place*, *27*, 229–242. https://doi.org/doi:10.1016/j.healthplace.2013.09.015

Blake, C. E., Monterrosa, E. C., Rampalli, K. K., Khan, A. N. S., Reyes, L. I., Drew, S. D., Dominguez-Salas, P., Bukachi, S. A., Ngutu, M., Frongillo, E. A., Iruhiriye, E., & Girard, A. W. (2023). Basic human values drive food choice decision-making in different food environments of Kenya and Tanzania. *Appetite*, *188*. https://doi.org/10.1016/j.appet.2023.106620

Blake, C. E., Wethington, E., Farrell, T. J., Bisogni, C. A., & Devine, C. M. (2011). Behavioral contexts, food-choice coping strategies, and dietary quality of a multiethnic sample of employed parents. *Journal of American Dietetic Association*, *111*(3), 401–407. https://doi.org/10.1016/j.jada.2010.11.012

Blitstein, J. L., Snider, J., & Evans, W. D. (2012). Perceptions of the food shopping environment are associated with greater consumption of fruits and vegetables. *Public Health Nutrition*, *15*(6), 1124–1129.

Bodor, J. N., Rose, D., Farley, T. A., Swalm, C., & Scott, S. K. (2008). Neighbourhood fruit and vegetable availability and consumption: The role of small food stores in an urban environment. *Public Health Nutrition*, *11*(4), 413–420.

Bogard, J. R., Andrew, N. L., Farrell, P., Herrero, M., Sharp, M. K., & Tutuo, J. (2021). A typology of food environments in the Pacific Region and their relationship to diet quality in Solomon Islands. *Foods*, *10*. https://doi.org/10.3390/foods10112592

Boggiano, M. M. (2016). Palatable eating motives scale in a college population: Distribution of scores and scores associated with greater BMI and binge-eating. *Eating Behaviors*, *21*, 95–98. https://doi.org/10.1016/j.eatbeh.2016.01.001

Bonanno, A., Bimbo, F., Castellari, E., & Sckokai, P. (2017). Five-a-day, fruit and vegetables portions, and the food environment: The Italian case. *Applied Economic Perspectives and Policy*, *39*(4), 682–709. https://doi.org/10.1093/aepp/ppw032

Boone-Heinonen, J., Gordon-Larsen, P., Kiefe, C. I., Shikany, J. M., Lewis, C. E., & Popkin, B. M. (2011). Fast food restaurants and food stores: Longitudinal associations with diet in young to middle-ages adults: The CARDIA study. *Archives of Internal Medicine*, *171*(13), 1162–1170. https://doi.org/10.1001/archinternmed.2011.283

Boutte, A. K., Turner-McGrievy, G. M., Eberth, J. M., Wilcox, S., Liu, J., & Kaczynski, A. T. (2021). Healthy food density is not associated with diet quality among pregnant women with overweight/obesity in South Carolina. *Journal of Nutrition Education and Behavior*, *53*(2), 120–129. https://doi.org/10.1016/j.jneb.2020.11.014

Briefel, R. R., Crepinsek, M. K., Cabili, C., Wilson, A., & Gleason, P. M. (2009). School food environments and practices affect dietary behaviors of US public school children. *Journal of the American Dietetic Association*, *109*(2), S91–S107.

Brown, M. C., Shrestha, U., Huber, C., Best, L. G., O'Leary, M., Howard, B., Beresford, S., & Fretts, A. M. (2019). Characterizing the local food environment and grocery-store among a large American Indian community in the north-central USA: qualitative results from the Healthy Foods Healthy Families Feasibility Study. *Public Health Nutrition*, *22*(14), 2653–2661. https://doi.org/10.1017/S1368980019001095

Bruening, M., Eisenberg, M., MacLehose, R., Nanney, M. S., Story, M., & Neumark-Sztainer, D. (2012). Relationship between adolescents' and their friends' eating behaviors: Breakfast, fruit, vegetable, whole-grain, and dairy intake. *Journal of the Academy of Nutrition and Dietetics*, *112*, 1608–1613. https://doi.org/10.1016/j.jand.2012.07.008

Burgoine, T., Forouhi, N. G., Griffin, S. J., Wareham, N. J., & Monsiviais, P. (2014). Associations between exposure to takeaway food outlets, takeaway food consumption, and body weight in Cambridgeshire, UK: population based, cross sectional study. *BMJ*, *348*. https://doi.org/10.1136%2Fbmj.g1464

Caldwell, E. M., Kobayashi, M. M., DuBow, W. M., & Wytinck, S. M. (2009). Perceived access to fruits and vegetables associated with increased consumption. *Public Health Nutrition*, *12*(10). https://doi.org/10.1017/S1368980008004308

Campbell, K. J., Crawford, D. A., Salmon, J., Carver, A., Garnett, S. P., & Baur, L. A. (2007). Associations between the home food environment and obesity-promoting eating behaviors in adolescence. *Obesity*, *15*(3), 719–730.

Cantor, J., Beckman, R., Collins, R. L., Dastidar, M. G., Richardson, A. S., & Dubowitz, T. (2020). SNAP participants improved food security and diet after a full service supermarket opened in and urban food desert. *Health Affairs*, *39*(8), 1386–1394. https://doi.org/10.1377/hlthaff.2019.01309

Carbonneau, E., Lamarche, B., Robitaille, J., Provencher, V., Desroches, S., Vohl, M. C., Begin, C., Belanger, M., Couillard, C., Pelletier, L., Bouchard, L., Houle, J., Langlois, M. F., Corneau, L., & Lemieux, S. (2019). Social support, but not perceived food environment, is associated with diet quality in French-Speaking Canadians from the PRESIDE study. *Nutrients*, *11*(12). https://doi.org/10.3390/nu11123030

Carter, M. A., & Swinburn, B. (2004). Measuring the “obesogenic” food environment in New Zealand primary schools. *Health Promotion International*, *19*(1), 15–20.

Caruso, O. T., Schaafsma, H. N., McEachern, L. W., & Gilliland, J. A. (2023). The campus food environment and postsecondary student diet: A systematic review. *Journal of American College Health*, 1-25. https://doi.org/10.1080/07448481.2023.2227725

Caspi, C. E., Kawachi, I., Subramanian, S. V., Adamkiewicz, G., & Sorensen, G. (2012). The relationship between diet and perceived and objective access to supermarkets among low-income housing residents. *Social Science & Medicine*, *75*(7), 1254–1262. https://doi.org/10.1016/j.socscimed.2012.05.014

Caspi, C. E., Lenk, K., Pelletier, J. E., Barnes, T. L., Harnack, L., Erickson, D. J., & Laska, M. N. (2017). Association between store food environment and customer purchases in small grocery stores, gas-marts, pharmacies and dollar stores. *International Journal of Behavioral Nutrition and Physical Activity*, *14*. https://doi.org/10.1186/s12966-017-0531-x

Caspi, C. E., Sorensen, G., Subramanian, S. V., & Ichiro, K. (2012). The local food environment and diet: A systematic review. *Health Place*, *18*(5), 1172–1187. https://doi.org/doi:10.1016/j.healthplace.2012.05.006

Caswell, M. S., & Hanning, R. M. (2018). Adolescent perspectives of the recreational ice hockey food environment and influences on eating behavior revealed through photovoice. *Public Health Nutrition*, *21*(7), 1255–1265. https://doi.org/10.1017/S1368980018000289

Cavanaugh, E., Mallya, G., Brensinger, C., Tierney, A., & Glanz, K. (2013). Nutrition environments in corner stores in Philadelphia. *Preventative Medicine*, *56*, 149–151. http://dx.doi.org/10.1016/j.ypmed.2012.12.007

Chalermsri, C., Herzig van Wees, S., Ziaei, S., Ekstrom, E. C., Muangpaisan, W., & Rahman, S. M. (2020). Exploring the experience and determinants of the food choices and eating practices of elderly Thai people: A qualitative study. *Nutrients*, *12*(11). https://doi.org/10.3390/nu12113497

Chan, J. A., Koster, A., Eussen, S. J. P. M., Pinho, M. G. M., Lakerveld, J., Stehouwer, C. D. A., Dagnelie, P. C., van der Kallen, C. J., van Greevenbroek, M. M. J., Wesselius, A., & Bosma, H. (2023). The association between the food environment and adherence to healthy diet quality: The Maastricht Study. *Public Health Nutrition*, *26*(9), 1775–1783. https://doi.org/10.1017/S1368980023001180

Charoenbut, P., Klaewkla, J., Srisorrachatr, S., Arphorn, S., & Wijitwanna, S. (2018). Workplace and individual factors influence eating practices of Thai factory workers. *Malaysian Journal of Nutrition*, *24*(3), 417–426.

Charreire, H., Casey, R., Salze, P., Simon, C., Chaix, B., Banos, A., Badariotti, D., Weber, C., & Oppert, J. (2010). Measuring the food environment using geographical information systems: A methodological review. *Public Health Nutrition*, *13*(11), 1773–1785. https://doi.org/doi:10.1017/S1368980010000753

Chavez, J. B. R., Garcia, L. M., Jehn, M., Pereria, M. A., & Bruening, M. (2020). Relationship between different levels of the Mexican food environment and dietary intake: A qualitative systematic review. *Public Health Nutrition*, *23*(11), 1877–1888. https://doi.org/10.1017/S1368980019004294

Chege, C. G. K., Wanyama, R., Lundy, M., Nguru, W., & Jager, M. (2021). Does retail food diversity in urban food environments influence consumer diets? *Sustainability*, *13*(7666). https://doi.org/10.3390/su13147666

Chen, X., & Yang, X. (2014). Does food environment influence food choices? A geographical analysis through "tweets." *Applied Geography*, *51*, 82–89. http://dx.doi.org/10.1016/j.apgeog.2014.04.003 0143-6228/

Choi, Y. J., Crimmins, E. M., & Ailshire, J. A. (2022). Food insecurity, food environments, and disparities in diet quality and obesity in a nationally representative sample of community-dwelling older Americans. *Preventive Medicine Reports*, *29*. https://doi.org/10.1016/j.pmedr.2022.101912

Chor, D., Cardoso, L. O., Nobre, A. A., Griep, R. H., Fonseca, M. J. M., Giatti, L., Bensenor, I., Molina, M. C. B., Aquino, E. M. L., Diez-Roux, A., Castiglione, D. P., & Santos, S. M. (2016). Association between perceived neighbourhood characteristics, physical activity and diet quality: Results of the Brazilian Longitudinal Study of

Adults Health (ELSA-Brazil). *BMC Public Health*, *16*. https://doi.org/10.1186/s12889-016-3447-5

Chrisinger, B. W., Kallan, M. J., Whiteman, E. D., & Hillier, A. (2018). Where do U.S. households purchase healthy foods? An analysis of food-at-home purchases across different types of retailers in a nationally representative dataset. *Preventative Medicine*, *112*, 15–22. https://doi.org/10.1016/j.ypmed.2018.03.015

Chum, A., Farrell, E., Vaivada, T., Labetski, A., Bohnert, A., Selvaratnam, I., Larsen, K., Pinter, T., & O'Campo, P. (2015). The effect of food environment on fruit and vegetable intake as modified by time spent at home: A cross-sectional study. *BMJ Open*, *5*(6). https://doi.org/10.1136/bmjopen-2014-006200

Clary, C., Lewis, D. J., Flint, E., Smith, N. R., Kestens, Y., & Cummins, S. (2016). The local food environment and fruit and vegetable intake: A geographically weighted regression approach in the ORiEL study. *American Journal of Epidemiology*, *184*(11), 837–846. https://doi.org/10.1093/aje/kww073

Colozza, D. (2022). A qualitative exploration of ultra-processed foods consumption and eating out behaviors in an Indonesian urban food environment. *Nutrition and Health*. https://doi.org/10.1177/02601060221133897

Connors, M., Bisogni, C. A., Sobal, J., & Devine, C. M. (2001). Managing values in person food systems. *Appetite*, *36*, 189–200. https://doi.org/doi:10.1006/appe.2001.0400, Cooksey-Stowers, K., Jiang, Q., Atoloye, A. T., Lucan, S., & Gans, K. (2020). Racial differences in perceived food swamp and food desert exposure and disparities in self-reported dietary habits. *International Journal of Environmental Research and Public Health*, *17*. https://doi.org/doi:10.3390/ijerph17197143

Cooksey-Stowers, K., Schwartz, M. B., & Brownell, K. D. (2017). Food swamps predict obesity rates better than food deserts in the United States. *International Journal of Environmental Research and Public Health*, *14*(11). https://doi.org/10.3390/ijerph14111366

Couch, S. C., Glanz, K., Zhou, C., Sallis, J. F., & Saelens, B. E. (2014). Home food environment in relation to children's diet quality and weight status. *Journal of the Academy of Nutrition and Dietetics*, *114*, 1569–1579. http://dx.doi.org/10.1016/j.jand.2014.05.015

Crino, M., Sacks, G., Vandevijvere, S., Swinburn, B., & Neal, B. (2015). The influence on population weight gain and obesity of the macronutrient composition and energy density of the food supply. *Current Obesity Reports*, *4*(1). https://doi.org/DOI 10.1007/s13679-014-0134-7

Cruwys, T., Bevelander, K. E., & Hermans, R. C. J. (2015). Social modeling of eating: A review of when and why social influence affects food intake and choice. *Appetite*, *86*, 3–18. http://dx.doi.org/10.1016/j.appet.2014.08.035

Cullen, K. W., & Dave, J. M. (2017). The new federal school nutrition standards and meal patterns: Early evidence examining the influence on student dietary behavior and the school food environment. *Journal of the Academy of Nutrition and Dietetics*, *117*(2), 185–191.

