

ABSTRACT

Title of Document: THE CHALLENGE OF TEEN NUTRITION:
AN ECOLOGICAL VIEW OF SOCIO-
COGNITIVE INFLUENCES ON URBAN,
AFRICAN-AMERICAN ADOLESCENT DIET
QUALITY

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Doctor of Philosophy, 2010

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The routine food choices that adolescents make impact their nutritional status, health, and their risk of developing chronic illnesses such as heart disease, cancer, and osteoporosis in the future. Nutrient requirements during adolescence are comparable to those in early infancy, emphasizing the importance of a high quality diet for healthy growth and development. A myriad of personal, social, and environmental factors influence adolescents in shaping their dietary intake and quality of diet. Low-income, African-American adolescents in Baltimore were identified as having sub-optimal nutritional intake compared to national dietary recommendations.

This study explored the dynamic and relative contributions that factors within three environmental levels (personal, social, and community) made as predictors of diet quality in a sample of low-income, urban African-American adolescents using an integrated Social Cognitive Theory (SCT) / ecological theoretical framework. It was

hypothesized that 1) the personal, social, and community environmental levels of dietary influences would all significantly contribute to diet quality, with community environment making the largest relative contribution; 2) self-efficacy for healthy eating moderated the relationship between parental beliefs about nutrition and diet quality; and 3) self-efficacy for healthy eating moderated the relationship between peer eating behaviors and diet quality.

There have been very few studies using an integrated SCT/ecological model to explore the dietary influences on adolescent nutrition, especially on this demographic. The significant influence the SCT construct of observational learning has on adolescents was evidenced in this study by the positive relationship found between diet quality, parental beliefs about nutrition, and peer eating behavior. Younger participants in early adolescence and females were predominately guided by their parents' beliefs about nutrition, while males in this study appeared to identify more with their peers' nutrition-related behaviors.

This study revealed that parents and peers play important roles in African-American adolescents' food choices and subsequent diet quality. Nutrition interventions should focus on parent-teen interactions and on improving the dietary habits of parents so they may be more effective role models for youth. Nutrition promotion research targeting young African-American men may consider using group interactive behavioral interventions with peers that build and reinforce peer modeling of positive nutrition behaviors.

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SOCIO-COGNITIVE INFLUENCES ON URBAN, AFRICAN-AMERICAN
ADOLESCENT DIET QUALITY

By

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2010

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Dedication

I would like to thank Maureen Black for introducing me to the world of “hands-on“ behavioral nutrition research and for giving me the opportunity to pursue research on disadvantaged and food insecure children and adolescents in Baltimore. I also want to thank her for being patient and sticking with me for the long haul!

I would also like to thank Nancy Atkinson and the rest of my dissertation committee members for their guidance and assistance in helping me achieve my academic goals.

Table of Contents

Dedication	ii
Table of Contents	iii
List of Tables	v
List of Figures	vii
List of Figures	vii
Chapter 1: Introduction	1
Statement of the Problem	1
Rationale for the Study	3
<i>Adolescent Diet Quality in the U.S.</i>	4
<i>Factors Influencing Diet Quality among Urban, African-American Adolescents</i>	5
<i>Improving Adolescent Diet Quality</i>	8
Study Overview	9
Theoretical Framework for Proposed Study	10
Research Questions and Hypotheses	14
Definition of Variables and/or Terms	15
<i>Definitions of construct variables</i>	18
CHAPTER 2: Background.....	20
Introduction.....	20
Adolescent Diet Quality.....	20
Adolescent Growth and Development	24
<i>Psychosocial Development</i>	25
Nutritional Requirements During Adolescence	28
Health Problems Related to Poor Diet Quality	30
<i>Dietary Patterns and Health Issues</i>	31
<i>Fruit and Vegetables in the Diet</i>	33
<i>Health Risks of Overweight in Adolescence</i>	34
Minority Health Disparities, Disease, and Diet Quality	36
<i>Health Disparities in Minority Children and Adolescents</i>	37
Determinants of Adolescent Eating Behaviors.....	39
<i>Personal and Social Influences on Adolescent Diet Quality</i>	39
<i>Environmental Influences on Adolescent Diet Quality</i>	47
Target Population Background and Context.....	57
<i>Economic Disparities Affecting African Americans in Baltimore</i>	59
<i>Health Disparities among African Americans in Baltimore</i>	60
<i>Diet Quality of Low-Income, African-American Adolescents in Baltimore</i>	62
Conceptual Framework.....	63
<i>Social Cognitive Theory</i>	63
<i>Ecological Theory</i>	71
<i>Integrated SCT and Ecological Model</i>	75
Conclusion	76
CHAPTER 3: Methodology.....	78

Introduction.....	78
Study Population: Challenge Study	78
Primary Data Collection	80
<i>Sample and Sampling Procedure</i>	80
<i>Data Collection</i>	81
<i>Human Subject Procedures</i>	81
<i>Primary Data Analysis</i>	82
Secondary Data Collection	84
<i>Characteristics of the Sample Population</i>	84
<i>Instrumentation for Secondary Analysis</i>	85
Secondary Data Analysis	105
<i>Data Cleaning</i>	106
Analyses to Answer Research Questions.....	110
Delimitations and Limitations.....	118
Summary.....	121
CHAPTER 4: Results	122
Properties of Scaled Measures.....	122
Sample Characteristics.....	124
Independent Variables Characteristics.....	127
Dependent Variable Characteristics for the Healthy Eating Index.....	133
Multivariate Results	139
Multiple Regression Analysis.....	139
Three-Stage Least Squares Analysis.....	146
Moderated Multiple Regression Analyses	146
Summary.....	147
CHAPTER 5: Discussion.....	150
Discussion of Survey Data and Psychometric Testing	150
Discussion of Descriptive Data.....	151
Discussion of Nutrition Behaviors.....	154
Discussion of Research Questions.....	156
Limitations of this Study.....	163
Study's Contribution to the Field of Public Health	167
Study Summary.....	171
Appendices.....	174
Glossary	189
Bibliography	190

List of Tables

Table 3.1 Behaviors Targeted in Challenge Intervention.....	80
Table 3.2 Challenge Baseline Data Measures	83
Table 3.3 USDA Dietary Recommendations	91
Table 3.4 Self-Efficacy for Healthy Eating Scale	97
Table 3.5 Perceived Parental Beliefs about Nutrition Scale	99
Table 3.6 Peer Eating Behaviors Scale	100
Table 4.1 Psychometric Characteristics for Scaled Variables.....	124
Table 4.2 Sample Demographic Characteristics by Gender Category.....	126
Table 4.3 Kilocalorie Intake by Adolescent Sex.....	126
Table 4.4 Nutrition-related Sample Characteristics by Adolescent Age Category...	127
Table 4.5 Study Variable Characteristics by Adolescent Sex.....	128
Table 4.6 Categorical Independent Variable Characteristics by Adolescent Age Category.....	133
Table 4.7 Descriptive Statistics for Healthy Eating Index (HEI-2005) Scored Variable by Adolescent Age Group.....	134
Table 4.8 Cross-tabulations of Diet Quality and Select Study Variables.....	136
Table 4.9 Correlations of Diet Quality and Independent Variables.....	137
Table 4.10 Regression Model Results on Determinants of Diet Quality by Environmental Level.....	140
Table 4.11 Combined Regression Model Results on Determinants of Diet Quality.....	141
Table 4.12 Environmental Level Regression Models: Determinants of Diet Quality by Younger (11-13 yrs) and Older (14-16 yrs.) Adolescents.....	143

Table 4.13 Environmental Level Regression Models: Determinants of Diet Quality by Adolescent Sex.....	145
Table 4.14 Results of 3-Stage Least Squares Regression	146

List of Figures

Figure 1.1 Theoretical Framework	19
Figure 3.1 Relationships Examined in Research Question 1	111
Figure 3.2 Relationships Examined in Research Question 2	114
Figure 3.3 Relationships Examined in Research Question 3	115
Figure 4.1 HEI-2005 Variable Histogram.....	135

Chapter 1: Introduction

The routine food choices that adolescents make impact their nutritional status, health, and risk of developing chronic illnesses such as heart disease, cancer, and osteoporosis in the future (Cromer & Harel, 2000; Must, Jacques, Dallal, Bajema, & Dietz, 1992; Ng-Mak, Dohrenwend, Abraido-Lanza, & Turner, 1999; Steinberger & Daniels, 2003; Steinmetz & Potter, 1996; Winkleby, Robinson, Sundquist, & Kraemer, 1999). A myriad of personal, social, and environmental factors influence the shaping of adolescents' nutritional intake and quality of diet (Story, Neumark-Sztainer, & French, 2002). Health and nutrition surveys have identified African-American children and adolescents in Baltimore, Maryland as having sub-optimal nutritional intake compared to national nutrition recommendations for Americans (CDC, 2005). This study examined some of the unique personal, social, and environmental influences on diet quality affecting low-income, urban African-American adolescents in Baltimore, Maryland, in an effort to gain a better understanding of the factors that helped to shape the food choices and diets of inner-city, young adults.

Statement of the Problem

Adolescence is a time of rapid physical, emotional and cognitive growth (Campbell, 1969; Rodwell Williams, 2000; Spear, 2000, 2002). Nutrient requirements during adolescence are greater than at any other period in the life cycle with the exception of early infancy, making this an especially vulnerable time for healthy growth and development (Spear, 2002). Increased nutritional requirements emphasize

the importance of high quality dietary intake for healthy physical and cognitive development in the growing adolescent (Campbell, 1969; DHHS, November 2000; Rodwell Williams, 2000; Spear, 2000, 2002).

Adolescence is also a time of social development and weighing advice from caregivers and peers about engaging in healthy eating behaviors (Campbell, 1969; Sturdevant & Spear, 2002). During this transitional phase from childhood into young adulthood, many individual and social influences impact adolescent food behaviors. Busy social schedules, growing independence, concern for their weight and appearance, eating away from home more often, and the need for peer acceptance have a significant impact on adolescent eating patterns and food choices (Story, et al., 2002).

Understanding the many factors shaping adolescents' eating patterns is necessary in developing nutrition recommendations aimed at improving adolescents' diet quality. Obesity in children is associated with health problems such as insulin resistance (a precursor to type 2 diabetes), hypertension, high serum cholesterol, sleep apnea, and orthopedic problems (IOM, 2005). Obesity can also lead to the development of metabolic syndrome, arthritis, cardiovascular disease (CVD), and cancer over time (IOM, 2005). Poor eating habits formed in adolescence are likely to track into adulthood (Story, et al., 2002) and increase the risk of developing chronic disease and obesity as adults (Must, et al., 1992; Ng-Mak, et al., 1999; Patterson, Haines, & Popkin, 1994; Steinberger & Daniels, 2003; Winkleby, et al., 1999). Unhealthy dietary practices and sub-optimal nutritional intake has short- and long-term health consequences for adolescents such as iron deficiency, dental caries,

malnutrition (Spear, 2000), overweight, type 2 diabetes, hypertension, CVD (Steinberger & Daniels, 2003; Winkleby, et al., 1999), osteoporosis (Cromer & Harel, 2000), and cancers of the breast, colon, lung, pancreas, esophagus and stomach (Steinmetz & Potter, 1996).

When compared to white teens, African-American adolescents are more likely to be overweight or obese (Hedley et al., 2004), potentially exposing them to more obesity-related health problems. Racial differences in early onset of CVD risk factors such as excessive weight and dietary fat intake, elevated systolic blood pressure, and hyperglycemia are seen in African-American children as young as six to nine years of age (Winkleby, et al., 1999), reinforcing the need for interventions to improve the health and diet of both African-American children and their parents.

Since poor dietary patterns among adolescents are related to increased risk of chronic disease, preventative action is key to maintain their short- and long-term health. Health problems associated with inadequate nutrition and poor diet quality among African-American adolescents may partially explain why the racial health disparity gap widens as minority teens mature into adulthood (Lytle, 2002; Xie, Gilliland, Li, & Rockett, 2003).

Rationale for the Study

Adolescents typically have poor nutritional intake, with diet quality declining throughout puberty (Munoz, Krebs-Smith, Ballard-Barbash, & Cleveland, 1997). Compared to younger children, adolescents consume less fruit, vegetables, and dairy products, and consume more snack foods, soft drinks, and high-fat convenience and fast foods (CDC, 2005; Munoz, et al., 1997; Neumark-Sztainer, Story, Hannan, &

Croll, 2002). Adolescents consuming poor quality diets are at increased risk for immediate problems like iron deficiency anemia (Spear, 2002), dental caries (Gillis & Bar-Or, 2003; Spear, 2000), eating disorders (Birch & Fisher, 1998), malnutrition, overweight (Hedley, et al., 2004; Mendoza, Drewnowski, Cheadle, & Christakis, 2006; Munoz, et al., 1997; Neumark-Sztainer, et al., 2002), and compromised bone health (Cromer & Harel, 2000; Whiting et al., 2004). Eating too many calorie-dense foods and too much dietary fat can cause overweight among adolescents; excessive body weight during adolescence and has been linked to obesity in adulthood (Hedley, et al., 2004; IOM, 2005). Excess body fat is also associated with developing type 2 diabetes (Steinberger & Daniels, 2003), and an intake high in dietary fat during adolescence can also increase the risk of developing CVD and cancer as an adult (Winkleby, et al., 1999).

Adolescents achieve their adult height and peak bone mass during puberty (Spear, 2002). Adolescents who fail to consume adequate amounts of dairy products, dark green vegetables, or other calcium-rich foods in their diets have a higher risk of developing osteoporosis in later years (Cromer & Harel, 2000). Osteoporosis is sometimes called a pediatric disease with geriatric consequences because the effects of inadequate dietary calcium in adolescence may not become apparent until late adulthood (Spear, 2000; Whiting, et al., 2004).

Adolescent Diet Quality in the U.S.

Unfortunately, the dietary intake reported by most teen-aged Americans falls far short of meeting the recommendations in the U.S. Department of Agriculture (USDA) Dietary Guidelines for Americans (Munoz, et al., 1997; Neumark-Sztainer,

et al., 2002), which outline the components of a quality diet (Nicklas, 2004). In a national sample of adolescents aged 11 to 21 years, almost three-quarters of adolescents reported they failed to eat at least two vegetables in the previous day, more than half did not eat two fruits, and almost half of adolescents surveyed reported they did not consume two or more servings of dairy foods. When compared to their white counter-parts, African-American adolescents were even more likely to report poor vegetable and dairy intake (Videon & Manning, 2003).

According to the 2005 Youth Risk Behavior Surveillance Survey, only one-fifth of students in Baltimore reported eating the recommended number of servings of fruits and vegetables daily, and less than one-tenth reporting drinking the recommended servings of milk each day; African-American students reported eating and drinking even less of these particular foods (CDC, 2005). Considering the importance diet has on preventing health problems, the relatively poor diet of African-American adolescents may be related to their higher risk of developing obesity and chronic disease as adults (Ng-Mak, et al., 1999).

Factors Influencing Diet Quality among Urban, African-American Adolescents

The quality of an adolescent's diet reflects in part the adolescent's grasp of nutrition knowledge, what motivates them to choose healthy foods (Croll, Neumark-Sztainer, & Story, 2001), their taste preferences, food cost and convenience (Larson, Story, Wall, & Neumark-Sztainer, 2006; Morland, Wing, & Diez Roux, 2002), food availability (Hanson, Neumark-Sztainer, Eisenberg, Story, & Wall, 2005; Jago, Baranowski, Baranowski, Cullen, & Thompson, 2007; Jago, Baranowski, &

Baranowski, 2007), and how closely they follow the nutritional guidelines (Neumark-Sztainer, Story, Perry, & Casey, 1999).

Living in an urban environment can make it difficult for low-income adolescents to consume a high quality diet. Over the past four decades, the migration of supermarkets to the suburbs and the lack of transportation available to low-income urban residents have contributed to malnutrition among the inner-city poor, disproportionately affecting minority populations (Flournoy, 2006; Heany & Hayes, 1997). In a 2002 survey of food stores in Mississippi, North Carolina, Maryland, and Minnesota, researchers found four times as many supermarkets located in predominately white communities compared to African-American neighborhoods (Morland, Wing, Diez Roux, & Poole, 2002).

Lack of access to affordable, healthy foods adversely affects an individual's ability to obtain a quality diet (Heany & Hayes, 1997). In a study comparing dietary intake with the local food environment, inner-city African Americans' fruit and vegetable consumption increased 32% for each additional supermarket in the neighborhood (Morland, Wing, & Diez Roux, 2002). Poorer families lacking transportation to supermarkets located outside the community often must rely on the local corner convenience store for their groceries (Jenkins & Horner, 2005). Although convenient, these small corner stores generally offer a large selection of high-fat snack foods and little or no fresh meat and produce, with food costs as much as 49% higher compared to supermarket prices (Flournoy, 2006).

A recent Baltimore study found that parents in many low-income African-American households limit access to family food after the dinner meal is finished, so

the adolescent will often go outside the home to find additional food to eat. Baltimore adolescents reported visiting fast food restaurants or corner convenience stores when they were hungry in the evenings (Dodson et al., 2008). Consumption of food away from home has increased among adolescents (Guthrie, Lin, & Frazao, 2002) and can account for 30% to 40% of their daily energy intake (Nielsen, Siega-Riz, & Popkin, 2002).

Most adolescents choose fast food when eating away from home (Nielsen, et al., 2002). More than a third of all teenagers in this country eat fast food on any given day (Bowman, Gortmaker, Ebbeling, Pereira, & Ludwig, 2004), with fast food consumption highest among African-American adolescents (Bowman, et al., 2004; Larson et al., 2008; Paeratakul, Ferdinand, Champagne, Ryan, & Bray, 2003; Schmidt et al., 2005). Fast food is often high in calories and contains significant amounts of fat, saturated fat, cholesterol, and sodium (Bowman, et al., 2004; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998; Heald, 1992; Paeratakul, et al., 2003). Frequent fast food consumption among children and adolescents is associated with poor diet quality (Bowman, et al., 2004; Paeratakul, et al., 2003; Schmidt, et al., 2005), and increased body weight (Duffey, Gordon-Larsen, Jacobs, Williams, & Popkin, 2007). Although fast food is ubiquitous in our society, the highest densities of fast food restaurants tend to cluster in low-income, African-American neighborhoods (Block, Scribner, & DeSalvo, 2004; Lewis et al., 2005; Powell, Chaloupka, & Bao, 2007). Convenient access to fast food restaurants in urban African-American neighborhoods (Block, et al., 2004) compromises residents' diet quality by displacing more healthy, nutrient-dense foods in the diet (Ludwig, Peterson, & Gortmaker, 2001; Pereira et al.,

2005), and may contribute to racial disparities in obesity rates and a higher prevalence of chronic disease among minorities (Lewis, et al., 2005; Powell, Chaloupka, et al., 2007).

Another consequence of poverty is food insecurity; when families lack the resources to obtain adequate amounts of safe and healthy food (Anderson, 1990; Nord, Andrews, & Carlson, 2007). More than one-fifth of food insecure families in Baltimore reported they could not give their children enough to eat because they did not have the resources to buy enough food (Black, Hager, Merry, & Quigg, 2008). When faced with limited resources to purchase food, parents may forgo purchasing costly food items like fresh fruit and vegetables, especially if they think the food will spoil if the adolescent will not eat it (Black, 2008; Jago, Baranowski, & Baranowski, 2007).

Improving Adolescent Diet Quality

The formative processes at work during adolescence afford a unique opportunity to positively influence adoption of healthy eating habits. A high quality diet during puberty can help protect the adolescent from becoming overweight or malnourished, and can protect against chronic disease development (Boumtje, Huang, Lee, & Lin, 2005; Steinberger & Daniels, 2003; Xie, et al., 2003). Poor diet quality is related to all of the four leading causes of death in the United States: CVD, hypertension, type 2 diabetes and cancer; all disproportionately affecting African-Americans with risk factors surfacing as early as childhood (ACS, 2008; ADA, 2008; AHA, 2007; Winkleby, et al., 1999). Much of the past research on adolescent nutrition has focused on aberrant nutrition behaviors such as eating disorders, with

little research devoted to understanding the factors influencing healthy eating behavior in African-American adolescents that are protective against overweight and chronic disease.

By uncovering new strategies for promoting diet quality in adolescents, we may better be able to help improve their dietary behaviors and lower the risk of chronic disease. For decades, nutrition education has focused on teaching individuals to improve their nutrition knowledge in hopes of improving diet. Unfortunately, this approach has not yielded significant and sustainable change in diet quality (Pirouznia, 2001). This study provided a unique opportunity to explore influences on African-American adolescents' diet quality in light of the health disparities facing inner-city, low-income African-American youth using a novel, integrated theoretical approach to measure the personal, social, and community influences on diet quality.

Study Overview

Since dietary choices occur within a context of multiple simultaneous influences in an adolescent's life, this study examined some of the socio-cognitive factors driving those food choices to better understand how these factors individually and collectively contributed to adolescent diet quality. These influences were evaluated in terms of adolescents' diet quality as the outcome measure. Diet is shaped by a myriad of factors influencing an adolescent's food choices; this study explored important socio-cognitive factors influencing adolescent diet that were found within three broad environmental layers surrounding and acting upon adolescents' food behaviors: the personal, social, and community environment.

Socio-cognitive influences on dietary choices occurring at the personal level included the adolescent's knowledge about nutrition and their self-efficacy for healthy eating, which was the degree of confidence that they could make nutritious food choices. Influences at the adolescent's social environment reflected interpersonal socio-cognitive factors such as parental beliefs about the teen's diet and what the adolescent's friends and peers were eating. Community influences on diet quality described food resources available to the adolescent at home and in the neighborhood.

Theoretical Framework for Proposed Study

The theoretical models that best explain eating behavior are those that describe how multiple personal, social and societal factors interact to influence dietary patterns and food choices (Story, et al., 2002). The dynamic interplay of how these various factors influence an adolescent's dietary habits is well captured within the conceptual framework of Social Cognitive Theory (SCT). SCT describes and predicts health behavior in terms of a dynamic reciprocal interchange where personal cognitions, behavior, and the social environment interact to motivate, change and influence performance of a behavior (Bandura, 1986). In terms of eating behavior, SCT can be used to examine how parental beliefs about diet, peer dietary behaviors and self-efficacy for eating healthy can collectively influence an adolescent's dietary habits and food choices (O'Dea & Wilson, 2006). Self-efficacy is a measure of adolescents' sense of their own capability to engage in specific behaviors (Bandura, 1986). Dietary self-efficacy is an integral component of how an adolescent makes nutrition-related decisions, and it reflects how confident they feel about being able to carry out particular nutrition behaviors. The construct of reciprocal determinism

captures how the continuous interaction between the individual's personal characteristics, their behavioral outcomes, and the environmental setting in which the behavior occurs can work together to form behavioral patterns, and describes how they come together in a three-way dynamic reciprocal interaction (Bandura, 1986; Baranowski, Perry, & Parcel, 1997).

In addition to the influence nutrition self-efficacy has on diet at the intrapersonal level, the SCT construct of behavioral capability describes the adolescent's mastery of nutrition knowledge, and the socio-cognitive construct of observational learning influence adolescent diet through social interactions with parents and peers. The surrounding physical setting affects the food choices available to the adolescent on a community level, while the SCT construct of social norms from the adolescent's cultural surroundings may help in part to shape their dietary behavior (Baranowski, et al., 1997).

Ecological models of health behavior offer another relevant perspective on how adolescents' behaviors are a result of their relationship to their social environment and are impacted through multiple layers of socio-cultural influences that surround and impact their lives. Many health behavior change models acknowledge the impact that personal and social environments can have on influencing behavior, but incorporating the importance the surrounding community has on health behavior is the hallmark of ecological theory (Sallis & Owen, 1997). In the late 1970s, Urie Bronfenbrenner developed ecological models designed for health promotion, proposing that the multiple levels that make up an individual's personal,

social and physical environments interact in a reciprocal dynamic that influences the individual's health behavior (Bronfenbrenner, 1979; Sallis & Owen, 1997).

Reciprocal determinism is the basic tenet that links SCT to an ecological perspective. When viewed through an ecological model, reciprocal determinism describes how environment shapes individuals' behavior, while, alternately, individuals change and reshape their environment, which cycles back around to potentially mitigating a change in behavior. An integrated theoretical framework using select SCT socio-cognitive constructs as viewed through an ecological perspective originally proposed by Story and colleagues (2002) was used in this study to examine factors affecting adolescent diet quality. These various socio-cognitive constructs act on three levels of socio-ecological environment that shape dietary behavior: personal, social, and community (Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008; Story, et al., 2002) as depicted in figure 1.1. The theoretical model used to guide this study differed from the original model presented by Story et al., (Story, et al., 2002) in order to capture those influences relevant to low-income, urban African-American adolescents.

The most proximal level of environment influencing an adolescent's dietary behavior included the psychosocial factors that guided intrapersonal decisions about food consumption habits: nutrition knowledge, food preferences, and self-efficacy to eat healthy. In this study, the adolescent's social environment reflected interpersonal factors, such as parental beliefs about healthy diet and peer eating behaviors. Adolescence is a time when normative influences and modeling behaviors play an important role in the food decisions teens make. The adolescent is pulled between

conforming to peers' behaviors and satisfying parental expectations for them (Campbell, 1969).

The third layer of environmental influence described the adolescents' accessibility and availability of food in their home and community. These influences were (1) whether the family experienced household food security, which is related to the quality and quantity of food they could obtain and afford; (2) an inventory of what kind of foods were available in the home; and (3) how frequently the family shopped at grocery stores and at corner convenience stores for food. This study hypothesized that the community level of dietary influence would make the largest relative contribution to diet quality because if nutritious foods were not available in the home or in the community for consumption, it would be difficult for the adolescent to consume a high quality diet.

The purpose of this study was to use an integrated SCT/ecological theoretical framework to compare the relative contributions three levels of socio-cognitive factors have on influencing adolescent diet quality. It was hypothesized that 1) the personal, social, and community environmental levels of dietary influences would all significantly contribute to diet quality, with community environment making the largest relative contribution; 2) self-efficacy for healthy eating moderated the relationship between parental beliefs about nutrition and diet quality; and 3) self-efficacy for healthy eating moderated the relationship between peer eating behaviors and diet quality.

The aims of this study were addressed using baseline data from the University of Maryland, School of Medicine's *Challenge!* Study. The *Challenge!* Study was a

randomized, controlled health promotion and obesity prevention intervention among urban African-American adolescents in Baltimore. Adolescence offers a unique window of opportunity to positively influence adoption of healthy eating behaviors that can be continued into adulthood.

Research Questions and Hypotheses

The following section presents the research questions and hypotheses that were tested in this investigation. All data came from the Baltimore Challenge Study.

Research Question 1:

What was the relative contribution that each of the environmental level of socio-cognitive influences (personal, social, and community) made towards the quality of urban, African-American adolescents' diets when compared together in an integrated SCT/ecological theoretical model?

Research Hypothesis 1: The personal, social, and community environmental levels of dietary influences compared in the integrated theoretical model would all significantly contribute to diet quality in this sample of low-income, urban African-American adolescents, with community environment making the largest relative contribution.

Research Question 2:

Does adolescents' self-efficacy for healthy eating moderate the relationship between parental beliefs about diet and the quality of urban African-American adolescents' diets?

Research Hypothesis 2: Adolescents' self-efficacy for healthy eating moderates the relationship between parental beliefs about diet and the quality of urban, African-American adolescents' diets.

Research Question 3:

Does adolescents' self-efficacy for healthy eating moderate the relationship between peer dietary behavior and the quality of urban, African-American adolescents' diets?

Research Hypothesis 3: Adolescents' self-efficacy for healthy eating moderates the relationship between peer eating behavior and the quality of urban, African-American adolescents' diets.

Definition of Variables and/or Terms

Diet quality is a pattern of food consumption that emphasizes fruits, vegetables, whole grains, and fat-free or low-fat dairy products. A healthy diet also includes lean meats, poultry, fish, beans, eggs, and nuts as quality protein sources, and is a diet that is low in saturated fat, trans-fat, cholesterol, sodium, and added sugars. The Dietary Guidelines for Americans (USDA, 2005) specifically recommend children and adults consume two cups of fruit, two-and-a-half cups of vegetables, three cups of low-fat or fat-free milk, and three or more servings of whole grains daily. A wide variety of fruits and vegetables should be represented in a quality diet, with dark green and orange produce and legumes consumed several times a week. Total dietary fat consumption is recommended to be 20 to 35 percent of calories, with most fats coming from sources of polyunsaturated and monounsaturated fatty acids

such as those found in fish, nuts, and vegetable oils. Less than 10 percent of calories should come from saturated fatty acids and a quality diet contains less than 300 milligrams per day of cholesterol. Trans-fatty acid consumption should be kept as low as possible. A quality diet will have less than 2,300 milligrams (approximately 1 teaspoon of salt) of sodium per day. To achieve this, choose and prepare foods with little or no added salt and consume potassium-rich foods such as fruits and vegetables (USDA, 2005).

Eating behavior encompasses the patterns, habits and behaviors individuals engage in when obtaining and consuming food (NRC, 1993)

Household food security means all family members have enough readily available and nutritionally adequate food for an active, healthy life. It also means that the family can acquire food in socially acceptable ways, without resorting to emergency food pantries, scavenging or stealing food. Food insecurity reflects limited or uncertain food availability of nutritious and safe food for all family members (Anderson, 1990).

Home food environment describes the food available in the adolescent's home. The consumption of particular foods is related to the availability of those foods in the home (Befort et al., 2006).

Nutrition knowledge reflects an individual's knowledge of the nutrient content of foods. For example, when asked which food contains more cholesterol, nutrition knowledge would be evident if, when given a choice, the respondent answered, "butter" instead of "margarine." Nutrition knowledge also reflects an individual's awareness of the health effects related to various food choices. Asking a

respondent whether "they have heard about any health problems related to how much saturated fat a person eats?" is a type of question that would gauge the individual's knowledge level of diet-related health effects (Variyam & Blaylock, 1999).

Perceived parental beliefs about diet are the dietary behaviors the adolescent feels the parent wants them to engage in when choosing and consuming foods (Gilmer, Speck, Bradley, Harrell, & Belyea, 1996b; Young, Fors, & Hayes, 2004).

Peer eating behaviors are the observed dietary practices that other adolescents engage in when obtaining and consuming food as well as the types of foods consumed (Croll, et al., 2001; Gilmer, Speck, Bradley, Harrell, & Belyea, 1996a).

Self-efficacy for eating healthy is how confident an individual feels about being able to consume a healthy diet. The adolescent's self-efficacy for eating healthy will be measured using a series of questions asking how confident they are about engaging in healthy eating behaviors such as: consuming two or more servings of vegetables most days; having two or more servings of fruit or 100% fruit juice most days; drinking 1% or skim milk; limiting soda consumption to one can or less most days; drinking two or more glasses of water most days; limiting consumption of fried foods; and limiting sugary and/or high-fat snacks most days; and choosing smaller sized portions of fast food. These were the dietary behaviors promoted in the Challenge intervention.

Socio-cognitive describes the integration of social and cognitive properties of models and systems pertaining to human behavior. This term is often used when

describing complex interactions of cognitive and social properties that are reciprocally connected and essential for a given problem (APA, 2008).

Definitions of construct variables

Diet quality was measured using the Healthy Eating Index-2005 (HEI-2005), a tool specifically designed to rate diet quality by assessing how closely American adults and children over the age of two years adhere to the 2005 Dietary Guidelines. Higher HEI-2005 scores indicated better diet quality.

Personal influences on adolescent diet quality included the individual's degree of nutrition knowledge and their level of self-efficacy to make healthy food choices.

Social influences on adolescent diet quality included the adolescent's perception of their parent's beliefs about the adolescent's diet, and what they observed about their peer's eating behavior.

Community influences on adolescent diet quality described the physical setting in which dietary behavior occurred in the adolescent's life, and included: an inventory of what foods were available in the adolescent's home and measured as home food availability; household food security; and family food source measured as where the family frequently shopped for food.