Cummins, S., Flint, E., & Matthews, S. A. (2014). New neighborhood grocery store increased awareness of food access but did not alter dietary habits or obesity. *Health Affairs*, *33*(2), 283–291. https://doi.org/10.1377/hlthaff.2013.0512

Curioni, C. C., Boclin, K. L. S., Silveira, I. H., Canella, D. S., Castro, I. R. R., Bezerra, F. F., Junger, W., & Faerstein, E. (2020). Neighborhood food environment and consumption of fruit and leafy vegetables: Pro-Saude Study Brazil. *Public Health*, *182*, 7–12.

Curl, A. L., Beresford, S. A. A., Hajat, A., Kaufman, J. D., Moore, K., Nettleton, J. A., & Diez-Roux, A. V. (2013). Associations of organic produce consumption with socioeconomic status and the local food environment: Multi-Ethnic Study of Atherosclerosis (MESA). *PLoS ONE*, *8*(7). https://doi.org/10.1371/journal.pone.0069778

da Silva, W. R., Ferreira, E. B., Maroco, J., da Silva Junior, S. I., Teodoro, M. A., & Campos, J. A. D. B. (2023). Relationships between three eating behaviors and nine motives for food choices among Brazilian adults: A structural equation model. *Perceptual and Motor Skills*, *130*(6), 2388–2409.

Daly, A. N., O'Sullivan, E. J., Walton, J., Kehoe, L., McNulty, B. A., Flynn, A., & Kearney, J. M. (2023). Determining the food choice motivations of Irish teens and their association with dietary intakes, using the Food Choice Questionnaire. *Appetite*, *189*. https://doi.org/10.1016/j.appet.2023.106981

Darmon, N., & Drewnowski, A. (2015). Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: A systematic review and analysis. *Nutrition Reviews*, *73*(10), 643–660. https://doi.org/doi: 10.1093/nutrit/nuv027

Dawson, J. (2013). Retailer activity in shaping food choice. *Food Quality and Preference*, *28*(1), 399–347. https://doi.org/10.1016/j.foodqual.2012.09.012

de Almeida Alves, M., Pinho, M. G. M., Correa, E. N., das Neves, J., & de Vasconcelos, F. A. G. (2019). Parental perceived travel time to and reported use of food retailers in association with school children's dietary patterns. *International Journal of Environmental Research and Public Health*, *16*(5). https://doi.org/10.3390/ijerph16050824

de Almeida, I. J., Garcez, A., Backes, V., de Lima Cunha, C. M., Schuch, I., & Canuto, R. (2023). Association between the community food environment and dietary patterns in residents of areas of different socio-economic levels of a southern capital city in Brazil. *British Journal of Nutrition*, *129*, 1066–1074.

de Deus Mendonca, R., Lopes, M. S., Freitas, P. P., Campos, S. F., de Menezes, M. C., & Lopes, A. C. S. (2019). Monotony in the consumption of fruits and vegetables and food environment characteristics. *Revista de Saude Publica*, *53*(63). https://doi.org/10.11606/S1518-8787.2019053000705

de Menezes, M. C., Roux, A. V. D., de Lima Costa, B. V., & Lopes, A. C. S. (2018). Individual and food environmental factors: Association with diet. *Public Health Nutrition*, *21*(15), 2782–2792. https://doi.org/10.1017/S1368980018001623 de Menezes, R. C. E., Oliveira, J. S., Almendra, R., de Lira, P. I. C., Costa, E. C., Leal, V. S., & Santana, P. (2022). Influence of food environment on ultra-processed drinks consumption among an economically vulnerable population in a metropolitan area in Brazil: A multilevel analysis. *Health & Place*, *77*. https://doi.org/10.1016/j.healthplace.2022.102869

de Wit, J. B. F., Stok, F. M., Smolenski, D. J., de Ridder, D. D. T., de Vet, E., Gaspar, T., Johnson, F., Nureeva, L., & Luszczynska, A. (2015). Food culture in the home environment: Family meal practices and values can support healthy eating and self-regulation in young people in four European countries. *Applied Psychology: Health and Well-Being*, *7*(1), 22–40. https://doi.org/doi:10.1111/aphw.12034

Dean, W. R., & Sharkey, J. R. (2011). Rural and urban differences in the associations between characteristics of the community food environment and fruit and vegetable intake. *Journal of Nutrition Education and Behavior*, *43*(6), 426–433. https://doi.org/10.1016/j.jneb.2010.07.001

Deierlein, A. L., Galvez, M. P., Yen, I. H., Pinney, S. M., Biro, F. M., Kushi, L. H., Teitelbaum, S., & Wolff, M. S. (2014). Local food environments are associated with girls' energy, sugar-sweetened beverage and snack-food intakes. *Public Health Nutrition*, *17*(10). https://www.cambridge.org/core/journals/public-health-nutrition/article/local-food-environments-are-associated-with-girls-energy-sugarsweetened-beverage-and-snackfood-intakes/B8493B700C28E87A7DA1B9106D47D887

Devine, L. D., Gallagher, A. M., Briggs, S., & Hill, A. J. (2023). Factors that influence food choices in secondary school canteens: A qualitative study of pupil and staff perspectives. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1227075

Dhakal, C. K., & Khadka, S. (2021). Heterogeneities in consumer diet quality and health outcomes of consumers by store choice and income. *Nutrients*, *13*(4). https://doi.org/10.3390/nu13041046

Dhillon, J., Rios, L. K. D., Aldaz, K. J., De La Cruz, N., Vu, E., Asghar, S. A., Kuse, Q., & Ortiz, R. M. (2019). We don't have a lot of healthy options: Food environment perceptions of first-year, minority college students attending a food desert campus. *Nutrients*, *11*(4). https://doi.org/10.3390/nu11040816

Diamond, A. (2019). A crispy, salty, American history of fast food. *Smithsonian Magazine*. https://www.smithsonianmag.com/history/crispy-salty-american-history-fast-food-180972459/#:~:text=White%20Castle%20was%20the%20country's,that%20was%20raging%20across%20America.

Dietary Guidelines Advisory Committee. (2020). *Scientific reports of the 2020 Dietary Guidelines Advisory Committee: Advisory report of the Secretary of Agriculture and the Secretary of Health and Human Services*. U.S. Department of Agriculture, Agricultural Research Service. https://doi.org/10.52570/DGAC2020

Ding, D., Sallis, J. F., Norman, G. J., Saelens, B. E., Harris, S. K., Kerr, J., Rosenberg, D., Durant, N., & Glanz, K. (2012). Community food environment, home food environment, and fruit and vegetable intake of children and adolescents. *Journal of Education and Behavior*, *44*(6), 634–638. http://dx.doi.org/10.1016/j.jneb.2010.07.003

Downs, S. M., Ahmed, S., Fanzo, J., & Herforth, A. (2020). Food environment typology: Advancing an expanded definition, framework, and methodological approach for improved characterization of wild, cultivated, and built food environments toward sustainable diets. *Foods*, *9*(4). https://doi.org/10.3390/foods9040532

Downs, S. M., Arnold, A., Marshall, D., McCargar, L. J., Raine, K. D., & Willows, N. D. (2009). Associations among the food environment, diet quality and weight status in Cree children in Quebec. *Public Health Nutrition*, *12*(9), 1504–1511. https://doi.org/10.1017/S1368980008004515

Downs, S. M., Fox, E. L., Mutuku, V., Muindi, Z., Fatima, T., Pavlovic, I., Husain, S., Sabbahi, M., Kimenju, S., & Ahmed, S. (2022). Food environments and their influence on food choices: A case study in informal settlements in Nairobi, Kenya. *Nutrients*, *14*(13). https://doi.org/10.3390/nu14132571

Dressler, H., & Smith, C. (2013). Food choice, eating behavior, and food liking differs between lean/normal and overweight/obese, low-income women. *Appetite*, *65*, 145–152. https://doi.org/10.1016/j.appet.2013.01.013

Drewnowski, A., Aggarwal, A., Tang, P., Hurvitz, P. M., Scully, J., Stewart, O., & Moudon, A. V. (2016). Obesity, diet quality, physical activity, and the built environment: The need for behavioral pathways. *BMC Public Health*, *16*.

https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-3798-y

Drisdelle, C., Kestens, Y., Hamelin, A. M., & Mercille, G. (2020). Disparities in access to healthy diets: How food security and food shopping behaviors relate to fruit and vegetable intake. *Journal Academy of Nutrition and Dietetics*, *120*(11), 1847–1858.

Dubois, L., Bedard, B., Goulet, D., Prud'homme, D., Tremblay, R. E., & Boivin, M. (2022). Eating behaviors, dietary patterns and weight status in emerging adulthood and longitudinal associations with eating behaviors in early childhood. *International Journal of Behavioral Nutrition and Physical Activity*, *19*. https://doi.org/10.1186/s12966-022-01376-z

Dubowitz, T., Ghosh-Dastidar, B., Cohen, D. A., Beckman, R., Steiner, E. D., Hunter, G. P., Florez, K. R., Huang, C., Vaughn, C. A., Sloan, J. C., Zenk, S. N., Cummins, S., & Collins, R. L. (2015). Changes in diet after introduction of a full service supermarket in a food desert. *Health Affairs*, *34*(11), 1858–1868. https://doi.org/10.1377/hlthaff.2015.0667

Dubowitz, T., Ghosh-Dastidar, M., Eibner, C., Slaughter, M. E., Fernandes, M., Whitsel, E. A., Bird, C. E., Jewell, A., Margolis, K. L., Li, W., Michael, Y. L., Shih, R. A., Manson, J. E., & Escarce, J. J. (2012). The Women's Health Initiative: The food environment, neighborhood socioeconomic status, BMI, and blood pressure. *Obesity*, *20*, 862–871. https://doi.org/doi:10.1038/oby.2011.141

Dubowitz, T., Zenk, S. N., Ghosh-Dastidar, B., Cohen, D. A., Beckman, R., Hunter, G., Steiner, E. D., & Collins, R. L. (2015). Healthy food access for urban food desert residents: Examination of the food environment, food purchasing practices, diet and BMI. *Public Health Nutrition*, *18*(12), 2220–2230. https://doi.org/10.1017/S1368980014002742

Dunaway, L. F., Carton, T., Ma, P., Mundorf, A. R., Keel, K., & Theall, K. P. (2017). Beyond food access: The impact of parent-, home-, and neighborhood-level factors on children's diets. *International Journal of Environmental Research and Public Health*, *14*(6). https://doi.org/10.3390/ijerph14060662

Duran, A. C., de Almeida, S. L., Latorre, Mdo. R., & Jaime, P. C. (2016). The role of the local retail food environment in fruit, vegetable and sugar-sweetened beverage consumption in Brazil. *Public Health Nutrition*, *19*(6), 1093–1102. https://doi.org/10.1017/S1368980015001524

Echouffo-Tcheugui, J., & Rexford, A. S. (2019). Does diet quality or nutrient quantity contribute more to health? *Journal of Clinical Investigation*, *129*(10), 3969–3970. https://doi.org/10.1172/JCI131449

Elliston, K. G., Ferguson, S. G., Schuz, N., & Schuz, B. (2016). Situational cues and momentary food environment predict everyday eating behavior in adults with overweight and obesity. *Health Psychology*, *36*(4), 337–345. http://dx.doi.org/10.1037/hea0000439

Engler-Stringer, R., Le, H., Gerrard, A., & Muhajarine, N. (2014). The community and consumer food environment and children's diet: A systematic review. *BMC Public Health*, *14*. https://doi.org/10.1186/1471-2458-14-522

Espel-Huynh, H. M., Muratore, A. F., & Lowe, M. R. (2018). A narrative review of the construct of hedonic hunger and its measurement by the Power of Food Scale. *Obesity Science & Practice*, 238–249. https://doi.org/doi: 10.1002/osp4.161

Evans, A. E., Jennings, R., Smiley, A. W., Medina, J. L., Sharma, S. V., Rutledge, R., Stigler, M. H., & Hoelscher, D. M. (2012). Introdution of farm stands in low-income communities increases fruit and vegetable among community residents. *Health & Place*, *18*, 1137–1143. http://dx.doi.org/10.1016/j.healthplace.2012.04.007

Fast food restaurants in the US - number of businesses 2005-2029. (2023, January 12). IBISWorld. https://www.ibisworld.com/industry-statistics/number-of-businesses/fast-food-restaurants-united-states/#:~:text=How%20many%20businesses%20are%20there,increase%20of%200.9%25%20from%202022.

Figueroa, R., Baker, K., Capellan, J., Pinheiro, L. C., Burd, L., Lim, J., Chiong, R., Eboh, R., & Phillips, E. (2022). Residential urban food environment profiles and diet outcomes among adults in Brooklyn, New York: A cross-sectional study. *Public Health Nutrition*, *26*(4), 877–885.

Flint, E., Cummins, S., & Matthews, S. (2013). Do perceptions of the neighbourhood food environment predict fruit and vegetable intake in low-income neighbourhoods? *Health Place*, *11*(5). https://doi.org/10.1016/j.healthplace.2013.07.005

Folkvord, F., van der Zanden, M., & Pabian, S. (2020). Taste and health information on fast food menus to encourage young adults to choose healthy food products: An experimental study. *International Journal of Environmental Research and Public Health*, *17*(19). https://doi.org/10.3390/ijerph17197139

Franco, M., Diez-Roux, A. V., Nettleton, J. A., Lazo, M., Brancati, F., Cabballero, B., Glass, T., & Moore, L. V. (2009). Availability of healthy foods and dietary patterns: The Multi-Ehnic Study of Atherosclerosis. *American Journal of Clinical Nutrition*, *89*, 987–904.

Freedman, D., Bell, B., Clark, J., Ngendahimana, D., Borawski, E., Trapl, E., Pike, S., & Sehgal, A. R. (2021). Small improvements in an urban food environment resulted in no changes in diet among residents. *Journal of Community Health*, *46*(1), 1–12. https://doi.org/10.1007/s10900-020-00805-z

Fuller, D., Cummins, S., & Matthews, S. A. (2013). Does transportation mode modify associations between distance to food store, fruit and vegetable consumption, and BMI in low-income neighborhoods? *American Journal of Clinical Nutrition*, *97*, 167–172.

Furst, T., Connors, M., Bisogni, C. A., Sobal, J., & Falk, L. W. (1996). *Food choice: A conceptual model of the process*. *26*, 247–266.

Gao, X., Engeda, J., Moore, L. V., Auchincloss, A. H., Moore, K., & Mujahid, M. (2022). Longitudinal associations between objective and perceived healthy food environment and diet: The Multi-Ethnic Study of Atherosclerosis. *Social Science & Medicine*, *292*. https://doi.org/10.1016/j.socscimed.2021.114542

Gase, L. N., DeFosset, A. R., Smith, L. V., & Kup, T. (2014). The association between self-reported grocery store access, fruit and vegetable intake, sugar-sweetened beverage consumption, and obesity in a racially diverse, low-income population. *Frontiers in Public Health*, *2*. https://doi.org/10.3389/fpubh.2014.00229

Gase, L. N., Glenn, B., & Kuo, T. (2016). Self-efficacy as a mediator of the relationship between the perceived food environment and healthy eating in a low income population in Los Angeles county. *Journal of Immigrant and Minority Health*, *18*(2), 345–352. https://doi.org/10.1007/s10903-015-0186-0

Gebremariam, M. K., Andersen, L. F., Bjelland, M., Klepp, K. I., Totland, T. H., Bergh, I. H., & Lien, N. (2012). Does the school food environment influence the dietary behaviours of Norwegian 11-year-olds? The HEIA study. *Scandinavian Journal of Public Health*, *40*(5), 491–497. https://doi-org.ezproxy.mtsu.edu/10.1177/1403494812454948

General food environment resources. (2014). Centers for Disease Control and Prevention. https://www.cdc.gov/healthyplaces/healthtopics/healthyfood/general.htm

Gilham, K., Gu, Q., Dummer, T. J. B., Spinelli, J. J., & Murphy, R. A. (2020). Diet quality and neighborhood environment in the Atlantic Partnership for Tomorrow's Health Project. *Nutrients*, *12*(10). https://doi.org/10.3390/nu12103217

Glabska, D., Skolmowska, D., & Guzek, D. (2021). Food preferences and food choice determinants in a Polish adolescents' COVID-19 experience (PLACE-19) study. *Nutrients*, *13*(8). https://doi.org/10.3390/nu13082491

Glanz, K. (2009). Measuring food environments a historical perspective. *American Journal of Preventive Medicine*, *36*(4S), S93–S98. https://doi.org/doi:10.1016/j.amepre.2009.01.010

Glanz, K., Sallis, J. F., Saelens, B. E., & Frank, L. D. (2005). Healthy nutrition environments: Concepts and measures. *American Journal of Health Promotion*, *19*(5), 330–333.

Glanz, K., Sallis, J. F., Saelens, B. E., & Frank, L. D. (2007). Nutrition Environment Measures Survey in Stores (NEMS-S) development and evaluation. *American Journal of Preventive Medicine*, *32*(4), 282–289. https://doi.org/doi:10.1016/j.amepre.2006.12.019

Glickman, A. R., Clark, J. K., & Freedman, D. A. (2021). A relational approach to evaluate food environments finds that the proximate food environment matters for those who use it. *Health Place*, *69*. https://doi.org/doi:10.1016/j.healthplace.2021.102564

Gomes, C. S., Silveira, E. A., & Velasquez-Melendez, G. (2022). Neighborhood environment is associated with unhealthy food intake in a Brazilian urban area. *Appetite*, *172*. https://doi.org/10.1016/j.appet.2022.105972

Gomi, T., Kitayuguchi, J., Okuyama, K., Kamada, M., Inoue, S., Kamioka, H., & Mutoh, Y. (2022). Relationship between neighborhood food environment and diet variety in Japanese rural community-dwelling elderly: A cross-sectional study. *Journal of Epidemiology*, *32*(6), 290–297.

Goodman, M., Thomson, J., & Landry, A. (2020). Food environment in the Lower Mississippi Delta: Food deserts, food swamps and hot spots. *International Journal of Environmental Research and Public Health*, *17*. https://doi.org/doi:10.3390/ijerph17103354

Gordon-Larsen, P., Rummo, P. E., Guilkey, D. K., Ng, S. W., Meyer, K. A., Popkin, B. M., Reis, J. P., & Shikany, J. M. (2017). Understanding bias in relationships between the food environment and diet quality: The Coronary Artery Risk Development in Young Adults (CARDIA) study. *Journal of Epidemiology and Community Health*, *71*(12), 1185–1190. https://doi.org/10.1136/jech-2017-209158

Granheim, S. I., Lovhaug, A. L., Terragni, L., Torheim, L. E., & Thurston, M. (2021). Mapping the digital food environment: A systematic scoping review. *Obesity Reviews*, *23*(1). https://doi.org/10.1111/obr.13356

Grant, E., Gearry, R. B., Wilson, R., Pearson, J., & Skidmore, P. M. L. (2017). Home availability of fruit and vegetables and obesogenic foods as an indicator of nutrient intake in 50 year olds from Canterbury, New Zealand. *Asia Pacific Journal of Clinical Nutrition*, *26*(3), 524–530.

Green, S. H., & Glanz, K. (2015). Development of a perceived nutrition environment measures survey. *American Journal of Preventive Medicine*, *49*(1), 50–61. http://dx.doi.org/10.1016/j.amepre.2015.02.004

Guine, R. P. F., Bartkiene, E., Szucs, V., Tarcea, M., Ljubicic, M., Cernelic-Bizjak, M., Isoldi, K., EL-Kenawy, A., Ferreira, V., Straumite, E., Korzeniowska, M., Vittadini, E., Leal, M., Frez-Munoz, L., Papageorgiou, M., Djekic, I., Ferreira, M., Correia, P., Cardoso, A. P., & Duarte, J. (2020). Study about food choice determinants according to six types of conditioning motivations in a sample of 11,960 participants. *Foods*, *9*(7). https://doi.org/10.3390/foods9070888

Gupta, N. R., & Freedman, D. A. (2021). Food security moderates relationship between perceived food environment and diet quality among adults in communities with low access to healthy food retail. *Public Health Nutrition*, *24*(10), 2975–2986. https://doi.org/10.1017/S1368980020001317

Gustafson, A. A., Sharkey, J., Samuel-Hodge, C. D., Jones-Smith, J., Folds, M. C., Cai, J., & Ammerman, A. S. (2011). Perceived and objective measures of the food store environment and the association with weight and diet among low income women in North Carolina. *Public Health Nutrition*, *14*(6), 1032–1038. https://doi.org/10.1017/S1368980011000115

Gustafson, A., Christian, J. W., Lewis, S., Moore, K., & Jilcott, S. (2013). Food venue choice, consumer food environment, but not food venue availability within daily travel patterns are associated with dietary intake among adults, Lexington Kentucky 2011. *Nutrition Journal*, *12*. https://doi.org/10.1186/1475-2891-12-17

Gustafson, A., Lewis, S., Perkins, S., Wilson, C., Buckner, E., & Vail, A. (2013). Neighbourhood and consumer food environment is associated with dietary intake among Supplemental Nutrition Assistance Program (SNAP) participants in Fayette County, Kentucky. *Public Health Nutrition*, *16*(7), 1229–1237. https://doi.org/10.1017/S1368980013000505

Gustafson, A., Pitts, S. J., McDonald, J., Ford, H., Connelly, P., Gillespie, R., Liu, E., Bush, H., Brancato, C., Babatande, T., & Mullins, J. (2017). Direct effects of the home, school, and consumer food environments on the association between food purchasing patterns and dietary intake among rural adolescents in Kentucky and North Carolina, 2017. *International Journal of Environmental Research and Public Health*, *14*(10). https://doi.org/10.3390/ijerph14101255

Hager, E. R., Cockerham, A., O'Reilly, N., Harrignton, D., Harding, J., Hurley, K. M., & Black, M. M. (2017). Food swamps and food deserts in Baltimore City, MD, USA: associations with dietary behaviours among urban adolescent girls. *Public Health Nutrition*, *20*(14), 2598–2607. https://doi.org/10.1017/S1368980016002123

Hanson, N. I., Neumark-Sztainer, D., Eisenberg, M. E., Story, M., & Wall, M. (2005). Associations between parental report of the home food environment and adolescent intakes of fruits, vegetables and dairy foods. *Public Health Nutrition*, *8*(1), 77–85. https://doi.org/10.1079/PHN2004661

Harbers, M. C., Beulens, J. W. J., Boer, J. M. A., Karssenberg, D., Mackenbach, J. D., Rutters, F., Vaartjes, I., Verschuren, W. M. M., & van der Schouw, Y. T. (2021). Residential exposure to fast-food restaurants and its association with diet quality, overweight and obesity in the Netherlands: A cross-sectional analysis in the EPIC-NL cohort. *Nutrition Journal*, *20*. https://doi.org/10.1186/s12937-021-00713-5

Hardcastle, S. J., Thogerson-Ntoumani, C., & Chatzisarantis, N. L. D. (2015). Food choice and nutrition: A social psychological perspective. *Nutrients*, *7*, 8712–8715. https://doi.org/doi:10.3390/nu7105424

Harper, K., Caulfield, L. E., Lu, S. V., Mmari, K., & Gross, S. M. (2022). Diet quality and contextual factors influencing food choice among adolescents with food security and food insecurity in Baltimore City. *Nutrients*, *14*(21). https://doi.org/10.3390/nu14214573

Hattori, A., An, R., & Sturm, R. (2013). Neighborhood food outlets, diet, and obesity among California adults, 2007 and 2009. *Preventing Chronic Disease*, *10*. https://doi.org/10.5888/pcd10.120123

Hawkesworth, S., Silverwood, R. J., Armstrong, B., Pilakas, T., Nanchahal, K., Sartini, C., Amuzu, A., Wannamethee, G., Atkins, J., Ramsay, S. E., Casas, J. P., Morris, R. W., Whincup, P. H., & Lock, K. (2017). Investigating the importance of the local food environment for fruit and vegetable intake in older men and women in 20 UK towns: A cross-sectional analysis of two national cohorts using novel methods. *International Journal of Behavioral Nutrition and Physical Activity*, *14*. https://doi.org/10.1186/s12966-017-0581-0

He, M., Tucker, P., Gilliland, J., Irwin, J. D., Larsen, K., & Hess, P. (2012). The influence of local food environments on adolescents' food purchasing behaviors. *International Journal of Environmental Research and Public Health*, *9*(4), 1458–1471. https://doi.org/10.3390/ijerph9041458

He, M., Tucker, P., Irwin, J. D., Gilliland, J., Larsen, K., & Hess, P. (2012). Obesogenic neighbourhoods: The impact of neighbourhood restaurants and convenience stores on adolescents' food consumption behaviours. *Public Health Nutrition*, *15*(12). https://doi.org/10.1017/S1368980012000584

Hearst, M. O., Pasch, K. E., & Laska, M. N. (2012). Urban v. Suburban perceptions of the neighbourhood food environment as correlates of adolescent food purchasing. *Public Health Nutrition*, *15*(2), 299–306. https://doi.org/10.1017/S1368980011002114

Heroux, M., Iannotti, R. J., Currie, D., Pickett, W., & Janssen, I. (2012). The food retail environment in school neighborhoods and its relation to lunchtime eating behaviors in youth from three countries. *Health & Place*, *18*(6), 1240–1247.

Hickson, D. A., Diez-Roux, A. V., Smith, A. E., Tucker, K. L., Gore, L. D., Zhang, L., & Wyatt, S. B. (2011). Associations of fast food restaurant availability with dietary intake and weight among African Americans in the Jackson Heart Study, 2000-2004. *American Journal of Public Health*, *101*, S301–S309. https://doi.org/10.2105/AJPH.2010.300006

Ho, S., Wong, B. Y., Lo, W., Mak, K., Thomas, G. N., & Lam, T. (2010). Neighbourhood food environment and dietary intakes in adolescents: Sex and perceived family affluence as moderators. *International Journal of Pediatric Obesity*, *5*, 420–427. https://doi.org/10.3109/17477160903505910

Hobbs, M., Green, M., Roberts, K., Griffiths, C., & McKenna, J. (2019). Reconsidering the relationship between fast-food outlets, area-level deprivation, diet quality and body mass index: An exploratory structural equation modeling approach. *Journal of Epidemiology and Community Health*, *73*(9). https://doi.org/10.1136/jech-2018-211798

Hoenink, J. C., Burgoine, T., Brage, S., Forouhi, N., Griffin, S. J., Monsivais, P., Wareham, N. J., Ahern, A., & Adams, J. (2023). The moderating role of eating behaviour traits in the association between exposure to hot food takeaway outlets and body fatness. *International Journal of Obesity*, *47*(6), 496–504. https://doi.org/10.1038/s41366-023-01290-9

Hollis-Hansen, K., Vermont, L., Zafron, M. L., Seidman, J., & Leone, L. (2019). The introduction of new food retail opportunities in lower income communities and the impact on fruit and vegetable intake: A systematic review. *Translational Behavioral Medicine*, *9*(5), 837–846.