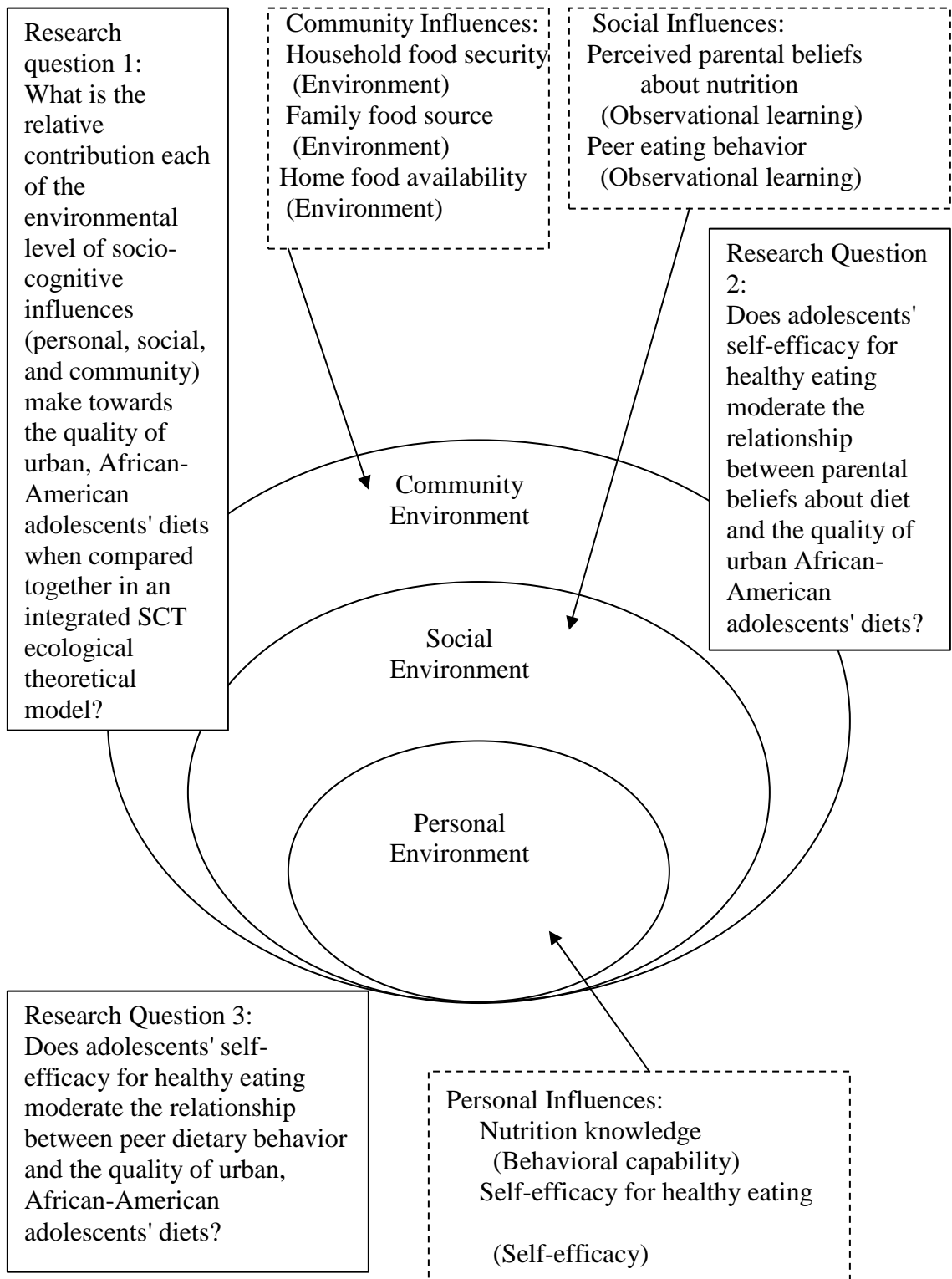


Figure 1.1: An integrated socio-cognitive and ecological framework depicting multiple influences on low-income, urban African-American adolescents' diet.

CHAPTER 2: Background

Introduction

The preceding chapter introduced the problem of sub-optimal diet quality in low-income, African-American adolescents. It discussed some of the causes and health consequences of poor diet quality among adolescents, especially in light of their growing developmental needs. Chapter 2 explores the epidemiology of poor adolescent diet, its behavioral and environmental causes, as well as health problems that are likely to occur as a result of inadequate nutritional intake in adolescents, particularly focusing on low-income, urban African-American adolescents living in Baltimore, Maryland.

This chapter also discusses the novel, integrated use of Social Cognitive Theory (SCT) as viewed through an ecological theoretical perspective that has not yet been tested on dietary behavior according to the review of the literature. An extensive literature review explores the use of SCT and ecological theory in nutrition research with adolescents and African-American youth. Research articles for this review of the literature were located using the Medline (PubMed), PsychInfo, Google Scholar, Web of Science and Human Nutrition databases from 1969 to 2010. The search strategy used a combination of dietary keywords with SCT and environmental factor keywords to locate relevant articles.

Adolescent Diet Quality

A quality diet during adolescence is necessary for healthy growth and development (Spear, 2002), yet many adolescents have dietary intakes that are

nutritionally inadequate (Briefel & Johnson, 2004; Cole & Fox, 2008; Johnson, Johnson, Wang, Smiciklas-Wright, & Guthrie, 1994). Eating habits developed in adolescence tend to continue into adulthood (Story, et al., 2002), placing adolescents with poor diet quality at increased risk of developing chronic disease (Must, et al., 1992; Ng-Mak, et al., 1999; Patterson, et al., 1994; Steinberger & Daniels, 2003; Winkleby, et al., 1999).

Diet quality is an overall assessment of the adolescents' nutritional intake and provides a benchmark to measure how closely the individual adheres to the U.S. Dietary Guidelines for Americans (USDA, 2005). The Dietary Guidelines are recommendations for choosing foods that will promote health and reduce the risk of chronic diseases in both children and adults and they reflect the goals of the Centers for Disease Control and Prevention (CDC) Healthy People 2010 objectives for improving our nation's health (USDA, 2000a). According to the Dietary Guidelines, a high quality diet is rich in fruits, vegetables, whole grains, and fat-free or low-fat dairy products. It also includes lean meats, poultry, fish, beans, eggs, and nuts as quality protein sources, and is a diet that is low in saturated fat, trans-fat, cholesterol, sodium, and added sugars (USDA, 2005). Added sugars are additional sugar used as an ingredient to foods in processing or preparation (Briefel & Johnson, 2004). The 2005 Dietary Guidelines for Americans were used in this study to measure diet quality.

Unfortunately, most adolescents do not meet nutritional guidelines (Cole & Fox, 2008; Croll, et al., 2001; Goodwin et al., 2006; Heald, 1992; Johnson, et al., 1994; Munoz, et al., 1997; Popkin, Zizza, & Siega-Riz, 2003; Story, et al., 2002).

Their emerging autonomy and independence impacts the adolescent's eating habits and diet quality declines through adolescence (Goodwin, et al., 2006; Heald, 1992; Story, et al., 2002).

According to national nutrition surveillance surveys, adolescent diets are characterized by low fruit and vegetable intakes, a very low consumption of whole grains, and intakes of dietary fat, saturated fat, sodium, and added sugars that exceed recommended levels (Cole & Fox, 2008; Johnson, et al., 1994; Munoz, et al., 1997; Popkin, et al., 2003; Story, et al., 2002). As adolescents age, they generally consume fewer calcium-rich dairy products like milk but drink more sweetened beverages, a practice that correlates to lifestyle and social changes that occur during puberty (Goodwin, et al., 2006; Story, et al., 2002). Adolescents typically engage in frequent snacking on energy-dense foods that are high in fat, sodium, and sugar, namely fast food, replacing more nutrient- and fiber-rich foods in the diet like complex carbohydrates, fruits and vegetables (Basiotis, Carlson, Gerrior, Juan, & Lino, 2002; Birch & Fisher, 1998; Heald, 1992; Popkin, et al., 2003). Research indicates that high fat diets of adolescents are inversely related to adolescents' intake of fruits, vegetables, and whole grains (Birch & Fisher, 1998). The foods contributing most of the saturated fat and sodium in adolescents' diets are hamburgers, cheeseburgers, sandwiches, and pizza with meat toppings. Whole milk and ice cream are also identified as top contributors of saturated fat in teens' diets (Cole & Fox, 2008).

Some of the socio-demographic factors influencing diet quality in adolescents have been identified as ethnicity, educational attainment for the head of household (Goodwin, et al., 2006), and income (Forshee & Storey, 2006), with higher

socioeconomic status (SES) households reported better diets compared to lower income families (Neumark-Sztainer, et al., 2002). A rise in family income is positively correlated to increased fruit and dairy consumption among adolescents in the home (Munoz, et al., 1997).

Educational attainment is favorably related to diet quality (Popkin, et al., 2003). The risk of having poor diet quality increased 67 percent for adolescents when the head of household had less than a high school diploma (Goodwin, et al., 2006), and lower parental education is associated with higher fat and cholesterol intakes and lower complex carbohydrate intake in both African American and white populations (Kronsberg et al., 2003). Home stability can also affect diet quality. In the National Heart, Lung, and Blood Institute (NHLBI) Growth and Health Study, researchers found that living in a two-parent household was associated with lower fat, cholesterol and higher carbohydrate consumption among both white and African-American adolescent girls compared to girls living in a single parent household (Kronsberg, et al., 2003).

Racial differences exist in adolescent diet quality. Nationally, African-American adolescents have lower diet quality scores for consuming milk, vegetables, and fat when compared to their white counterparts (Basiotis, et al., 2002), and African-American adolescents were 1.3 times more likely to have poor quality diets compared to white adolescents (Goodwin, et al., 2006). When comparing the nutritional intakes of different racial groups against the Dietary Guidelines, African-American adolescents had the highest meat and the lowest dairy intakes according to the USDA Continuing Surveys of Food Intakes by Individuals (CSFII), although this

survey also found African-American children and adolescents were more likely to meet recommendations for consuming vegetables (Munoz, et al., 1997).

Adolescent Growth and Development

Increased velocity of growth associated with hormonal, physical, cognitive, and emotional changes during adolescence create special nutritional needs, making adolescence a nutritionally demanding and especially vulnerable time of life (Spear, 2002). Adolescence is the period of transitioning from childhood to adulthood. The slow, steady physiological growth that occurs during childhood accelerates rapidly during puberty. Adolescence is the only time in life where the growth rate is as rapid as that of early infancy. During childhood, children gain about five pounds per year and grow approximately two to three inches each year in stature (Spear, 2002). In adolescence, girls grow about ten inches in height and boys gain about twelve inches (Wardlaw & Smith, 2006), rapidly gaining approximately 45 percent of their maximum skeletal mass in the form of bone growth, bone mineralization, and bone density (Spear, 2000, 2002).

Since adolescent boys experience greater rates of growth and larger gains in skeletal bone and lean tissue, their nutritional needs will differ from those of girls. Teenage boys typically require increased amounts protein, iron, zinc, and calcium to meet greater growth needs of developing muscle tissue and bone elongation compared to adolescent girls (Spear, 2000, 2002).

Psychosocial Development

Mid-puberty is characterized by the adolescent challenging family or parental authority, relying on peers for appearance and behavioral standards, and experimenting with dating and sexual behavior. A central task of adolescent psychosocial growth is to develop a sense of identity. Successful identity development in adolescence depends upon the individual successfully interacting with their environment- especially their school, home, and community environments (Sturdevant & Spear, 2002).

Risk behavior in adolescents is a crucial component to the development of their identity, and serves to expand their personal and social identity and aids in the formation of self-competence. "Trying on" different lifestyles aid identity development in adolescent individuals by allowing them to test themselves. Healthy role models allow developing adolescents to experiment with risk taking within a network of adult involvement and concern, allowing adolescents to build self-competence in academics, athletics, and the arts. Adolescents lacking healthy adult role models have fewer areas in which to achieve self-competence, and may choose unsafe aspects of risk taking such as premature sexual behavior, drug and/or alcohol use, or violence (Sturdevant & Spear, 2002).

Adolescence is the first time an individual consciously tries to conceptualize himself and experiments with various images of themselves before different audiences. During this time of life, an adolescent will slowly put away childish things and start to think of the future in terms of choices he must make. The adolescent begins to develop a fuller awareness of his competence to pursue the life choices that

are laid out before him and senses the urgent reality related to making critically important decisions.

Adolescence is a period of life to learn and hone social skills. Towards the end of adolescence, a personal identity begins to emerge that is shaped not solely by close family members, but also by friends and peers, teachers, and by various adults acting as role models. The socialization of the adolescent occurs through various settings such as interpersonal relationships with family, friends and peers, the social environment of school, and the system of norms and values associated with the prevailing youth culture (Campbell, 1969).

Adolescent efficacy can be enhanced or lowered through modeling or feedback given by a person deemed important in the adolescent's life such as a parent, peer, teacher, or counselor. Adolescents tend to choose their friends who are similar to themselves, which enhances the potential influence of modeling behavior among peers. The influence of peers modulates through adolescence, rising during childhood and peaking around eighth or ninth grade, then declining through high school. Peer influence becomes especially influential between the ages of 12 and 16 when parents' involvement in their children's activities tends to decrease (Schunk & Meece, 2006).

Self-efficacy beliefs in adolescents have an influence and reciprocal relationship to self-regulation processes that in turn, influence efficacy perceptions. Bandura (1986) postulated that an individual's self-efficacy perceptions are influenced by their degree of skills mastery and prior accomplishments, vicarious experiences, physiological reactions, and various forms of persuasion by others. Goal setting behavior allows the individual to monitor goal progress and develop personal

mastery of skills and tasks instrumental to achieving a particular goal. In a study of dart throwing skills in adolescent girls, individuals who were coached to focus on the technique-specific strategies useful in achieving their goals, like bending the knees correctly, proved to be highly efficacious compared to girls focused solely on the outcome of hitting the target. Technique-focused strategies also shifted the individual's attention to evaluating processes that influenced their success rather than attributing success or failure to external factors outside of their control (Zimmerman & Cleary, 2006).

In adolescents, this distinction is important in the ability to adapt and change strategies in order to achieve success. Highly efficacious students believe performance outcomes are a result of their personal efforts and believe failures result from factors that can be changed, whereas students with low self-efficacy attribute failure to factors outside their control, leading them to increasing feelings of helplessness and a despondency for achieving success (Zimmerman & Cleary, 2006).

Personal efficacy is highly influenced by the adolescent's ability to self-regulate their actions in the form of setting appropriate goals, implementing effective strategies to realize goals, accurately monitoring the goal process, using appropriate criteria in evaluating outcomes, and attributing causation of outcomes to strategies and processes that can be modified and improved for subsequent goal achievement (Zimmerman & Cleary, 2006). According to Pajares (2006), self-efficacy in adolescence is not "so much about learning how to succeed as it is about learning how to persevere when one does not succeed."

Adolescence is an important period for brain maturation, with substantial changes in brain structure occurring during this period of rapid growth and development (Steinberg, 2009). Formative cognitive and psychosocial processes developing at different rates during adolescence partially explain the some differences in behavioral decisions in maturing young adults. Development of cognitive abilities enables adolescents to use logical reasoning and make decisions about social, moral, and inter-personal matters. Although brain maturation during puberty varies between individuals, most adolescents have achieved cognitive maturity by age 16. Unlike cognitive processes, psychosocial abilities continue to develop throughout adolescence and into young adulthood. Psychosocial capacities are those that govern impulse control, resistance to peer pressure, and impulses for risky behaviors such as binge drinking, reckless driving, and crime (Steinberg, Cauffman, Woolard, Graham, & Banich, 2009). Younger adolescents participating in this study aged 11 to 13 years, would most likely still be developing both cognitive and psychosocial abilities, whereas older adolescents aged 14 to 16 years, would theoretically be approaching cognitive maturity although still developing psychosocial capabilities.

Nutritional Requirements During Adolescence

Due to the wide variability in adolescent growth rates, physical activity, and metabolic rate, nutritional requirements are grouped by age rather than maturational development. For this reason, the nutritional guidelines for adolescents include a safety factor so that intakes below recommended levels are probably adequate to meet physiologic needs (USDA, 2000b).

Protein needs during adolescence correspond to growth patterns rather than to chronological age and are based on the height of the individual. Recommended protein levels for adolescents range from 34 to 52 grams (g) per day, or about 4 to 7 ounces of lean meat per day (Wardlaw & Smith, 2006). Average protein intakes of American adolescents are well above the recommended amounts to maintain growth and insufficient protein consumption rarely occurs in this country. However if energy intake is insufficient due to food insecurity, illness, dieting, or disordered eating practices, protein will be mobilized in the individual to meet energy demands and will be unavailable for tissue synthesis and repair. When protein is used to meet energy needs, it may result in reduced lean body mass and a compromised growth rate, especially during adolescent growth spurts. Intentional caloric restriction among adolescents commonly occurs as a result of dieting behavior in females and in athletes, particularly among gymnasts and wrestlers (Spear, 2000).

Calcium needs during adolescence are greater than at any other time in the lifecycle to support the rapidly growing skeleton and increases in bone density. Calcium is important for growth, formation of healthy teeth and bones, and in later life, calcium is important for maintaining bone health and reducing hypertension (HTN) (Briefel & Johnson, 2004). Adolescents and young adults aged 11 to 24 years are recommended to obtain between 1,200 and 1,500 mg calcium each day to achieve peak bone mass. This amount of calcium may be obtained by consuming 4 to 5 servings of dairy products daily (Wardlaw & Smith, 2006). Bone accretion dramatically slows after puberty, so the bone mass achieved during adolescence must sustain the individual throughout adulthood (Spear, 2000).

Iron requirements are increased during adolescence to accommodate expanding blood volume, a rise in hemoglobin concentration that occurs with male sexual maturation, and for onset of female menstrual iron losses (Spear, 2002). Iron is essential for several cellular and neurological functions (Kretchmer, Beard, & Carlson, 1996). Due to increased growth demands during adolescence, iron deficiency anemia may result in adolescent girls with marginal dietary iron intakes and increased menstrual blood flow (Spear, 2002).

Health Problems Related to Poor Diet Quality

In comparison to the Dietary Guidelines, the overall diet quality among adolescents in the U.S. needs improvement (Goodwin, et al., 2006). In a national survey of youth using the CSFII, mean number of servings from all food groups reported by adolescents fell short of recommended intakes, with 16 percent of youth not meeting any of the recommendations for a healthy diet (Munoz, et al., 1997). National nutrition surveillance data indicates the diets of adolescents are placing them at a heightened risk for developing cardiovascular disease (CVD), cancer, and osteoporosis as evidenced by their consumption of dietary fat, saturated fat, sodium, and soft drinks, and by not eating adequate amounts of fruit, vegetables, dietary fiber, and calcium-rich foods (Lytle, 2002).

Good diet quality is positively related to long-term health and 25-year survival rates, especially in men (Patterson, et al., 1994). The health consequences of poor quality diet in adolescence are many: compromised growth and development, under-nutrition, overweight and obesity (and possibly accompanying sleep apnea, orthopedic problems and arthritis, and metabolic syndrome); health problems (anemia

and dental caries); and risk of chronic disease (CVD, cancer, type 2 diabetes, HTN, and osteoporosis) in adulthood.

Dietary Patterns and Health Issues

A longitudinal analysis of adolescent dietary intake in 2004 using the Nationwide Food Consumption Survey (NFCS), National Health and Nutrition Examination Survey (NHANES), and the CSFII found mean energy intake changed little among 12- to 15-year old adolescents from the mid-1970s to the year 2000, although older adolescent girls experienced a 13% increase in energy intake over the same timeframe. The prevalence of overweight among adolescents increased from 6% to 15%, with the highest prevalence of overweight at 27% among African-American adolescent girls (Briefel & Johnson, 2004).

Consuming more processed foods and eating away from home more frequently can contribute to higher levels of dietary sodium (Briefel & Johnson, 2004). A report using NHANES data from 1999-2004 found that 90% of the adolescents surveyed consumed sodium in amounts that exceeded the recommended upper limits of dietary intake (Cole & Fox, 2008).

In a survey comparing Healthy People 2010 nutrition objectives to eating patterns of adolescents in Minnesota, researchers found consumption of fruit, vegetables, and grains were lower than recommended amounts, and there were major differences in diet between genders and racial groups. Among the adolescent girls and boys who met the Healthy People 2010 objectives for limiting dietary fat, the majority was white and approximately one-third was African American. Of those adolescents who met the objective for limiting calories from saturated fat, almost half

were white and less than one-third were African American (Neumark-Sztainer, et al., 2002).

Maximizing peak bone density through adequate intake of calcium and vitamin D during puberty is protective against adult bone disease later in life. In a recent report using NHANES data from 1999-2004, adolescent calcium intake was insufficient to meet daily needs (Cole & Fox, 2008). In comparing Healthy People 2010 nutrition objectives to eating patterns of adolescents in Minnesota, researchers found that less than half of boys and girls met the recommended intakes for calcium (Neumark-Sztainer, et al., 2002). Between the 1970s and 2000, NHANES data indicate mean daily calcium intake in adolescents decreased 17% (-1082 mg) in boys and 6% (-793 mg) for girls. In 1988-1994, more than one-half of lower-income Americans did not meet calcium recommendations. African Americans in all age groups consume fewer servings of milk and dairy products compared to whites, and have lower mean intakes of calcium and other minerals important for bone health (Fulgoni et al., 2007).

Of those foods that provide calcium in the diet, milk and dairy products contribute about half of the calcium for adolescents. Dietary research indicates that female girls are at greatest risk for inadequate calcium intake (Cole & Fox, 2008) in part because the overall milk consumption in adolescent girls has dropped 36% since the late 1970s, putting them at increased risk of developing osteoporosis (Cromer & Harel, 2000; Spear, 2000; Whiting, et al., 2004).

A decline in milk consumption and calcium intake has been related to an increase in soft drink use (Vartanian, Schwartz, & Brownell, 2007). A prospective

study among adolescents in Massachusetts found that drinking soft drinks was related to obesity, in that for every additional serving of sweetened beverages consumed, kids' body mass index (BMI) increased and those adolescents consuming sweetened beverages had a nearly two-fold increased risk of obesity (Ludwig, et al., 2001).

Dairy consumption also appears to be protective against insulin resistance and development of type 2 diabetes. In a longitudinal study following young adults, dairy consumption was inversely related to insulin resistance in overweight individuals after controlling for lifestyle and other dietary factors (Pereira et al., 2002).

Fruit and Vegetables in the Diet

Diets containing excessive amounts of fat, saturated fat, sodium, and inadequate amounts of dietary fiber are associated with an increased risk of developing CVD, HTN, and cancers of the breast, colon, lung, esophagus, and stomach (NRC, 1993; Lytle, 2002; Steinberger & Daniels, 2003; Steinmetz & Potter, 1996; Winkleby, et al., 1999). Inadequate servings of fruit and vegetables increases cancer risk because this type of diet lacks many of the protective phytonutrients found in produce (NRC, 1993). Fruit and vegetables are rich sources of dietary fiber and phytonutrients, and are very low in fat, saturated fat, and sodium (Lytle, 2002). According to NHANES III data, adolescents would have to nearly double their fiber intake to reach recommended levels (Alaimo et al., 1994).

Long-term fruit and vegetable consumption may also be protective against developing type 2 diabetes mellitus. After controlling for lifestyle factors, consuming five or more daily servings of fruit and vegetables lowered the hazard ratio 27% for developing diabetes compared to adults consuming none (Ford & Mokdad, 2001).

Fruit and vegetable consumption promotes heart health. The strongest protective effect was seen from the consumption of green leafy vegetables and from fruit and vegetables rich in vitamin C (Joshiyura et al., 2001).

Health Risks of Overweight in Adolescence

The prevalence of overweight among American children and adolescents has been steadily increasing over the past three decades. Overweight status is more prevalent in African Americans (Ogden et al., 2006), especially among adolescent females (Hedley, et al., 2004). Twenty-four percent of all African American and Hispanic children are above the 95th BMI percentile (IOM, 2005).

A high quality diet including low-fat milk and dairy products, fruit, and legumes, has shown to be inversely related to development of overweight in adolescents, while consumption of soft drinks, fats and oils, and sodium in the diet is related to overweight status (Boumtje, et al., 2005). Overweight and obesity in adolescence leads to adult overweight with a heightened risk of chronic disease (Boumtje, et al., 2005).

Increasing rates of adolescent type 2 diabetes over the past decade have paralleled the rising rates and severity of obesity in children and adolescents (Spiotta & Luma, 2008; Steinberger & Daniels, 2003), especially among minority populations (Lytle, 2002). Excess body weight is implicated in increased risk of type 2 diabetes by interfering with the body's ability to properly use its insulin (NRC, 1993; Wardlaw & Smith, 2006). As obesity in adolescents increase, so does the risk of developing type 2 diabetes, HTN, hyperlipidemia, and metabolic syndrome (Spiotta & Luma, 2008).

Overweight in adolescents is strongly related to metabolic syndrome (Crespo, Perera, Lodeiro, & Azuara, 2007), a constellation of risk factors that leads to type 2 diabetes and CVD (Steinberger & Daniels, 2003). As many as half of all severely overweight adolescents have metabolic syndrome (Spiotta & Luma, 2008). In a sample of 4,450 adolescents surveyed for NHANES 1999-2002, metabolic syndrome was 16 times more prevalent in overweight teenagers (14.5%) compared to those individuals of normal weight (0.9%). The study found that adolescents consuming good quality diets, as measured by higher Healthy Eating Index (HEI) scores, had a much lower prevalence of metabolic syndrome and that a healthy diet had a protective effect (Pan & Pratt, 2008).

It is yet unclear as to which dietary component in particular ameliorates the prevalence of metabolic syndrome and its accompanying insulin resistance, although current research indicates a diet containing whole grains and dietary fiber is related to greater insulin sensitivity in adolescents (Steffen et al., 2003). Higher whole grain intake was also related to higher quality diets that included a greater intake of fruit and vegetables, dietary fiber, iron, zinc, and calcium among adolescents (Steffen, et al., 2003).

Adolescent BMI can also serve as a predictor of diabetes and CVD risk. Adolescent participants with a mean age of 12.7 years in the Bogalusa Heart Study underwent assessment measures for BMI, metabolic syndrome factors, and CVD risk factors and were then followed into young adulthood. Adolescents in the top quartile of BMI compared to the lowest BMI quartile were 11.7 times more likely to develop

risk factors of metabolic syndrome as young adults (Srinivasan, Myers, & Berenson, 2002).

Many pathological processes of CVD risk factor development begin in childhood and adolescence (Spear, 2000). Research found that obese adolescents (mean age of 13) were found to have arterial plaque buildup similar to that typically seen in middle-aged adults. Researchers estimated that these children's "vascular age" was 30 years older than their actual age, putting these adolescents at high risk for CVD as a result of their obesity, hyperlipidemia, and/or family history of CVD (Raghuveer et al., 2008).

As the research indicates, CVD and diabetes in adults require a closer examination of the dietary habits in place during the childhood to adulthood transition through adolescence to better understand how diet affects the etiology of chronic disease. The following section explores how increasing disparities in chronic disease across racial and income groups have lead researchers to examine the social and environmental factors that influence diet.

Minority Health Disparities, Disease, and Diet Quality

Compared to the rest of the U.S. population, African Americans are disproportionately affected by diabetes, cancer and cardiovascular diseases. The combined death rate for all cancers in 2003 was 18% higher in African-American women and 35% higher in African-American men compared to white women and men (ACS, 2008), and African Americans are almost twice as likely to have diabetes compared to whites (ADA, 2008).

Cardiovascular disease remains America's leading cause of death among both African Americans and whites. Among African Americans, about half of all adults have CVD, compared to approximately one-third of white men and women (AHA, 2007a). In 2007, African Americans were reported to have one of the highest rates of HTN in the world, affecting almost half of all African-American adults in this country (AHA, 2007b). Compared to whites, African Americans have higher rates of HTN (AHA, 2007b), are more likely to be overweight or obese (Hedley, et al., 2004), and are more likely to have diabetes (ADA, 2008). All of these chronic disease conditions are primary risk factors for developing CVD. The causes for health inequities among minority populations are complex but can be linked to socioeconomic disparities in income, education, housing, community environment, and social barriers to accessing quality healthcare.

In a national survey of over 12,000 adults, African Americans had higher rates of HTN, CVD, and arthritis compared to whites, although the differences disappeared when researchers controlled for SES. The authors concluded that SES might affect chronic disease because it is a significant determinant for access to healthcare (Kington & Smith, 1997).

Health Disparities in Minority Children and Adolescents

Ethnic disparities in health are evident in childhood and adolescence. A longitudinal study comparing 9-year old African-American girls and white girls found a 2.5-fold increased prevalence of obesity among minority girls. Insulin resistance was correlated to BMI and the racial differences in insulin resistance preceded puberty and were related to early onset of obesity in African Americans and

increasing BMI in whites (Klein et al., 2004). A similar study found that by age nine or ten, African-American girls were heavier, had higher percent body fat measures, and had higher blood pressure than their white counterparts ("Obesity and cardiovascular disease risk factors in black and white girls: the NHLBI Growth and Health Study," 1992), indicating racial differences in CVD risk factors are already present at a young age (Kimm et al., 2001).

An analysis of NHANES data examining ethnic variation in CVD risk factors among children, adolescents, and young adults found ethnic differences apparent in BMI by age six to nine years and widening thereafter into adulthood. African-American girls had significantly higher BMI compared to their white counterparts. African-American boys and girls of all age groups had higher glycosylated hemoglobin, a measure of long-term abnormally high blood sugar implying impaired insulin function in the body. All ethnic differences remained significant after adjusting for age and SES (Winkleby, et al., 1999).

Racial differences in early onset CVD risk factors such as excessive weight and dietary fat, elevated systolic blood pressure, and hyperglycemia in African-American children as young as six to nine years reinforce the need to improve the health and diets of both African-American children and their parents (Steinberger & Daniels, 2003; Winkleby, et al., 1999). Obesity increases the risk of metabolic syndrome in children and adolescents. In a sample of obese, inner-city African-American youth, 35% were identified as having metabolic syndrome, and among morbidly obese individuals the prevalence of metabolic syndrome increased to 44% (Quintos et al., 2006).

Diet quality was measured using the HEI from NHANES 1999-2000 data and revealed Hispanics and whites had higher mean HEI scores compared to the African Americans sampled (Briefel & Johnson, 2004). The energy density of diets can also predict obesity in adolescents, and the highest levels of dietary energy density were found among Food Stamp Program participants and African-American adolescents (Mendoza, et al., 2006).

Determinants of Adolescent Eating Behaviors

Not only do adolescents have generally poor nutritional intakes, they often engage in erratic dietary patterns that put them further at risk during this nutritionally vulnerable time in their lives (Croll, et al., 2001). The following section discusses adolescents' personal eating behaviors that are driven by the lifestyle influences, social pressures, or environmental factors that contribute to poor diet quality.

Personal and Social Influences on Adolescent Diet Quality

Taste, Cost and Convenience of Food

In a national survey of food preferences, young adults reported that taste, followed by cost of food were the most important factors in making dietary choices. In decreasing order of importance, survey respondents also listed nutrition, convenience, and weight control as determinants of diet. Cost and convenience rated highest among African Americans and low-income respondents (Glanz, et al., 1998).

Skipping Breakfast

Across all racial groups, there is a significant decline in breakfast consumption as adolescents age into young adulthood (Harris, Gordon-Larsen, Chantala, & Udry, 2006; Lytle, 2002). Skipping breakfast has a detrimental effect on cognition, learning, concentration, and performance in school (Pollitt & Mathews, 1998; Story, et al., 2002), and the negative effect was more pronounced among children nutritionally at risk compared to well-nourished children (Pollitt & Mathews, 1998). Breakfast consumption improves school attendance and students' diet quality (Pollitt & Mathews, 1998).