Hulst, A. V., Barnett, T. A., Gauvin, L., Daniel, M., Kestens, Y., Bird, M., Gray-Donald, K., & Lambert, M. (2012). Associations between children’s diets and features of their residential and school neighbourhood food environments. *Canadian Journal of Public Health*, *9*. https://doi.org/10.1007/BF03403835

Isaacs, A., Spires, M., Halloran, A., & Stridsland, T. (2022). Gathering data on food environment and food practices through photo elicitation in Copenhagen, Denmark: Implications for adapting the EAT-LANCET reference diet to local circumstances. *Cities & Health*, *6*. https://doi.org/10.1080/23748834.2022.2078072

Izumi, B. T., Zenk, S. N., Schulz, A. J., Mentz, G. B., & Wilson, C. (2011). Associations between neighborhood availability and individual consumption of dark-green and orange vegetables among ethically diverse adults in Detroit. *Journal of the American Dietetics Association*, *111*(2), 274–279. https://doi.org/10.1016/j.jada.2010.10.044

Jack, D., Neckerman, K., Schwartz-Soicher, O., Lovasi, G. S., Quinn, J., Richards, C., Bader, M., Weiss, C., Konty, K., Arno, P., Viola, D., Kerker, B., & Rundle, A. (2013). Socio-economic status, neighbourhood food environments and consumption of fruits and vegetables in New York City. *Public Health Nutrition*, *16*(7), 1197–1205. https://doi.org/10.1017/S1368980012005642

Jackson, J. A., Smit, E., Manore, M. M., John, D., & Gunter, K. (2015). The family-home nutrition environment and dietary intake in rural children. *Nutrients*, *7*(12), 9707–9720. https://doi.org/10.3390/nu7125495

Jago, R., Baranowski, T., Baranowski, J. C., Cullen, K. W., & Thompson, D. (2007). Distance to food stores & adolescent male fruit and vegetable consumption: Mediation effects. *International Journal of Behavioral Nutrition and Physical Activity*, *4*(35). https://doi.org/10.1186/1479-5868-4-35

Jaime, P. C., Duran, A. C., Sarti, F. M., & Lock, K. (2011). Investigating environmental determinants of diet, physical activity, and overweight among adults in Sao Paulo, Brazil. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, *88*(3). https://doi.org/10.1007/s11524-010-9537-2

James, P., Seward, M. W., O'Malley, A. J., Subramanian, S., & Block, J. P. (2017). Changes in the food environment over time: Examining 40 years of data in the Framingham Heart Study. *International Journal of Behavioral Nutrition and Physical Activity*, *14*. https://doi.org/10.1186/s12966-017-0537-4

Janda, K. M., Salvo, D., Ranjit, N., Hoelscher, D. M., Nielsen, A., Lemoine, P., Casnovsky, J., & van den Berg, A. (2022). Whop shops at their nearest grocery store? A cross-sectional exploration of disparities in geographic food access among a low-income, racially/ethnically diverse cohort in central Texas. *Journal of Hunger & Environmental Nutrition*. https://doi.org/DOI: 10.1080/19320248.2022.2128962

Jennings, A., Welch, A., Jones, A. P., Harrison, F., Bentham, G., van Sluijs, E. M. F., Griffin, S. J., & Cassidy, A. (2011). Availability of local food outlets is associated with weight status and dietary intake in 9-10 year olds. *American Journal of Preventive Medicine*, *40*(4), 405–410. https://doi.org/10.1016/j.amepre.2010.12.014

Jilcott, S. B., Laraia, B. A., Evenson, K. R., & Ammerman, A. S. (2009). Perceptions of the community food environment and related influence on food choice among midlife women residing in rural and urban areas: A qualitative analysis. *Women & Health*, *49*, 164–180. https://doi.org/10.1080/03630240902915085

Jin, H., & Lu, Y. (2021). Evaluating consumer nutrition environment in food deserts and food swamps. *International Journal of Environmental Research and Public Health*, *18*. https://doi.org/10.3390/ijerph18052675

Kalbus, A., Cornelsen, L., Ballatore, A., & Cummins, S. (2023). Associations between the food environment and food and drink purchasing using large-scale commercial purchasing data: A cross-sectional study. *BMC Public Health*, *23*. https://doi.org/10.1186/s12889-022-14537-3

Kaya, I. H. (2016). Motivation factors of consumers' food choice. *Food and Nutrition Sciences*, *7*(3). https://doi.org/10.4236/fns.2016.73016

Keane, E., Cullinan, J., Perry, C. P., Kearney, P. M., Harrignton, J. M., Perry, I. J., & Layte, R. (2016). Dietary quality in children and the role of the local food environment. *SSM - Population Health*, 770–777.

Kegler, M. C., Alcantara, I., Haardorfer, R., Gazmararian, J. A., Ballard, D., & Sabbs, D. (2014). The influence of home food environments on eating behaviors of overweight and obese women. *Context*, *46*(3), 188–196. https://doi.org/10.1016/j.jneb.2014.01.001

Kegler, M. C., Hermstad, A., & Haardorfer, R. (2021). Home food environment and associations with weight and diet among U.S. adults: A cross-sectional study. *BMC Public Health*, *21*. https://doi.org/10.1186/s12889-021-11102-2

Kelly, B., Flood, V. M., & Yeatman, H. (2011). Measuring local food environments: An overview of available methods and measures. *Health & Place*, *17*, 1284–1293. https://doi.org/doi:10.1016/j.healthplace.2011.08.014

Kelly, C., Callaghan, M., & Gabhainn, S. N. (2021). "It's hard to make good choices and it costs more": Adolescents perception of the external school food environment. *Nutrients*, *13*. https://doi.org/10.3390/nu13041043

Kelly, C., Callaghan, M., Molcho, M., Gabhainn, S. N., & Thomas, A. A. (2019). Food environments in and around post-primary schools in Ireland: Associations with youth dietary habits. *Appetite*, *132*, 182–189.

Khandpur, N., Zatz, L. Y., Bleich, S. N., Taillie, L. S., Orr, J. A., Rimm, E. B., & Moran, A. J. (2020). Supermarkets in cyberspace: A conceptual framework to capture the influence of online food retail environments on consumer behavior. *International Journal of Environmental Research and Public Health*, *17*. https://doi.org/doi:10.3390/ijerph17228639

Khonje, M. G., Ecker, O., & Qaim, M. (2020). Effects of modern food retailers on adult and child diets and nutrition. *Nutrients*, *12*(6). https://doi.org/10.3390/nu12061714

Kibe, L. W., Schrode, K., Bazargan, M., & Shaheen, M. (2023). Impact of food insecurity and food environment on the diet quality of older African Americans during the COVID-19 pandemic. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1268961

Kim, C. (2016). Food choice patterns among frail older adults: The associations between social network, food choice values, and diet quality. *Appetite*, *96*, 116–121.

Kruger, D. J., Greenberg, E., Murphy, J. B., DiFazio, L. A., & Youra, K. R. (2014). Local concentration of fast-food outlets is associated with poor nutrition and obesity. *American Journal of Health Promotion*, *28*(5), 340–343. https://doi.org/DOI: 10.4278/ajhp.111201-QUAN-437

Kubik, M. Y., Lytle, L. A., Hannan, P. J., Perry, C. L., & Story, M. (2003). The association of the school food environment with dietary behaviors of young adolescents. *American Journal of Public Health*, *93*(7), 1168–1173.

Lachat, C., Nago, E., Verstraeten, R., Roberfroid, D., Van Camp, J., & Kolsteren, P. (2012). Eating out of home and its association with dietary intake: A systematic review of the evidence. *Obesity Reviews*, *13*, 329–346. https://doi.org/doi: 10.1111/j.1467-789X.2011.00953.x

Lacko, A., Ng, S. W., & Popkin, B. (2020). Urban vs. Rural socioeconomic differences in the nutritional quality of household packaged food purchases by store type. *International Journal of Environmental Research and Public Health*, *17*. https://doi.org/doi:10.3390/ijerph17207637

Lamichhane, A. P., Mayer-Davis, E. J., Puett, R., Bottai, M., Porter, D. E., & Liese, A. D. (2012). Associations of built food environment and dietary intake among youth with diabetes. *Journal of Nutrition Education and Behavior*, *44*(3), 217–224.

Laraia, B. A., Siega-Riz, A. M., Kaufman, J. S., & Jones, S. J. (2004). Proximity of supermarkets is positively associated with diet quality index for pregnancy. *Preventative Medicine*, *39*(5), 869–875. https://doi.org/10.1016/j.ypmed.2004.03.018

Larson, N. I., Story, M. T., & Nelson, M. C. (2009). Neighborhood environments: Disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine*, *36*(1), 74–81.

Laska, M. N., Caspi, C. E., Lenk, K., Moe, S. G., Pelletier, J. E., Harnack, L. J., & Erickson, D. J. (2019). Evaluation of the first U.S. staple foods ordinance: Impact on nutritional quality of food store offerings, customer purchases and home food environments. *International Journal of Behavioral Nutrition and Physical Activity*, *16*(1). https://doi.org/10.1186/s12966-019-0818-1

Laska, M. N., Hearst, M. O., Forsyth, A., Pasch, K. E., & Lytle, L. (2010). Neighborhood food environments: Are they associated with adolescent dietary intake, food purchases and weight status? *Public Health Nutrition*, *13*(11), 1757–1763. https://doi.org/10.1017/S1368980010001564

Lassen, A. D., Thorsen, A. V., Sommer, H. M., Fagt, S., Trolle, E., Biltoft-Jensen, A., & Tetens, I. (2011). Improving the diet of employees at blue-collar worksites: Results from the “Food at Work” intervention study. *Public Health Nutrition*, *14*(6), 965–974. https://doi.org/10.1017/S1368980010003447

LeDoux, T. F., & Vojnovic, I. (2014). Examining the role between the residential neighborhood food environment and diet among low-income households in Detroit, Michigan. *Applied Geography*, *55*, 9–18.

Leme, A. C. B., & Philippi, S. T. (2017). Home food availability, parents’/caregivers’ support, and family meals influence on dietary servings of low-income urban adolescent girls from Brazil. *Nutrire*, *42*. https://link.springer.com/article/10.1186/s41110-017-0053-y

Leone, L. A., Fleischhacker, S., Anderson-Steeves, B., Harper, K., Winkler, M., Racine, E., Baquero, B., & Gittelsohn, J. (2020). Healthy food retail during COVID-19 pandemic: Challenges and future directions. *International Journal of Environmental Research and Public Health*, *17*. https://doi.org/doi:10.3390/ijerph17207397

Li, Y., Luo, M., Wu, X., Xiao, Q., Luo, J., & Jia, P. (2019). Grocery store access and childhood obesity: A systematic review and meta-analysis. *Obesity Reviews*, *22*(S1). https://doi.org/10.1111/obr.12945

Lind, P. L., Jensen, P. V., Glumer, C., & Toft, U. (2016). The association between accessibility of local convenience stores and unhealthy diet. *European Journal of Public Health*, *26*(4), 634–639.

Liu, B., Widener, M., Burgoine, T., & Hammond, D. (2020). Association between time-weighted activity space-based exposures to fast food outlets and fast food consumption among young adults in urban Canada. *International Journal of Behavioral Nutrition and Physical Activity*, *17*. https://doi.org/10.1186/s12966-020-00967-y

Livingstone, K. M., Abbott, G., Lamb, K. E., Dullaghan, K., Worsley, T., & McNaughton, S. A. (2021). Understanding meal choices in young adults and interactions with demographics, diet quality, and health behaviors: A discrete choice experiment. *Journal of Nutrition*, *151*(8), 2361–2371. https://doi.org/10.1093/jn/nxab106

Lo, K. B., Megiel, S., Liu, E., Folta, S. C., Graham, M. L., & Seguin, R. A. (2019). Associations between frequency of food shopping at different sources and fruit and vegetable intake among rural residents in upstate New York, USA. *Public*

Health Nutrition, *22*(13), 2472–2478. https://doi.org/10.1017/S1368980019000843

Longacre, M. R., Drake, K. M., MacKenzie, T. A., Gibson, L., Owens, P., Titus, L. J., Beach, M. L., & Dalton, M. A. (2012). Fast-food environments and family fast-food intake in nonmetropolitan areas. *American Journal of Preventive Medicine*, *42*(6), 579–587.