A nationwide study reports that over the past 30 years, breakfast consumption by adolescents has declined up to 20%. Almost two-thirds of high school students reported skipping breakfast at least three times during the past week, and 42% of 12- to 13-year old children say they do not eat breakfast every day (Rampersaud, Pereira, Girard, Adams, & Metzl, 2005).

The nationwide NHLBI Growth and Health Study found the frequency of eating breakfast in adolescent girls is associated with higher calcium intake and dietary fiber consumption (Affenito et al., 2005). The increased calcium intake associated with breakfast is important to adolescents because bone calcium accretion is highest during puberty, and the nutrients lost to breakfast skippers are not compensated for in subsequent meals in either children, adolescents, or adults (Rampersaud, et al., 2005).

Breakfast skipping is more prevalent in older children and adolescents, females, those from lower SES backgrounds, and in African Americans (Rampersaud,

et al., 2005). In the NHLBI Growth and Health Study, African-American females skipped breakfast more often than white females with the greatest differences in intake occurring at age 12; subsequent differences declined in intake with advancing age (Affenito, et al., 2005). Another national longitudinal study found African-American adolescents ate breakfast on fewer days of the week compared to their white counterparts, and skipping breakfast was an independent predictor of higher adult body weight (Niemeier, Raynor, Lloyd-Richardson, Rogers, & Wing, 2006).

Eating Away From Home

Consuming food away from home has a detrimental effect on adolescent diet quality (Duffey, et al., 2007; French, Story, & Jeffery, 2001; French, Story, Neumark-Sztainer, Fulkerson, & Hannan, 2001; Gillis & Bar-Or, 2003; Gillman et al., 2000; Guthrie, et al., 2002; Nielsen, et al., 2002; Paeratakul, et al., 2003). Defined as food from sit-down or fast food restaurants (Duffey, et al., 2007), adolescent consumption of food away from home has increased from 20% of their daily energy intake in the 1970s to 35% of their calories in 1996 (Guthrie, et al., 2002). A more recent study estimates food away from home can account for a third to almost half of adolescents' daily energy intake, and found these calories are predominately from snacking on pizza, cheeseburgers, and salty snacks (Nielsen, et al., 2002).

Food eaten away from home by adolescents is typically higher in fat, saturated fat, cholesterol, and calories of energy compared to food consumed at home (Guthrie, et al., 2002; Paeratakul, et al., 2003). Eating family dinners at home is associated with more healthful dietary patterns in adolescents like higher fruit and vegetable

consumption, and lower intake of fried foods and soft drinks, lower consumption of saturated fat and trans-fat, more dietary fiber, and a higher intake of micronutrients. (Gillman, et al., 2000). Videon and Manning found that as the number of meals shared with family increased, adolescents were more likely to eat breakfast and consume more fruit and vegetables compared to those adolescents eating meals with family less often (Videon & Manning, 2003).

Fast Food Consumption

The ubiquity of fast food restaurants (FFR) in this country may in part account for increasing trends in fast food consumption. The proportion of adolescents' energy intake from fast food has increased nearly 300% from 1977 to 1996 (Nielsen, et al., 2002). Frequent fast food consumption among adolescents is associated with poorer diet quality and with greater increases in body weight (Duffey, et al., 2007; French, et al., 2001; Pereira, et al., 2005).

Fast food is typically high in calories and contains significant amounts of saturated fat, cholesterol, and sodium (Bowman, et al., 2004; Glanz, et al., 1998; Heald, 1992; Paeratakul, et al., 2003), and may replace healthier foods in the diet like fruit and vegetables, milk, breads and cereals (Bowman, et al., 2004; French, et al., 2001; Paeratakul, et al., 2003).

Fast food consumption appears to differ by ethnicity (Bowman, et al., 2004). In a cross-sectional study using CSFII data, African Americans reported the highest frequency of eating fast food (45.8 %) compared to whites (42.0%), Hispanics (40.5%), and other racial groups (38.5%). In another national sample, Niemeier and

colleagues reported higher rates of fast food consumption among African-American adolescents, and fast food consumption predicted a higher adult body weight (Niemeier, et al., 2006).

Consuming Junk Food and Convenience Foods

Nationwide NHANES III data indicated that children and adolescents aged 8- to 18-years increased consumption of low-nutrient-dense foods such as soft drinks, candy, sugar, baked and dairy desserts, salty snacks, and added fats, and these foodstuffs accounted for almost one-third of the child's daily caloric intake. The study found that the amount of dietary nutrients declined as consumption of low-nutrient-dense foods increased (Kant, 2003). A study examining snacking habits using data from two national nutrition surveys found almost two-thirds of adolescents reported consuming one or more high-fat snacks on the day they were surveyed (Dausch et al., 1995). Adolescents' justification for eating unhealthy foods was that they are readily available more so than healthy foods choices and they are simply more appetizing (Croll, et al., 2001).

A study targeting low-income East Baltimore adolescents found that snacking between meals is a common occurrence. The foods the African-American adolescents in the study most often cited as snack choices included soft drinks, fast food, potato chips, or a "chicken box" (Dodson, et al., 2008) which is a take-out box containing four to five pieces of fried chicken, usually wings, and French fries ("Urban Dictionary: Chicken box," 2008).

Nutrition Knowledge to Choose Healthy Foods

In a series of focus groups conducted to find which foods adolescents perceived as being healthy, study participants identified fruits and vegetables as the foods most commonly perceived as "healthy foods," followed by salad; carbohydrate-rich foods like rice, bread, and pasta; lean meats including turkey and baked chicken; natural foods and tofu. Virtually all of the teenaged participants neglected to mention milk as a healthful food, and only a few participants identified low-fat or fat-free foods as healthy choices. Focus group participants had no difficulty in naming numerous foods they considered to be unhealthy. Foods such as chips, cookies, candy, pie, brownies, and prepackaged snack cakes were identified as unhealthy snack choices. As one teen stated, "If it comes in the little red plastic bags that you get for a quarter, it is probably junk food." In addition, adolescents identified pizza, fast food, sugary foods, soda, chocolate, high fat meats like steak, ribs, chicken with the skin, pork, or any artificially made or greasy foods as being unhealthy (Croll, et al., 2001).

Most adolescents in the study also defined healthy eating as achieving a "balanced diet" that consisted of a variety of foods. It is evident that adolescents have the nutrition knowledge to make sound food choices, but they cite lack of time and social eating pressures from peers as barriers to making good food choices (Croll, et al., 2001).

Interventions for middle school students aimed at increasing nutrition knowledge have demonstrated significant improvements in diet quality and increased fruit and vegetable consumption after exposure to nutrition education (Fahlman,

Dake, McCaughtry, & Martin, 2008). A nutrition and physical activity intervention targeting low-income, overweight African-American adolescent females, called Go Girls! recruited 56 adolescents with a mean age of 13.5 years. The study found that girls who attended more sessions had significantly higher nutrition knowledge scores and reported engaging in more low-fat dietary behaviors compared to girls who attended fewer sessions during the intervention (Resnicow et al., 2000).

Nutrition interventions focusing on nutrition knowledge may be more successful when targeting adolescent by age groups or by cognitive developmental levels. A study measuring nutrition knowledge between sixth, seventh, and eighth graders, aged 11 to 13, found no correlation between nutrition knowledge and food choices among the sixth-graders. However, among the older adolescents in the seventh and eighth grades, the researchers detected a significant correlation between nutrition knowledge and adolescents' food choices in both boys and girls (Pirouznia, 2001).

Peer and Parental Influences on Food Choices

Adolescents reported that choosing to eat healthy foods was often in conjunction with being home or at a relative's house, especially eating meals with parents and older family members, and less often with friends and in social situations. Social events with friends or specific locales like baseball games were often associated with consumption of unhealthy foods (Croll, et al., 2001).

Among adolescents in Minnesota, parental intake of healthy foods served as positive role modeling and was associated with increased intake of dairy, fruit and

vegetables for adolescent girls, while parental consumption of milk at meals was related to increased dairy intake in adolescent boys (Hanson, et al., 2005). Increased calcium intake among adolescent girls is related to parental modeling and seeing fathers drink milk, and is associated with parents and peers encouraging milk consumption (Lee & Reicks, 2003).

Among low-income, African-American adolescents, mothers and grandmothers were identified as supportive to adolescents in consuming fruit and vegetables, while peers were viewed negatively for eating these healthy foods (Molaison, Connell, Stuff, Yadrick, & Bogle, 2005). Low-income, urban African-American adolescents living in East Baltimore reported mothers and grandmothers as admired and respected family members who often prepared family dinners, which was the most common meal adolescents consumed at home (Dodson, et al., 2008).

The social environment surrounding adolescents also has an influence on their food choices and diet quality. Adolescents attribute eating unhealthy foods to social pressures within peer groups (Evans, Wilson, Buck, Torbett, & Williams, 2006). Eating "junk" food is more often associated with adolescents eating with their friends as compared to eating generally healthier foods in the home environment (Evans, et al., 2006; Feunekes, de Graaf, Meyboom, & van Staveren, 1998; Larson, et al., 2008; Molaison, et al., 2005). Adolescents are certainly influenced by what their peers eat. In a study of 15-year old adolescents, Feunekes and colleagues found that 19% of the foods consumed by adolescents were the same foods reported as eaten by their friends as reported on a food frequency questionnaire (Feunekes, et al., 1998).

Environmental Influences on Adolescent Diet Quality

Community access to foods enables people to make healthy food choices. Without access to healthful foods, individuals will have difficulty improving dietary intake and poor food availability prevents intake of healthy foods known to protect against chronic disease risk and promote health.

Food Availability in the Home

The types of food available in the home can influence the diet quality of adolescents (Befort, et al., 2006; Edmonds, Baranowski, Baranowski, Cullen, & Myres, 2001; Hanson, et al., 2005; Larson, et al., 2006; Molaison, et al., 2005; Neumark-Sztainer, et al., 2002; Neumark-Sztainer, Wall, Perry, & Story, 2003). Home availability was the strongest predictor of fruit, fruit juice, and low-fat vegetable consumption among adolescents (Jago, Baranowski, Baranowski, et al., 2007). Availability of healthier foods like fruit, vegetables, and dairy in the home and the absence of unhealthier foods have a positive influence on adolescent diets. In a large study examining adolescent eating habits, Project EAT reported that household availability of fruit and vegetables was associated with girls' intake of these foods. Soft drink availability was inversely related to dairy consumption among girls, and in males, serving milk with meals was associated with boys' intake of dairy (Hanson, et al., 2005). Additionally, calcium intake among adolescent boys was also inversely related to consuming soft drinks and fast food (Larson, et al., 2006). Availability of unhealthy food alternatives becomes a barrier to adolescents making healthy food choices at home (Hanson, et al., 2005).

In a comparison of African-American and white urban, adolescents' intake of fruit and vegetables, researchers found that home availability and family meals were associated with fruit consumption among white teenagers, while among black adolescents, eating at restaurants where fruit and vegetables were offered was a stronger predictor of fruit and vegetable intake compared to having those foods available at home (Befort, et al., 2006). In another study among African-American adolescents, restaurant vegetable and fruit juice availability predicted adolescent consumption of those foods (Edmonds, et al., 2001).

Family Income and Diet Quality

Edmonds and colleagues noted an inverse relationship between family median income and the availability of fruit, vegetables, and fruit juice in the home (Edmonds, et al., 2001). In a study focusing on fruit and vegetable intake among low-income African-American adolescents, Molaison and colleagues reported that the lack of fruit and vegetable availability at home was cited as a barrier to adolescent consumption of these foods. Adolescents attributed the unavailability of fruit and vegetables at home to either 1) the parent did not buy these foods, or 2) the grocery stores where the family shopped did not have fruits and vegetables available for purchase (Molaison, et al., 2005).

Lower median incomes are associated with less healthy dietary intake (Diez-Roux et al., 1999). Higher household education and income has been seen to have a positive impact on fruit and vegetable consumption (Riediger, Shooshtari, & Moghadasian, 2007). Adolescents from higher-income families have a greater variety

of fresh fruit and vegetables available to them, while those children from low-income homes are likely to have less variety of foods to choose from, and more often consume canned and frozen foods. Neighborhood availability of nutritious foods also predicts parental ability to purchase healthy foods (Jago, Baranowski, & Baranowski, 2007).

In a study examining diet quality among predominately African-American, low-income, urban children and adolescents aged 7- to 13-years, researchers found 75% of these children failed to consume the recommended number of servings for vegetables, dairy, grains, and fruit; consuming quantities of these foods that were significantly below the recommendations (Langevin et al., 2007).

Food Insecurity

Approximately 13 million families or 11% of American households did not have dependable access to enough food and were food insecure. These households experienced some degree of difficulty in the past year providing adequate amounts of food for all members living in the household due to insufficient resources (Nord, Andrews, & Carlson, 2008). By definition, household food security means all family members have enough readily available and nutritionally adequate food for an active, healthy life. It also means that the family can acquire food in socially acceptable ways, without resorting to emergency food pantries, scavenging or stealing food. Food insecurity reflects limited or uncertain food availability of nutritious and safe food for all family members (Anderson, 1990).

Food insecurity affects growth and development in children and adolescents. Children living in homes with female-headed households have the highest rates of food insecurity in the U.S., with approximately one-third of these households being food insecure (Chilton, Chyatte, & Breaux, 2007). Young children living in food insecure households have a 51% higher odds of having fair to poor health status compared to young children living in food secure homes (Cook et al., 2006), and 18% of low-income young food insecure children in food insecure households were determined to be at developmental risk compared to 13% from food secure homes (Rose-Jacobs et al., 2008). In school-aged children, food insecurity is associated with lower physical functioning, poor academic performance, and less adaptive psychosocial functioning. According to research using the National Survey of American Families, household food insecurity is related to a higher incidence of poor nutritional and health status among young adolescents (Ashiabi & O'Neal, 2007) and food insecurity in adolescents aged 12- to 18-years is associated with a 3-point reduction in HEI scores indicating poorer diet quality (Bhattacharya, Currie, & Haider, 2004).

African-American households are disproportionately affected by food insecurity. African-American households with children under the age of 18 have food insecurity rates three times that of children living in white households (Chilton, et al., 2007).

Community Food Sources: Access to Supermarkets and Healthy Food

Neighborhood food availability in low-income and minority communities can have a substantial impact on residents' health and on adolescents' dietary behaviors, food choices, and their diet quality (Diez-Roux, et al., 1999; Hersey et al., 2001; Jago, Baranowski, & Baranowski, 2007; Langevin, et al., 2007).

There are racial and economic disparities in the kinds of food stores available in different neighborhoods. The migration of supermarkets to suburban areas from urban neighborhoods, and the lack of transportation available to low-income residents both contribute to poor diet quality among the urban poor (Moore & Diez Roux, 2006). The scarcity of supermarkets in disadvantaged communities forces residents to shop at small corner markets and convenience stores that offer limited selection of foods at much higher prices. Urban residents pay up to 37% more for groceries in their local community compared to suburban dwellers who shop at large supermarkets for the same food items (Morland, Wing, Diez Roux, et al., 2002).

In a four-state survey that included North Carolina, Mississippi, Maryland, and Minnesota, researchers found that the location of different types of grocery stores is related to the wealth and racial profile of various neighborhoods. Wealthier neighborhoods contain over three times the number of supermarkets compared to the lowest wealth areas, and there were four times as many supermarkets to be found in white communities compared to African-American neighborhoods (Morland, Wing, Diez Roux, et al., 2002). Residents of higher-income neighborhoods also had higher energy-adjusted intakes of fruit, vegetables, and fish, and lower intakes of meat compared to those living in lower income communities (Diez-Roux, et al., 1999).

Residents of low-income neighborhoods living close to small groceries and convenience stores had higher BMI compared to residents of middle-class communities who lived close to supermarkets (Wang, Kim, Gonzalez, MacLeod, & Winkleby, 2007).

Neighborhood food availability among low-income populations influences their dietary behaviors. A national survey of Food Stamp Program recipients reported that easy access to a supermarket (within five miles) related to higher household fruit consumption (Rose & Richards, 2004). In Chicago, poorer communities had fewer and smaller retail stores and supermarkets compared to more affluent areas in the city, and residents living in low-income neighborhoods typically had to travel more than two miles to access supermarkets (Alwitt & Donley, 1997).

The lack of neighborhood supermarkets in urban areas has a negative impact on diet quality in minority populations. Poor access to supermarkets in African-American neighborhoods is a byproduct of economic divestment, and has a deleterious effect on diet quality among low-income, African-American adolescents (Zenk et al., 2005).

As part of a study of low-income African-American adolescents in East Baltimore, researchers visited several grocery stores in the area to assess the availability of foods and the quality of fresh produce in the neighborhood food outlets. They noted that the fresh produce displayed in many stores was surrounded by sugary snack foods like ice pops wrapped up in mesh bags resembling packaging for tangerines and bags of cotton candy. Some stores did not offer fresh fruit and vegetables, low-fat milk, or lean meats for sale, although they did carry higher fat,

lower cost meats such as pork, pigs feet, pigs ears, pig tails, and higher-fat ground beef (Dodson, et al., 2008).

Access to Healthy Foods

Diet quality is related to access to specific types of foods (Bodor, Rose, Farley, Swalm, & Scott, 2007; Cheadle et al., 1991; Fisher & Strogatz, 1999; Morland & Filomena, 2007; Zenk, et al., 2005), and to availability of affordable, healthy foods in neighborhood stores (Baker, Schootman, Barnidge, & Kelly, 2006; Block & Kouba, 2006; Cheadle, et al., 1991; Galvez et al., 2007; Horowitz, Colson, Hebert, & Lancaster, 2004; Sloane et al., 2003; Zenk, Schultz, Israel, Bao, & Wilson, 2006).

In the Chicago area, Block and Kouba found that poor communities typically had only one supermarket compared to an average of three in more affluent neighborhoods. The price, availability of healthy foods, and quality of food sold in small groceries in low-income neighborhoods greatly affects the diet quality of community residents. The prices of prepackaged food items in small grocery stores in Chicago were found to be overwhelmingly more expensive than food items sold in supermarkets. Less than two-thirds of independent grocers carried fresh produce items, but more than half of these vendors stocked inferior quality produce that was deemed unacceptable for consumption due to rotting, mold, soft dark flesh, or slime (Block & Kouba, 2006).

Neighborhood Racial Disparities

Racial disparities exist in community access to healthy foods. Residents of African-American communities were less likely to have access to food outlets compared to those living in higher income, white neighborhoods. There are often no supermarkets available in African-American communities and the quality of food available in these minority neighborhoods made it difficult for residents to make healthy food choices (Baker, et al., 2006; Galvez, et al., 2007; Moore & Diez Roux, 2006).

Environmental racial disparities in access to healthy food exist even in large, diversified metropolitan centers like New York City. Horowitz and colleagues found that food stores in high-income neighborhoods were more than three times likely to sell healthy food items compared to stores in poor neighborhoods in the city. Small grocery stores in white neighborhoods were five times more likely to offer healthy foods for sale compared to corner grocery markets in African-American neighborhoods (Horowitz, et al., 2004)

The limited availability of fruit and vegetables in minority neighborhoods impacts diet quality of African Americans. Supermarkets typically have the largest selection of fresh fruit and vegetables, and in New York City the prevalence of supermarkets is highest in predominately white areas with predominately African-American areas having none at all. Compared to the array of fresh produce usually found in supermarkets, researchers found 64% of the amount of fresh fruit and vegetables in corner grocery stores in predominately white area stores, 31% in racially mixed area stores, and only 5% of the amount of fresh produce in corner

stores within predominately African-American areas of the city (Morland & Filomena, 2007).

Increasing access to high-quality fresh produce in low-income communities is important to support healthy dietary choices in residents of these communities. Grocery stores in African-American neighborhoods sold less fresh fruit and vegetables, with half the selection of produce, and of inferior quality compared to non-African American neighborhoods in Los Angeles. African-American residents complained to researchers that the stores in their communities carried "brown bananas and bad meat" (Sloane, et al., 2003). A study in Detroit found that the quality of fresh produce sold was significantly lower in low-income, African-American communities compared to that sold in a racially heterogeneous, middle-income neighborhood. The low-income neighborhood also had fewer grocery stores but four times as many liquor stores as the middle-class neighborhood (Zenk, et al., 2006).

Lack of local supermarkets in minority communities may also be a barrier to adolescents consuming a healthy diet. A study examining more than 30,000 eighth- and tenth-grade students nationwide found a relationship between neighborhood supermarket availability and adolescent BMI. Access to supermarkets in the community related to lower African-American adolescent BMI, while more convenience stores in the community was associated with higher adolescent BMI and risk of overweight (Powell, Auld, Chaloupka, O'Malley, & Johnston, 2007). Jago and colleagues found that adolescents who have less access to convenience-type stores are more likely to eat fruit and vegetables at home or at other locations, and will develop preferences for fruit and vegetables. They believe this finding is due to less exposure

to highly processed, convenience foods in adolescents' diet (Jago, Baranowski, Baranowski, et al., 2007).

Healthy food products are less available in poor African-American neighborhoods, making it more difficult for residents to consume a healthy diet associated with lower chronic disease risk in communities with poor nutritional resources. A study examining neighborhood characteristics and disease incidence found that those who developed CHD were more likely to live in disadvantaged neighborhoods, regardless of racial groups. Those who developed the disease also tended to have lower incomes and educational attainment, and were less likely to work in professional or managerial occupations. Low-income African Americans living in poor neighborhoods were 2.5 times more likely to develop CHD compared to high-income African Americans living in affluent communities. The study authors theorize this health disparity may be because residents of poor neighborhoods are exposed to more tobacco advertising, have less affordable healthy foods and limited access to healthy foods, are under more chronic stress from violence, noise, and economic challenges, and have less social support (Diez-Roux, et al., 1999).

Community Food Sources: Restaurants

Residents living in communities with limited nutritional resources for dining away from home make it more difficult to eat a healthy diet. Poorer communities with higher racial mix of African-American residents have fewer healthier menu choices when eating out and these communities tend to have more fast food restaurants than

full service restaurants (Block, et al., 2004; Hoag, 2008; Lewis, et al., 2005; Powell, Chaloupka, et al., 2007; Simon, Kwan, Angelescu, Shih, & Fielding, 2008).

In a national survey comparing neighborhood income and ethnic characteristics to availability of full service and fast food restaurants (FFR), low- and middle-income neighborhoods had the highest number of restaurants, with up to 1.3 times the number available compared to high-income neighborhoods. Predominately African-American versus white urban neighborhoods had moderately higher proportions of FFR, although neighborhoods that were low-income and predominately black had a 28% higher proportion of FFR compared to high-income, predominately white neighborhoods (Powell, Chaloupka, et al., 2007).

In South Los Angeles, Lewis and colleagues found that low-income African-American areas of the city had more FFR (25.6%) compared to affluent white communities (11.2%). Fast food restaurants in the low-income areas were also more likely to promote unhealthy food options and menu items. The study found that the availability of healthy dining options (like broiled versus fried), was higher (40%) in affluent white neighborhoods compared to poorer black communities (27%), which may contribute to racial disparities in obesity and disease rates for African Americans (Lewis, et al., 2005).

Target Population Background and Context

This research used baseline data from the Challenge study conducted at the University of Maryland in Baltimore. Challenge was a health promotion, obesity prevention intervention targeting low-income, urban African-American adolescents from neighborhoods in West Baltimore, Maryland. The Challenge study targeted

adolescents ranging in age from 11 to 16 years, with a mean enrollment age of 13. Two hundred and thirty-five adolescents enrolled in the Challenge study completed the baseline evaluations from July 2002 through May 2004 (Black et al., in press).

Similar to other northeastern cities, over the past ten years Baltimore has undergone one of the highest population losses in the U.S. Like other cities in the northeast, Baltimore's residents have relocated to suburban areas at the expense of its urban hub. Since 1990, 28% of Baltimore's white population has migrated out of the city, leaving Baltimore with a growing proportion of African-American residents (Planning, 2001 December). Over the past fifteen years, the proportion of African Americans living in the city has increased about 8% while the proportion of white city residents has declined by 17%. In 2007, nearly two-thirds of Baltimore's residents were African American compared to almost one-third who were white (Sharfstein, 2008 October).

Forty percent of Baltimore households reported earning less than \$30,000 in 2007, compared to 20% statewide. The median household income in 2007 for Baltimore City was \$36,949; approximately half that of the statewide median income. African Americans earn less than any other racial group in the city, with incomes \$1,276 below the median city income. Three times as many Baltimore families reported an income that was below the poverty level compared to families in the rest of Maryland, with African Americans being twice as likely to report incomes below the poverty level compared to whites (Sharfstein, 2008 October).

Economic Disparities Affecting African Americans in Baltimore

The higher rate of chronic disease in Baltimore may be a function of racial and economic barriers. According to 2006 Census Bureau ethnicity data, 12% of the overall U.S. population were African American, while African Americans accounted for 64% of Baltimore residents (FactFinder, 2008). Twenty-four percent of Baltimore's residents in 2004 were living in poverty, while less than 9 percent of Maryland residents were impoverished. In terms of families and children living in poverty in that same year, 19% of all families and 35% of all children living in Baltimore were in poverty, compared to less than 6% of families and 11% of children who were impoverished statewide ("Baltimore City Results and Indicators Report: Stable and Economically Independent Families," 2006).

One consequence of poverty is food insecurity, and the utilization of the School Lunch Program may serve as a proxy indicator of this in Baltimore. In the 2005-2006 school year, 78% of Baltimore middle-school children received reduced price or free lunch, compared to 35% of middle-school children statewide ("Baltimore City Results and Indicators Report: Stable and Economically Independent Families," 2006). Approximately 13.5% of low-income Baltimore families with young children participating in The Children's Sentinel Nutrition Assessment Program (C-SNAP) were food insecure, slightly higher than the 10.9% national average reported by the USDA in 2006 (Black, et al., 2008; Nord, et al., 2007). In Baltimore, 22% of food insecure families reported they could not give their children enough to eat because they could not afford to buy enough food (Black, et al., 2008).

Health Disparities among African Americans in Baltimore

Evidence of ethnic differences in chronic disease is pronounced in Baltimore, Maryland. In Baltimore, the incidence of diabetes has jumped from 5.8% to 10.3% in the nine years leading up to 2004, and Baltimore's death rate from diabetes in that year was 56% higher than the diabetes death rate for the entire U.S. (Choudhry & Rahmanou, 2007). When examined by ethnicity, 70% of the diabetes deaths in Baltimore in 2004 were among African Americans (Demeter, 2006). In that same year, the age-adjusted death rate for CVD in Baltimore was calculated at 356 per 100,000 population, compared to 281 for Maryland overall. Of the total CVD-related deaths in Baltimore that year, 62% of deaths were among African Americans (Demeter, 2006).

A recent analysis of a subset of Challenge participants was conducted to investigate the relationship between physical activity, body composition and insulin sensitivity in this sample of inner city, low-income adolescents. Among the predominately African-American sample, both physical activity and body composition were independently related to the adolescents' insulin sensitivity. These findings indicate the disease process leading to type 2 diabetes is present in this sample of urban youth in West Baltimore (Snitker, Le, Hager, Caballero, & Black, 2007).

Baltimore is a city of neighborhoods, drawing its personality, charm, and resiliency from the diversity of its mixed population. Many neighborhoods in Baltimore differ in terms of socioeconomic resources and in the health of its residents. The Baltimore City Health Department working in conjunction with the

Johns Hopkins Bloomberg School of Health has compiled a series of Neighborhood Health Profiles representing the 55 distinct, recognizable neighborhoods in the city in order to provide health data on a local level to inspire residents to improve the well being of their communities (*Poppleton/The Terraces/Hollins Market Health Profile 2008*, 2008 October). Since the Challenge study sample recruited adolescents from West Baltimore, this study compared data from the Poppleton/The Terraces/Hollins Market (PTHM) neighborhood as representative of the general health, socioeconomic status, and ethnic diversity approximated in the Challenge sample.

The racial distribution of the PTHM neighborhood differs from Baltimore city as a whole. Based on data from the year 2000, the residents of the PTHM neighborhood are 82% African American and 15% white, compared to 64% and 31% of Baltimore residents, respectively. Educational attainment is similar at 28% for PTHM and 29% for Baltimore, although the people living in this neighborhood have a much higher unemployment rate of 48%, compared to Baltimore's overall 29% unemployment rate (*Poppleton/The Terraces/Hollins Market Health Profile 2008*, 2008 October).

Household median income is a proxy of neighborhood residents' economic resources, with higher income related to longer life expectancy and to improved health status. The PTHM neighborhood is one of the poorest in the city, with 62% of the neighborhood households earning less than \$25,000 annually, compared to 43% of Baltimore households who are in this income bracket. Life expectancy is a measure summarizing health over an entire lifespan. A child born in the PTHM neighborhood can expect to live 62.5 years compared to an average life expectancy of 70.9 years in

Baltimore City based on annual averages for the years 2002-2006. The leading causes of death in PTHM exceed Baltimore City overall death rates for all categories including heart disease, cancer, stroke, HIV/AIDS, and accidents. Death rates in this neighborhood are more than doubled that of Baltimore City for septicemia (blood poisoning), homicide, chronic lower respiratory disease, diabetes, and drug-induced deaths (*Poppleton/The Terraces/Hollins Market Health Profile 2008*, 2008 October).

Most of the East Baltimore adolescents who participated in a focus group study viewed their neighborhoods as physically dangerous environments where violence and gunfire commonly occurred. Corner convenience stores and fast food restaurants are reported as the primary outlets for purchasing food in their neighborhoods, although the presence of Plexiglas barriers in corner stores and carry-out restaurants limit the range of food items adolescents buy when they are forced to purchase food sight unseen (Dodson, et al., 2008).

Diet Quality of Low-Income, African-American Adolescents in Baltimore

Access to affordable, healthy food can be a challenge for urban families and adolescents living in Baltimore. In recent years, the city has lost 15% of its supermarkets, forcing residents to rely on corner grocery stores and convenience stores to purchase groceries (Klein, 2002). Traditional Baltimore street vendors, called Arabbers, offer a variety of fruit and vegetables for sale from horse-drawn carts but their numbers are declining, and Arabbers are becoming a quaint relic of Baltimore's past (Dodson, et al., 2008; Kay, 2007).

According to the 2005 Youth Risk Behavior Surveillance Survey, only 21% of students in Baltimore reported eating five or more servings of fruits and vegetables

each day over the past week, and less than 9% reporting drinking the recommended three or more glasses of milk each day, with African-American students eating and drinking less of these particular foods (CDC, 2005). Aside from purchasing snacks from corner convenience stores, adolescents in Baltimore also purchase food from vending machines available in school. According to a study of urban, African-American adolescents in Baltimore, almost all students surveyed reported purchasing food from a vending machine at school at least once a day (Dodson, et al., 2008).

Conceptual Framework

This investigation incorporated constructs from Social Cognitive Theory (SCT) into a multi-level ecological theoretical approach. SCT is a theoretical framework that emphasizes the cognitive, socio-environmental, and behavioral aspects of health behaviors and their interactions (Baranowski, et al., 1997), while ecological theoretical models focus on how behavior is a product of how individuals transact with their physical and socio-cultural surroundings (Sallis & Owen, 1997).

Social Cognitive Theory

Social Cognitive Theory is grounded in the concept of reciprocal determinism, where human behavior is explained in terms of a dynamic, triadic reciprocity of influencing factors. In the social cognitive theoretical view, individuals are neither solely controlled by internal forces, nor are they automatically responding to external stimuli in their surroundings, but rather are using a triadic, reciprocal model in which behavior, cognitions and personal factors, and environmental influences interact to uniquely shape an individual's behavior (Bandura, 1986; Baranowski, et al., 1997).

Reciprocity does not imply symmetry in the strength of the interacting influences, nor does it mean there are fixed patterns of bi-directional causation between influencing factors. The relative influence of any of the three sets of influencing factors in the triad will vary for different activities, for different individuals who find themselves in different situations. Through SCT, Bandura posits that behavior is the product of this dynamic, reciprocal interchange where personal cognitions, behavior, and the social environment interact to motivate, change and influence performance of a behavior (Baranowski, et al., 1997).