Lorts, C., Tasevska, N., Adams, M. A., Yedidia, M. J., Tulloch, D., Hooker, S. P., & Ohri-Vachaspati, P. (2019). Participation in the Supplemental Nutrition Assistance Program and dietary behaviors: Role of community food environment. *Journal Academy of Nutrition and Dietetics*, *119*(6), 934–943. https://doi.org/10.1016/j.jand.2018.11.021

Lowe, M. R., & Butryn, M. L. (2007). Hedonic hunger: A new dimensions of appetite? *Physiology & Behavior*, *91*(4), 432–439. https://doi.org/10.1016/j.physbeh.2007.04.006

Lucan, S. C., Maroko, A. R., Patel, A. N., Gjonbalaj, I., Elbel, B., & Schechter, C. B. (2020). Healthful and less healthful foods and drinks from store front and non-storefront businesses: Implications for “food deserts,” “food swamps,” and food source disparities. *Public Health Nutrition*, *23*(8), 1428–1439. https://doi.org/doi:10.1017/S1368980019004427

Lytle, L. A. (2009). Measuring the food environment state of the science. *American Journal of Preventive Medicine*, *36*(4S), S134–S144. https://doi.org/doi:10.1016/j.amepre.2009.01.018

Lytle, L. A., & Sokol, R. L. (2017). Measures of the food environment: A systematic review, 2007-2015. *Health & Place*, *44*, 18–34. http://dx.doi.org/10.1016/j.healthplace.2016.12.007

Macdonald, L., Ellaway, A., Ball, K., & Macintyre, S. (2011). Is proximity to a food retail store associated with diet and BMI in Glasgow, Scotland? *BMC Public Health*, *11*. https://doi.org/10.1186/1471-2458-11-464

Mackenbach, J. D., Lakerveld, J., Generaal, E., Gibson-Smith, D., Penninx, B. W. J. H., & Beulens, J. W. J. (2019). Local fast-food environment, diet and blood pressure: The moderating role of mastery. *European Journal of Nutrition*, *58*, 3129–3134. https://doi.org/10.1007/s00394-018-1857-0

Mackenbach, J. D., Nelissen, K. G. M., Dijkstra, C., Poelman, M. P., Daams, J. G., Leijssen, J. B., & Nicolaou, M. (2019). A systematic review on socioeconomic differences in the association between the food environment and dietary behaviors. *Nutrients*, *11*. https://doi.org/10.3390/nu11092215

Mackenbach, J. D., Widener, M. J., van der Gaag, E., & Pinho, M. G. M. (2023). Survey-derived activity space-based exposures to fast food outlets and their cross-sectional associations with use of fast food outlets, diet quality and BMI. *Health & Place*, *79*. https://doi.org/10.1016/j.healthplace.2023.102966

Madlala, S. S., Hill, J., Kunneke, E., Lopes, T., & Faber, M. (2023). Adult food choices in association with the local retail food environment and food access in resource-poor communities: A scoping review. *BMC Public Health*, *23*. https://doi.org/10.1186/s12889-023-15996-y

Madrigal, J. M., Cedillo-Couvert, E., Ricardo, A. C., Appel, L. J., Anderson, C. A. M., Deo, R., Hamm, L. L., Cornish-Zirker, D., Tan, T. C., Sha, D., Hsu, J. Y., Zenk, S. N., Saunders, M. R., Persky, V., & Lash, J. P. (2020). Neighborhood food outlet access and dietary intake among adults with chronic kidney disease: Results from the Chronic Renal Insufficiency Cohort Study. *Journal Academy of Nutrition and Dietetics*, *120*(7), 1151–1162. https://doi.org/10.1016/j.jand.2019.12.013

Majid, M. R., Lim, N. H. H., Zaman, M., & Ruslik, N. (2021). Exploring the link between BMI, perceived neighborhood environment and health behaviours in Malaysia. *Journal of Sustainability Science and Management*, *16*(7), 190–208. https://doi.org/10.46754/jssm.2021.10.015

Marshall, A. N., Markham, C., Ranjit, N., Bounds, G., Chow, J., & Sharma, S. V. (2020). Long-term impact of a school-based nutrition intervention on home nutrition intervention on home nutrition environment and family fruit and vegetable intake: A two-year follow-up study. *Preventive Medicine Reports*, *20*. https://doi.org/10.1016/j.pmedr.2020.101247

Martin, K. S., Havens, E., Boyle, K. E., Matthews, G., Schilling, E. A., Harel, O., & Ferris, A. M. (2012). If you stock it, will they buy it? Healthy food availability and customer purchasing behaviour within corner stores in Hartford, CT, USA. *Public Health Nutrition*, *15*(10). https://www.cambridge.org/core/journals/public-health-nutrition/article/if-you-stock-it-will-they-buy-it-healthy-food-availability-and-customer-purchasing-behaviour-within-corner-stores-in-hartford-ct-usa/6071D43161A9162F004B6100147A13B0

Martin, S., & McCormack, L. (2024). Eating behaviors and the perceived nutrition environment among college students. *Journal of American College Health*, *72*(3), 685–689. https://doi.org/10.1080/07448481.2022.2068019

Martinez-Garcia, A., Trescastro-Lopez, E. M., Galiana-Sanchez, M. E., Llorens-Ivorra, C., & Pereyra-Zamora, P. (2020). Cultural adaptation and evaluation of the Perceived Nutrition Environment Measures Survey to the Mediterranean Spanish context (NEMS-P-MED). *Nutrients*, *12*. https://doi.org/doi:10.3390/nu12113257

Marty, L., de Lauzon-Guillain, B., Labesse, M., & Nicklaus, S. (2021). Food choice motives and the nutritional quality of diet during the COVID-19 lockdown in France. *Appetite*, *157*. https://doi.org/10.1016/j.appet.2020.105005

Masse, L. C., de Niet-Fitzgerald, J. E., Watts, A. W., Naylor, P. J., & Saewyc, E. M. (2014). Associations between the school food environment, student consumption and body mass index of Canadian adolescents. *International Journal of Behavioral Nutrition and Physical Activity*, *11*. https://doi.org/10.1186/1479-5868-11-29

Mathieu, A.-A., Robitaille, E., & Paquette, M.-C. (2022). Is food outlet accessibility a significant factor of fruit and vegetable intake? Evidence from a cross-sectional province-wide study in Quebec, Canada. *Obesities*, *2*(1), 35–50. https://doi.org/10.3390/obesities2010004

Mathieu, I. P., Sommer, E. C., Mitchell, S. J., & Barkin, S. L. (2016). Urban Latino families' food built environment and young children's produce consumption. *Journal of Health Care for the Poor and Underserved*, *27*(4), 1899–1908. https://doi.org/10.1353/hpu.2016.0170

McGuirt, J. T., Pitts, S. B. J., & Gustafson, A. (2018). Association between spatial access to food outlets, frequency of grocery shopping, and objectively-assessed and self-reported fruit and vegetable consumption. *Nutrients*, *10*(12). https://doi.org/10.3390/nu10121974

McInerney, M., Csizmadi, I., Friedenreich, C. M., Uribe, F. A., Nettel-Aguirre, A., McLaren, L., Potestio, M., Sandalack, B., & McCormack, G. R. (2016). Associations between the neighbourhood food environment, neighbourhood socioeconomic status, and diet quality: An observational study. *BMC Public Health*, *16*. https://doi.org/10.1186/s12889-016-3631-7

McKerchar, C., Gage, R., Smith, M., Lacey, C., Abel, G., & Mhurchu, C. N. (2022). Children's community nutrition environment, food and drink purchases and consumption on journeys between home and school: A wearable camera study. *Nutrients*, *14*(10). https://doi.org/10.3390/nu14101995

McKinnon, R. A., Reedy, J., Morrissette, M. A., Lytle, L. A., & Yaroch, A. L. (2009). Measures of the food environment a compilation of the literature, 1990-2007. *American Journal of Preventive Medicine*, *36*(4S), S124–S133.

McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, *15*(4), 351–377.

Mejia, N., Lightstone, A. S., Basurto-Davila, R., Morales, D. M., & Sturm, R. (2015). Neighborhood food environment, diet, and obesity among Los Angeles county adults, 2011. *Preventing Chronic Disease*. https://doi.org/10.5888/pcd12.150078

Menezes, M. C., Costa, B. V. L., Oliveira, C. D. L., & Lopes, A. C. S. (2017). Local food environment and fruit and vegetable consumption: An ecological study. *Preventive Medicine Reports*, *5*, 13–20. https://doi.org/ttp://dx.doi.org/10.1016/j.pmedr.2016.10.015

Mensah, D. O., & Oyebode. (2022). “We think about the quantity more”: Factors influencing emerging adults’ food outlet choice in a university food environment, a qualitative enquiry. *Nutrition Journal*, *21*. https://doi.org/10.1186/s12937-022-00801-0

Minaker, L. M., Olstad, D. L., Thompson, M. E., Raine, K. D., Fisher, P., & Frank, L. D. (2016). Associations between frequency of food shopping at different store types and diet and weight outcomes: Findings from the NEWPATH study. *Public Health Nutrition*, *19*(12), 2268–2277. https://doi.org/10.1017/S1368980016000355

Minaker, L. M., Raine, K. D., Wild, T. C., Kykiforuk, C. I. J., Thompson, M. E., & Frank, L. D. (2013). Objective food environments and health outcomes. *American Journal of Preventive Medicine*, *45*(3), 289–296. http://dx.doi.org/10.1016/j.amepre.2013.05.008

Moayyed, H., Kelly, B., Feng, X., & Flood, V. (2017). Is living near healthier food stores associated with better food intake in regional Australia? *International Journal of Environmental Research and Public Health*, *14*(8). https://doi.org/10.3390%2Fijerph14080884

Moffat, L. F., Ritchie, L. D., Gosliner, W., Plank, K. R., & Au, L. E. (2021). Perceived produce availability and child fruit and vegetable intake: The healthy communities study. *Nutrients*, *13*(11). https://doi.org/10.3390/nu13113681

Monterio, C. A., Moubarac, J.-C., Cannon, G., Ng, S. W., & Popkin, B. (2013). Ultra-processed products are becoming dominant in the global food system. *Obesity Reviews*, *14*, 21–28. https://doi.org/doi: 10.1111/obr.12107

Moore, L. V., Diez-Roux, A. V., Nettleton, J. A., Jacobs, D. R., & Franco, M. (2009). Fast food consumption, diet quality, and neighborhood exposure to fast food. *American Journal of Epidemiology*, *170*(1), 29–36. https://doi.org/10.1093/aje/kwp090

Moore, L. V., Roux, A. V. D., Nettleton, J. A., & Jacobs, D. R. (2008). Associations of the local food environment with diet quality-A comparison of assessments based on surveys and geographic information systems. *American Journal of Epidemiology*, *167*(8), 917–924. https://doi.org/10.1093/aje/kwm394

Moubarac, J.-C., Batal, M., Louzada, M. L., Steele, E. M., & Monterio, C. A. (2017). Consumption of ultra-processed foods predicts diet quality in Canada. *Appetite*, *108*, 512–520. http://dx.doi.org/10.1016/j.appet.2016.11.006

Murakami, K., Sasaki, S., Takahashi, Y., & Uenishi, K. (2009). Neighborhood food store availability in relation to food intake in young Japanese women. *Nutrition*, *25*, 640–646. https://doi.org/10.1016/j.nut.2009.01.002

Murakami, K., Sasaki, S., Takahashi, Y., & Uenishi, K. (2010). No meaningful association of neighborhood food store availability with dietary intake, body mass index, or wait circumference in young Japanese women. *Nutrition Research*, *30*, 565–573. http://dx.doi.org/10.1016/j.nutres.2010.08.002

Nackers, L. M., & Appelhans, B. M. (2013). Food insecurity is linked to a food environment promoting obesity in households with children. *Journal of Nutrition Education and Behavior*, *45*, 780–784. https://doi.org/10.1016/j.jneb.2013.08.001

Nash, D. M., Gilliland, J. A., Evers, S. E., Wilk, P., & Campbell, M. K. (2013). Determinants of diet quality in pregnancy: Sociodemographic, pregnancy-specific, and food environment influences. *Journal of Nutrition Education and Behavior*, *45*(6), 627–634. https://doi.org/10.1016/j.jneb.2013.04.268

Neumark-Sztainer, D., French, S. A., Hannan, P. J., Story, M., & Fulkerson, J. A. (2005). School lunch and snacking patterns among high school students: Associations with school food environment and policies. *International Journal of Behavioral Nutrition and Physical Activity*, *2*. https://doi.org/10.1186/1479-5868-2-14

Nicholas, K. M., Thompson, A. L., Wasser, H. M., & Bentley, M. E. (2023). Healthy home food environments of pregnant Black women are shaped by food outlet access and participation in nutrition assistance programs. *American Journal of Human Biology*, *35*(8). https://doi.org/10.1002/ajhb.23903

Nogueira, L. R., Fontanelli, M. M., Aguiar, B. S., Failla, M. A., Florindo, A. A., Barrozo, L. V., Goldbaum, M., Cesar, C. L. G., Alves, M. C. G. P., & Fisberg, R. M. (2018). Access to street markets and consumption of fruits and vegetables by adolescents living in Sao Paulo, Brazil. *International Journal of Environmental Research and Public Health*, *15*(3). https://doi.org/10.3390/ijerph15030517

Nutritional Environment Measures Survey. (n.d.). NEMS | Nutritional Environment Measures Survey. https://nems-upenn.org/tools/

Ohri-Vachaspati, P., & Berry, A. (2012). Environmental, parental, and demographic determinants of home food environment. *Journal of Nutrition Education and Behavior*, *44*(4). https://doi.org/10.1016/j.jneb.2012.03.139

Ollberding, N. J., Nigg, C. R., Geller, K. S., Horwath, C. C., Motl, R. W., & Dishman, R. K. (2012). Food outlet accessibility and fruit and vegetable consumption. *American Journal of Health Promotion*, *26*(6), 366–370. https://doi.org/10.4278/ajhp.101215-ARB-401