SCT Constructs

Besides reciprocal determinism, a number of constructs act as additional undergirding for the social cognitive theoretical framework and help to explain the process of shaping behavior within the SCT model. These constructs are: environment, observational learning, behavioral capability, reinforcement, outcome expectations, outcome expectancies, and self-efficacy (Baranowski, et al., 1997). This research measured four of these constructs in the integrated theoretical model, which included *environment, observational learning, behavioral capability, and self-efficacy*.

Environment entailed factors that could influence a person's behavior that were physically external to the individual. In this research, various interacting environments influencing adolescent diet were measured as food availability in the adolescent's home, food sources in the neighborhood, and household food security

which addressed whether the adolescent's family had the financial resources to purchase food.

The construct *observational learning* was the use of role models for individuals to learn and mimic behavior through observing the behavior and vicariously experiencing the reinforcements that the role model received for the behavior. Peer eating behaviors and parental nutrition beliefs for the adolescent were dietary influences providing measurable examples of the observational learning construct. *Behavioral capability* was the result of an individual incorporating the necessary knowledge and skills to practice, perform, and master a desired behavior, and in this research, nutrition knowledge was a proxy measure of the adolescent's behavioral capability.

Self-efficacy is defined as the confidence a person has in him- or herself about performing a certain behavior, including the ability to overcome any potential barriers to completing the target behavior. Self-efficacy is a concept that goes beyond the individual's knowledge and skills to perform a behavior; self-efficacy is how people judge their specific capabilities in determining whether a sufficient self-precept of ability will motivate them to carry out the intended behavior (Bandura, 1986). This investigation used a measure called "self-efficacy for healthy eating" that represented the sociocognitive construct of self-efficacy in terms of how assured the adolescent felt about being able to incorporate healthy foods into their diet.

Application of SCT Constructs in Nutrition Research

SCT posits an understanding of the relationships between the subject's actual behavior, personal factors and cognitions, and environmental influences are requisite in order to change their behavior. The various constructs within the SCT model describe the factors acting on an individual's behavioral decisions.

Studies Using the Environment Construct

Accessibility to healthy foods in an adolescent's physical environment at home (Befort, et al., 2006; Edmonds, et al., 2001; Hanson, et al., 2005; Jago, Baranowski, & Baranowski, 2007; Larson, et al., 2006; Molaison, et al., 2005; Neumark-Sztainer, et al., 2002; Neumark-Sztainer, et al., 2003), or in the community (Cheadle, et al., 1991; Fisher & Strogatz, 1999; Morland & Filomena, 2007; Zenk, et al., 2005) is strongly related to their quality of diet.

Adolescents typically consume approximately 35% to 40% of their daily calories while at school (Burghardt, Gordon, Chapman, Gleason, & Fraker, 1993). A study examining the sources of fat in 24 middle schools found cafeteria lunches contributed 42% of students' total dietary fat at the lunch meal (Zive et al., 2002). In middle schools where vending machines and fast food outlets are available, more students report buying and consuming sweetened beverages more than any other type of food item (Wiecha, Finkelstein, Troped, Fragala, & Peterson, 2006). High school students reported that when choosing foods from the cafeteria, taste and getting a lot of food for the price was most important to them in their food purchasing decisions (Shannon, Story, Fulkerson, & French, 2002).

Studies Using the Observational Learning Construct

Peer and parental influences are important to adolescents while they are making the transition from childhood to adulthood (Campbell, 1969). The SCT construct, observational learning, was measured in this study as the impact that peer-eating behaviors and that adolescent's perceived parental nutrition beliefs had on diet quality. When interviewing adolescents about factors influencing food choices, Neumark-Sztainer and colleagues found parental influence included parental modeling of eating and cooking behaviors, food purchasing habits, their concerns about nutrition, and family meal patterns in the household (Neumark-Sztainer, et al., 1999). Parents are usually children's first role models for learning eating behaviors (Rhee, 2008; Savage, Fisher, & Birch, 2007). One study found adolescents' consumption of dietary fat and energy is similar to that of their parents in almost all foods, regardless of the frequency of shared meals (Feunekes, et al., 1998).

In a recent study Boutelle et al., reported that adolescent's perception of maternal parental concern about healthy eating influenced the adolescent's food choices. Fruit and vegetable consumption among adolescents was positively associated with their perception that their mothers cared that the adolescent eat healthy foods. The authors reported this finding was a form of parental modeling influence on adolescent dietary choices (Boutelle, Birkeland, Hannan, Story, & Neumark-Sztainer, 2007). In a similar study conducted in the United Kingdom, young adolescents' fruit consumption was associated with mothers' belief in the importance

of disease prevention through a healthy diet rich in fruit and vegetables (Gibson, Wardle, & Watts, 1998).

Peers have a significant influence on adolescent eating behaviors (Ball et al., 2008; Evans, et al., 2006; Feunekes, et al., 1998; Larson, et al., 2008; Lee & Reicks, 2003; Mackey & La Greca, 2007; Neumark-Sztainer, et al., 1999; Salvy, Romero, Paluch, & Epstein, 2007). Peer support for healthy eating behaviors leads to healthier diets in adulthood (Larson, et al., 2008). Granner and colleagues found that white adolescents reported family influences such as more frequent family meals and higher availability of healthy foods at home were important to them, while African-American adolescents attributed peer modeling and normative social influences as being more important in choosing what foods to eat (Granner et al., 2004).

In a study of peer influence on overeating behavior, adolescent girls were paired with similar-weight peers or in a discordant-weight dyad. When offered snack foods, overweight girls ate more calories of energy when paired with overweight peers, compared to those overweight girls who were paired with a normal-weight peer. Normal-weight girls' caloric intake did not differ when eating snacks with either overweight or with lean dyads. (Salvy, et al., 2007).

Low-income adolescents participating in focus groups were asked for suggestions for healthier eating strategies, and many recommended more emphasis on role models and peers to facilitate healthier food consumption among adolescents. They reported adolescent diets would likely improve if adults who were respected or admired asked them to eat healthier, or if peer leaders set an example for others by

eating healthy themselves, or if popular peers chose healthier places to eat, making those food outlets socially acceptable (Evans, et al., 2006).

Studies Using the Behavioral Capability Construct

The SCT construct behavioral capability was represented by nutrition knowledge in this study. In homes with high fruit and vegetable availability, nutrition knowledge and self-efficacy for eating healthy were strong predictors of fruit and vegetable intake among adolescents (Jago, Baranowski, & Baranowski, 2007). In contrast, Reinhardt found that increased knowledge about nutrition and a balanced diet does not necessarily translate into positive dietary behaviors (Reinhardt & Brevard, 2002).

Studies Using the Self-Efficacy Construct

Dietary self-efficacy is an integral component of how an adolescent makes nutrition-related decisions, and it reflects how confident they feel about being able to carry out particular nutrition behaviors. Adolescent dietary self-efficacy is a powerful characteristic within the intrapersonal realm that can mediate the relationship between social influences and the nutrition-related decisions that determine the quality of a teens diet (Granner, et al., 2004; Larson, et al., 2006; Molaison, et al., 2005; Watters, Satia, & Galanko, 2007).

Children and adolescents who ate a wide variety of foods were likely to have high self-efficacy related to eating healthy (O'Dea & Wilson, 2006). In a study of adolescents with a mean age of 15 years, Larson and colleagues found that calcium

and dairy intake was related to a strong sense of self-efficacy in the adolescent to make healthy food choices. Among the constructs examined in their study, the researchers found factors associated with improved calcium intake span across all three interacting SCT domains of influence: nutrition self-efficacy and nutrition attitudes in the personal domain; eating breakfast, and an inverse relationship to fast food and soft drink consumption in the behavioral domain; and finally, higher family SES, availability of milk at meals, and social support for eating healthy all related to adolescent calcium intake. This model of calcium intake and psycho-environmental factors described 71% of the variance in adolescent males' and 72% of variance in females' calcium consumption (Larson, et al., 2006).

Nutrition interventions using SCT to improve diet quality through improving self-efficacy are not always successful. In an after-school nutrition intervention targeting urban Native American youth, the intervention significantly improved the diet and self-efficacy of children aged five to ten years, but had no effect on Native American adolescents in the study (Rinderknecht & Smith, 2004).

Low-income, African-American adolescents living in the lower Mississippi delta participated in focus groups for a study investigating the influences on their fruit and vegetable intake. Among these 10- to 13-year olds, lack of availability of fruit and vegetables in the home and stores in the community was cited as a factor impacting consumption, although most adolescents expressed high self-efficacy for eating fruit and vegetables in a variety of settings and situations, with the exception of 13-year old males (Molaison, et al., 2005).

As one of its research questions, this study tested whether self-efficacy moderated the relationship between perceived parental beliefs about nutrition for the adolescent and the adolescent's diet quality. In a study investigating SCT factors influencing young adolescents' fruit and vegetable consumption, Granner and colleagues found that parental modeling was strongly associated with adolescents' self-efficacy for eating fruit and vegetables. Of the SCT constructs examined, self-efficacy was the strongest correlate of eating fruit and vegetables as a snack among both African-American and white adolescents (Granner, et al., 2004). A study conducted in Australia among 12- to 15-year old adolescents found that self-efficacy mediated the relationship between SES and fruit consumption. This study also discovered that family support for eating healthy was more important than support from friends, perhaps because younger adolescents spend more time sharing meals with family rather than with friends (Ball, et al., 2008).

Ecological Theory

Bandura's SCT overlaps with ecological theory through the shared approach that behavior is a product of not only personal influences, but also a result of the surrounding social and physical environment. Ecological models focus on individuals' interaction with their environment and the settings in which behavior occurs, in particular on how the physical and socio-cultural surroundings uniquely affect behavior (Sallis & Owen, 1997).

In terms of ecological theory, "environment" refers to the physical and social space surrounding the individual. Psychological environments exist within individuals and describe their cognitive and emotional processes; in ecological

models of health behavior, the social environment relates to interpersonal interactions, while the community environment reflects the home and neighborhood setting in which the adolescent's behavior occurs. Many health behavior change models acknowledge the impact that personal and social environments can have on influencing behavior, but incorporating the importance the surrounding community has on health behavior is the hallmark of ecological theory (Sallis & Owen, 1997).

Early theorizing in the development of ecological approaches to explain behavior led Kurt Lewin in 1936 to coin the term "ecological psychology." Lewin posited that behavior was indirectly influenced by environments through effects on psychological factors; he focused on how the perception of an individual's external environment influences their actions (Sallis & Owen, 1997), and that human behavior is a function of both the environment and the individual (Brug, van Lenthe, & Kremers, 2006). Lewin's ecological approach is regaining interest in public health childhood obesity prevention research and in how macro-level environmental change interventions are necessary to address the obesogenic surroundings in which present-day children are immersed (Brug, et al., 2006).

In developing ecological models designed for health promotion, Urie Bronfenbrenner proposed that the multiple environmental levels that make up an individual's personal, social, and physical surroundings interact in a reciprocal dynamic that influences the individual's health behavior (Bronfenbrenner, 1979; Sallis & Owen, 1997). Bronfenbrenner's nested approach to ecological models has four levels of influence on behavior: microsystem or individual environment; mesosystem or social environment; exosystem or community environment; and

macrosystem represented as societal influences in the cultural environment (Bronfenbrenner, 1979). Due to the nature of the research data, this study focused on only the first three levels of influence as ecological levels of influence on adolescent dietary behavior and resulting diet quality.

Application of Ecological Theory in Nutrition Research

An ecological study conducted at the social environmental level investigated the relationship between social and environmental determinants of obesity. Australian researchers examined the relationship between SES and the density of fast food restaurants in Melbourne, Australia's second largest city. There were 331 fast food franchise restaurants across 267 postal code districts in the sample, and what appeared to be a dose-response relationship between residents' SES and fast food outlet density. Residents living in areas of Melbourne from the poorest SES categories had 2.5 times the exposure to fast food outlets in their communities compared to those living in the wealthiest SES areas (Reidpath, Burns, Garrard, Mahoney, & Townsend, 2002), indicating an association between low-income communities and obesogenic environments.

A study based on national, longitudinal data in the U.S. investigated the societal influence television food advertising has on childhood obesity rates. A study by Chou and colleagues published in the Journal of Law and Economics, suggested that a ban on television advertising of fast food in the U.S. could reduce the number of overweight children aged 3- to 11-years old by 18% and could reduce overweight

among 12- to 18-year old adolescents by as much as 14% (Chou, Rashad, & Grossman, 2008).

An ecological study in Texas conducted at the community level of environment investigated whether there was a relationship between availability of certain nutritious foods in the community and intake of these foods by a sub-group of the population. The study examined whether fruit, juice, and vegetable availability in households, restaurants, and grocery stores within geopolitical units (census tracts) correlated with consumption of these foods among adolescent African-American males. Researchers found restaurant juice and vegetable availability correlated with consumption of these foods by adolescent boys participating in the study (Edmonds, et al., 2001).

Ecological models can also address interpersonal nutrition behaviors in the home environment. A Baltimore study using a mentorship model targeted first-time, African-American adolescent mothers living in multigenerational households to decrease cultural barriers to adopting optimal infant feeding practices. The study taught young mothers to better interpret infant cues and was an ecological intervention because infants play an active role in determining caregiver strategies. Low-income adolescent moms are vulnerable to practicing sub-optimal infant feeding behaviors because they have little first-hand experience and often rely on their own mothers for guidance. The intervention was designed to delay the early introduction of complementary foods to infants three months of age or younger using a mentoring model to interpret infant cues, non-food strategies for managing infant behavior, and negotiating cultural mother-grandmother infant feeding practices. After controlling

for infant and family income, four times as many moms of infants following optimal feeding practices were likely to have received the mentoring intervention (Black, Siegel, Abel, & Bentley, 2001).

The home environment can play an important role in nutritional intake among adolescents. In a study sample of more than 2,500 adolescents in Australia, the availability of junk food in the home was found to be the strongest mediator between SES and adolescent dietary eating behavior (Ball, et al., 2008), highlighting the importance that the environment has on influencing adolescent food choices.

Integrated SCT and Ecological Model

The theoretical underpinning of this study was an integrated use of SCT as viewed through an ecological perspective to explain adolescent quality of diet. Use of an integrated theoretical model can be effective in addressing virtually any health behavior.

An integrated multi-level, social-ecological theoretical model was used in a physical activity promotion, the Trial of Activity for Adolescent Girls (TAAG). The theoretical structure for this intervention incorporated SCT, operant learning theory, organizational change theory, and the diffusion of innovation model in a multi-level ecological framework. In the TAAG study, ecological and social-ecological models described health behavior as a result of multiple levels of influence on the health behavior with an emphasis on the influence environment and policy have on health behaviors of interest. The overarching purpose of the TAAG study was to create environments within schools and communities that were conducive to physical activity, and to enhance social support and encouragement from peers, school staff,

and from community agency personnel in these environments to provide the adolescent girls with motivation to engage in physical activity in any of those settings (Elder et al., 2007).

Delivering SCT-based interventions to adolescents through the Internet is a new approach in using an integrated ecological model. Technology can be considered another ecological environment to reach adolescents in the 21st century, and is especially appropriate for this young, tech-savvy generation.

Technology is potentially a powerful means of reaching minority populations with targeted health and nutrition education interventions, and use of interactive media for health promotion allows tailoring of messages to address the needs of specific individuals or entire population sub-groups. Vicarious learning through use of games and simulated outcomes of a variety of virtual health behaviors can help to build self-efficacy in adolescents and to develop health and nutrition behavior skills through guided practice on complex behaviors like healthy cooking (Atkinson & Gold, 2002) and adoption of healthy eating habits using goal-setting strategies.

Conclusion

This chapter provided an in-depth review of the epidemiology of adolescent dietary influences, social and environmental forces at work that help to shape adolescent dietary behaviors, as well as potential health problems that are likely to occur as a result of inadequate nutritional intake in adolescents. This chapter reviewed adolescent diet quality in general terms and discussed the environmental and psychosocial influences on adolescent diet quality as it related to low-income, urban African-American adolescents living in Baltimore, Maryland.

The following chapter presents a detailed research plan and methodology that was used to conduct this investigation examining the various psychosocial and environmental factors influencing the diet quality of inner-city, African-American adolescents. This research employed an integrated theoretical framework to guide the investigation in measuring how sociocognitive, behavioral, environmental, and ecological factors simultaneously interact in a reciprocal dynamic synergy to influence the dietary behaviors of low-income, African-American urban youth.

CHAPTER 3: Methodology

Introduction

This study conducted a secondary analysis of baseline data from the *Challenge!* study. Challenge was a health promotion, obesity prevention intervention targeting low-income, urban African-American adolescents in Baltimore, Maryland. This analysis used select questionnaires from the original Challenge study to examine the personal, social, and environmental influences that helped shape the dietary choices and subsequent diet quality of this low-income, minority population sample of inner-city youth.

Study Population: Challenge Study

This study was a secondary analysis using baseline data from the University of Maryland in Baltimore's Challenge study, a randomized controlled health promotion and obesity prevention intervention targeting urban, African-American adolescents from low-income communities in Baltimore, Maryland (Black et al., (in press); Mitola, Papas, Le, Fusillo, & Black, 2007). The research was led by Principal Investigator Dr. Maureen Black and was completed with support from the Maternal and Child Health Bureau (grants R40MC00241 and R40MC04297), the General Clinical Research Centers Program (grant M01 RR16500), the Annie E. Casey Foundation, and the Thomas Wilson Sanitarium for Children of Baltimore City. The primary goal of the intervention was to prevent adolescent overweight through health promotion. Secondary goals included increasing adolescents' physical activity by increasing time spent in moderate-vigorous activity and curtailing time spent in

sedentary pursuits, and to improve teens' diet by increasing fruit and vegetable consumption, and to decrease sweetened beverage and high-fat, high-sugar snack food consumption (UMD-SOM, 2008).

The home- and community-based Challenge intervention taught adolescents how to adopt healthy lifestyle changes through the process of facilitated goal setting, where study personnel would help participants identify community resources the adolescent could use to increase their physical activity and improve diet. Once identified, the participants were challenged to meet dietary and activity goals for themselves.

The Challenge intervention focused on twelve key behaviors delivered to individual adolescent participants during twelve lessons spanning a period of approximately six months. A race- and gender-matched college-aged mentor, referred to as the participant's "personal trainer" administered the intervention to adolescents. The teen's personal trainer helped to set goals that would incorporate key intervention behaviors into their lifestyle. The key behaviors emphasized during the intervention are outlined in Table 3.1. The primary hypothesis of the Challenge study was that adolescents receiving the intervention would be more likely to engage in physical activity, more likely to consume fruits and vegetables, and less likely to consume dietary fat compared to the control group (Hager & Treuth, 2007).

Table 3.1: Description of physical activity and dietary behaviors targeted in the Challenge intervention.

- Have 2 or more servings of vegetables each day
- Have 2 or more servings of fruit each day (including 100% juice)
- When eating fast foods, choose small or medium instead of large or super-sized
- Drink 2 or more glasses of water each day
- Drink mostly skim or 1% milk instead of 2% or whole/ “red cap” milk
- Drink no more than 1 can of soda each day
- Eat no more than 1 sugary snack each day (ie; candy, cookies, cakes, or sweet rolls)
- Eat no more than 1 salty, greasy snack each day (ie: corn chips, potato chips, cheese curls)
- Eat fried foods only every other day (ie: fried chicken, French fries, fried fish, etc.)
- Walk 45 minutes or more each day
- Do physical activity 30 minutes or more each day
- Watch TV, play on the computer, or play video games no more than 2 hours per day

Primary Data Collection

The following section describes data collection procedures and the survey instruments used in the Challenge study, with detailed descriptions provided for the surveys that were adopted for use in this research.

Sample and Sampling Procedure

The Challenge study targeted adolescents ranging in age from 11 to 16 years, with a mean enrollment age of 13, recruited from a primary care site at the University of Maryland, School of Medicine or from fliers posted at three Baltimore City public middle schools. The study advertisements did not indicate this study was an obesity prevention trial, or that weight was in any way a criterion for participation in the study. Recruitment flyers for the Challenge study stated the goal of the investigation

was to help adolescents be healthy. Eligibility criteria for Challenge enrollment included participant's age between 11 and 16 years and willingness to participate in a randomized controlled health promotion study program. Two hundred and thirty-five adolescents enrolled in the Challenge study and completed the baseline evaluations.

Data Collection

Baseline measures were collected from July 2002 through May 2004 from 235 adolescents and their primary caregivers prior to being randomized into intervention groups. Participants were randomized to either the intervention group or the control group, which received no intervention. Participants were followed for approximately two years. The intervention phase for participants lasted about six months, followed by 6- and 12-month repeat evaluations to test the sustainability of the intervention's effects.

Human Subject Procedures

The Institutional Review Board of the University of Maryland's School of Medicine in Baltimore approved all study protocols and materials. Prior to engaging in any study measures or intervention activities, all adolescents and caregivers completed written informed consent and were compensated for evaluation visits. Each participant was assigned a confidential study identification number. Participant files were maintained in secure areas with access restricted to appropriate study personnel. Research data resides in a computerized database and is identified by the study subject ID number only. The computerized study data is stored in a password protected directory on the Division of Growth and Nutrition's network drive, which is

part of the University of Maryland School of Medicine's managed network. Only the principal investigator and limited study personnel have access to subject identifiers. All study personnel have completed Human Research Compliance and Health Insurance Portability and Accountability Act (HIPAA) training which educates staff about confidentially matters.

Primary Data Analysis

Challenge subject data were loaded into a computerized dataset and an SPSS (Statistical Package for the Social Sciences Inc., Chicago, Illinois) data file. Some of the Challenge data had been analyzed for research questions pertaining to physical activity and physiologic measures of insulin resistance and diabetes risk, but very little of the nutrition-related data had been examined prior to this study.

Instrumentation

Adolescents completed a series of questionnaires at baseline, at 12 months, and two years post intervention. Questionnaires were self-administered on a laptop computer, with questions presented both verbally through headphones and simultaneously on the laptop computer screen. Participants responded to items using a mouse to select answers. Table 3.2 lists the baseline measures used in Challenge.

All data from the Challenge study were coded and electronically loaded into an SPSS dataset directly from the laptop interviewing software used in data collection (Questionnaire Development System, Nova Research Company, Bethesda, Maryland). Challenge data managers have already addressed missing data using a mean imputation method in two scales from the Challenge data set, including the U.S.

Department of Agriculture (USDA) Core Food Security Module and the Nutrition Knowledge Scale.

Table 3.2: Baseline Data Measures Collected for Challenge Study

Data Collected at Baseline	Challenge Teens	Challenge Caregivers
Measured height & weight (for calculated BMI)	X	X
Bioelectrical Impedance Analysis (BIA)	X	X
Dual Energy X-ray Absorptiometry (DEXA)	X	
Accelerometry	X	
Self-administered Physical Activity Checklist (SAPAC)	X	
Youth Adolescent Food Frequency Questionnaire (YAQ)	X	
Healthy Eating Index (HEI-2005) calculated from YAQ data	X	
Demographics- gender	X	X
Demographics- age	X	X
Demographics- ethnicity	X	
Demographics- relationship to teen		X
Demographics- poverty ratio		X
Family Food Security		X
Food Shelf Inventory (Home Food Inventory)		X
Maturity: Tanner Staging	X	
Rosenberg Self-Esteem Scale	X	X
Body Image Perception: Contour Drawing Scale	X	X
Body Esteem Scale for Adolescents and Adults	X	X
Stages of Change (includes Self-efficacy for Healthy Eating Scale)	X	
Authoritative Parenting Index (Parenting Style)	X	
Parental Feeding Strategies (Child Feeding Questionnaire)		X
Children's Version of Eating Attitudes Test (ChEAT)	X	
Eating Attitudes Test (EAT)		X
Amherst Health & Activity Study- Student Survey (PA recall)	X	
Amherst Health & Activity Study- Student Survey (PA barriers)	X	
Amherst Health & Activity Study- Student Survey (PA environment)	X	
Amherst Health & Activity Study- Student Survey (PA caregiver support)	X	
Amherst Health & Activity Study- Student Survey (PA peer support)	X	
Beck Depression Inventory (BDI)	X	X
Insulin	X	
Leptin	X	
Insulin Sensitivity HOMA	X	
Perceived Parental Beliefs about Nutrition	X	
Peer Eating Behaviors	X	
Nutrition Knowledge	X	

Secondary Data Collection

This study used baseline data from the following measures collected from adolescents in the Challenge study: age, gender, body mass index (BMI), ethnicity, Healthy Eating Index (HEI-2005) scored from the Youth/Adolescent Food Frequency Questionnaire (YAQ) data, self-efficacy for healthy eating scale, perceived parental beliefs about nutrition scale, peer eating behaviors scale, and the nutrition knowledge scale. Baseline data from caregivers was used for the following measures: family food security, home food inventory, as well as questions added to the home food inventory that asked caregivers about where and how frequently the family shopped for food. This study also used adolescent BMI, gender, parental BMI, and number of people living in the household as covariates in multivariate analyses.

Characteristics of the Sample Population

A sample derived from baseline data was used for this cross-sectional study. The current study used the following exclusionary criteria: 1) adolescents were excluded from the sample if they did not identify themselves as African American 7/235 (2.9%), and 2) had not completed the YAQ 13/235 (5.5%), which this study used to assess nutritional intake and to calculate adolescent quality of diet. Nutritional intake results from the YAQ included energy intake. Since the YAQ data were tied to the outcome variable, HEI-2005, subjects reporting extremes in dietary intake (<500 or >8,000 kilocalories per day) were excluded from the analysis. This study used data from 216 African-American adolescent participants who completed baseline evaluations prior to randomization into the Challenge intervention.

Instrumentation for Secondary Analysis

Demographics

Demographic information collected at baseline from both adolescents and their primary caregivers used self-reported questionnaires. Adolescents provided information about their birth date, gender and ethnicity. Primary caregivers completed questionnaires describing their socio-economic status by providing information about highest level of education completed, family income, number of dependents and food security.

Anthropometry

Body weight of adolescents and caregivers was measured to the nearest 0.1 pound using a digital balance scale (TANITA 300GS, Tanita Corp., Tokyo, Japan). Participants' height was measured using a wall-mounted stadiometer to the nearest 0.1 cm. Body mass index (BMI) was calculated as weight (kg) divided by height (m²) using these anthropometric measures. Challenge study personnel converted participant BMI values into z-scores and percentiles using the 2000 Centers for Disease Control (CDC) age- and gender-specific tables and algorithms (Kuczmarski, Ogden, & Guo, 2002). Challenge study researchers assigned adolescents to weight categories based on their age-adjusted, gender-specific BMI percentiles: normal weight (<85th percentile), overweight ($\geq 85^{\text{th}}$ percentile and <95th percentile), and obese ($\geq 95^{\text{th}}$ percentile) (Mitola, et al., 2007). This study used BMI as a continuous covariate in the analysis.

Adolescent Dietary Intake

Dietary intake was assessed using the Youth/Adolescent Food Frequency Questionnaire (YAQ), a self-administered, 151-item food frequency questionnaire specifically developed for older children and adolescents. The YAQ is a modified version of the adult food frequency questionnaire used in the Nurses' Health Study that has been adapted for use in youth (Rockett, Wolf, & Colditz, 1995). The YAQ has an additional 27 snack food items and foods such as chicken nuggets, turkey, chicken or turkey sandwiches, tacos, and instant breakfast drink added to the adult version.

Food items on the YAQ were sorted into seven broad categories: 1) beverages, 2) dairy products, 3) main dishes, 4) miscellaneous foods like gravy and condiments, 5) breads and cereals, 6) fruits and vegetables, and 7) snack foods and desserts. In addition to food intake, the YAQ asked participants about dietary behaviors important to healthy growth and development in children: multivitamin use; frequency of eating breakfast; frequency of eating meals away from home; how often convenience food items were eaten for dinner; frequency of eating fried foods at home and away from home; and the frequency of eating snacks on school days, on weekends, and while on vacation.

Each food item was presented using standard portion sizes with naturally occurring portions used when appropriate (e.g. bread = 1 slice, apple = 1). There were up to seven frequency response categories for the amount eaten for each particular food item ranging from "never/less than 1 per month" to "5 or more times per week."

An example question from the YAQ was "how often do you drink diet soda (one can or glass)?" Six response categories were offered and range from "none" to "2 or more cans per day." All questions on the YAQ referred to what the adolescent ate over the past twelve months. Completed questionnaires were sent to Harvard Medical School, Cambridge, Massachusetts, for scoring and nutrient analysis (see Appendix A for complete scale).

In a test-retest reliability study conducted on 179 multiethnic participants aged 9 to 18 years (mean age 14 years) who completed the YAQ twice in a 12-month interval, good reproducibility and reliability were found for both nutrient values and food items. Subjects for the reproducibility study were the recruited children of participants in the Nurse's Health Study II. Correlation coefficients for nutrients ranged from 0.26 for protein to 0.58 for calcium, and the correlation coefficients for foods were 0.39 for meats, 0.57 for soda, 0.49 for fruit and 0.48 for vegetables. After adjusting for energy intake, the mean Pearson correlation coefficient was 0.44 for females and 0.34 for males (Rockett et al., 1997; Rockett, et al., 1995).

Validity testing on the YAQ was conducted using 261 predominately Caucasian youth (96% white, 1% African American, 1% Asian, 1% Hispanic, 1% other race), aged 9 to 18 years, who were also children of nurses participating in the Nurse's Health Study II. Two YAQ surveys given one year apart and three 24-hour dietary recalls were administered within that year time period. Validity testing compared mean YAQ nutrient values to mean 24-hour recall nutrient values. Correlation coefficients between mean energy-adjusted nutrients ranged from 0.21 for sodium and 0.58 for folate. After adjusting for within-person error, the mean

correlation coefficient was 0.54, similar to correlation coefficients found for adult food frequency questionnaires (Rockett, et al., 1997).

Similar results in validity testing of another food frequency questionnaire (FFQ) adopted for youth were found in a sample of fourth to seventh grade inner-city boys and girls, with African-American students making up 82% of the sample. Interestingly, the authors observed 3 to 19 times more variability within than between subjects for all nutrients measured. After correcting for within-person variation, the one-year reproducibility Spearman correlations for the FFQ ranged from 0.02 for percent calories from fat to 0.42 for saturated fat intake among the younger students, and from 0.07 for percent calories from fat to 0.76 for vitamin C intake among the sixth and seventh graders. Both age groups showed similar reproducibility for calories, protein, saturated fat and total fat, but the older age group had higher correlations for calcium, fiber, phosphorus, iron, and vitamin C (Field et al., 1999).

When tested in a relatively small sample of 89 low-income, minority seventh and eighth grade youth, the YAQ was reported to have low validity and modest reliability (Cullen & Zakeri, 2004). The adolescent participants completed the YAQ twice in three weeks, and recorded six daily food records. The sample consisted of African-American (54%) and Hispanic (46%) adolescent boys and girls. Although the authors state the YAQ showed modest reliability in this sample, the reliability coefficient values were higher than those found in previous testing among white students. Overall reliability coefficients of repeat administration of the YAQ instrument was 0.80 ($p < .001$) among African-American adolescents, with values ranging from 0.31 ($p < .05$) for percent dietary fat to 0.66 ($p < .001$) for high fat

vegetables and 0.66 ($p < .001$) for total fruit/juice/vegetables. After correction for intra-class correlation, validity coefficients between the YAQ and food records for African-American adolescents ranged from 0.004 for fruit to 0.45 for fruit juice (Cullen & Zakeri, 2004). Validity testing on the YAQ in various sample populations has produced mixed psychometrics, indicating limitations may exist when using this instrument in minority samples.

Adolescent Diet Quality

The diet quality of adolescents participating in this study was assessed based on the 2005 Dietary Guidelines for Americans (USDA, 2005). To rate diet quality, the original Healthy Eating Index (HEI) (Basiotis, et al., 2002; Kennedy, Ohls, Carlson, & Fleming, 1995) was created as a scoring tool to measure how closely individuals adhered to the Dietary Guidelines. Higher HEI scores indicate better diet quality. The release of revised Dietary Guidelines for Americans in 2005 prompted a revision of the HEI that would assess diet quality based on the new MyPyramid recommendations.

HEI-2005 scores reflect adherence to nutrition recommendations represented in MyPyramid and differs from the original HEI in that the new scoring standards use a density approach where dietary components are expressed as a percentage of total calories, specifically as per 1,000 calories (Guenther, Reedy, Krebs-Smith, Reeve, & Basiotis, 2007). This approach assesses the diet in terms of the relative proportion of foods eaten rather than the total quantity of food consumed (Guenther et al., 2007). A distinct advantage of using a density approach in calculating diet quality is that it is

independent of an individual's energy requirement and provides a common standard across all genders and in all but the youngest and oldest age groups (Guenther, et al., 2007).

The HEI-2005 was divided into twelve components, worth a maximum of 5-, 10-, or 20-points with all components summed for the total HEI-2005 score. The components represented MyPyramid food groups (total fruit, total vegetables, total grains, milk, meat and beans), and additional components such as whole fruit (i.e. forms other than juice), dark green and orange vegetables and legumes, whole grains, oils, saturated fat, sodium, and calories from solid fat, alcohol, and added sugar (SoFAAS). The whole fruit component reflected the 2005 Dietary Guidelines recommendation to limiting juice to less than half of total fruit intake. The dark green and orange vegetables and legumes component was added because Americans' intake of these three subgroups of vegetables is furthest from recommended levels. The whole grains component score was based on the MyPyramid recommendation to make whole grains at least half of total grain consumption, and the component calories from SoFAAS, served as a proxy measure for discretionary calories recommended in moderation that round out the daily diet (Guenther, et al., 2007).

Each component score within the HEI-2005 was calculated based on the degree of adherence to the specific dietary recommendations (shown in Table 3.3), and was scored from 0 for lack of compliance up to the maximum component's points for full compliance. Intermediate component scores reflected the degree of partial compliance to dietary recommendations. The HEI-2005 was a summative score totaling all twelve components, and could range from 0 as the worst score possible to

a perfect score of 100 indicating an ideal diet (Feskanich, Rockett, & Colditz, 2004). When determining diet quality, HEI scores above 80 indicated a "good" diet, scores ranging from 51 to 80 reflected a diet that "needed improvement," while HEI scores below 51 implied the person had a "poor" diet (Basiotis, et al., 2002).

Table 3.3: HEI-2005 components and standards for scoring¹.

Component	Maximum points	Standard for maximum score	Standard for minimum score of zero
Total Fruit (includes 100% juice)	5	≥ 0.8 cup equiv. per 1,000 kcals	No Fruit
Whole Fruit (not juice)	5	≥ 0.4 cup equiv. per 1,000 kcals	No Whole Fruit
Total Vegetables	5	≥ 1.1 cup equiv. per 1,000 kcals	No Vegetables
Dark Green and Orange Vegetables and Legumes	5	≥ 0.4 cup equiv. per 1,000 kcals	No Dark Green or Orange Vegetables or Legumes
Total Grains	5	≥ 3.0 oz equiv. per 1,000 kcals	No Grains
Whole Grains	5	≥ 1.5 oz equiv. per 1,000 kcals	No Whole Grains
Milk (includes all milk products and soy milk)	10	≥ 1.3 cup equiv. per 1,000 kcals	No Milk
Meat and Beans	10	≥ 2.5 oz equiv. per 1,000 kcals	No Meat or Beans
Oils	10	≥ 12 grams per 1,000 kcals	No Oil
Saturated Fat	10	≤ 7% of energy	≥ 15% of energy
Sodium	10	≤ 0.7 grams per 1,000 kcals	≥ 2.0 grams per 1,000 kcals
Calories from Solid Fats, Alcoholic beverages, and Added Sugars (SoFAAS)	20	≤ 20% of energy	≥ 50% of energy

¹(Guenther, et al., 2006)

The HEI-2005 psychometric properties were evaluated using data from 8,650 children over the age of two, and adults participating in the National Health and Nutrition Examination Survey 2001-2002 (NHANES 01-02). Survey respondents

completed a 24-hour recall administered by NHANES study personnel in a mobile examination center.

This diet quality instrument had good content validity, and was a valid reflection of the 2005 Dietary Guidelines for Americans key nutrition recommendations (Guenther, et al., 2007). Reliability testing found the highest correlations among HEI-2005 components were 0.65 for saturated fat correlating with total fat, followed by a negative -0.43 correlation between meat and sodium, and -0.41 correlation for meat with cholesterol (Guenther, et al., 2007). Internal consistency addresses whether the HEI-2005 component scores all measure the same, unidimensional, and underlying construct. Diet quality, as outlined by the Dietary Guidelines, is by definition multi-dimensional and requires varying levels of ten different components, so internal consistency was neither expected nor desired for the HEI-2005. The HEI-2005 coefficient alpha was 0.43. Component scores having the highest correlations with total HEI-2005 score were for calories from SoFAAS (0.57) and the fruit components (0.43 for total fruit and 0.45 for whole fruit). Negative correlations with total HEI-2005 score were found for sodium (-0.22), milk (-0.12), and meat and beans (-0.01). Overall, correlations between total HEI-2005 score and all other components ranged from 0.07 to 0.26 (Guenther, et al., 2007).

When tested as a tool to predict chronic disease, the original HEI has met with mixed success. Higher HEI scores in adult men and women were associated with a lower risk of CVD but the scores were weak indicators of overall chronic disease risk (McCullough, Feskanich, Rimm, et al., 2000; McCullough, Feskanich, Stampfer, et

al., 2000). According to the literature, the HEI-2005 has not been tested as a tool to predict chronic disease to date.

A recent study involving this author analyzed the HEI as a tool to predict chronic disease in adolescents compared to the Youth Healthy Eating Index (YHEI) using Challenge study data (Hurley et al., 2008). The YHEI is a modified version of the HEI specifically designed for youth and adolescent populations, but it had only been tested on primarily white children and adolescents aged 9 to 14 years with parents enrolled in the Nurses' Health Study II. The YHEI rates quality of diet in youth by scoring food consumption and dietary behaviors that contribute to healthy growth and development, such as eating breakfast, attending family dinners, and avoiding high-fat, sugar-laden snack foods and soft drinks (Feskanich, et al., 2004).

Mean HEI component scores and total HEI scores were calculated using a data sample of from the Challenge study at baseline. Pearson correlations on 196 male and female adolescents enrolled in the Challenge study examined relationships between HEI total scores and energy and micronutrient intake, sweetened beverage intake, snacks and desserts intake, and percent body fat and percent abdominal fat from DEXA measures. Statistically significant correlations ($p < 0.001$) were found between total HEI score and micronutrient intakes of iron (0.52), fiber (0.67), folate (0.59), and calcium (0.39). Total HEI score was also significantly correlated with dietary items such as snacks and desserts (0.46, $p < 0.001$), sweetened beverages (0.14, $p < 0.05$), and kilocalories of energy (0.53, $p < 0.001$). Physical measures of adolescents' adiposity using DEXA were negatively correlated ($p < 0.05$) to total HEI

scores, specifically percent body fat (-0.17) and percent abdominal fat (-0.19) (Hurley, et al., 2008).

The comparative study using Challenge data found that lower adolescent percent body fat and percent abdominal fat were related to higher HEI scores, unlike YHEI scores that were not related to either abdominal fat or body fat percentages. This distinction may be explained by the different scoring mechanisms used in the HEI and YHEI. For example, the YHEI accounts for whole wheat breads and grains, but does not allow points in the scoring for refined types of grain, while the HEI gives points for all grain products, regardless of their inherent nutritional value. The HEI directly measures dietary fat, whereas the YHEI does not. Given the differences in HEI and YHEI scoring protocols, we found higher YHEI scores indicated participants consumed nutrient-dense, healthy foods and engaged in more nutrition-promoting eating behaviors. Apparently, the HEI is a better measure of the nutrient quality of the diet, while the YHEI reflects the quality of dietary patterns and consumption of healthy foods (Hurley, et al., 2008). Therefore, the HEI appears to be more successful than the YHEI in predicting chronic disease risk, and the newer, revised HEI-2005 was used to measure diet quality for this investigation.

Nutrition Knowledge

Adolescents' nutrition knowledge was measured using select questions from the Nutrition Knowledge, Attitudes and Behaviors Questionnaire (KAB). The KAB was developed for use in the Pathways intervention study to measure change in physical activity and nutrition knowledge, attitudes and behaviors among American

Indian third- and fourth-grade children (Stevens et al., 1999). The 130-item KAB was validated in 516 fourth-grade children and assessed the following concept areas: physical activity, nutrition and diet, weight-related attitudes and cultural identity. Validity testing in the Pathways study for the KAB calculated Cronbach's α at 0.56 and test-retest r at 0.52.

A subscale from the KAB assessing nutrition knowledge was adopted for the Challenge study and was used in this research (see Appendix B for complete scale). The self-administered 24-item questionnaire measured three constructs: food choice intentions, fat content knowledge, and knowledge about nutrition behaviors targeted in the Challenge intervention.

Eight questions measured food choice intentions using a paired-choice format of simple line drawings of foods. Each food pair depicted a high-fat or sugar laden food or a healthier food (lower in fat or sugar) and a third response "I don't know." A sample item that depicted a soda can asks: "Which would you choose?" with response choices: "diet soda," "regular soda," or "I don't know." The Cronbach's α for this scale was 0.58 for fifth-graders in the Pathways study (Stevens et al., 2003).

Four items asked adolescents "Which food has more fat?" and were presented in a paired-choice format showing a simple drawing of a higher fat and lower fat food along with the name of each food below the drawing. A sample item was: "fried meat in a pan," "meat cooked on a grill," or "I don't know." There were also six items in a three-point nominal response set format that asked adolescents about lower fat food choices. A sample item asked: "Which has the lowest amount of fat?" with response

choices "pretzels," "donuts," and "potato chips." The Cronbach's α for this scale was 0.74 for fifth-graders in the Pathways study (Stevens, et al., 2003).

The final six items on the Challenge nutrition knowledge questionnaire focused on curriculum knowledge for nutrition behaviors targeted in the intervention. These questions were in a three-point nominal response set format. An example question read, "It is recommended that every day you eat at least how many servings of fruit and vegetables?" Response choices were: "one serving of fruit and one serving of vegetables," "two servings of fruit and three servings of vegetables," or "one serving of fruit or one serving of vegetables, but not both." The Cronbach's α for this scale was 0.54 for fifth-graders in the Pathways study (Stevens, et al., 2003).

The Nutrition Knowledge Questionnaire for this study was scored as a summative scale, ranging from 0 to 60 points, with higher values indicating greater nutrition knowledge. For each of the 24 questions, correct answers were assigned two (questions 1-12) or three points (questions 13-24), while incorrect and "I don't know" responses received zero points.

Self-Efficacy for Healthy Eating

Adolescents' confidence about their ability to engage in healthy eating behaviors was measured using a sub-set of nine items from Carlo DiClemente's Diet and Exercise Stages of Change Questionnaire developed for the Challenge study. This questionnaire was created for the Challenge study and although the physical activity items have been analyzed, the nutrition-related self-efficacy questions had not been validated or psychometrically evaluated prior to this investigation.

The nine items relating to the adolescent's self-efficacy for eating healthy asked the youth questions like, "how sure are you that you can... have two or more servings of vegetables most days?" or "...drink skim or 1% milk?" A four-point ordinal response set listed the possible answer choices: 1 = I know I can't; 2 = I am not sure I can; 3 = I think I can; and, 4 = I know I can. Since not all participants preferred to drink milk or had the physiologic ability to consume dairy products, a dichotomous question was used from another section of the Challenge questionnaire that asked respondents, "Do you currently drink milk?" to screen for non-milk drinking participants. Participants who responded "no" to drinking milk did not have the milk self-efficacy question included in their scoring rubric. Scale item responses were summed and converted into the percentage of the highest possible total score, with 36 possible points for milk drinkers and 32 points possible for non-milk drinkers. Higher percentage scores indicated the adolescent had greater self-efficacy to make healthy dietary choices. Exploratory data analysis for this study indicated 28.1% (55) of adolescents in the study sample did not drink milk.

Table 3.4: Self-Efficacy for Healthy Eating Scale

How sure are you that you can...

1. Have two or more servings of vegetables most days?
 2. Have two or more servings of fruit (including 100% fruit juice) most days?
 3. Drink skim or 1% milk?
 4. Drink no more than one can of soda most days?
 5. Drink two or more glasses of water most days?
 6. Eat healthy snacks that are not sugary most days?
 7. Eat healthy snacks that are not salty or greasy most days?
 8. Usually choose small or medium sized fast food portions?
 9. Eat no more than three servings per week of fried foods?
-

Perceived Parental Beliefs about Nutrition

A sub-set of questions from the What Others Believe Scale measured the adolescents' perception of what they think their parents wanted them to eat. The What Others Believe Scale is from the Youth Health Survey, and was used in the Cardiovascular Health in Children and Youth Study (Gilmer, Speck, Bradley, Harrell, & Belyea, 1996). This subscale contained ten nutrition-related questions that asked the adolescent what nutrition behaviors they thought their parents would expect them to carry out. An example item stated, "my parents think I should eat no more than one salty or greasy snack most days (corn chips, potato chips, cheese curls)." A four-point Likert response scale offered answers ranging from, "strongly agree" to "strongly disagree." No reliability and validity information is available in the literature about this nutrition-related subscale.

Responses to these survey items were assigned a numerical value with higher values representing stronger agreement with parental beliefs. Scale items were summed into a new variable representing Perceived Parental Beliefs about Nutrition. Higher total scores for this measure indicated higher levels of adolescents' beliefs in their parents' desire for them to consume a nutritious diet.

Reliability testing conducted on the 10-item Perceived Parental Beliefs About Nutrition Scale in a data sample from the Challenge study yielded a Cronbach's α of 0.88 (Merry, Oberlander, Hurley, & Black, 2008). This is the same subscale that was used in this research investigation (shown in Table 3.5).

Table 3.5: Perceived Parental Beliefs about Nutrition Scale

My parents think I should...

1. Eat a healthy diet.
 2. Eat two or more servings of vegetables most days.
 3. Eat two or more servings of fruit (including 100% fruit juice) most days.
 4. Drink skim or 1% milk (instead of 2% or whole/vitamin D/red cap).
 5. Drink no more than one can of soda most days.
 6. Drink two or more glasses of water most days.
 7. Eat no more than one sugary snack most days (like candy, candy bar, cookies, cakes, sweet rolls).
 8. Eat no more than one salty or greasy snack most days (corn chips, potato chips, cheese curls).
 9. Choose small or medium sized portions when eating fast food (instead of large or super-sized).
 10. Eat no more than three servings of fried foods (fried chicken, French fries) most weeks.
-

Peer Eating Behaviors

The influence that the adolescent's peers and friends had on his or her eating habits were measured using a sub-set of items from the Perception of Peers Health Behavior Scale, adapted from the Youth Health Survey used in the Cardiovascular Health in Children and Youth Study (Gilmer, et al., 1996). This ten item nutrition-related set of questions from the Perception of Peers Health Behavior Scale is one of three sub-scales in the instrument, with the other two measuring adolescent peer smoking behavior and physical activity. No reliability and validity information is available for this nutrition-related subscale since Gilmer and colleagues determined that this measure of friend's eating habits did not fit conceptually into either the smoking or physical activity scales they did not include it in their reliability and validity testing for the Perception of Peers Health Behavior Scale.

The Peer Eating Behaviors sub-scale contained ten items and instructed the adolescent participant to "think about your closest friend. The next questions are about your closest friends. Select the answer that best applies." An example item from this sub-scale asked the respondent, "how many of your closest friends drink skim or 1% milk (instead of 2% or whole/vitamin D/red cap)?" A five-point, numbered response set listed the possible answer choices: 1 = none; 2 = some; 3 = most; 4 = all; 0 = I don't know. Sub-scale items were summed into a new variable called Peer Eating Behaviors, with higher total scores indicating more of the adolescent's peers are engaging in healthy nutrition behaviors.

Table 3.6: Peer Eating Behaviors Scale

How many of your closest friends...

1. Eat a healthy diet?
 2. Eat two or more servings of vegetables most days?
 3. Eat two or more servings of fruit (including 100% fruit juice) most days?
 4. Drink skim or 1% milk (instead of 2% or whole/vitamin D/red cap)?
 5. Drink no more than one can of soda most days?
 6. Drink two or more glasses of water most days?
 7. Eat no more than one sugary snack most days (like candy, candy bar, cookies, cakes, sweet rolls)?
 8. Eat no more than one salty or greasy snack most days (corn chips, potato chips, cheese curls)?
 9. Choose small or medium sized portions when eating fast food (instead of large or super-sized)?
 10. Eat no more than three servings of fried foods (fried chicken, French fries) most weeks?
-

Home Food Inventory

The Challenge study used a modified version of the Food Shelf Inventory (Crockett, Potter, Wright, & Bacheller, 1992) to account for the types of food present

in each study participant's home. The original Food Shelf Inventory listed 80 food items that the subject could mark either "yes" or "no" to indicate whether the food was present in the home at the time of the survey. A summative score for the shelf inventory indicated how many of the listed items are in the home, with lower scores reflecting less food and higher scores indicating a larger number of food items available in the home.

The Food Shelf Inventory has been deemed to be a useful dietary assessment tool for evaluating household food availability. A validation study used an abbreviated food frequency questionnaire to compare food consumption over “the past two months” with the shelf inventory. The food frequency questionnaire specifically listed only those foods occurring on the food shelf inventory. The measure’s overall sensitivity was found to be 86% and 87%, and overall specificity was 92% and 90%, respectively (Crockett, et al., 1992), demonstrating the food shelf inventory is a valid measure of assessing the presence of particular foods in the home.

Since the Food Shelf Inventory has only been validated for use in a non-Hispanic white, Midwestern middle-class population by Crockett and colleagues, the Challenge intervention staff modified the shelf inventory to reflect the types of foods typically found in a Mid-Atlantic, urban African-American community. An advisory board of African-American youth in Baltimore helped to guide instrument modification. The resulting Home Food Inventory (HFI) adapted for the Challenge study lists 105 foods in twelve categories: milk and dairy; cheese; salad dressing; cereal and breakfast foods; bread, pasta, and rice; baked goods and sweets; vegetables; fruits; meats (fresh or frozen); snacks and crackers; beans; and beverages.

Adolescents' caregivers in the Challenge study marked foods listed on the HFI as either present or absent in the household (see Appendix C for complete instrument).

Foods specifically targeted in the intervention are included in the survey, as well as an eight-item section added to the end of the survey that asked adolescents' caregivers about demographic information, who does most of the shopping for the household, the frequency of eating away from home, and water consumption. This section also asked the adolescent's caregiver about how often someone in the household shopped at a grocery store; and how often someone shopped at a corner convenience store. These last eight items were added to the HFI by Challenge staff were not included in the scoring protocol, but were used as part of the descriptive analysis. In addition, the last two added survey items about where the family shopped for food were used separately as proxy measures of food availability in the neighborhood representing family food source.

Family Food Source

There are two items on the Home Food Inventory that asked the adolescents' caregiver about how frequently they shopped for food at grocery stores and shopped at corner convenience stores. These items were proxy measures to gauge where the family shopped for food most of the time. The questions were "how often does someone in your household shop at a grocery store?" and "how often does someone in your household shop at a corner store/convenience store?" The seven response categories for each question were: "daily," "4-6 days of the week," "2-3 days of the week," "once a week," "once every two weeks," "once a month," and "never." The

response categories were assigned numerical values so that higher item scores would have indicated more frequent shopping at the specified location. These items were created for the Challenge study and have not been validated or psychometrically evaluated prior to this investigation.

Household Food Security

The 18-item USDA Core Food Security Module was used in the Challenge study to determine household food security caused by income limitations. Household food security means all family members have enough readily available and nutritionally adequate food for an active, healthy life. It also means that the family can acquire food in socially acceptable ways, without resorting to emergency food pantries, scavenging or stealing food. Food insecurity reflects limited or uncertain food availability of nutritious and safe food for all family members (Anderson, 1990). The food security status of family households lies along a continuum ranging from high food security to very low food security. The four categories of food security are:

- **High food security** - Households have no anxiety about consistently obtaining adequate and nutritious food.
- **Marginal food security** - Households experience periodic problems or anxiety about obtaining enough food for the household, although the quality, variety, and quantity of their food intake is not substantially reduced or compromised.

- **Low food security** - Households had reduced diet quality and variety, but the quantity of food intake and normal eating patterns were not substantially disrupted.

- **Very low food security** - Periodically during the past 12 months, one or more household members' food intake was reduced because the household lacked money and other resources to secure adequate food (ERS/USDA, 2008).

The USDA Core Food Security Module is an 18-item scale with one screener question, 14 questions with either affirmative or negative responses, and three questions determining the duration of certain problems. An example of a question assessing the mildest level of food security asked respondents, "We worried whether our food would run out before we got money to buy more" and whether the following statement was "often," "sometimes," or "never true" for them in the last 12 months. If the response was "never true," then there was little indication of food insecurity. The most severe levels of food insecurity were identified by the following questions: "in the last 12 months, did you ever not eat for a whole day because there wasn't enough money for food?" or "in the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food?" The USDA Core Food Security Module score measured the degree of food insecurity for a household over the past 12 months as a total score ranging from 0 to 10, with higher values indicating higher levels of food insecurity.

This measure has undergone extensive field-testing to produce a valid indicator for the presence and severity of food security. Assessing household food security has been included in a number of national health and nutrition surveys,

including the Continuing Survey of Food Intakes by Individuals (CSFII) and the National Health and Nutrition Examination Survey (NHANES) (Bickel, Nord, Price, Hamilton, & Cook, 2000). Validity testing within and outside of the USDA has found this tool to be a consistent measure of food security across major population groups and types of households in the US (ERS/USDA, 2008).

The Challenge study used a modified 11-item version of the USDA Core Food Security Module that did not include the screener question and items determining the duration of certain food security problems (see Appendix C for complete instrument). The Challenge study personnel cleaned and analyzed the Household Food Security Scale data and created a dichotomous variable indicating whether adolescents' households were food secure or food insecure. This binary variable for food security was used in this current research study.

Secondary Data Analysis

The data used to examine the research questions in this investigation were analyzed using SPSS GradPack 17.0.2 (SPSS Corp., Chicago, Illinois) and Stata 8.0 (StataCorp LP, College Station, Texas). Descriptive statistics describing frequencies for categorical variables and describing tests of central tendency on continuous variables were conducted on all of the independent and dependent variables identified for this investigation. Univariate and bivariate analyses were performed on possible confounders and covariates such as gender, age group, and BMI.

Data Cleaning

Missing values in the Challenge baseline data sample were addressed using a variety of strategies according to the nature of the data and the extent of missing values in the data set, and whether the data were missing at random or completely at random. Little's MCAR test in SPSS was conducted to determine whether data were missing completely at random (MCAR) or were missing at random (MAR). When Little's MCAR test results were not significant, then the data were assumed to be MCAR. MCAR was then confirmed by running t-tests of mean differences on key variables between groups of respondents with and without missing data to determine if the groups were significantly different. If the data were MCAR, then pairwise or listwise deletion of cases was an option if less than 5% of cases are missing data. If the data are MAR, then an appropriate imputation method would be used for data replacement (Garson, 2008). Since this data set is relatively small at 216 cases, a data imputation method was used to preserve all possible cases and maintain an adequate sample size for multivariate analyses.

Data that are MAR have missing values that are not randomly distributed across the sample, but rather are missing differentially within one or more sub-samples, such as differences in racial groups reporting or missing responses for an income variable (Hair, Anderson, Tatham, & Black, 1998). Examination of missing data using SPSS Missing Values Analysis and by case indicated whether any one individual had a high level of missing responses. Typically if the data are MAR, missing data would be replaced using the Maximum Likelihood Estimation (MLE) imputation method for individual cases having less than 10% of values missing within

each scale (Garson, 2008). Individual cases that were missing 10% or more of item responses within a scale were found to be missing, the scale was considered invalid for that individual and was not included in the analysis.

The Missing Values Analysis module in SPSS was used to find only the self-efficacy for healthy eating variable was MAR. The scaled variables representing peer eating behaviors and perceived parental beliefs were determined to be MCAR but imputation was conducted on all three scaled variables to preserve sample size. All analyses were later conducted on both the original and imputed datasets to determine whether the data replacement led to a significant difference in findings, which it did not.

Continuous variables were examined for outliers by using box-plot diagrams and histograms. Dietary data were searched for implausible intake values, and six cases that had total energy values <500 or >8,000 kilocalories per day were dropped from the analysis. This exclusion procedure is widely accepted for use when analyzing self-reported nutrition data (Feskanich, et al., 2004; Field, et al., 1999; Hurley, et al., 2008; Rockett, Berkey, Field, & Colditz, 2001; Rockett, et al., 1997; Rockett, et al., 1995).

Psychometric and reliability testing for a Cronbach's alpha was conducted on the following scales: HEI, nutrition knowledge, nutrition self-efficacy, parental beliefs about nutrition, and peer eating behaviors.

Preliminary Data Analysis

Independent variables for this analysis representing socio-cognitive factors were nutrition knowledge, self-efficacy for healthy eating, perceived parental beliefs about nutrition, peer eating behaviors, home food availability, frequency of shopping at a grocery store, frequency of shopping at a convenience store, and household food security. The two variables measuring shopping frequency and household food security variables were categorical; all other independent variables including nutrition knowledge, self-efficacy, parental beliefs, and peer eating behaviors were continuous. HEI-2005 score was a continuous variable that represented adolescent diet quality and was the dependent outcome measure. Multivariate analyses covariates included: adolescent sex; age category; BMI; parental BMI; and number of people living in the household with the adolescent. Descriptive statistics provided means and standard deviations for each continuous variable and frequencies for the categorical variables. Univariate analysis provided information about the distribution of scores on continuous variables in terms of skewness and kurtosis, as well as symmetry and peakedness or flatness of the distribution. The Kolmogorov-Smirnov statistic assessed the normality of the sample data's distribution, with a non-significant result indicating a normal Gaussian distribution. Due to missing counts in some levels of the shopping frequency variables, both measures' levels were collapsed from seven to three response categories.

Bivariate analyses tested for associations between the individual socio-cognitive factors and diet quality using either the Pearson product moment correlation coefficient for continuous variables and Spearman's rank order correlation for the

shopping variables. One-way analysis of variance (ANOVA) tested whether the categorical variables household food security, frequency of shopping at a grocery store, convenience store shopping frequency, sex, and age category were related to diet quality.

Multivariate regression models were tested for adherence to the assumptions outlined for classical linear regression models. These assumptions are that 1) variables are normally distributed; 2) there is a linear relationship between the dependent and independent variables; 3) the mean of the error is zero; 4) the model is homoscedastic, meaning there is homogeneity of variance where the variance of all errors is the same at all levels of the independent variable; and 5) variables are independent and there is no multicollinearity. These assumptions were necessary to obtain the best linear unbiased estimators. A residual analysis plotted the residuals against the predicted values to test the linearity, normality, independence, and variance assumptions.

Based on exclusionary criteria, the study sample included 222 African-American adolescent participants who had characterized themselves as African American and had completed the food frequency questionnaire. A preliminary post hoc power analysis stipulating a 0.05 significance level using multiple regressions testing with seven variables and a moderate to large 0.5 effect size resulted in 0.995 power (Gpower, version 2.0). Eliminating cases with outlier caloric values of <500 or >8,000 kilocalories per day as described in the data cleaning section of this chapter reduced the sample size to 216, thus resulting in an adjusted 0.988 value for calculated power.

Analyses to Answer Research Questions

This section presents the research questions, hypotheses, and analysis plans used in this investigation. The purpose of this study was to identify which socio-cognitive factors acting within the three environmental levels of personal, social, and community influences were associated with adolescent diet quality, and whether any one environmental level significantly impacted adolescent diet quality more than the other levels. This study also tested whether adolescents' self-efficacy moderated the relationship between parental beliefs about nutrition and diet quality, as well as whether adolescents' self-efficacy moderated the relationship between peer eating behaviors and diet quality.

Adolescents who have greater nutrition knowledge and self-efficacy to engage in healthy eating behaviors were expected to have better diet quality because of their higher levels of knowledge and confidence to make better food choices. Similarly, social factors such as positive role modeling and observational learning of healthy eating habits were expected to positively influence adolescent diet, although these influences could have worked both ways, and initially it was uncertain whether negative peer social influences would have had a deleterious effect on adolescent diet quality. The first research aim to compare the relative contribution each environmental made towards adolescent diet quality and hypothesized the community level was going to be a significant factor. The logic for this conjecture was that it would prove very difficult for the adolescent to consume a high quality diet if nutritious foods were not available in the home or in the community for consumption. A significance level of 0.05 was used for all analyses in this research.

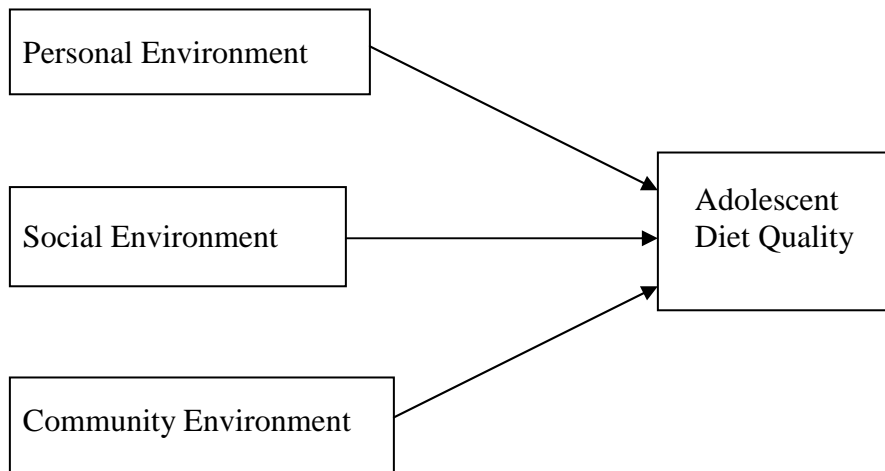
Research Question 1

A unique aspect of this study design was that it integrated Social Cognitive Theory (SCT) into an ecological theoretical framework to test whether sets of socio-cognitive factors operating on three environmental levels had significant influence on adolescent diet quality.

- 1. Will the personal, social, and community environmental levels of dietary influences all significantly contribute to diet quality in this sample of low-income, urban African-American adolescents, and will the community environmental level make the largest relative contribution?***

Research Hypothesis 1: The personal, social, and community environmental levels of dietary influences compared in the integrated theoretical model will all significantly contribute to diet quality in this sample of low-income, urban African-American adolescents, with community environment making the largest relative contribution.

Figure 3.1: Relationships Examined in Research Question 1



A series of three multivariate models were built using the sets of socio-cognitive variables occurring within each level of environmental influence on diet. One multiple regression model examining how socio-cognitive factors contribute to diet quality at the personal environmental level of influence contained the variables for *Nutrition Knowledge* and *Self-Efficacy for Healthy Eating*. A second model examined the socio-cognitive factors represented by *Perceived Parental Beliefs about Nutrition* and *Peer Eating Behaviors* at the social level of influence. Finally, variables describing community environmental factors such as *Home Food Availability*, *Family Food Source (grocery store shopping and convenience store shopping)*, and *Household Food Security* were tested for their relative contribution to diet quality in a third regression model.

Multiple linear regressions were used to determine if the level-specific associations existed and persisted after controlling for covariates. The literature review indicated that younger adolescents are more receptive to parental influences on diet (Feunekes, et al., 1998), while older adolescents rely on peer modeling to guide their eating behaviors (Evans, et al., 2006), therefore, this analysis controlled for age as a categorical covariate divided by theoretical psychosocial developmental stage (11-13 years vs. 14-16 years). Parental BMI also served as a covariate because some adolescents modeled their eating patterns and food choices after those of their parents. Parents with diets containing excess calories from poor quality diet were likely to be overweight and might have shared these dietary behaviors and food choices with their children (Larson, et al., 2008). The number of people living in the

household hypothetically affected how extensively household food resources were shared and may have impinged on how much food in the home was available to the adolescent (Dodson, et al., 2008). Therefore, each multiple regression model incorporated covariates to control for adolescent sex, age, BMI, parental BMI, and number of people living with the adolescent in the household.