Osei-Kwasi, H., Mohindra, A., Booth, A., Laar, A., Wanjohi, M., Graham, F., Pradeilles, R., Cohen, E., & Holdsworth, M. (2020). Factors influencing dietary behaviours in urban food environments in Africa: A systematic mapping review. *Public Health Nutrition*, *23*(14), 2584–2601. https://doi.org/10.1017/S1368980019005305

Pacific, R., Martin, H. D., Kulwa, K., & Petrucka, P. (2020). Contribution of home and school environment in children’s food choice and overweight/obesity prevalence in African context: Evidence for creating enabling healthful food environment. *Pediatric Health, Medicine and Therapeutics*, *11*, 283–295. https://doi.org/10.2147/PHMT.S257549

Paquet, C., Montigny, L., Labban, A., Buckeridge, D., Ma, Y., Arora, N., & Dube, L. (2017). The moderating role of food cue sensitivity in the behavioral response of children to their neighborhood food environment: A cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity*, *14*. https://doi.org/10.1186/s12966-017-0540-9

Park, S., Choi, B. Y., Wang, Y., Colantuoni, E., & Gittelsohn, J. (2013). School and neighborhood nutrition environment and their association with students' nutrition behaviors and weight status in Seoul, South Korea. *Journal of Adolescent Health*, *53*, 655–662. http://dx.doi.org/10.1016/j.jadohealth.2013.06.002

Pearce, J., Hiscock, R., Blakely, T., & Witten, K. (2008). The contextual effects of neighbourhood access to supermarkets and convenience stores on individual fruit and vegetable consumption. *Journal of Epidemiology and Community Health*, *62*(3), 198–201. https://doi.org/10.1136/jech.2006.059196

Pearce, J., Hiscock, R., Blakely, T., & Witten, K. (2009). A national study of the association between neighbourhood access to fast-food outlets and the diet and weight of local residents. *Health & Place*, *15*, 193–197. https://doi.org/10.1016/j.healthplace.2008.04.003

Pechey, R., & Marteau, T. M. (2018). Availability of healthier vs. Less healthy food and food choice: An online experiment. *BMC Public Health*, *18*. https://doi.org/10.1186/s12889-018-6112-3

Pemjean, I., Mediano, F., Ferrer, P., Garmendia, M. L., & Corvalan, C. (2023). Food access, domestic environments, and dietary quality of low-middle income

Chilean children during the COVID-19 pandemic. *Frontiers in Public Health*. https://doi.org/10.3389/fpubh.2023.1164357

Perez, P. M. P., Castro, I. R. R., Canella, D. S., & Franco, A. S. (2019). Effect of implementation of a University restaurant on the diet of students in a Brazilian public university. *Ciência & Saúde Coletiva*, *24*(6). https://doi.org/10.1590/1413-81232018246.11562017

Perez-Cueto, F. J. A. (2019). An umbrella review of systematic reviews on food choice and nutrition published between 2017 and 2019. *Nutrients*, *11*(2398). https://doi.org/doi:10.3390/nu11102398

Perez-Ferrer, C., Auchincloss, A. H., Menezes, M. C., Kroker-Lobos, M. F., Cardoso, L. O., & Barrientos-Gutierrez, T. (2019). The food environment in Latin America: A systematic review with a focus on environments relevant to obesity and related chronic diseases. *Public Health Nutrition*, *22*(18), 3447–3464. https://doi.org/10.1017/S1368980019002891

Pessoa, M. C., Mendes, L. L., Gomes, C. S., Martins, P. A., & Velasquez-Melendez, G. (2015). Food environment and fruit and vegetable intake in a urban population: A multilevel analysis. *BMC Public Health*, *15*. https://link.springer.com/article/10.1186/s12889-015-2277-1

Pineda, E., Cunha, D. B., Sharabiani, M. T. A., & Millett, C. (2023). Association of the retail food environment, BMI, dietary patterns, and socioeconomic position in urban areas of Mexico. *PLOS Global Public Health*, *3*(2). https://doi.org/10.1371/journal.pgph.0001069

Pinho, M. G. M., Lakerveld, J., Harbers, M. C., Sluijs, I., Vermeulen, R., Huss, A., Boer, J. M. A., Verschuren, W. M. M., Brug, J., Beulens, J. W. J., & Mackenbach, J. D. (2021). Ultra-processed food consumption patterns among older adults in the Netherlands and the role of the food environment. *European Journal of Nutrition*, *60*(5), 2567–2580. https://doi.org/10.1007/s00394-020-02436-5

Pitt, E., Gallegos, D., Comans, T., Cameron, C., & Thornton, L. (2017). Exploring the influence of local food environment on food behaviours: A systematic review of qualitative literature. *Public Health Nutrition*, *20*(13), 2393–2405. https://doi.org/10.1017/S1368980017001069

Pitts, S. B. J., Wu, Q., McGuirt, J. T., Sharpe, P. A., & Rafferty, A. P. (2018). Impact on dietary choices after discount supermarket opens in low-income community. *Journal of Nutrition Education and Behavior*, *50*(7). https://doi.org/10.1016/j.jneb.2018.03.002

Pitts, S. B. J., Wu, Q., Truesdale, K. P., Haynes-Maslow, L., McGuirt, J. T., Ammerman, A., Bell, R., & Laska, M. N. (2018). One-year follow-up examination of the impact of the North Carolina healthy food small retailer program on healthy food availability, purchases, and consumption. *International Journal of Environmental Research and Public Health*, *15*(12). https://doi.org/10.3390/ijerph15122681

Pitts, S. B. J., Wu, Q., Truesdale, K. P., Laska, M. N., Grinchak, T., McGuirt, J. T., Haynes-Maslow, L., Bell, R. A., & Ammerman, A. S. (2017). Baseline assessment of a healthy corner store initiative: Associations between food store environments, shopping patterns, customer purchases, and dietary intake in Eastern North

Carolina. *International Journal of Environmental Research and Public Health*, *14*(10). https://doi.org/10.3390/ijerph14101189

Polsky, J. Y., & Garriguet, D. (2023). The local restaurant environment in relation to eating out and sugary drink intake among Canadian children and youth. *Health Reports*, *34*. https://www.doi.org/10.25318/82-003-x202300800001-eng

Poti, J. M., Braga, B., & Qin, B. (2017). Ultra-processed food intake and obesity: What really matters for health—Processing or nutrient content? *Current Obesity Reports*, *6*(4), 420–431. https://doi.org/doi:10.1007/s13679-017-0285-4

Pradeilles, R., Irache, A., Wanjohi, M. N., Holdsworth, M., Laar, A., Zotor, F., Tandoh, A., Klomegah, S., Graham, F., Muthuri, S. K., Kimani-Murage, E. W., Coleman, N., Green, M. A., Osei-Kwasi, H. A., Bohr, M., Rousham, E. K., Asiki, G., Akparibo, R., Mensah, K., … Griffiths, P. (2021). Urban physical food environments drive dietary behaviours in Ghana and Kenya: A photovoice study. *Health Place*, *71*. https://doi.org/10.1016/j.healthplace.2021.102647

Privitera, G. J., & Zuraikat, F. M. (2014). Proximity of foods in a competitive food environment influences consumption of a low calories and a high calorie food. *Appetite*, *76*, 175–179. https://doi.org/10.1016/j.appet.2014.02.004

Qiu, N., Moore, J. B., Wang, Y., Fu, J., Ding, K., & Li, R. (2021). Perceived parental attitudes are indirectly associated with consumption of junk foods and sugar-sweetened beverages among Chinese adolescents through home food environment and autonomous motivation: A path analysis. *Nutrients*, *13*. https://doi.org/10.3390/nu13103403

Rahmanian, E., Gasevic, D., Vukmirovich, I., & Lear, S. A. (2014). The association between the built environment and dietary intake—A systematic review. *Asia Pacific Journal of Clinical Nutrition*, *23*(2), 183–196. https://doi.org/10.6133/apjcn.2014.23.2.08

Ranjit, N., Evans, A. E., Springer, A. E., Hoelscher, D. M., & Kelder, S. H. (2015). Racial and ethnic differences in the home food environment explain disparities in dietary practices of middle school children in Texas. *Journal of Nutrition Education and Behavior*, *47*. http://dx.doi.org/10.1016/j.jneb.2014.09.001

Raskind, I. G., Kegler, M. C., Girard, A. W., Dunlop, A. L., & Kramer, M. R. (2020). An activity space approach to understanding how food access is associated with dietary intake and BMI among urban, low-income African American women. *Health Place*, *66*. https://doi.org/10.1016/j.healthplace.2020.102458

Reale, S., & Flint, S. W. (2016). Menu labelling and food choice in obese adults: A feasibility study. *BMC Obesity*, *3*(17). https://doi.org/10.1186/s40608-016-0095-3

Recchia, D., Perignon, M., Rollet, P., Vonthron, S., Tharrey, M., Darmon, N., Feuillet, T., & Mejean, C. (2020). Associations between retail food environment and the nutritional quality of food purchases in French households: The Mont'Panier cross-sectional study. *PLoS ONE*, *17*(4). https://doi.org/10.1371/journal.pone.0267639

Reitzel, L. R., Okamoto, H., Hernandez, D. C., Regan, S. D., McNeill, L. H., & Obasi, E. M. (2016). The built food environment and dietary intake among African-American adults. *American Journal of Health Behavior*, *40*(1), 3–11. https://doi.org/10.5993/AJHB.40.1.1

Reitzel, L. R., Regan, S. D., Nguyen, N., Cromley, E. K., Strong, L. L., Wetter, D. W., & McNeill, L. H. (2014). Density and proximity of fast food restaurants and Body Mass Index among African Americans. *American Journal of Public Health*, *104*(1), 110–116.

Ren, Y., Zhao, J., Glauben, T., & Campos, B. C. (2022). Supermarket environment and nutrition outcomes: Evidence from rural China. *Journal of Rural Studies*, *92*, 79–92. https://doi.org/10.1016/j.jrurstud.2022.03.019

Rex, S. M., Kopetsky, A., Bodt, B., & Robson, S. M. (2021). Relationships among the physical and social home food environments, dietary intake, and diet quality in mothers and children. *Journal of the Academy of Nutrition and Dietetics*, *121*(10). https://doi.org/10.1016/j.jand.2021.03.008

Richard, R., Akhund, A., & Adjoian, T. (2016). Small convenience stores and the local food environment: An analysis of resident shopping behavior using multilevel modeling. *American Journal of Health Promotion*, *30*(3). https://doi.org/10.4278/ajhp.140326-QUAN-121

Richardson, A. S., Boone-Heinonen, J., Popkin, B. M., & Gordon-Larsen, P. (2011). Neighborhood fast food restaurants and fast food consumption: A national study. *BMC Public Health*, *11*. https://doi.org/10.1186/1471-2458-11-543

Richardson, A. S., Meyer, K. A., Howard, A. G., Boone-Heinonen, J., Popkin, B. M., Evenson, K. R., Kiefe, C. I., Lewis, C. E., & Gordon-Larsen, P. (2014).

Neighborhood socioeconomic status and food environment: A 20-year longitudinal latent class analysis among CARDIA participants. *Health Place*, *30*, 145–153. https://doi.org/doi:10.1016/j.healthplace.2014.08.011

Richardson, A. S., Meyer, K. A., Howard, A. G., Boone-Heinonen, J., Popkin, B. M., Evenson, K. R., Shikany, J. M., Lewis, C. E., & Gordon-Larsen, P. (2015). Multiple pathways from the neighborhood food environment to increased body mass index through dietary behaviors: A structural equation-based analysis in the CARDIA study. *Health Place*, *36*, 74–87. https://doi.org/10.1016/j.healthplace.2015.09.003

Rideout, K., Mah, C. L., & Minaker, L. (2015). Food environments: An introduction for public health practice. *National Collaborating Centre for Environmental Health*. https://www.ncceh.ca/sites/default/files/Food_Environments_Public_Health_Practice_Dec_2015.pdf

Riggsbee, K. A., Riggsbee, J., Vilaro, M. J., Moret, L., Spence, M., Steeves, E. A., Zhou, W., Olfert, M. D., Franzen-Castle, L., Horacek, T., Hall, E., & Colby, S. (2019). More than fast food: Development of a story map to compare adolescent perceptions and observations of their food environments and related food behaviors. *International Journal of Environmental Research and Public Health*, *16*(1). https://doi.org/10.3390/ijerph16010076

Robson, S. M., Vadiveloo, M., Green, S., Couch, S. C., Sallis, J. F., Glanz, K., & Saelens, B. E. (2020). Examining the consumer restaurant environment and dietary intake in children. *Preventive Medicine Reports*, *20*. https://doi.org/10.1016/j.pmedr.2020.101274

Rocha, L. L., Pessoa, M. C., Gratao, L. H. A., Carmo, A. S., Cordeiro, N. G., Cunha, C. F., Oliveira, T. R. P. R., & Mendes, L. L. (2021). Characteristics of the school food environment affect the consumption of sugar-sweetened beverages among adolescents. *Frontiers in Nutrition*, *8*. https://doi.org/10.3389/fnut.2021.742744

Rodriguez-Guerra, A. I., Lopez-Olmedo, N., Medina, C., Hernandez-Alcaraz, C., Ortega-Avila, A. G., & Barquera, S. (2022). Association between density of convenience and small grocery stores with diet quality in adults living in Mexico City: A cross sectional study. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.857754