Multiple regression analysis compared the relative contribution each environmental level made towards adolescent diet while holding the others constant. A three-stage least squares regression for simultaneous equations (3SLS) model compared the three environmental level regression equations while controlling for correlated error terms using Stata software. Relative differences in contribution to diet quality between equations was examined by comparing which equation had the larger r-squared value relative to the others, and which equation had the smaller root mean square errors in the 3SLS model. A significance level of 0.05 was set for the 3SLS analyses.

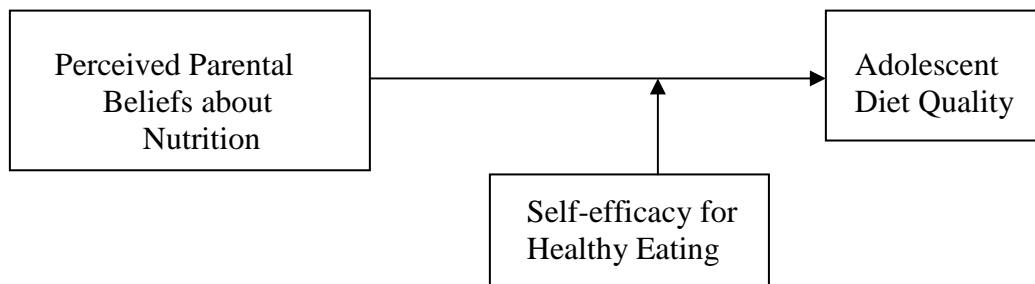
Research Question 2

The second and third aims of this research were to test whether adolescents' self-efficacy for healthy eating moderated the relationship between the socio-cognitive factors found at the social level of dietary influences and diet quality.

- 2. Does adolescents' self-efficacy for healthy eating moderate the relationship between perceived parental beliefs about diet and the quality of urban African-American adolescents' diets?***

Research Hypothesis 2: Adolescents' *Self-Efficacy for Healthy Eating* moderates the relationship between the socio-cognitive factor role modeling measured as *Perceived Parental Beliefs about Nutrition* and the quality of urban African-American adolescents' diets.

Figure 3.2: Relationship Examined in Research Questions 2



Research Question 3

3. *Does adolescents' self-efficacy for healthy eating moderate the relationship between peer dietary behavior and the quality of urban, African-American adolescents' diets?*

Research Hypothesis 3: Adolescents' *Self-Efficacy for Healthy Eating* moderates the relationship between the socio-cognitive factor observational learning measured as *Peer Eating Behaviors* and the quality of urban African-American adolescents' diets.

Figure 3.3: Relationship Examined in Research Questions 3



Stepwise, moderated multiple regression (MMR) analyses tested whether adolescents' *Self-Efficacy for Healthy Eating* moderated the relationship between *Perceived Parental Beliefs about Nutrition* and diet quality. The following illustrates the MMR equation, also known as a multiple regression model with an interaction term:

$$\hat{Y} = b_0 + b_1X + b_2Z + b_3XZ + e$$

where Y represented adolescent diet quality;

X represented *Perceived Parental Beliefs about Nutrition* (or *Peer Eating Behaviors*);

Z represented the moderator *Self-Efficacy for Healthy Eating*;

XZ represented the interaction term;

and *e* represented random error.

Generally, effects found in multiple regression models using an interaction term are interpreted as one variable's effect when the other variable in the interaction is equal to zero. In the social sciences this can be problematic because many variables are measured in interval scales and do not include zero as a possible value (e.g., Likert-type scales, blood pressure readings, BMI, etc.). In this investigation, first order variables were centered, or scaled to their mean value, prior to creating a cross

product interaction term. Centering variables is useful in minimizing non-essential collinearity between first and second order variables in a regression model, and it also prevented overly inflated standard errors on unstable first order regression coefficients if their raw score's minimum values were far from zero. Centering did not change the results of an interaction analysis but aided in the interpretation of the solution. The primary difference in centered versus non-centered solutions is the meaning of the "zero" value; non-centered variables measure the effects of a first order predictor while the other predictor is at *zero*; centered variables are interpreted as the effect one predictor has *at the mean* of the other predictor.

To test the first hypothesis addressing this research question, a cross product term was created from centered variables representing *Self-Efficacy for Healthy Eating* and *Perceived Parental Beliefs about Nutrition*. An MMR containing the first order predictor variables *Self-Efficacy for Healthy Eating* and *Perceived Parental Beliefs about Nutrition* and the second order variable tested the unstandardized regression coefficient of the cross product term to indicate the presence of a moderating effect.

Another stepwise MMR tested the second hypothesis for the research question examining whether adolescent *Self-Efficacy for Healthy Eating* moderated the relationship between *Peer Eating Behaviors* and diet quality. A new cross product term was created from the centered first order predictor variables *Self-Efficacy for Healthy Eating* and *Peer Eating Behaviors*. A second stepwise MMR using the first order centered variables *Self-Efficacy for Healthy Eating* and *Peer Eating Behaviors* and the second order variable tested the unstandardized regression coefficient of the

cross product term to indicate the presence of a moderating effect in this MMR model.

If the cross product term in either of the MMR models had resulted in a significant interaction, then the nature of the interaction would have been probed by computing the simple slopes to help describe the interaction. Using the basic MMR model described earlier as an illustration, to estimate the effect of Y on X (or Y on Z) using simple slopes, the moderator variable Z would have been assigned values that represented a reasonable range in the data to explore the interaction. The three newly scaled "Z variables" would have corresponded to values of Z at one standard deviation (SD) below the mean of Z; at the mean of Z; and at one SD above the mean of Z. By using ± 1 SD intervals, one can expect to capture approximately two-thirds of the data that lies within one SD of the mean in either direction. This would have allowed estimation of the simple slopes of Y on X at three different levels of the Z moderating variable, representing participants with low, moderate, or high levels of self-efficacy for healthy eating.

The simple slopes analysis for the first MMR model would have used three simple regression equations of diet quality on *Perceived Parental Beliefs about Nutrition* at 1 SD below, at, and 1 SD above the mean of *Self-Efficacy for Healthy Eating*. The simple slopes analysis for the second MMR model would have used three simple regression equations of diet quality on *Peer Eating Behaviors* at 1 SD below, at, and 1 SD above the mean of *Self-Efficacy for Healthy Eating*. In order to determine whether the slopes at varying levels of self-efficacy would have been

significantly different from one another, the test for equality of two regression lines would have been applied as found in Neter and Wasserman (1974).

The slopes test is a test of equality for two, or in this case, three regression lines. From each regression, the error sum of squares would be summed and a reduced regression model would have combined the common parameters for the three regression lines to calculate an error sum of squares for the reduced model. The degrees of freedom associated with each regression model would have then used to calculate a test statistic and decision rule for testing the inequality of the three regression lines (Neter & Wasserman, 1974).

An analysis of the moderating effect of adolescents' self-efficacy for healthy eating at the community level was not performed since it was not hypothesized to result in a meaningful or significant interaction. Conceptually, no matter how strongly an adolescent wants to improve his or her diet, without access to nutritious foods in the home or community it is not likely that personal environmental factors such as nutrition knowledge or self-efficacy for healthy eating can have a measurable impact on the community setting to improve adolescent diet quality.

Delimitations and Limitations

This study was delimited by the sample of African-American adolescents who participated in the Challenge study. This study focused on low-income, African-American adolescents living in the West Baltimore urban community surrounding the University of Maryland's Baltimore campus who participated in the 2001-2004 Challenge Study. Therefore the results of this study do not reflect the dietary influences on all African-American urban teenagers, although may approximate the

impact these socio-cognitive and environmental factors have on many poor African-American adolescents living in urban areas within the mid-Atlantic United States.

The data used for this study were derived from a non-probability sample of self-selected, non-randomized individuals collected as a convenience sample taken from a sampling frame of low-income, minority adolescents living in and around West Baltimore. A self-selected sample of adolescent study participants responding to a proposed health promotion intervention may have been biased towards those individuals as having a greater interest in health and nutrition compared to their peers, and who may be more receptive to changing health behaviors (Babbie, 2001; Cozby, 2003).

The self-reported data collected for the original Challenge study delimits this research in that participant responses may have been subject to socially desirability bias. Participants using self-reporting surveys tend to report what they believe the research expects and may choose responses that positively reflects on their own personal knowledge, beliefs, capabilities, or opinions (Cook & Campbell, 1979). Recall bias may have also impacted the accuracy of nutritional intake because the YAQ instrument is designed to query participants about their dietary intake over the past 12 months (Yu, 2008).

Measuring self-efficacy in an adolescent population was also a limitation of this study. Self-efficacy can be a validity issue in adolescent research because of variability in adolescents' psychological maturity (Pajares, 2006). Therefore this study endeavored to compensate for changing self-efficacy beliefs among adolescents as they matured by analyzing the sample by age category that delineated "younger"

adolescents (aged 11-13 years) from "older" adolescents (aged 14-16 years) for comparison purposes.

This study was also delimited by the type of data describing the food environment in schools for this study sample. The school food environment can have a large impact on adolescents' eating habits and diet quality since adolescents can consume approximately 35% to 40% of their daily calories while at school (Burghardt, et al., 1993). However, these data were not collected.

The study was delimited by the nature of the data collected by the Challenge study in other ways. There are not any data describing the type and number of restaurants and carry-out food outlets available in the West Baltimore neighborhoods sampled for the Challenge study. Unlike the integrated SCT and ecological theoretical model published by Story et al. (Story, et al., 2008), this study did not have data measuring the macro-level ecological environmental influence on adolescent diet that comes from policy, societal and cultural norms, food and beverage marketing, and media influences on diet.

One component of this investigation was examining the effect neighborhood food availability had on adolescent diet quality. Since we did not have an accounting of the number and types of food stores doing business during the 2001-2004 timeframe of the original Challenge study, this study used proxy measures for food outlets available in the community by using data describing how often adolescents' families in this study shopped at two different types of stores for food.

Food availability within the home of adolescent study participants may have varied depending on the time of the month the home food inventory was administered

if the family were USDA Food Stamp recipients. Survey data collected closer to the beginning of the month when Food Stamps are typically issued may have resulted in reports of more food in the home compared to those surveys collected near month's end. This study was limited by the assumption that the home food inventory reflected what foods were available in the home at any given time.

Reliability of the outcome variable measuring diet quality was of concern since the original Challenge data collection protocol stipulated the YAQ be an interviewer administered instrument, although all but the earliest YAQ surveys collected at baseline were participant self-administered (Erin Hager, PhD, personal communication, June 5, 2008). The cross-sectional design of this study limited inferences drawn to be of an associative nature rather than a causal one.

Summary

This chapter described the methodological procedures and measures used in the secondary analysis of Challenge data to address the stated research questions and hypotheses. The analysis explored relationships of socio-cognitive factors occurring at three different environmental levels of dietary influence on adolescent diet quality. In addition, adolescents' *Self-Efficacy for Healthy Eating* was tested to determine if it moderated the relationship between *Perceived Parental Beliefs about Nutrition* and diet quality, and whether it moderated the relationship between *Peer Eating Behaviors* and diet quality.

CHAPTER 4: Results

This study explored the dynamic and relative contributions that factors within three environmental levels (personal, social, and community) made as predictors of diet quality in a sample of low-income, urban African-American adolescents using an integrated SCT/ ecological theoretical framework. It was hypothesized that 1) the personal, social, and community environmental levels of dietary influences would all significantly contribute to diet quality, with community environment making the largest relative contribution; 2) self-efficacy for healthy eating moderated the relationship between parental beliefs about nutrition and diet quality; and 3) self-efficacy for healthy eating moderated the relationship between peer eating behaviors and diet quality.

The first section of this chapter describes psychometric properties of scaled variables used in this study, followed by the sample's characteristics. The next section reports results for each study variable, while the final section reports the results of the multivariate analyses presented by research question.

Properties of Scaled Measures

Reliability assessments were performed on the dependent and independent variables: 2005 Healthy Eating Index (HEI-2005), nutrition knowledge, self-efficacy for healthy eating, perceived parental beliefs about nutrition, and peer eating behaviors (see Table 4.1). Variables other than the HEI-2005 had adequate internal consistency with alphas in the 0.84 to 0.88 ranges.

Diet quality is multi-dimensional measure requiring varying levels of ten different subscale components, so internal consistency was neither expected nor desired for the HEI-2005. The HEI-2005 coefficient alpha was low, the subscales that were logically related were well correlated. HEI-2005 component scores having the highest inter-item correlations was 0.78 for total fruit correlating with whole fruit, followed by 0.73 for dark green, orange vegetables and legumes correlating with total vegetables. The third highest correlation of non-related food components was -0.43 for total grains negatively correlating to dietary sodium.

HEI-2005 testing on this sample revealed good concurrent validity. HEI-2005 score was significantly correlated with adolescent dietary intakes of iron ($r = 0.19$, $p = 0.006$), vitamin C ($r = 0.16$, $p = 0.019$), and both vitamin A ($r = 0.34$, $p < 0.001$) and the pro-form of vitamin A, carotene ($r = 0.37$, $p < 0.001$).

Cronbach's alpha for the nutrition knowledge scale was 0.84, and higher than when the original nutrition knowledge scale (0.74) was used in the Pathways Study (Stevens et al., 2003). The self-efficacy for healthy eating scale developed for the Challenge Study and used for this investigation also had a good 0.86 Cronbach's alpha. This is the first psychometric testing of the nutrition-related items in this scale to date, so it was not possible to compare this scale's reliability to its use on another sample.

There was no reliability and validity information available in the literature for the perceived parental beliefs about nutrition scale from its use in the Cardiovascular Health in Children and Youth Study (Gilmer, Speck, Bradley, Harrell, & Belyea, 1996), but this study found that the Cronbach's alpha was 0.88, which is a very strong

measure of scale reliability. The coefficient alpha for the peer eating behaviors scale was also high at 0.86 in this investigation, although no previous reliability validation measures were available to compare to this set of scaled items.

Table 4.1: Psychometric Characteristics for Scaled Variables			
	X (SD)	Cronbach Alpha	Possible Range
HEI 2005	62.3 (8.37)	0.37	0 - 100
Nutrition Knowledge	44.3 (7.90)	0.84	0 - 60
Self Efficacy for Healthy Eating	78.1 (17.33)	0.86	1 - 100
Perceived Parental Beliefs about Nutrition	26.6 (6.90)	0.88	10 - 40
Peer Eating Behaviors	12.9 (7.98)	0.86	0 - 40

Sample Characteristics

The study sample was almost evenly split between male (50.5%) and female (49.5%) participants with 13.2 years as the mean age in this sample of 216 African-American adolescents. The majority of the sample consisted of adolescents aged 11-13 years (77.8%) compared to older adolescents aged 14-16 years (22.8%). Frequencies of age by adolescent sex are listed in Table 4.2.

Mean BMI was within the normal weight-for-height range at 23.0 kg/m², and varied from 14.5 to 47.2 kg/m². Across the sample, 56% of males and 51% of females had BMIs that were in the healthy weight-for-height category. Table 4.2 provides BMI weight-for-age percentile categories for the entire sample and by sex. Although the majority of adolescents (57%) in this study had BMI percentiles in the healthy

range, nearly 40% of those participating in this study had BMIs that were indicative of being either overweight or obese. This analysis also found a significant, yet modest, correlation between adolescent BMI and skipping breakfast ($r = 0.14$, $p = 0.046$), alluding to the relationship reported in the literature between not eating breakfast and increased body weight.

The BMI's of adolescents participating in this study differed significantly by sex and age group. A closer examination of adolescent BMI scores found that female mean BMI (24.3) was significantly higher than male score (21.8) in this study [$t(214) = -3.06$, $p = 0.002$]. An analysis by age category found that older adolescents had higher BMI scores [$t(214) = -2.08$, $p = 0.038$] compared to younger adolescents mean scores.

The majority of participant parents (76%) were overweight or obese. When examining the relationship of parental obesity to adolescent weight, parental overweight and/or obesity was positively correlated with participant BMI ($r = 0.21$, $p = 0.002$).

Table 4.2: Sample Demographic Characteristics by Gender Category

	Male (n=109) n (% of males)	Female (n=107) n (% of females)	Total Sample (N=216) n (% of total)
Age			
11 yrs.	10 (9.2%)	6 (5.6%)	16 (7.0 %)
12 yrs.	34 (31.2%)	33 (30.8%)	67 (31.0%)
13 yrs.	36 (33.0%)	28 (26.2%)	64 (29.6%)
14 yrs.	22 (20.2%)	13 (12.1%)	35 (16.2%)
15 yrs.	5 (4.6%)	4 (3.7%)	9 (4.1%)
16 yrs.	2 (1.8%)	0 (0%)	2 (<0.1%)
BMI* kg/m² [X(SD)]	21.8 (5.62)	24.3 (6.35)	23.0 (6.10)
Parental BMI kg/m² [X(SD)]	31.8 (9.31)	31.4 (7.91)	31.6 (8.62)
BMI Percentile* X(SD)	63.0 (30.20)	73.9 (27.15)	68.4 (29.18)
BMI Weight-for-age Percentiles			
Underweight (<5th percentile)	6 (5.5%)	2 (1.9%)	8 (3.7%)
Healthy weight (5th to < 85th percentile)	69 (63.3%)	54 (50.5%)	123 (56.9%)
At risk of overweight (85th to < 95th percentile)	12 (11.0%)	13 (12.1%)	25 (11.6%)
Overweight (≥95th percentile)	22 (20.2%)	38 (35.5%)	60 (27.8%)

*Mean differences are significant at the p< 0.01 (2-tailed)

Although female participants had significantly higher BMI percentile scores, there was no significant difference in energy intake between males and female participants. Mean energy intake of the sample was 2934.1 kilocalories, ranging from 522 to 7762 kilocalories. Table 4.3 reports mean caloric intake for each quartile of the total sample and by adolescent sex.

Table 4.3: Kilocalorie Intake by Adolescent Sex

	Total Sample (N=216)	Male (n=109)	Female (n=107)
Caloric intake, X(SD)	2934 (1495.6)	2918 (1544.6)	2950 (1451.0)
Minimum intake	523	523	546
Maximum intake	7762	7762	7539
Kilocalorie distribution			
25th percentile	1676	1627	1852
50th percentile	2645	2640	2675
75th percentile	3819	3777	4057

A majority (72%) of the sample reported that they drank milk. Drinking milk was correlated to sex ($r = 0.20$, $p = 0.003$), and a further examination of the data revealed that significantly more males drank milk than did females ($\chi^2 = 7.86$, $p = 0.005$). Only 6.5 percent of the sample reported that they did not eat breakfast, with younger adolescents appearing to skip breakfast more often. The majority of adolescents reported eating away from home two or less times each week (75.5%), regardless of whether they were younger or older adolescents. These and other nutrition-related sample characteristics described by adolescent age group are presented in Table 4.4.

Table 4.4: Nutrition-related Sample Characteristics by Adolescent Age Category				
	Total Sample (N=216)	Younger Adolescents 11-13 yrs. (n=168)	Older Adolescents 14-16 yrs. (n=48)	
	N (%)	N (%)	N (%)	P-value ¹
Skips breakfast				0.356
Yes	14 (6.5%)	9 (5.4%)	5 (10.4%)	
No	202 (93.5%)	159 (94.6%)	43 (89.6%)	
Currently drink milk				0.586
Yes	156 (72.2%)	122 (72.6%)	34 (70.8%)	
No	60 (27.8%)	46 (27.4%)	14 (29.2%)	
Eat away from home				0.884
2 or less times/week	167 (77.3%)	131 (77.9%)	36 (75%)	
3-5 times/week	45 (20.9%)	34 (20.2%)	11 (22.9%)	
6-8 times/week	1 (0.5%)	1 (0.6%)	-	
12 or more times/wk	3 (1.4%)	2 (1.3%)	1 (2.1%)	

¹Chi-square analysis

Independent Variables Characteristics

This study used eight independent variables categorized into three environmental levels: personal, social, and community. At the personal level,

nutrition knowledge and self-efficacy for healthy eating were the socio-cognitive influences on dietary choices. Influences at the adolescent's social environmental level reflect interpersonal socio-cognitive factors such as perceived parental beliefs about nutrition and peer eating behaviors. Community influences on diet quality reflect the variety of food available in the adolescent's home, whether the family is food secure, and the frequency of when the family shopped at grocery stores or at corner convenience stores for food. Table 4.5 summarizes variable means and standard deviations for the entire sample and by adolescent sex.

Table 4.5: Study Variable Characteristics by Adolescent Sex				
	Total Sample (N=216)	Males (n=109)	Females (n=107)	
	X (SD)	X (SD)	X (SD)	P-value
Nutrition Knowledge	44.3 (7.90)	43.0 (9.46)	45.7 (5.66)	0.010
Self-efficacy for Healthy Eating	78.1 (17.33)	74.4 (18.01)	81.4 (16.07)	0.006
Perceived Parental Beliefs	26.6 (6.90)	25.3 (6.73)	27.9 (6.88)	0.005
Peer Eating Behaviors	12.9 (7.98)	12.4 (8.58)	13.3 (7.40)	0.445
Home Food Inventory	49.1 (16.57)	49.7 (16.98)	48.4 (16.26)	0.537
Number of people living with adolescent	3.5 (2.18)	3.5 (1.95)	3.6 (2.42)	0.650

Personal Level Factors

Scores for the scale measuring Nutrition Knowledge ranged from 1 to 55 (mean = 44.33, SD = 7.90). The nutrition knowledge scale scores were densely clustered around the mean (kurtosis = 6.2) and asymmetrically skewed (-2.1) towards greater nutrition knowledge. Nutrition knowledge scores did not significantly differ

between younger and older adolescent age groups, although scores differed when compared by sex. Female adolescents had significantly higher mean nutrition knowledge scores [$t(214) = -2.62, p = 0.010$] compared to male adolescents.

Bivariate analysis found nutrition knowledge significantly correlated with self-efficacy for eating healthy ($r = 0.408, p < 0.001$), and with parental beliefs about nutrition ($r = 0.395, p < 0.001$), reflecting positive nutrition behavior. Nutrition knowledge was also found to be inversely related to how often someone in the household shopped at a corner convenience store for food ($r = -0.168, p < 0.014$), although it was a weak association.

The scale measuring Self-efficacy for Healthy Eating had scores slightly skewed (-0.66) toward greater feelings of self-efficacy for making nutritious food choices. Scores ranged from 25 to 100 (mean = 78.1, SD = 17.33), with female adolescents mean scores significantly higher than male scores [$t(205) = -2.80, p = 0.006$]. Self-efficacy was moderately correlated with nutrition knowledge food ($r = 0.14, p < 0.001$), which may indicate adolescents with more knowledge about nutrition feel more confident making healthy food choices. Self-efficacy was also shown to be weakly correlated to parental beliefs about nutrition ($r = 0.249, p < 0.001$) and with peer eating behaviors ($r = 0.180, p = 0.010$).

Social Level Factors

The normal distribution of scores on the scale measuring Perceived Parental Beliefs about Nutrition ranged from 1 to 40 (mean = 26.61, SD = 6.90), with a slight skew towards positive parental influence on diet (-0.551). Although mean scores were

virtually identical when comparing younger and older adolescents, the distribution for older adolescents had a slightly stronger skew towards believing their parents wished they would eat healthier (-0.778 versus -0.491 for adolescents aged 11-13).

When analyzed by sex, female adolescents had significantly higher perceived parental belief scores compared to their male counterparts [$t(212) = -2.81, p = 0.005$], indicating females relate to parental influence in making personal food choices. The analysis also found that overall parental beliefs about nutrition scores were significantly correlated with adolescent diet quality ($r = 0.21, p = 0.002$), indicating a positive relationship between perceived parental influences and adolescent nutritional intake.

Scores for the Peer Eating Behaviors scale ranged from 0 to 38 (mean = 12.87, SD = 7.98) and were normally distributed across the sample. A relatively higher peer eating behavior mean for younger adolescents indicates the adolescent's peers and friends had a relatively stronger influence on eating habits when compared to their older counterparts, although both groups had a similar skew (0.360 and 0.357, respectively) in their sample distribution. Scores measuring peer eating behaviors did not significantly differ between age groups or gender, but peer eating behavior scores were found to be significantly associated with HEI-2005 scores, indicating peer dietary behavior had a weak, yet positive, influence on adolescent diet quality ($r = 0.18, p = 0.009$).

Community Level Factors

Fifty-six percent of the sample lived at or below the poverty line and 61 percent of participants lived in female-led, single parent households. While most of the sample households were considered to be food secure, almost 30 percent of the participants' households were estimated to be food insecure. Family food security did not differ by adolescent age category (see Table 4.6).

The mean number of people living in the household with the adolescent was 3.5 and ranged between one and 13 individuals. Since the number of people sharing household food resources would theoretically affect how much food is available for the adolescent's consumption, this variable was used as a covariate in multivariate analyses. There was no significant difference in the number of individuals living with the adolescent when examined by adolescent age group or by sex.

The variety of food available in the household was estimated using the Home Food Inventory, with scores normally distributed and ranging from 15 to 100 (mean = 49.05, SD = 16.57). The mean number of different food items reported in the home was slightly higher for younger adolescents, indicating a somewhat larger variety of foodstuffs available in younger adolescent households but not significantly different from the variety of food reported in older adolescent homes. Household food was divided into 12 categories; the three categories with the highest number of food items reported in the household were vegetables (18 items), fruit (13 items), and dairy (13 items).

Food availability in the neighborhood was measured by asking adolescents' caretakers how often they shopped for food at grocery stores or at corner convenience

stores. Caregivers reported most frequently shopping at a grocery store once every two weeks ($n = 67, 31\%$) and reported most frequently shopping for food at a corner convenience store on a daily basis ($n = 51, 24\%$). Both older and younger adolescent caregivers reported they most frequently purchased food at a grocery store either once a week or once every two weeks. About two-thirds of participants also reported shopping at corner convenience stores for food either daily or two-to-three days a week in households of both younger and older adolescents.

Overall, shopping at corner convenience stores was found to be negatively related to adolescent nutrition knowledge score ($r = -0.168, p = 0.014$). There was also a positive correlation between the number of people living in the adolescent household and frequency of shopping at convenience stores for food ($r = 0.148, p = 0.031$), and, finally, household food security was inversely related to corner convenience store shopping ($r = -0.143, p = 0.038$).

Table 4.6: Categorical Independent Variable Characteristics by Adolescent Age Category				
	Total Sample (N=216)	Younger Adolescents 11-13 yrs. (n=168)	Older Adolescents 14-16 yrs. (n=48)	
	N (%)	N (%)	N (%)	P-value¹
Family Food Security				0.910
Food secure	152 (70.3%)	117 (69.6%)	35 (72.9%)	
Food insecure	64 (29.7%)	51 (30.4%)	13 (27.1%)	
Grocery Store Shopping²				0.485
≤ 1 every 2 wks	101 (46.8%)	81 (48.2%)	19 (39.6%)	
1-3 days a week	94 (43.5%)	70 (41.7%)	25 (52.1%)	
≥ 4 days a week	21 (9.7%)	17 (10.1%)	4 (8.3%)	
Convenience Store Shopping²				0.886
≤ 1 every 2 wks	68 (31.5%)	52 (31.0%)	16 (33.3%)	
1-3 days a week	75 (34.7%)	58 (34.5%)	17 (35.4%)	
≥ 4 days a week	73 (33.8%)	58 (34.5%)	15 (31.3%)	

¹ Chi-square analysis

² Chi-square analysis conducted on shopping frequencies collapsed into 3 categories

Dependent Variable Characteristics for the Healthy Eating Index

The univariate statistics for adolescent diet quality as measured by the HEI-2005 are presented in Table 4.7 as total HEI-2005 scores and HEI-2005 component scores by age category. Although younger adolescent mean HEI-2005 total scores appear to be higher, they were not significantly different compared to older adolescent HEI-2005 total scores.

There was a difference between the age groups when analyzing HEI-2005 component scores. Older adolescents aged 14 to 16 years had significantly higher total grain component scores compared to younger adolescents [$t(105) = -2.18, p = 0.032$].

Table 4.7: Descriptive Statistics for Healthy Eating Index (HEI-2005) Scored Variable by Adolescent Age Group

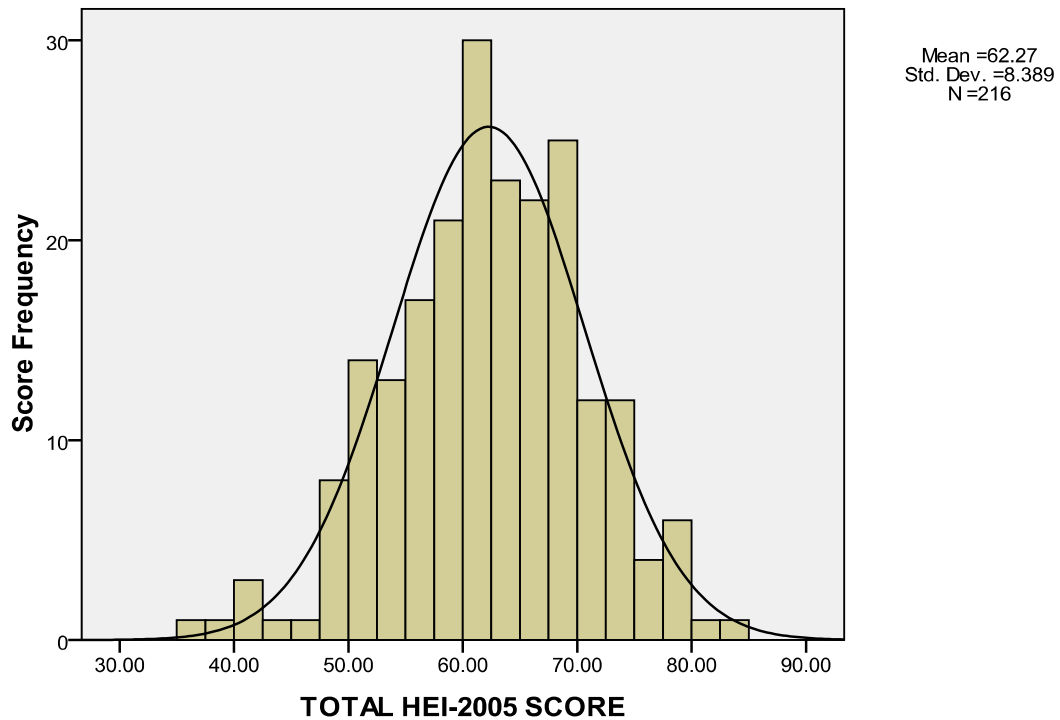
	Total Sample (N=216)	Younger Adolescents, 11-13 yrs. (n=168)			Older Adolescents, 14-16 yrs. (n=48)		
	X (SD)	Min.	Max.	X (SD)	Min.	Max.	X (SD)
Total HEI-2005 Score ¹	62.3 (8.34)	37.3	82.7	62.4 (8.44)	40.8	78.5	61.7 (8.26)
HEI Component Scores:							
Total Fruit	3.6 (1.40)	0.4	5.0	3.6 (1.40)	0.1	5.0	3.7 (1.42)
Whole Fruit	3.7 (1.46)	0.04	5.0	3.8 (1.48)	0.0	5.0	3.7 (1.41)
Total Grains*	4.7 (0.60)	1.6	5.0	4.6 (0.63)	3.3	5.0	4.8 (0.45)
Whole Grains	1.1 (0.79)	0.04	5.0	1.1 (0.82)	0.0	3.0	1.0 (0.68)
Milk	7.2 (2.42)	1.9	10.0	7.2 (2.48)	3.2	10.0	7.4 (2.20)
Meat & Beans	7.7 (2.42)	0.0	10.0	7.7 (2.21)	2.8	10.0	7.7 (1.95)
Total Vegetables	2.8 (1.03)	0.0	5.0	2.8 (1.01)	1.1	5.0	2.8 (1.09)
Dark Green, Orange Vegetables & Legumes	1.7 (1.19)	0.0	5.0	1.7 (1.18)	0.0	5.0	1.5 (1.22)
Oils	7.6 (2.01)	0.9	10.0	7.6 (2.05)	3.0	10.0	7.7 (1.88)
Saturated Fat	5.7 (2.70)	0.0	10.0	5.8 (2.57)	0.0	9.3	5.2 (3.07)
Sodium	7.3 (1.19)	0.0	9.6	7.3 (1.22)	5.0	9.1	7.4 (1.10)
Calories from Solid Fat, Alcohol & Added Sugar (SoFAAS)	9.1 (3.40)	0.0	18.9	9.2 (3.96)	2.6	18.5	8.8 (4.16)

*Correlation is significant at the $p < 0.05$ (2-tailed)

¹Possible range for HEI 2005 is 0-100 points

Figure 4.1 illustrates the HEI-2005 total score as normally distributed with a small negative skew (-.218) towards lower HEI-2005 scores but not enough to warrant transforming the data. The HEI-2005 score distribution curve had a kurtosis of (-.006).

Figure 4.1: HEI 2005 Histogram



Adolescent diet quality was assessed using the HEI-2005 total score. Total HEI-2005 score fell into one of three categories rating diet: *good* diet, diet *needs improvement*, and *poor* diet. HEI scores above 80 indicated a good diet, scores ranging from 51 to 80 reflected a diet that needed improvement, while HEI scores below 51 implied the adolescent had a poor diet (Basiotis, Carlson, Gerrior, Juan, & Lino, 2002). Only one of the participants (0.5%) was assessed as having an HEI-2005 score in the good range, and close to 10 percent of the entire sample was in the poor range, leaving the majority of participants (90%) with diets that needed improvement.

Table 4.8 shows that adolescents who skipped breakfast had significantly lower diet quality [$t(19) = 2.68, p = 0.015$]. Differences in diet quality due to

skipping breakfast did not persist when comparing adolescent age groups or gender, probably due to the small number of adolescents who reported this behavior.

Table 4.8: Cross-tabulations of Diet Quality and Select Study Variables (N=216)					
		Diet Quality ¹			
	Number in category n	Poor n (%)	Needs Improvement n (%)	Good n (%)	P-value ¹
Adolescent Gender					0.207
Male	109	10 (50.0%)	98 (50.2%)	1 (100.0%)	
Female	107	10 (50.0%)	97 (49.8%)	0 (0%)	
Age Category					0.585
11-13 years	168	16 (9.5%)	151 (89.9%)	1 (100.0%)	
14-16 years	48	4 (8.3%)	44 (91.7%)	0 (0%)	
Food Security					0.430
Food Secure	154	13 (8.6%)	140 (90.7%)	1 (100.0%)	
Food Insecure	62	7 (11.5%)	55 (88.5%)	0 (0%)	
Skips Breakfast					0.015
Yes	14	1 (5.0%)	13 (6.7%)	0 (0%)	
No	202	19 (95.0%)	182 (93.3%)	1 (100%)	
Living at or below poverty line					0.281
Yes	111	11 (78.6%)	99 (54.7%)	1 (100.0%)	
No	85	3 (21.4%)	82 (45.3%)	0 (0%)	
Family Food Source: Grocery Store					0.869
≤ 1 every 2 wks	99	59 (84.3%)	89 (46.6%)	1 (100.0%)	
1-3 days a week	92	8 (11.4%)	84 (44.0%)	0 (0%)	
≥ 4 days a week	21	3 (4.3%)	18 (9.4%)	0 (0%)	
Family Food Source: Corner Convenience Store					0.875
≤ 1 every 2 wks	67	5 (25.0%)	61 (31.6%)	1 (100.0%)	
1-3 days a week	74	8 (40.0%)	66 (34.2%)	0 (0%)	
≥ 4 days a week	73	7 (35.0%)	66 (34.2%)	0 (0%)	
Number of People Living in Household with Teen					0.695
≤ 2	71	9 (45.0%)	62 (32.0%)	0 (0%)	
3-4	92	8 (40.0%)	84 (43.3%)	0 (0%)	
≥ 5	52	3 (15.0%)	48 (24.7%)	1 (100.0%)	

¹ All tests of significance were calculated for differences among categories of participants and continuous HEI-2005 score using independent t-tests or ANOVA

Bivariate relationships between diet quality and variables hypothesized to influence adolescent diet quality were examined to identify significant differences in mean values within gender and age groups. Table 4.9 presents correlations between diet quality measured as HEI-2005 score and the independent variables used in this study. Diet quality was significantly correlated with perceived parental beliefs about nutrition and with peer eating behaviors ($r = 0.21, p = 0.002$; $r = 0.18, p = 0.009$, respectively). These correlations bear out the concept that adolescent behavior is shaped by both parental and peer influences.

Table 4.9 Correlations of Diet Quality and Independent Variables								
	2	3	4	5	6	7	8	9
Diet Quality (HEI-2005)	0.07	0.11	0.21**	0.18**	0.08	-0.04	-0.02	0.06
2. Nutrition Knowledge	1	0.41**	0.40**	0.12	0.01	0.06	-0.18*	-0.03
3. Self Efficacy for Healthy Eating		1	0.25**	0.18**	0.07	-0.05	-0.11	-0.01
4. Perceived Parental Beliefs about Nutrition			1	0.20**	-0.07	-0.02	-0.02	0.07
5. Peer Eating Behaviors				1	-0.01	-0.10	-0.10	-0.12
6. Home Food Inventory					1	-0.12	0.03	-0.05
7. Family Food Source: Grocery Store						1	0.09	0.07
8. Family Food Source: Corner Store							1	-0.14*
9. Food Security								1

* Correlations are significant at the $p < 0.05$ (2-tailed)

** Correlations are significant at the $p < 0.01$ (2-tailed)

HEI-2005 Correlations by Age Group

Correlations of HEI-2005 score to predictor variables analyzed by age group resulted in statistically significant relationships. Among adolescents aged 11-13 years, HEI-2005 score was significantly related to peer eating behavior and to perceived parental beliefs about nutrition ($r = 0.18, p = 0.021$; $r = 0.21, p = 0.007$, respectively). Among the older adolescents aged 14 to 16 years, HEI-2005 score was not significantly associated with any of the independent variables used in this study. These results show that unlike their older peers, younger adolescents' dietary choices were influenced by both what they think their parents would want them to eat and by what their peers are eating, although given the correlation coefficient values, the strength of these relationships were fairly weak.

HEI Correlations by Adolescent Sex

Male adolescents' HEI-2005 score was significantly related to peer eating behavior ($r = 0.27, p = 0.006$), indicating males modeling peer nutrition behaviors to make food choices may have improved diet quality. A different independent variable was significantly related to diet quality among female adolescents participating in this study. Among females, HEI-2005 score was associated with perceived parental beliefs about nutrition ($r = 0.23, p = 0.019$). These results indicate males are significantly influenced by peer eating behavior, while females are influenced by what they believe their parents would want them to eat; with both being positive influences on diet quality. Although these relationships are statistically significant,

given the correlation coefficients the strength of these associations appears to be modest.

Multivariate Results

Multiple Regression Analysis

Research Hypothesis 1: The personal, social, and community environmental levels of dietary influences compared in the integrated theoretical model will all significantly contribute to diet quality in this sample of low-income, urban African-American adolescents, with community environment making the largest relative contribution.

Multivariate estimates of diet quality were made using separate linear regression models for each of the three sets of variables representing the personal, social, and community levels of environmental influences on adolescent diet quality.

The social level multiple regression model yielded significant results as illustrated in Table 4.10. When regressed against diet quality, the model containing predictor variables resulted in both peer eating behaviors [$t = 2.07$, $p = 0.040$] and perceived parental beliefs about nutrition [$t = 2.79$, $p = 0.006$] significantly related to diet quality. In the full regression model with covariates examining social-level influences, perceived parental beliefs about nutrition was the only variable to remain significantly related to diet quality [$t = 2.63$, $p = 0.009$]. An analysis of the regression models estimating personal and community influences on diet quality did not result in variables significantly contributing to diet quality.

Table 4.10: Regression Model Results on Determinants of Diet Quality by Environmental Level								
Variables regressed on HEI-2005	Predictors only model				Full model with covariates			
	β	SE	P-value	Adjusted R ² of model	β	SE	P-value	Adjusted R ² of model
Personal Level Model				0.009				0.002
Nutrition knowledge	0.13	0.095	0.167		0.13	0.101	0.214	
Nutrition self-efficacy	0.06	0.095	0.529		0.05	0.097	0.608	
Gender					1.48	1.207	0.221	
BMI					-0.05	0.104	0.623	
Parent BMI					0.03	0.071	0.678	
No. people in household					0.04	0.795	0.652	
Social Level Model				0.058				0.051
Parental beliefs	0.24	0.084	0.006		0.25	0.094	0.009	
Peer behaviors	0.15	0.072	0.040		0.15	0.074	0.052	
Gender					1.12	1.187	0.345	
BMI					-0.08	0.105	0.448	
Parent BMI					0.03	0.069	0.631	
No. people in household					0.57	0.777	0.465	
Community Level Model				0.015				0.018
Food security	0.84	1.308	0.522		0.82	1.345	0.541	
Home food inventory	0.02	0.037	0.607		0.02	0.038	0.524	
Grocery store shops	-0.22	0.901	0.806		-0.39	0.924	0.673	
Convenience store shops	-0.35	0.735	0.632		-0.52	0.759	0.491	
Gender					1.83	1.227	0.137	
BMI					-0.04	0.104	0.677	
Parent BMI					0.02	0.071	0.777	
No. people in household					0.30	0.276	0.283	

SE = standard error; β = unstandardized regression coefficient

In a combined model across environmental levels, only one influence on diet quality remained significant as depicted in Table 4.11. Perceived parental beliefs about nutrition was significantly related to adolescent diet quality. This variable

retained its statistical significance in both the predictors-only model [$t = 2.17$, $p = 0.031$], as well as in the full regression model with covariates [$t = 2.32$, $p = 0.022$].

Table 4.11: Combined Regression Model Results on Determinants of Diet Quality

Variables regressed on HEI-2005	Predictors only model				Full model with covariates			
	β	SE	P-value	Adjusted R ² of model	β	SE	P-value	Adjusted R ² of model
Nutrition knowledge	0.11	0.107	0.306	0.039	0.11	0.110	0.304	0.031
Nutrition self-efficacy	0.002	0.098	0.983		-0.02	0.100	0.860	
Parental beliefs	0.21	0.097	0.031		0.25	0.107	0.022	
Peer behaviors	0.14	0.078	0.084		0.12	0.082	0.152	
Food security	1.11	1.336	0.407		0.94	1.381	0.496	
Home food inventory	0.02	0.037	0.564		0.02	0.038	0.565	
Shop grocery store	-0.15	0.911	0.867		-0.24	0.940	0.799	
Shop corner store	-0.05	0.745	0.944		-0.27	0.776	0.733	
Sex					1.41	1.247	0.261	
BMI					-0.12	0.113	0.271	
Parent BMI					0.01	0.072	0.892	
No. people living with adolescent					0.47	0.830	0.575	

SE = standard error; β = unstandardized regression coefficient

Multivariate Analysis by Age Group

Multivariate linear regression estimates were repeated to analyze the sample by age category with results shown in Table 4.12. In the social environmental level regression model controlling for covariates, parental beliefs about nutrition was significantly related to diet quality but only among younger adolescents aged 11 to 13 years [$t = 2.28$, $p = 0.024$], as one would expect of less mature teens.

Regression analysis by adolescent age group of personal and community-level influences on diet quality found no predictor variables or covariates being significant predictors of diet quality for adolescents in the study. However, in an analysis of all independent variables and covariates by age group shown as a combined model in Table 4.12, among younger adolescents perceived parental beliefs about nutrition was significantly related to diet quality [$t = 2.13$, $p = 0.035$].

Table 4.12: Environmental Level Regression Models: Determinants of Diet Quality by Younger (11-13 yrs) and Older (14-16 yrs.) Adolescents

Variables regressed on HEI-2005	Age 11-13 yrs.			Age 14-16 yrs.		
	β	SE	P-value	β	SE	P-value
Personal Level Model¹						
Nutrition knowledge	0.03	0.122	0.808	0.34	0.202	0.100
Nutrition self-efficacy	0.04	0.106	0.714	0.10	0.251	0.695
Sex	-2.59	1.379	0.063	-2.80	2.666	0.300
BMI	-0.03	0.131	0.822	0.04	0.196	0.856
Parent BMI	0.03	0.077	0.690	-0.04	0.198	0.849
No. people living with adolescent	0.33	0.890	0.714	1.04	1.902	0.589
Social Level Model²						
Parental beliefs	0.24	0.106	0.024	0.27	0.216	0.217
Peer behaviors	0.16	0.088	0.074	0.14	0.153	0.366
Sex	2.29	1.355	0.093	-3.17	2.721	0.252
BMI	-0.09	0.126	0.486	-0.02	0.210	0.935
Parent BMI	0.04	0.075	0.609	-0.04	0.207	0.863
No. people living with adolescent	0.45	0.863	0.605	0.99	1.921	0.608
Community Level Model³						
Food security	0.56	1.529	0.714	0.27	3.339	0.936
Home food inventory	0.02	0.045	0.624	0.08	0.083	0.364
Shop grocery store	-0.22	1.045	0.837	-0.87	2.358	0.714
Shop corner store	0.17	0.858	0.846	-2.85	1.913	0.144
Sex	2.69	1.403	0.057	-0.20	3.395	0.953
BMI	-0.05	0.127	0.706	-0.06	0.218	0.800
Parent BM	0.03	0.077	0.685	-0.05	0.215	0.804
No. people living with adolescent	0.44	0.905	0.625	0.78	2.134	0.716
Combined Model⁴						
Nutrition knowledge	0.04	0.138	0.797	0.34	0.235	0.159
Nutrition self-efficacy	-0.03	0.110	0.797	-0.05	0.283	0.861
Parental beliefs	0.25	0.119	0.035	0.19	0.293	0.527
Peer behaviors	0.13	0.100	0.203	0.21	0.164	0.217
Food security	0.54	1.585	0.733	0.13	3.397	0.969
Home food inventory	0.02	0.045	0.709	0.11	0.088	0.222
Shop grocery store	0.14	1.085	0.897	-1.40	2.376	0.560
Shop corner store	0.17	0.886	0.850	-1.20	2.083	0.568
Sex	2.54	1.434	0.079	-2.50	3.479	0.478
BMI	-0.12	0.142	0.391	-0.03	0.231	0.904
Parent BMI	0.02	0.079	0.840	0.04	0.220	0.854
No. people living with adolescent	0.04	0.949	0.680	0.29	2.119	0.893

SE = standard error; β = unstandardized regression coefficient

¹Adjusted R2 = 0.008 (younger adolescents); adjusted R2 = 0.014 (older adolescents)

²Adjusted R2 = 0.091 (younger adolescents); adjusted R2 = 0.104 (older adolescents)

³Adjusted R2 = 0.023 (younger adolescents); adjusted R2 = 0.112(older adolescents)

⁴Adjusted R2 = 0.015 (younger adolescents); adjusted R2 = 0.044 (older adolescents)

Multivariate Analysis by Adolescent Sex

Multivariate linear regression estimates were repeated to analyze the sample by adolescent gender, with results shown in Table 4.13. In the social environmental level regression model controlling for covariates, peer eating behavior among males was significantly related to diet quality [$t = 2.46, p = 0.016$]. In the same model, parental beliefs about nutrition significantly predicted diet quality among female adolescents in the study [$t = 2.31, p = 0.023$]. These findings parallel the significant correlations found between peer influence on male participants' diet quality and females' diet quality significantly influenced by parental nutrition beliefs.

In the combined model, perceived parental beliefs about nutrition significantly predicted diet quality among female adolescents in the study [$t = 2.10, p = 0.039$]. No other variables resulted in significant multivariate relationships when analyzed by sex.

Table 4.13: Environmental Level Regression Models: Determinants of Diet Quality by Adolescent Sex

Variables regressed on HEI-2005	Male			Female		
	β	SE	P-value	β	SE	P-value
Personal Level Model¹						
Nutrition knowledge	0.08	0.138	0.565	0.20	0.157	0.199
Nutrition self-efficacy	0.05	0.149	0.745	0.08	0.127	0.530
BMI	0.03	0.162	0.837	-0.18	0.139	0.209
Parent BMI	-0.10	0.100	0.340	0.18	0.102	0.082
No. people living with adolescent	1.35	1.263	0.289	-0.42	1.033	0.683
Social Level Model²						
Parental beliefs	0.14	0.143	0.330	0.29	0.127	0.023
Peer behaviors	0.26	0.103	0.016	0.04	0.108	0.689
BMI	0.03	0.164	0.860	-0.21	0.138	0.133
Parent BMI	-0.07	0.094	0.447	0.15	0.103	0.150
No. people living with adolescent	0.68	0.486	0.167	-0.17	0.333	0.610
Community Level Model³						
Food security	-1.07	2.066	0.605	2.05	1.809	0.260
Home food inventory	-0.01	0.056	0.953	0.04	0.054	0.525
Shop grocery store	-1.49	1.561	0.342	0.52	1.170	0.659
Shop corner store	-0.41	1.173	0.729	-0.44	1.024	0.670
BMI	-0.01	0.162	0.966	-0.12	0.139	0.384
Parent BMI	-0.06	0.097	0.512	0.11	0.108	0.330
No. people living with adolescent	1.67	1.271	0.191	-0.15	1.099	0.892
Combined Model⁴						
Nutrition knowledge	0.15	0.156	0.356	0.05	0.173	0.775
Nutrition self-efficacy	-0.09	0.161	0.590	0.09	0.130	0.471
Parental beliefs	0.23	0.183	0.206	0.29	0.136	0.039
Peer behaviors	0.21	0.118	0.079	0.08	0.123	0.499
Food security	-0.54	2.196	0.808	1.95	1.830	0.291
Home food inventory	-0.02	0.056	0.692	0.05	0.054	0.396
Shop grocery store	-2.26	1.644	0.172	1.24	1.220	0.313
Shop corner store	-0.06	1.225	0.962	-0.02	1.043	0.984
BMI	-0.03	0.178	0.882	-0.26	0.152	0.097
Parent BMI	-0.10	0.101	0.313	0.09	0.108	0.430
No. people living with adolescent	1.85	1.341	0.171	-0.65	1.120	0.562

SE = standard error; β = unstandardized regression coefficient

¹Adjusted R2 = 0.022 (male adolescents); adjusted R2 = 0.009 (female adolescents)

²Adjusted R2 = 0.067 (male adolescents); adjusted R2 = 0.037 (female adolescents)

³Adjusted R2 = 0.036 (male adolescents); adjusted R2 = 0.031 (female adolescents)

⁴Adjusted R2 = 0.037 (male adolescents); adjusted R2 = 0.004 (female adolescents)

Three-Stage Least Squares Analysis

A three-stage least squares analysis was conducted to compare regression models to one another and test whether the community level of environmental influence contributed significantly more towards diet quality compared to the personal or social levels. The three-stage least squares analysis revealed that when compared to each other, no one regression model of nutrition influences contributed to diet quality significantly more than the comparison regression models (see Table 4.14). Therefore we accept the null for the first research hypothesis, that no one environmental level made a larger contribution to diet quality compared to the other levels.

Table 4.14: Results of 3-stage least squares regression			
Equation	Root mean square error (RMSE)	R²	P-value
Personal	8.373	0.0009	0.844
Social	8.349	0.0066	0.155
Community	8.377	-0.0000	1.000

Moderated Multiple Regression Analyses

Research Hypothesis 2: Adolescents' *Self-Efficacy for Healthy Eating* moderates the relationship between the variable measuring *Perceived Parental Beliefs about Nutrition* and the quality of urban African-American adolescents' diets.

A stepwise, moderated multiple regression of diet quality on adolescent nutrition self-efficacy for eating healthy, perception of their parents' beliefs about

nutrition, and the interaction between these centered variables was estimated. No significant interactions of the nutrition self-efficacy/perceived parental beliefs cross-product were observed ($t = 0.776$; $p = 0.439$), suggesting that the effects of parental beliefs about nutrition on diet quality were constant across varying levels of adolescents' self-efficacy for healthy eating. Since nutrition self-efficacy does not appear to moderate the relationship between perceived parental beliefs about nutrition and diet quality, we fail to reject the null hypothesis and conclude no significant interaction effect occurs among these influences on adolescent diet quality.

Research Hypothesis 3: Adolescents' *Self-Efficacy for Healthy Eating* moderates the relationship between the variable measuring *Peer Eating Behaviors* and the quality of urban African-American adolescents' diets.

A stepwise, moderated multiple regression of diet quality on adolescent nutrition self-efficacy for eating healthy, peer eating behavior, and the interaction between these centered predictor variables was conducted. There was no significant interaction of the nutrition self-efficacy/peer eating behaviors cross-product observed ($t = 1.103$; $p = 0.271$). Therefore, nutrition self-efficacy did not appear to moderate the relationship between peer eating behaviors and diet quality, so we failed to reject the null hypothesis and concluded there was no significant interaction effect among these influences on adolescent diet quality.

Summary

Chapter 4 presented the results of statistical analyses conducted on this sample of 216 African-American, inner-city adolescents to answer the research questions

driving this investigation. All of the scaled variables used in this study showed acceptable internal reliability coefficients.

Descriptive and bivariate statistics of the study data described the relationships between study variables and participants. In these preliminary analyses, the inter-relationships between peer eating behaviors, perceived parental beliefs about nutrition, adolescent age group and gender surfaced. The dietary intake of younger adolescents was found to be influenced by both peers and parental beliefs about healthy eating. Females were significantly influenced by parental views about eating healthy, while male study participants were influenced more by the nutrition behaviors of those in their peer group. In this study, peer eating behaviors and perceived parental beliefs about nutrition were sociocognitive factors that significantly influenced adolescent diet quality, with both positively contributing to adolescent nutrition.

Overall, these relationships remained true in subsequent multivariate analyses. Although a number of the sociocognitive variables used in this investigation were shown to be significant predictors of diet quality within multivariate analyses, the overall comparison of which environmental-level model contributed more to diet quality, as outlined in Research Question 1, was not statistically relevant. Therefore, we could not reject the null hypothesis for Research Question 1.

When addressing Research Questions 2 and 3, this study did not find adolescent self-efficacy for healthy eating significantly moderating social level influences such as peer eating behavior or perceived parental beliefs about nutrition. Self-efficacy did not have a moderating effect on perceived parental beliefs about

nutrition and subsequent diet quality as stated as Research Question 2, so therefore we could not reject the null hypothesis. Similarly, self-efficacy did not have a moderating effect on peer eating behavior as hypothesized in Research Question 3. Lack of a significant interaction effect in the analysis prevents us from rejecting the null hypothesis for Research Question 3.

Chapter 5 presents the summary, conclusion, and discussion of the research findings. A number of potential reasons are presented to explain significant relationships and results found in this study. The following chapter also provides a discussion of the study limitations and the implications this study holds for theory, nutrition education practices, and future research.

CHAPTER 5: Discussion

Data from 216 urban, low-income African-American adolescents were used in this secondary analysis to determine whether socio-cognitive and environmental factors at the personal, social, and community levels of environment significantly influenced adolescent diet quality in this sample. This chapter presents a discussion of the research findings as they relate to adolescent diet quality and the limitations of this study. Outlined in this chapter are the contributions this study made to the field of behavioral nutrition research, as well as the implications these study results have for health behavior theory, nutrition education practice, and future research.

Discussion of Survey Data and Psychometric Testing

With the exception of the HEI-2005, all summed scales used in this research were found to have good internal consistency, indicating items in each scale were measuring the same unidimensional, latent construct. The HEI-2005 was designed as an instrument to measure various divergent dietary components, in so much that achieving a diversity of dietary components translates into higher HEI-2005 diet quality scores. Diet quality is, by definition, a multi-dimensional construct measuring twelve different food categories.

Validity testing has confirmed the multidimensional nature of the diet quality construct measured by the HEI-2005. The key recommendations outlined in the 2005 Dietary Guidelines for Americans are accurately reflected in the HEI-2005 subscale components indicating good content validity. Face validity testing of the instrument has shown the HEI-2005 not only reflects the current Dietary Guidelines but also

confirms that there are numerous diets that can be rated as better or worse in diet quality that are represented in HEI-2005 scores ranging between the highest and lowest scores (Guenther, Reedy, Krebs-Smith, & Reeve, 2008).

The HEI-2005 well captured the theoretical construct of a high quality dietary intake. It demonstrated excellent construct validity when achieving perfect or near perfect scores after analyzing dietary models of healthy eating patterns represented by MyPyramid and Dietary Approaches to Stop Hypertension (DASH) menus (Guenther, et al., 2007). In this investigation, the HEI-2005 demonstrated good concurrent validity in its relationship to micronutrients important to adolescent health and development.

Discussion of Descriptive Data

The majority of the participants in this study were adolescents aged 11 to 13 years, and most participants lived in a female-led, single-parent household. Children in homes with female-head of household have the highest national rates of food insecurity (Chilton, et al., 2007). Living in a single-parent home has also been shown to be adversely related to diet quality among both white and African-American adolescent females compared to girls living in a two-parent household (Kronsberg, et al., 2003). Counter to these expectations, this study did not find a difference in diet quality between adolescents who lived in female-led households compared to those living in a two-parent home. It is possible that the lack of an association between diet quality and living in a female-led single-parent household in this study may be due to the modest sample size. Compared to the 2,379 subjects recruited to participate in the Kronsberg et al, study cited above, the sample size of this investigation was 216

subjects and may not have had the statistical power to detect subtle differences in diet quality by household status.

Most participants' parents in this study were overweight or obese. Diet quality may be adversely affected when one or both parents are overweight. The Social Cognitive Theory (SCT) construct *observational learning* detected significant parental dietary influences in this study, indicating children and adolescents learn eating behaviors through observing parental dietary patterns. Research shows that the diets of children and adolescents tend to resemble those of their parents (Beydoun & Wang, 2009), and overweight parents consuming a poor quality diet containing excess calories are likely to share these dietary behaviors and food choices with their children (Larson, et al., 2008), modeling poor eating habits and increasing availability of less nutritious foods in the home that could compromise adolescent diet quality. As the research indicates, overweight and obese parental weight in this study positively correlated with adolescent BMI.

More than half of participant households lived at or below the poverty line, with almost a third of the sample determined to be food insecure. Food insecurity can negatively impact adolescent diet quality (Bhattacharya, et al., 2004). People living in disadvantaged neighborhoods in households with lower median incomes have been associated with less healthy dietary intakes compared to those living in more affluent areas (Diez-Roux, et al., 1999). Although there was not a difference in diet quality among those in this study living above or below the poverty line, this was a low-income sample with the majority of participants' households living in poverty. It is possible that this sample may have been too homogeneous to detect a significant

difference in diet quality when subjects' household incomes had little variation, with 91% of this sample reporting family income below \$40,000 annually and were classified as impoverished. The data from this study indicated virtually all participants had diets that were either poor or needed improvement.

Baltimore City has been described as an urban food desert because many grocery stores have migrated to the outskirts of the city into suburban areas in recent years (Klein, 2002). Participant households in this study determined to be food insecure were found to be more likely to shop at corner convenience stores for food. Limited economic resources would make traveling to distant grocery stores less likely for most households; so shopping at neighborhood corner convenience stores may have been the only affordable means of securing household food supplies for this low-income sample.

Most participant caregivers reported shopping at a grocery store once every two weeks, and the majority reported shopping at convenience stores on a daily basis. Having multiple people sharing household resources was also found to be associated with convenience store shopping. Even if participant families had additional economic resources like food stamps to buy food, lack of transportation resources and funds to procure food at suburban grocery stores may have left shopping at convenience stores as the default choice. When left with convenience stores as the predominant source of household food, accessibility to a variety of nutritious foods in Baltimore becomes limited (Dodson, et al., 2008).

Bivariate relationships from this sample indicated that reliance on convenience stores for food had an adverse relationship to family food security and

adolescent nutrition knowledge. In addition, multiple people living in the home and sharing household resources was associated with convenience store shopping.

Inadequate nutrition knowledge may detrimentally affect quality of diet if it leads to the purchase of nutrient-poor foods typically found in convenience stores.

Discussion of Nutrition Behaviors

Several nutrition behaviors were related to diet quality in this study. Skipping breakfast proved to be detrimental to participants' diet quality, but only a small percentage of participants engaged in this dietary behavior. Eating away from home is another dietary behavior that can have a negative impact on diet quality in adolescents. Diet quality is adversely affected when adolescents choose to eat high-fat, calorie-dense fast food, which is the predominant type of restaurant found in low-income, African-American urban areas (Powell, Chaloupka, et al., 2007).

The majority of adolescents in this sample reported eating away from home no more than twice a week. The infrequency of eating away from home conforms to the expectation that members of low-income households would have limited economic resources to allow adolescents to eat out more often.

Females had higher nutrition knowledge scores when compared to males in the study. Pirouznia (2001) found a correlation between nutrition knowledge and healthy food choices among girls in seventh and eighth grades, which confirms these results. While Pirouznia (2001) contends that girls' are preoccupied with body weight and appearance at an earlier age than boys, which may motivate girls to learn more about nutrition, it was unclear whether any African-American girls participated in the previous study.

Older adolescents reported consuming significantly more grain products such as breads, cereals, rice, and pastas when compared to their younger counterparts in this study. Perhaps older adolescents ate more starchy carbohydrates in response to their increasing physiologic caloric need translated into larger appetites, driving them to fill up on relatively inexpensive and readily available sources of calories.

Compared to national data, this study sample had better diet quality than one would expect from low-income adolescents. When compared to the diet quality of low-income children aged two to eighteen years from a national nutrition survey, this sample had higher overall diet quality (56.4 versus 62.3, respectively) and higher diet quality component scores except for total grains, milk, and meat and beans. Not only did adolescents in this study appear to have better diet quality than other low-income children, but they also had superior diet quality when compared to children and adolescents from higher income families (Guenther et al., 2008). The weakest areas of diet quality in this study sample were total grains, milk, and meat and beans, although there was only a small deficit in each component score when compared to national averages. Other areas of diet quality in this sample were relatively strong compared to national data. The sample's component scores were somewhat higher than national averages for total fruit, total vegetables, total grains, whole grains, and saturated fat, and appreciably higher than average for whole fruit, dark green and orange vegetables and legumes, oils, sodium, and SoFAAs. Although the results are striking, interpretation should be tempered because this is not a direct comparison; this national nutrition data included children aged two to eighteen years and represented different ethnicities. Without a similar comparison sample, it is difficult

to determine why this study sample's diet quality differed so unexpectedly from national averages for diet quality.

Discussion of Research Questions

Research Question 1: Contribution of dietary influences at the personal, social, and community environmental levels to diet quality.

The most significant finding of this research was that perceived parental influence on adolescent nutrition improved diet quality even when accounting for adolescent gender, their weight status (BMI), parental BMI, and how many people lived in the household and shared resources with the adolescent. When comparing adolescents by age and sex, parental beliefs about nutrition remained a positive influence on quality of diet among younger adolescents and females in the study.

Dividing adolescents participating in this investigation into “younger” and “older” age groups helped account for differences in cognitive and psychosocial developmental stages, which may in part explain why certain SCT sociocognitive factors measured in this study were more influential than others when compared by age group. That most of the younger adolescents had not yet achieved psychological maturity may explain why the parental influence was a significant factor in participants' diet quality. The family mediates children's eating behavior in early adolescence, acting as the main provider of food and shaping children's food habits by conveying food attitudes, patterns, and preferences throughout childhood (Mitchell, 1997). Until adolescents begin to gain a greater degree of autonomy in asserting their own food behaviors and preferences, younger adolescents will tend to rely more on parents for guiding their food decisions. Conversely, older adolescents

exhibit greater autonomy in making more of their own food choices and tend to eat fewer meals at home compared to younger adolescents (Goodwin, et al., 2006).