Rongen, S., Poelman, M. P., Thornton, L., Abbott, G., Lu, M., Kamphuis, C. B. M., Verkooijen, K., & Vet, E. (2020). Neighbourhood fast food exposure and consumption: The mediating role of neighbourhood social norms. *International Journal of Behavioral Nutrition and Physical Activity*, *17*. https://doi.org/10.1186/s12966-020-00969-w

Rose, D., & Richards, R. (2004). Food store access and household fruit and vegetable use among participants in the US food stamp program. *Public*, *7*(8), 1081–1088. https://doi.org/10.1079/PHN2004648

Roy, R., Soo, D., Conroy, D., Wall, C. R., & Swinburn, B. (2019). Exploring university food environment and on-campus food purchasing behaviors, preferences, and opinions. *Journal of Nutrition Education and Behavior*, *51*(7), 865–875. https://doi.org/10.1016/j.jneb.2019.03.003

Ruff, R. R., Akhund, A., & Adjoian, T. (2016). Small convenience stores and the local food environment: An analysis of resident shopping behavior using multilevel modeling. *American Journal of Health Promotion*, *30*(3). https://doi.org/DOI: 10.4278/ajhp.140326-QUAN-121

Rummo, P. E., Algur, Y., McAlexander, T., Judd, S. E., Lopez, P. M., Adhikaru, S., Brown, J., Meeker, M., McClure, L. A., & Elbel, B. (2021). Comparing competing geospatial measures to capture the relationship between the neighborhood food environment and diet. *Annals of Epidemiology*, *61*. https://doi.org/10.1016/j.annepidem.2021.05.005

Rummo, P. E., Guilkey, D. K., & Ng, S. W. (2017). Understanding bias in relationships between the food environment and diet quality: The Coronary Artery Risk Development in Young Adults (CARDIA) study. *Journal of Epidemiology and Community Health*, *71*(12). https://doi.org/10.1136/jech-2017-209158

Rummo, P. E., Meyer, K. A., Boone-Heinonen, J., Jacobs, D. R., Kiefe, C. I., Lewis, C. E., Steffen, L. M., & Gordon-Larsen, P. (2015). Neighborhood availability of convenience stores and diet quality: Findings from 20 years of follow-up in the Coronary Artery Risk Development in Young Adults study. *American Journal of Public Health*, *105*(5). https://doi.org/10.2105/ AJPH.2014.302435

Saelens, B. E., Glanz, K., Frank, L. D., Couch, S. C., Zhou, C., Colburn, T., & Sallis, J. F. (2018). Two-year changes in child weight status, diet, and activity by neighborhood nutrition and physical activity environment. *Obesity*, *26*(8), 1338–1346. https://doi.org/10.1002/oby.22247

Saksena, M. J., Okrent, A. M., Anekwe, T. D., Cho, C., Dicken, C., Effland, A., Elitzak, H., Guthrie, J., Hamrick, K. S., Hyman, J., Jo, Y., Lin, B.-H., Mancino, L., McLaughlin, P. W., Rahkovsky, I., Ralston, K., Smith, T. A., Stewart, H., Todd, J., & Tuttle, C. (2018). *America's eating habits: Food away from home* (196). United States Department of Agriculture Economic Research Service.

Santiago-Torres, M., Adams, A. K., Carrel, A. L., LaRowe, T. L., & Schoeller, D. A. (2014). Home food availability, parental dietary intake, and familial eating habits influence the diet quality of urban Hispanic children. *Childhood Obesity*, *10*(5), 408–415. https://doi.org/10.1089/chi.2014.0051

Santoso, I., Wijana, S., Ismawati, A., & Sunarharum, W. B. (2019). Relationship between hedonic hunger and health interest on habit and sodium intake patterns in food consumption. *International Journal of Food Science*. https://doi.org/10.1155/2019/9517140

Serasinghe, N., Vepsalainen, H., Lehto, R., Abdollahi, A. M., Erkkola, M., Roos, E., & Ray, C. (2023). Association between socioeconomic status, home food availability, parental role-modeling, and children's fruit and vegetable consumption: A mediation analysis. *BMC Public Health*, *23*. https://doi.org/10.1186/s12889-023-15879-2

Seto, E., Hua, J., Wu, L., Shia, V., Eom, S., Wang, M., & Li, Y. (2016). Models of individual dietary behavior based on smartphone data: The influence of routine, physical activity, emotion, and food environment. *PLoS ONE*, *11*(4). https://doi.org/10.1371/journal.pone.0153085

Sexton-Dhamu, M. J., Livingstone, K. M., Pendergast, F. J., Worsley, A., & McNaughton, S. A. (2021). Individual, social-environmental and physical-environmental correlates of diet quality in young adults aged 18-30 years. *Appetite*, *162*. https://doi.org/10.1016/j.appet.2021.105175

Shanks, C. B., Ahmed, S., Dupuis, V., Houghtaling, B., Crane, M. A. R., Tryon, M., & Pierre, M. (2020). Perceptions of food environments and nutrition among residents of the Flathead Indian Reservation. *BMC Public Health*, *20*. https://doi.org/10.1186/s12889-020-09584-7

Shareck, M., Lewis, D., Smith, N. R., Clary, C., & Cummins, S. (2018). Associations between home and school neighbourhood food environments and adolescents' fast-food and sugar-sweetened beverage intakes: Findings from the Olympic Regeneration in East London (ORiEL) study. *Public Health Nutrition*, *21*(15). https://doi.org/10.1017/S1368980018001477

Sharkey, J. R., Johnson, C. M., & Dean, W. R. (2010). Food access and perceptions of the community and household food environment as correlates of fruit and vegetable intake among rural seniors. *BMC Geriatrics*, *10*. https://bmcgeriatr.biomedcentral.com/articles/10.1186/1471-2318-10-32

Sharkey, J. R., Johnson, C. M., Dean, W. R., & Horel, S. A. (2011). Association between proximity to and coverage of traditional fast-food restaurants and non-traditional fast-food outlets and fast-food consumption among rural adults.

International Journal of Health Geographics, *10*(37). http://www.ij-healthgeographics.com/content/10/1/37

Shaw, S., Barrett, M., Shand, C., Cooper, C., Crozier, S., Smith, D., Barker, M., & Vogel, C. (2023). Influences of the community and consumer nutrition environment on the food purchases and dietary behaviors of adolescents: A systematic review. *Obesity Reviews*, *24*(7). https://doi.org/10.1111/obr.13569

Shaw, S. C., Ntani, G., Baird, J., & Vogel, C. A. (2020). A systematic review of the influences of food store product placement on dietary-related outcomes. *Nutrition Reviews*, *78*(12), 1030–1045. https://doi.org/10.1093/nutrit/nuaa024

Shepherd, R. (1999). Social determinants of food choice. *Proceedings of the Nutrition Society*, *58*, 807–812. https://doi.org/10.1017/S0029665199001093

Shier, V., Nicosia, N., & Datar, A. (2016). Neighborhood and home food environment and children’s diet and obesity: Evidence from military personnel’s installation assignment. *Social Science & Medicine*, *158*, 122–131. https://doi.org/10.1016/j.socscimed.2016.03.043

Siddiqui, N. Z., Pinho, M. G. M., Rutters, F., Beulens, J. W. J., & Mackenbach, J. D. (2023). The interaction between the community food environment and cooking skills in association with diet-related outcomes in Dutch adults. *Public Health Nutrition*, *26*(12), 2945–2952. https://doi.org/10.1017/S1368980023002148

Sim, S., Veugelers, P. J., Prowse, R., Nykiforuk, C. I. J., & Maximova, K. (2021). Unhealthy food options in the school environment are associated with diet quality and body weights of elementary school children in Canada. *Public Health Nutrition*, *24*(14), 4572–4581. https://doi.org/10.1017/S1368980020004437

Smith, D., Cummins, S., Clark, C., & Stansfeld, S. (2013). Does the local food environment around schools affect diet? Longitudinal associations in adolescents attending secondary schools in East London. *BMC Public Health*, *70*. https://doi.org/10.1186/1471-2458-13-70

Sob, C., Siegrist, M., & Hartmann, C. (2023). The positive eating scale: Associations with eating behavior, food choice, and body mass index. *Eating Behaviors*, *48*. https://doi.org/10.1016/j.eatbeh.2023.101706

Sobal, J., & Bisogni, C. A. (2009). Constructing food choice decisions. *Annals of Behavioral Medicine*, *38*, S37–S46. https://doi.org/DOI 10.1007/s12160-009-9124-5

Sohi, I., Bell, B. A., Liu, J., Battersby, S. E., & Liese, A. D. (2014). Differences in food environment perceptions and spatial attributes of food shopping between residents of low and high food access areas. *Journal of Nutrition Education and Behavior*, *46*(4), 241–249. https://doi.org/10.1016/j.jneb.2013.12.006

Spoer, B. R., Cantor, J. H., Rummo, P. E., & Elbel, B. D. (2018). Food environment does not predict self-reported SSB consumption in New York City: A cross sectional study. *PLoS ONE*, *13*(10). https://doi.org/10.1371/journal.pone.0196689

Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: The food choice questionnaire. *Appetite*, *25*(3), 267–284. https://doi.org/10.1006/appe.1995.0061

Stevenson, A. C., Brazeau, A. S., Dasgupta, K., & Ross, N. A. (2019). Evidence synthesis—Neighbourhood retail food outlet access, diet and body mass index in Canada: A systematic review. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy, and Practice*, *39*(10), 261–280. https://doi.org/10.24095/hpcdp.39.10.01

Stowers, K. C., Jiang, Q., Atoloye, A. T., Lucan, S., & Gans, K. (2020). Racial differences in perceived food swamp and food desert exposure and disparities in self-reported dietary habits. *International Journal of Environmental Research and Public Health*, *17*(19). https://doi.org/10.3390/ijerph17197143

Tabak, R., Hipp, J. A., Dodson, E. A., Yang, L., Adlakha, D., & Brownson, R. C. (2016). Exploring associations between perceived home and work neighborhood environments, diet behaviors, and obesity: Results from a survey of employed adults in Missouri. *Preventive Medicine Reports*, *4*, 591–596. https://doi.org/10.1016/j.pmedr.2016.10.008

Tam, R., Yassa, B., Parker, H., O'Connor, H., & Allman-Farinelli, M. (2017). University students' on-campus food purchasing behaviors, preferences, and opinions on food availability. *Nutrition*, *37*, 7–13. http://dx.doi.org/10.1016/j.nut.2016.07.007

Terry-McElrath, Y. M., O'Malley, P. M., & Johnston, L. D. (2014). Accessibility over availability: Associations between the school food environment and student fruit and green vegetable consumption. *Childhood Obesity*, *10*(3), 241–250. https://doi.org/10.1089/chi.2014.0011

Tester, J. M., Yen, I. H., & Laraia, B. (2010). Mobile food vending and the after-school food environment. *American Journal of Preventive Medicine*, *38*(1), 70–73. https://doi.org/10.1016/j.amepre.2009.09.030

Thompson, C., Cummins, S., Brown, T., & Kyle, R. (2013). Understanding interactions with the food environment: An exploration of supermarket food shopping routines in deprived neighbourhoods. *Health & Place*, *19*, 116–123.

Thompson, O. M., Yaroch, A. L., Moser, R. P., Rutten, L. J. F., & Agurs-Collins, T. (2010). School vending machine purchasing behavior: Results from the 2005 YouthStyles survey. *Journal of School Health*, *80*, 225–232. https://doi.org/10.1111/j.1746-1561.2010.00494.x

Thornton, L. E., Ball, K., Lamb, K. E., McCann, J., Parker, K., & Crawford, D. A. (2016). The impact of a new McDonald's restaurant on eating behaviours and perceptions of local residents: A natural experiment using repeated cross-sectional data. *Health & Place*, *39*, 86–91. http://dx.doi.org/10.1016/j.healthplace.2016.03.005

Thornton, L. E., Bentley, R. J., & Kavanagh, A. M. (2009). Fast food purchasing and access to fast food restaurants: A multilevel analysis of VicLANES. *International Journal of Behavioral Nutrition and Physical Activity*, *6*(28). https://doi.org/10.1186/1479-5868-6-28

Thornton, L. E., Crawford, D. A., & Ball, K. (2010). Neighbourhood-socioeconomic variation in women's diet: The role of nutrition environments. *European Journal of Clinical Nutrition*, *64*(12), 1423–1432. https://doi.org/10.1038/ejcn.2010.174

Thornton, L. E., Crawford, D. A., Lamb, K. E., & Ball, K. (2017). Where do people purchase food? A novel approach to investigating food purchasing locations. *International Journal of Health Geographics*, *16*(9). https://doi.org/OI 10.1186/s12942-017-0082-z

Thornton, L. E., & Kavanagh, A. (2012). Association between fast food purchasing and the local food environment. *Nutrition and Diabetes*, *2*, 1–6. https://doi.org/10.1038/nutd.2012.27

Thornton, L. E., Lamb, K. E., & Ball, K. (2013). Employment status, residential and workplace food environments: Associations with women's eating behaviours. *Health & Place*, *24*, 80–89. http://dx.doi.org/10.1016/j.healthplace.2013.08.006

Thornton, L. E., Pearce, J. R., Macdonald, L., Lamb, K. E., & Ellaway, A. (2012). Does the choice of neighbourhood supermarket access measure influence associations with individual-level fruit and vegetable consumption? A case study from Glasgow. *International Journal of Health Geographics*. https://doi.org/10.1186/1476-072X-11-29

Timperio, A., Ball, K., Roberts, R., Campbell, K., Andrianopoulos, N., & Crawford, D. (2008). Children's fruit and vegetable intake: Associations with the neighbourhood food environment. *Preventative Medicine*, *46*(4), 331–335. https://doi.org/10.1016/j.ypmed.2007.11.011

Timperio, A., Crawford, D., Leech, R. M., Lamb, K. E., & Ball, K. (2018). Patterning of neighbourhood food outlets and longitudinal associations with children's eating behaviours. *Preventative Medicine*, *111*, 248–253. https://doi.org/10.1016/j.ypmed.2018.03.003

Timperio, A. F., Ball, K., Roberts, R., Andrianopoulos, N., & Crawford, D. A. (2009). Children's takeaway and fast-food intakes: Associations with the neighbourhood food environment. *Public Health Nutrition*, *12*(10), 1960–1964. https://doi.org/10.1017/S1368980009004959

Torraco, R. J. (2016). Writing integrative literature reviews: Using the past and present to explore the future. *Human Resource Development Review*, *15*(4), 404–428. https://doi.org/DOI: 10.1177/1534484316671606

Trapp, G. S. A., Hickling, S., Christian, H. E., Bull, F., Timperio, A. F., Boruff, B., Shrestha, D., & Giles-Corti, B. (2015). Individual, social, and environmental correlates of healthy and unhealthy eating. *Society for Public Health Education*, *42*(6). https://doi.org/10.1177/1090198115578750

Trapp, G. S. A., Hooper, P., Thornton, L., Kennington, K., Sartori, A., Hurworth, M., & Billingham, W. (2021). Association between food-outlet availability near secondary schools and junk-food purchasing among Australian adolescents. *Nutrition*, *91*. https://doi.org/10.1016/j.nut.2021.111488

Trofholz, A. C., Tate, A. D., Draxten, M. L., Neumark-Sztainer, D., & Berge, J. M. (2016). Home food environment factors associated with presence of fruit and vegetables at dinner: A direct observational study. *Appetite*, *96*, 526–532. https://doi.org/10.1016/j.appet.2015.10.019

Trubswasser, U., Talsma, E. F., Ekubay, S., Poelman, M. P., Holdsworth, M., Feskens, E. J. M., & Baye, K. (2022). Factors influencing adolescents' dietary behaviors in the school and home environment in Addis Ababa, Ethiopia. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.861463

Turner, C., Aggarwal, A., Walls, H., Herfoth, A., Drewnowski, A., Coates, J., Kalamatianou, S., & Kadiyala, S. (2018). Concepts and critical perspectives for food environment research: A global framework with implications for action in low and middle income countries. *Global Food Security*, *18*, 93–101. https://doi.org/10.1016/j.gfs.2018.08.003

Turner, G., Green, R., Alae-Carew, C., & Dangour, A. D. (2021). The association of dimensions of fruit and vegetable access in the retail food environment with consumption: A systematic review. *Global Food Security*, *29*. https://doi.org/10.1016/j.gfs.2021.100528

Vabo, M., & Hansen, H. (2014). The relationship between food preferences and food choice: A theoretical discussion. *International Journal of Business and Social Science*, *5*(7).

van Ansem, W. J. C., Schrijvers, C. T. M., Rodenburg, G., & van de Mheen, D. (2013). Is there an association between the home food environment, the local food shopping environment and children's fruit and vegetable intake? Results from the Dutch INPACT study. *Public Health Nutrition*, *16*(7), 1206–1214. https://doi.org/10.1017/S1368980012003461 van der Horst, K., Timperio, A., Crawford, D., Roberts, R., Brug, J., & Oenema, A. (2008). The school food environment: Associations with adolescent soft drink and snack consumption. *American Journal of Preventive Medicine*, *35*(3), 217–223. https://doi.org/10.1016/j.amepre.2008.05.022

van der Velde, L. A., Zitman, F. M. P., Mackenbach, J. D., Numans, M. E., & Jong, J. C. K. (2020). The interplay between fast-food outlet exposure, household food insecurity and diet quality in disadvantaged districts. *Public Health Nutrition*, *25*(1), 105–113. https://doi.org/10.1017/S1368980020004280

Vandevijvere, S., Chow, C. C., Hall, K. D., Umali, E., & Swinburn, B. A. (2015). Increased food energy supply as a major driver of the obesity epidemic: A global analysis. *Bulletin World Health Organization*, *93*(7), 446–456.

Vedovato, G. M., Trude, A. C. B., Kharmats, A. Y., & Martins, P. A. (2015). Degree of food processing of household acquisition patterns in a Brazilian urban area is related to food buying preferences and perceived food environment. *Appetite*, *87*, 296–302. https://doi.org/10.1016/j.appet.2014.12.229

Vepsalainen, H., Korkalo, L., Mikkila, V., Lehto, R., Ray, C., Nissinen, K., Skaffari, E., Fogelholm, M., Koivusilta, L., Roos, E., & Erkkola, M. (2018). Dietary patterns and their associations with home food availability among Finnish pre-school children: A cross-sectional study. *Public Health Nutrition*, *21*(7), 1232–1242. https://doi.org/10.1017/S1368980017003871

Vepsalainen, H., Mikkila, V., Erkkola, M., Broyles, S. T., Chaput, J. P., Hu, G., Kuriyan, R., Kurpad, A., Lambert, E. V., Maher, C., Maia, J., Matsudo, V., Olds, T., Onywera, V., Sarmiento, O. L., Standage, M., Tremblay, M. S., Tudor-Locke, C., Zhao, P., … Fogelholm, M. (2015). Association between home and school food environments and dietary patterns among 9-11-year old children in 12 countries. *International Journal of Obesity Supplements*, *5*. https://www.nature.com/articles/ijosup201522

Vereecken, C., Haerens, L., Bourdeaudhuij, I. D., & Maes, L. (2010). The relationship between children's home food environment and dietary patterns in childhood and adolescence. *Public Health Nutrition*, *13*, 1729–1735. https://doi.org/10.1017/S1368980010002296

Vilaro, M. J., Barnett, T. E., Mathews, A., Pomeranz, J., & Curbow, B. (2016). Income differences in social control of eating behaviors and food choice priorities among Southern rural women in the US: a qualitative study. *Appetite*, *107*, 604–612. https://doi.org/10.1016/j.appet.2016.09.003

Vilaro, M. J., Colby, S. E., Riggsbee, K., Zhou, W., Byrd-Bredbenner, C., Olfert, M. D., Barnett, T. E., Horacek, T., Sowers, M., & Mathews, A. E. (2018). Food choice priorities change over time and predict dietary intake at the end of the first year of college among students in the US. *Nutrients*, *10*(9). https://doi.org/10.3390/nu10091296

Vogel, C., Abbott, G., Ntani, G., Barker, M., Cooper, C., Moon, G., Ball, K., & Baird, J. (2019). Examination of how food environment and psychological factors interact in their relationship with dietary behaviours: Test of a cross-sectional model.

International Journal of Behavioral Nutrition and Physical Activity, *16*. https://doi.org/10.1186/s12966-019-0772-y

Vogel, C., Lewis, D., Ntani, G., Cummins, S., Cooper, C., Moon, G., & Baird, J. (2017). The relationship between dietary quality and the local food environment differs according to level of educational attainment: A cross-sectional study. *PLoS One*, *12*(8). https://doi.org/10.1371/journal.pone.0183700

Vogel, C., Ntani, G., Inskip, H., Barker, M., Cummins, S., Cooper, C., Moon, G., & Baird, J. (2016). Education moderates the association between supermarket environment and diet. *American Journal of Preventive Medicine*, *51*(2), e27–e34. https://doi.org/10.1016/j.amepre.2016.02.030

Vuong, V. T., Fiorella, K. J., Jones, A. D., Trinh, H. T., Khoury, C. K., Huynh, T. T. T., Hoang, K. T., & Nguyen, K. T. (2023). The association between food environment, diet quality and malnutrition in low- and middle-income adult populations across the rural-urban gradient in Vietnam. *Journal of Human Nutrition and Diet*, *36*. https://onlinelibrary.wiley.com/doi/pdf/10.1111/jhn.13242

Watts, A. W., Barr, S. I., Hanning, R. M., Lovato, C. Y., & Masse, L. C. (2018). The home food environment and associations with dietary intake among adolescents presenting for a lifestyle modification intervention. *BMC Nutrition*, *4*. https://doi.org/10.1186/s40795-018-0210-6

Wedick, N. M., Ma, Y., Olendzki, B. C., Procter-Gray, E., Cheng, J., Kane, K. J., Ockene, I. S., Pagoto, S. L., Land, T. G., & Li, W. (2015). Access to healthy food stores modifies effect of a dietary intervention. *American Journal of Preventive Medicine*, *48*(3), 309–317. https://doi.org/10.1016/j.amepre.2014.08.020

Weigel, M. M., & Armijos, R. X. (2022). The Ecuadorian school food environment: Association with healthy and unhealthy food and beverage consumption and BMI. *Food and Nutrition Bulletin*, *43*(4), 439–464. https://doi.org/10.1177/03795721221116447

Wertheim-Heck, S. C. O., & Raneri, J. E. (2019). A cross-disciplinary mixed-method approach to understand how food retail environment transformations influence food choice and intake among the urban poor: Experiences from Vietnam. *Appetite*, *142*. https://doi.org/10.1016/j.appet.2019.104370

Westbury, S., Ghosh, I., Jones, H. M., Mensah, D., Samuel, F., Irache, A., Azhar, N., Al-Khudairy, L., Iqbal, R., & Oyebode, O. (2021). The influence of the urban food environment on diet, nutrition and health outcomes in low-income and middle-income countries: A systematic review. *BMJ Global Health*, *6*(10). https://doi.org/10.1136/bmjgh-2021-006358

Williams, L., Ball, K., & Crawford, D. (2010). Why do some socioeconomically disadvantaged women eat better than others? An investigation of the personal, social and environmental correlates of fruit and vegetable consumption. *Appetite*, *55*(3), 441–446. https://doi.org/10.1016/j.appet.2010.08.004

Wyse, R., Campbell, E., Nathan, N., & Wolfenden, L. (2011). Associations between characteristics of the home food environment and fruit and vegetable intake in preschool children: A cross-sectional study. *BMC Public Health*, *16*. https://doi.org/10.1186/1471-2458-11-938

Xin, J., Zhao, L., Wu, T., Zhang, L., Li, Y., Xue, H., Xiao, Q., Wang, R., Xu, P., Visscher, T., Ma, X., & Jia, P. (2021). Association between access to convenience stores and childhood obesity: A systematic review. *Obesity Reviews*, *22*(S1). https://doi.org/10.1111/obr.12908

Yang, M., Wang, H., & Qiu, F. (2020). Neighbourhood food environments revisited: When food deserts meet food swamps. *The Canadian Geographer*, *64*(1), 135–154. https://doi.org/DOI: 10.1111/cag.12570

Zenk, S. N., Lachance, L. L., Schulz, A. J., Mentz, G., Kannan, S., & Ridella, W. (2009). Neighborhood retail food environment and fruit and vegetable intake in a multiethnic urban population. *American Journal of Health Promotion*, *23*(4), 255–265. https://doi.org/10.4278/ajhp.071204127

Zenk, S. N., Schulz, A. J., Hollis-Neely, T., Watkins, G., Nwankwo, R., & Odoms-Young, A. (2005). Fruit and vegetable intake in African Americans income and store characteristics. *American Journal of Preventive Medicine*, *29*(1). https://doi.org/10.1016/j.amepre.2005.03.002

Zhang, M., Zhang, N., Zhou, M., & Ma, G. (2022). Association between neighborhood food environment and dietary diversity score among older people in Beijing, China: A cross-sectional study. *Frontiers in Nutrition*, *9*. https://doi.org/10.3389/fnut.2022.903214

Zhang, R., Yu, X., Yu, Y., Guo, D., He, H., Zhao, Y., & Zhu, W. (2020). Family food environments and their association with primary and secondary students' food consumption in Beijing, China: A cross-sectional study. *Nutrients*, *14*. https://doi.org/10.3390/nu14091970

Zhang, T., & Huang, B. (2018). Local retail food environment and consumption of fruit and vegetable among adults in Hong Kong. *International Journal of Environmental Research and Public Health*, *15*(10). https://doi.org/10.3390/ijerph15102247

Zhao, A. W., McGowan, C. C., Zenk, S. N., & Kershaw, K. N. (2020). Associations of the consumer food environment with eating behaviours and BMI. *Public Health Nutrition*, *23*(17), 3197–3203. https://doi.org/10.1017/S1368980020002633

Zhao, P., Kwan, M., & Zhou, S. (2018). The uncertain geographic context problem in the analysis of the relationship between obesity and the built environment in Guangzhou. *International Journal of Environmental Research and Public Health*, *15*. https://doi.org/doi:10.3390/ijerph15020308

Ziegler, A. M., Kasprzak, C. M., Mansouri, T. H., Gregory, A. M. I., Barich, R. A., Hatzinger, L. A., Leone, L. A., & Temple, J. L. (2021). An ecological perspective of food choice and eating autonomy among adolescents. *Frontiers in Psychology*. https://doi.org/doi: 10.3389/fpsyg.2021.654139

Zuccolotto, D. C. C., Barbieri, P., & Sartorelli, D. S. (2015). Food environment and family support in relation to fruit and vegetable intake in pregnant women. *Archivos Latinoamericanos de Nutrición*, *65*(4).

https://ve.scielo.org/scielo.php?pid=S0004-

06222015000400002&script=sci_arttext