Perceived parental nutrition beliefs were found to be a significant positive dietary influence on female participants' diet quality in this investigation when compared to males. This study confirmed research where parental modeling of dietary behaviors and attitudes about healthy diet were positively associated with healthy dietary intake in adolescents (Boutelle, et al., 2007).

Children tend to emulate their parents, and the findings of this study illustrate that parental modeling can positively influence adolescent diet. A substantial amount of coaching about behavioral expectations and role performance occurs between a parent and the adolescent, and the ties between parent and child remain close throughout adolescence (Campbell, 1969). This study's findings support the well-established role that parents play in transmitting dietary habits, customs, and food preferences to their children. In Baltimore, studies have shown that African-American adolescents regard their mothers and grandmothers as respected family members who were entrusted with family care and with providing home-cooked meals (Dodson, et al., 2008) and as models for nutrition-related behaviors.

Younger adolescents' diet was positively associated with both parental beliefs about nutrition and by peer eating behaviors. This important finding about perceived parental nutrition beliefs is to be expected of adolescents who have not yet matured cognitively and psychosocially and still rely on their parents not only for food, but also as models for dietary behavior. This study found both parents and peers were influential, possibly because middle-adolescence is a transition period when

adolescents are eating at home most of the time and not yet have achieved adequate independence to spend more time with friends. This reasoning corresponds to research that found peer support for healthy eating was less important to 12- to 15-year old adolescents than family support of healthy eating behaviors, possibly because at this age, adolescents spend more time sharing meals with family than with peers (Ball, et al., 2008).

When comparing adolescents by gender, another notable finding from this study was that peer eating behavior was associated with *increased* adolescent diet quality and remained an important positive influence for male participants. While some adolescents look to parents as role models, other adolescents look to their social surroundings for behavioral cues. In this study, male participants appeared to be influenced by peer eating behaviors to shape dietary behavior more so than females, which is consistent with research suggesting males are afforded more independence earlier in adolescence than females, and have more opportunity to socialize with friends outside the home (Beydoun & Wang, 2009).

Finding peer dietary behaviors as a positive influence appears to be contrary to the generally held belief that peers exert a negative influence on adolescent diet (Evans, et al., 2006). This may be explained by this study's use of a scale to measure peer eating behavior that focused on observed positive dietary behaviors. Perhaps if this study had also focused on both positive and negative dietary behaviors in peers, the results may have shown a decrease in participant diet quality. Peer behavior is a strong dietary influence on adolescents, especially in older adolescents, regardless of directionality. Adolescents emulate the behaviors of friends and popular peers within

their social groups, and they have even been found to have BMIs that correlate strongly with friends' BMI (Renna, Grafova, & Thakur, 2008).

Although both peer eating behaviors and perceived parental beliefs were both significant influential factors in the social environmental level, social environment did not prove to be a singularly significant force associated with adolescent diet quality. No one environmental model played a predominant role in driving dietary behavior among adolescents in this study. Although both socio-cognitive factors were significant, upon closer examination the model effect sizes of both peer and parental dietary influences were small and evidently not strong enough to drive the entire social ecological level to contribute significantly more towards diet quality than the personal or community level models. The majority of models testing the psychosocial correlates of dietary habits have typically accounted for less than 30 percent of the variability in eating behaviors of children, adolescents, and adults (Baranowski, Cullen, & Baranowski, 1999; Cusatis & Shannon, 1996; Story, et al., 2002). Identification of additional factors making the model more parsimonious within the integrated Social Cognitive Theory/ecological model would strengthen these relationships and possibly improve the predictability of the diet quality outcome measure.

Research Question 2: Does adolescents' Self-Efficacy for Healthy Eating moderate the relationship between the variable measuring Perceived Parental Beliefs about Nutrition and the quality of urban African-American adolescents' diets?

This study found self-efficacy for healthy eating practices did not moderate parental influences on adolescents in this sample, nor did it affect parents' influence on diet quality at varying levels of adolescent self-efficacy. Self-efficacy for healthy eating was not associated with adolescent diet quality in this study as a significant dietary influence, so it followed that self-efficacy did not moderate the more powerful normative influence parents had on adolescent diet quality, especially in this minority sample. The adolescent sample used in this study were younger in age and most likely had not yet developed the self-efficacy beliefs common in older, more psychologically mature adolescents (Steinberg, Cauffman, Woolard, Graham, & Banich, 2009).

Numerous studies have shown that healthy dietary behaviors and enhanced fruit and vegetable consumption can be attributed to high levels of self-efficacy (Anderson, Winett, & Wojcik, 2007; Jago, Baranowski, & Baranowski, 2007; Larson, et al., 2008), even among low-income adolescents (Ball, et al., 2008). However, parental modeling of healthy eating behaviors, like consuming fruits and vegetables, has also been related to strong nutritional self-efficacy in adolescents (Granner, et al., 2004), suggesting parental influences on diet remain strong in adolescence.

Research has found that low-income, African-American adolescents reported high self-efficacy for consuming fruits and vegetables, although self-efficacy for healthy eating was not found to be a motivation for eating healthfully among young male African-American adolescents (Molaison, et al., 2005). The finding by Molaison and colleagues that self-efficacy for healthy eating did not influence diet in male African-American adolescents was confirmed in this investigation.

Lower self-efficacy may also be a function of racial differences. Large racial and socioeconomic disparities exist for nutritional self-efficacy in adolescents (AbuSabha & Achterberg, 1997; Fahlman, McCaughtry, Martin, & Shen, 2010). This study's findings were consistent with research that found low-income urban, African-American adolescents reported significant differences in their self-efficacy to choose healthy food options at a fast food restaurant when compared to the self-efficacy of higher income, white adolescents (Fahlman, et al., 2010).

Sometimes higher levels of self-efficacy for eating healthfully are dependent on having access to a variety of healthful foods (O'Dea & Wilson, 2006). The ineffectiveness of self-efficacy to help this sample of African-American adolescents choose a healthy diet may be a consequence of living in a disadvantaged, inner-city community with limited economic resources and limited healthy food options. Living in a food insecure environment may shift adolescents' emphasis from the ability to consume healthy foods to the ability to consume adequate amounts of food. Environmental social stressors such as crime, high unemployment, drug and alcohol abuse, and homicide associated with living in economically disadvantaged communities have adverse effects on diet and health (Williams & Collins, 2001).

Baltimore adolescents viewed their neighborhoods as physically dangerous environments where violence and gunfire were common (Dodson, et al., 2008). Adolescents living in East Baltimore cite drugs, crimes, homelessness, homicides, and HIV as issues of concern for them when considering trips to the neighborhood grocery or convenience store. Living in a dangerous area of the city may limit adolescents' willingness to venture far to seek healthy food and can curtail their

dietary choices (Dodson, et al., 2008) and may render self-efficacy for eating healthy an intangible, idealistic concept for them.

Research Question 3: Does adolescents' Self-Efficacy for Healthy Eating moderate the relationship between the variable measuring Peer Eating Behaviors and the quality of urban African-American adolescents' diets?

This study found that self-efficacy for healthy eating practices did not moderate peer dietary influences on adolescents in this sample. Social growth and the development of social skills increase throughout puberty (Campbell, 1969). Later adolescence is a period where self-efficacy increases as the adolescent becomes more mature and has accrued experience testing their abilities and building confidence through practicing adult behaviors (Campbell, 1969). Self-efficacy is developed through the successful repetition of a specific task or behavior that slowly changes the adolescent's performance expectations (Baranowski, et al., 1997).

In this investigation, self-efficacy for healthy eating was not an effective moderator of peer dietary influences. Perhaps we see the failure of self-efficacy to be a strong dietary influence because the majority of adolescents in this study were younger in age and in an earlier stage of psychological maturity. The immature psychosocial self-regulatory system in middle adolescence has not developed adequately for the adolescent to resist peer influence (Steinberg, 2009), and the teen has had inadequate experience practicing autonomous dietary behaviors to as yet build a strong sense of dietary self-efficacy. Therefore, probable psychological

immaturity in many of the younger adolescents in this study may explain why peer influence was stronger than the adolescents' sense of nutritional self-efficacy.

Limitations of this Study

There are several limitations of this study. The overarching purpose of this investigation was to explore socio-cognitive factors delegated to ecological levels that were hypothesized to influence adolescent diet quality among a sample of low-income, African-American adolescents living in an inner-city environment. A cross-sectional study design was chosen using baseline Challenge study data to capture a naturalistic ecological perspective of dietary influences in an urban setting prior to exposing the study sample to a health promotion and obesity prevention intervention. The cross-sectional design was a limitation of this study because it precluded conclusions about causal relationships derived from the sample, and only allowed the researcher to make conclusions about the relative strength of associations between predictor and outcome variables.

Another limitation of the study was the possibility of self selection bias. Data were derived from a non-probability sample of self-selected, non-randomized individuals collected as a convenience sample taken from a sampling frame of low-income, minority adolescents living in and around West Baltimore.

Social desirability bias can be problematic when collecting sensitive information about personal behavior, self-efficacy, and food choices from study participants. Instead of answering truthfully, participants and caretakers may have provided socially acceptable responses to questions about household income, the

types of food reported in the home, number and relationships of people living in the household, and the quality and amount of food consumed.

An examination of the tally of foods reported on the Home Food Inventory by adolescents' caretakers prompts one to suspect socially desirable answers may have been provided. Results from Home Food Inventory survey instrument revealed that the three food categories with the highest number of items were vegetables, fruit, and dairy. It was unexpected to see the most prevalent foods in the household were healthy items, when the majority of adolescents surveyed had diet quality characterized as "poor" or "needs improvement," making the validity of this measure somewhat questionable. Although responses to this measure may have been biased by social desirability, the Home Food Inventory was not related to the study outcome.

Collecting survey data from an adolescent sample was a study limitation. Either intentionally or unintentionally, some adolescents may not have answered questions accurately. A few adolescents reported extremes in food consumption on the Youth and Adolescent Food Frequency Questionnaire (YAQ). Since kilocalories and the outcome measure were both estimated from YAQ data, these outlier cases were dropped from the analysis.

Measuring self-efficacy in an adolescent population was also a limitation of this study. Self-efficacy can be a validity issue in adolescent research because individuals going through puberty are immersed in the formative process of shaping their perceptions about their personal efficacy, and this perception can modulate depending on their stage of psychological development and age (Pajares, 2006).

The data for this study were self-reported, possibly contributing to a low response rate for some groups of survey items. Self-administered surveys have the advantages of lower cost and the elimination of interviewer bias, but self-administered surveys typically have a lower response rate and a tendency for partial or incomplete responses. When reviewing the completed survey, it was impossible to determine whether participants skipped items because they did not understand the question, or felt uncomfortable about answering self-efficacy questions about healthy eating behaviors, wanted to skip ahead to complete the survey faster, or simply got bored. Participants sometimes skip questions when they lack clarification of confusing or complex questions without having an interviewer administering the instrument (Margetts, 1991).

Missing data was also a limitation of this study. This study had missing data for survey items used to compile scales for nutrition self-efficacy, perceived parental beliefs about nutrition, and peer eating behaviors. Due to the modest sample size, a multiple imputation data replacement strategy was conducted to minimize loss of additional cases. There are a number of reasons to explain missing data values. The scale items that had missing values asked participants about personal behaviors and beliefs that may have made the adolescent uncomfortable, such as questions about their sense of self-efficacy in making autonomous decisions about consuming healthy foods, compliance in heeding parental advice about making food choices, and modeling their own actions on peer eating behaviors. It is also possible that some adolescents may have arbitrarily skipped over questions that did not particularly interest them.

Misclassification of dietary intake data is a persistent problem in nutritional epidemiological studies affecting all types of dietary measurements (Clayton & Gill, 1991). In this study, this occurred because of a weakness in the survey instrument itself. When coding the YAQ for HEI-2005 scoring, there were only two items on the YAQ that could have been coded as whole grain: “dark bread” and “other grains, like kasha, couscous, or bulgur.” We may have been able to capture a more accurate representation of adolescent diet quality had the YAQ included additional foods made from whole grain products.

The small sample size of this study was also a limitation. The majority of adolescents in this sample were younger in age, leaving the older age category with less than 23% of the sample represented. It is possible the category representing older adolescents was not large enough to detect significant differences among select sociocognitive factors (e.g. self-efficacy) that were hypothesized to influence diet quality in this sample. The racial and socioeconomic homogeneity of this study sample may have also limited the number of significant findings. The entire sample consisted of low-income, African-American adolescents and may not have provided sufficient variance within study variables to produce statistical significance while answering the research questions addressed in this investigation. A final limitation of this study is that findings may only be generalizable to low-income, African-American adolescents in urban areas within the mid-Atlantic United States, or to Baltimore, Maryland, in particular.

Study's Contribution to the Field of Public Health

There have been numerous research studies and nutrition interventions designed to improve adolescent nutrition, but none to date have employed an integrated Social Cognitive Theory/ecological theoretical model to explore the personal, social, and community factors influencing adolescent diet quality as seen through an ecological lens. In recent years, nutrition researchers have discovered that the community environment itself plays a role in determining the variety, scope, and quality of food choices available to people living in those neighborhoods. As nutrition researchers increase their understanding of how ecological factors affect diet quality, this integrated theoretical approach will prove a valuable tool to help understand the intricate interplay of influences between adolescent nutrition knowledge and beliefs, social, and parental pressures to make food choices, and the food environment that characterize adolescents' neighborhoods and communities (Brug, Kremers, van Lenthe, Ball, & Crawford, 2008).

This investigation is the first time the HEI-2005 has been used to analyze data from the Youth and Adolescent Food Frequency Questionnaire. The HEI-2005 was originally designed to estimate diet quality from 24-hour food recall records, and it now has been modified to analyze diet quality from food frequency questionnaires (Savoca et al., 2009). Recently this author collaborated with researchers at the University of Maryland in Baltimore to modify the HEI-2005 scoring protocol to assess diet quality from the YAQ questionnaire (Wroblewski, Hurley, Oberlander, Merry, & Black, 2010). This investigation was the first time the HEI-2005 has been

validated on a dietary data collection tool designed specifically for children and adolescents.

This is the first time the HEI-2005 has been validated for use on a low-income, African-American adolescent population. Because of its limited use in the past as an instrument that could only analyze diet quality from 24-hour diet recalls, the HEI-2005 has not been extensively tested in a large number of research studies. To date, the HEI-2005 has only been validated as a tool to assess the diet quality of adults, older adults, and aggregate population samples. This study is the first validation of the HEI-2005 on a sample of African-American adolescents.

The relationships uncovered by this research have shed light on some of the interpersonal influences that helped shape diet quality among low-income, African-American adolescents. Parental and peer influences were hypothesized to contribute to adolescent diet, but finding that these two socio-cognitive factors, and not self-efficacy, as the primary significant predictors of diet quality in this sample will be useful in planning future interventions targeting low-income, urban African-American youth.

Future Implications for Theory, Research, & Practice

A logical next step would be to confirm this study's findings on Challenge follow-up data to determine whether intervention-driven changes in dietary behaviors related to improved diet quality among adolescents receiving the intervention. In practice, the findings from this study will allow nutrition educators and research

interventionists to tailor their behavior change strategies to improve the diet quality of minority urban teens.

Future formative research could provide strategies and ideas for tailoring interventions incorporating parental and peer modeling to more effectively change adolescent dietary behaviors. Development of research strategies involving community leaders and adolescent peer role models can enhance “buy-in” of the community and study participants to accept and engage in nutrition interventions.

Future research could apply the integrated Social Cognitive Theory and ecological theoretical model to further explore the environmental influences community and the built environment has on diet quality. Inner-city residents living in impoverished areas have limited access to grocery stores and healthy foods as indicated by the food shopping habits reported in this study. Improving the diet quality of poor, urban residents may require changing the “food landscape” environment of inner-cities, especially in areas recognized as food deserts. Environmental interventions changing availability of nutritious foods in city neighborhoods while incorporating the SCT constructs of observational learning (parental and peer influence) and behavioral capability (nutrition knowledge) would increase availability of healthy foods to more disadvantaged residents. For example, Baltimore has an initiative to establish community gardens in the city to improve neighborhood accessibility to fresh produce for city residents (Scharper, 2010). The gardens would also encourage children and high school students to increase vegetable consumption, and correspond with Michele Obama’s national initiative to improve childhood nutrition and health (Let’s Move Campaign, 2010). Interventions affecting

the community environment while exposing more adolescents to fresh produce will not only enable healthier adolescent eating habits, but it may also help them improve the quality of their friends' nutrition by acting as peer role models when they practice healthy food behaviors.

Incorporating the SCT observational learning construct into interventions to enhance peer and parental influence may not only improve adolescent diet quality but also may advance their nutrition knowledge. This study suggested that nutrition knowledge remains a useful tool related to social dietary influences although future study needs to explore the relationship nutrition knowledge has to parental and peer influence and to devise strategies to better understand how nutrition knowledge can improve diet through social influences.

If replicated, this study could be improved by collecting higher quality, more sensitive information about community-level environmental dietary influences. This study could have been strengthened with the inclusion of data describing the number and density of food outlets in West Baltimore at the time of the original investigation, details about Challenge study subjects' participation in the National School Breakfast and Lunch Program, and information about when the Home Food Inventory was conducted in relation to when the family received food stamps. It would have been beneficial to have information about whether the adolescents' caretaker purchased food from sources other than grocery or corner convenience stores, like farmer's markets, or Arabbers, who are roving fruit and vegetable vendors in Baltimore. This study could have also collected data about whether the household received food from alternate sources in the community such as food pantries and religious out-reach food

programs or whether the family received foodstuffs from a family member's participation in the Supplemental Food and Nutrition Program for Women, Infants, and Children (WIC).

Finally, future research needs to test the integrated Social Cognitive Theory /ecological theoretical model on larger adolescent samples expanded to encompass a wider range of racial and socioeconomic variability. Such studies are needed to confirm these results and to improve the generalizability of these study findings for broader application in nutrition education research and practice.

Study Summary

Maintaining a good quality diet is challenging for African-American youth living in an economically disadvantaged urban community. Limited family food resources, living in a single-parent household, and the possibility of food insecurity can make maintaining a nutritious diet difficult. In addition to the environmental and economic barriers limiting access to nutritious food, adolescents must also face the realities of living in a dangerous environment where crime, homelessness, violence, and drug abuse are real considerations before making a trip to the neighborhood corner convenience store, which may be the only available outlet to purchase food.

Despite the challenges of living in a low-income community, African-American adolescents in Baltimore appeared to have strong social bonds, identifying with family and friends when making dietary decisions. Perhaps the social environment is the reason why African-American adolescent diet quality was better in this study than national data would suggest or predict. This study showed low-income, African-American youth look to their parents and peers for cues to choose

healthy foods. Combined with nutrition knowledge, this study confirms that social influences from parents and peers positively relates to adolescents' diet quality. Therefore, health and nutrition interventions must consider these social influences when addressing the diet quality of minority, urban adolescents.

There have been very few studies using an integrated Social Cognitive Theory /ecological model to explore the dietary influences on adolescent nutrition, especially with this demographic. The significant influence the SCT construct of observational learning has on adolescents was evidenced in this study by the positive relationship found between diet quality, parental beliefs about nutrition, and peer eating behavior. The extent of dietary influence attributed to parents or peers appeared to be differentially affected by the adolescent's stage of psychological maturity, as proxy by age group, and their gender. Younger participants in early adolescence and females were predominantly guided by their parents' beliefs about nutrition, while males in this study appeared to identify more with their peers' nutrition-related behavior.

This study revealed that parents play an important role in African-American adolescents' food choices affecting the quality of their diet. Nutrition interventions should focus on parent-teen interactions and on improving the dietary habits of parents so they may be more effective role models for youth. Nutrition promotion research targeting young African-American men may consider using group interactive behavioral interventions with peers that build and reinforce peer modeling of positive nutrition behaviors.

Using theory as a guide, the overarching goal of this investigation was to better understand the interplay of nutrition-related influences guiding urban, African-American adolescents to make healthy food choices, so that we can use this information to lay the groundwork for developing new nutrition education strategies and tools to improve the diet quality of this nutritionally challenged population. This study provided evidence that using a multi-level, integrated theoretical approach to assessing diet quality can be an effective means of identifying the socio-cognitive factors that act as effective motivators of this group of under-served, African-American adolescent youth.

Appendices

APPENDIX A:

Youth/Adolescent Food Frequency Questionnaire (YAQ)

[Please refer to: Rockett, H. R. H., Wolf, A. M., & Colditz, G. A. (1995).

Development and reproducibility of a food frequency questionnaire to assess diets of older children and adolescents. *J Am Diet Assoc.*, 95, 336-340.]

APPENDIX B:

Nutrition Knowledge Scale

The following questions will ask you about your food choices, eating a healthy diet, and physical activity choices. Please answer each question to the best of your ability.

202. Which food has more fat?

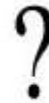


1. Meat fried in a pan

2. Meat cooked on a grill

3. Don't know

203. Which food has more fat?

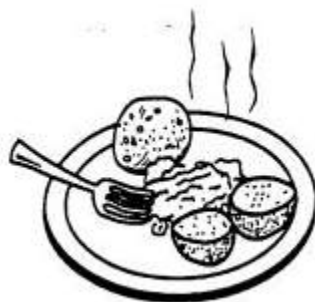


1. Corn with no butter

2. Corn with butter

3. Don't know

204. Which food has more fat?



1. Boiled potato

2. Fried potato

3. Don't know

205. Which food has more fat?



1. Cold cereal



2. Fried eggs



3. Don't know

206. Which would you pick as a snack?



1. Potato chips

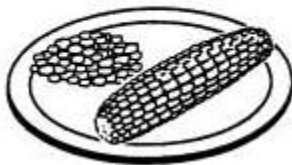


2. Pretzels

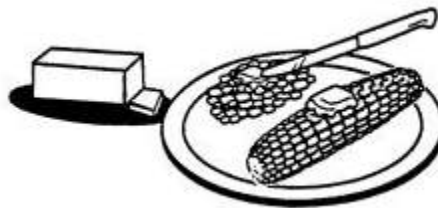


3. Don't know

207. Which would you do?



1. Eat corn with no butter



2. Eat corn with butter



3. Don't know

208. Which would you choose?



1. Popsicle



2. Ice cream



3. Don't know

209. Which would you chose for breakfast?



1. Eggs, bacon



2. Cold cereal



3. Don't know

210. Which would you order at a fast-food restaurant?



1. Regular hamburger

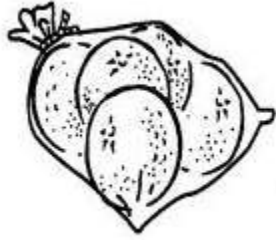


2. Extra big hamburger



3. Don't know

211. Which food would you ask the adults in your house to buy?

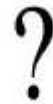
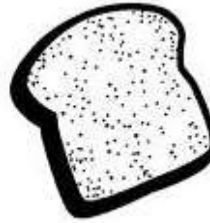
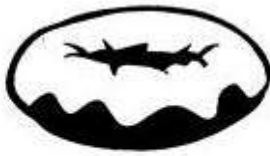


1. Bag of oranges

2. Bag of corn chips

3. Don't know

212. Which would you chose to eat in the morning?



1. Donut

2. Toast with no butter

3. Don't know

213. Which would you chose to drink?



1. Diet soda

2. Regular soda

3. Don't know

- 214. Which kinds of foods are the most healthy to eat every day?**
- Foods with no fats or very little fat
 - Foods that are fried
 - Foods that have butter or margarine added to them
- 215. Which lets you know that you are doing an exercise that is healthy for your body?**
- Breathing harder
 - Getting dizzy
 - Becoming sleepy
- 216. Which food has the lowest amount of fat?**
- Pretzels
 - Donuts
 - Potato chips
- 217. Which kind of milk has the lowest amount of fat?**
- Whole milk
 - Skim milk
 - 2% milk
- 218. Which of these breakfasts has the lowest amount of fat?**
- Cereal and low fat milk
 - Fried eggs and bacon
 - Pancake and sausage
- 219. Which will get rid of the most fat in ground meat before you eat it?**
- Fry the ground meat until well done
 - Cook the ground meat without using oil
 - Cook the ground meat, drain it, and rinse it with hot water
- 220. Which is the best way to help friends get more exercise?**
- Ignore them
 - Tell them some things you do to get exercise
 - Become their exercise partner
- 221. Which will have the lowest amount of fat?**
- A hamburger with cheese
 - A hamburger with lettuce, tomato and pickle
 - A hamburger with fries
- 222. Which of these foods has the lowest amount of fat?**
- Fried chicken
 - Green vegetables
 - Chocolate candy

223. Which is the best way to make sure you exercise at least 15 minutes each day?

- Wait until you feel like exercising and have some spare time
- Exercise whenever you can find the time during the week
- Plan for when and where you will exercise each day

224. It is recommended that every day you eat at least how many servings of fruits and vegetables?

- One serving of fruit and one serving of vegetables
- Two servings of fruits and three servings of vegetables
- One serving of fruit or one serving of vegetables, but not both

225. Which is best for a low fat, every day snack?

- Pretzels
- Ice cream bar
- Sunflower seeds

226. How much sugar is in a can of most kinds of regular soda?

- About 40 grams or 10 teaspoons of sugar
- About 100 grams or 25 teaspoons of sugar
- Most regular pop has little or no sugar

227. Which is the best way to know for sure whether a food has a lot of fat?

- Look for signs of fat on the food label
- Look for the number of grams of fat listed on the nutrition facts
- Taste the food to see if it tastes like it has a lot of fat in it

228. Which of the following contains no fat?

- Fried potato
- Potato chips
- Raw potato

APPENDIX C:
Home Food Inventory

Please use this checklist to tell us which foods are present in your home **right now**.

- Place a check in the
 - “Yes” box when you find a food.
 - “No” box if a food is not present.

Milk/Dairy

- | Yes | No | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Whole Milk (Red top or Vitamin D Milk) |
| <input type="checkbox"/> | <input type="checkbox"/> | Low Fat Milk (2%) |
| <input type="checkbox"/> | <input type="checkbox"/> | Low Fat (1%) or Buttermilk |
| <input type="checkbox"/> | <input type="checkbox"/> | Skim Milk |
| <input type="checkbox"/> | <input type="checkbox"/> | Low Fat Yogurt |
| <input type="checkbox"/> | <input type="checkbox"/> | No Fat Yogurt |
| <input type="checkbox"/> | <input type="checkbox"/> | Sour Cream & Sour Cream Dips |
| <input type="checkbox"/> | <input type="checkbox"/> | Light or Low fat Sour Cream & Sour Cream Dips |
| <input type="checkbox"/> | <input type="checkbox"/> | Cream or Half & Half |
| <input type="checkbox"/> | <input type="checkbox"/> | Regular Ice Cream |
| <input type="checkbox"/> | <input type="checkbox"/> | Low Fat or Light Ice Cream & Frozen Yogurt |
| <input type="checkbox"/> | <input type="checkbox"/> | Butter |
| <input type="checkbox"/> | <input type="checkbox"/> | Margarine |
| <input type="checkbox"/> | <input type="checkbox"/> | Other (please
list) _____ |



Cheese

- | Yes | No | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Regular Cottage Cheese |
| <input type="checkbox"/> | <input type="checkbox"/> | Low Fat Cottage Cheese |
| <input type="checkbox"/> | <input type="checkbox"/> | Regular Cream Cheese |
| <input type="checkbox"/> | <input type="checkbox"/> | Light Cream Cheese |
| <input type="checkbox"/> | <input type="checkbox"/> | Velveeta, other Cheese foods & spreads, Cheddar, American, Swiss or
Monterey Jack, or Mozzarella Cheese |
| <input type="checkbox"/> | <input type="checkbox"/> | Diet Cheese (such as Lite-n-Lively or Weight Watchers) |
| <input type="checkbox"/> | <input type="checkbox"/> | Other (please
list) _____ |

Salad Dressing

- | Yes | No | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Regular Salad Dressing (including Miracle Whip) |

- Reduced Calorie, Low Fat, Light Salad Dressing
- Regular Mayonnaise
- Low Fat or Light Mayonnaise
- Other (please list)_____

Cereal & Breakfast Foods



- | Yes | No | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Oatmeal (includes instant and packets of oatmeal) |
| <input type="checkbox"/> | <input type="checkbox"/> | Waffles (including fresh or frozen) |
| <input type="checkbox"/> | <input type="checkbox"/> | Cheerios |
| <input type="checkbox"/> | <input type="checkbox"/> | Bagels |
| <input type="checkbox"/> | <input type="checkbox"/> | Poptarts |
| <input type="checkbox"/> | <input type="checkbox"/> | Cream of Wheat |
| <input type="checkbox"/> | <input type="checkbox"/> | Cereal Bars (like NutriGrain bars) |
| <input type="checkbox"/> | <input type="checkbox"/> | Corn, Oat, or Wheat Flake Cereals (like Cornflakes or Wheaties) |
| <input type="checkbox"/> | <input type="checkbox"/> | Sweetened Cereals (like Lucky Charms, Froot Loops, Cap'n Crunch, Trix, Sugar Pops) |
| <input type="checkbox"/> | <input type="checkbox"/> | Other types of Cereal (please list)_____ |

Bread, Pasta, Rice

- | Yes | No | |
|--------------------------|--------------------------|------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | Whole Wheat Bread or Rolls |
| <input type="checkbox"/> | <input type="checkbox"/> | White Bread or Rolls |
| <input type="checkbox"/> | <input type="checkbox"/> | Ramen Noodles or Oodles of Noodles |
| <input type="checkbox"/> | <input type="checkbox"/> | Macaroni and Cheese |
| <input type="checkbox"/> | <input type="checkbox"/> | Brown or Wild Rice |
| <input type="checkbox"/> | <input type="checkbox"/> | White Rice |
| <input type="checkbox"/> | <input type="checkbox"/> | Pasta (like macaroni or spaghetti) |
| <input type="checkbox"/> | <input type="checkbox"/> | Other (please list)_____ |

Baked Goods/Sweets

- | Yes | No | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Snack Cakes (honey buns, Little Debbie, Starcrunch etc.) |
| <input type="checkbox"/> | <input type="checkbox"/> | Donuts |
| <input type="checkbox"/> | <input type="checkbox"/> | Cookies (like Oreos or chocolate chip cookies) |
| <input type="checkbox"/> | <input type="checkbox"/> | Snack Pies |

- Muffins
 Candy (any candy)
 Other (please
list) _____

Vegetables (Fresh, Frozen or Canned)

- | Yes | No | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Lettuce or bagged salad |
| <input type="checkbox"/> | <input type="checkbox"/> | Potato (including French fries or hash browns) |
| <input type="checkbox"/> | <input type="checkbox"/> | Corn |
| <input type="checkbox"/> | <input type="checkbox"/> | Brussels Sprouts |
| <input type="checkbox"/> | <input type="checkbox"/> | Peas |
| <input type="checkbox"/> | <input type="checkbox"/> | Carrots |
| <input type="checkbox"/> | <input type="checkbox"/> | Cauliflower |
| <input type="checkbox"/> | <input type="checkbox"/> | Sweet Potato |
| <input type="checkbox"/> | <input type="checkbox"/> | Broccoli |
| <input type="checkbox"/> | <input type="checkbox"/> | Cabbage |
| <input type="checkbox"/> | <input type="checkbox"/> | Celery |
| <input type="checkbox"/> | <input type="checkbox"/> | Spinach |
| <input type="checkbox"/> | <input type="checkbox"/> | “Greens” (collard, mustard, kale, Swiss chard) |
| <input type="checkbox"/> | <input type="checkbox"/> | Green Beans |
| <input type="checkbox"/> | <input type="checkbox"/> | Squash (zucchini, pumpkin) |
| <input type="checkbox"/> | <input type="checkbox"/> | Mixed Vegetables |
| <input type="checkbox"/> | <input type="checkbox"/> | Turnips |
| <input type="checkbox"/> | <input type="checkbox"/> | Tomatoes |
| <input type="checkbox"/> | <input type="checkbox"/> | Other vegetables (please list) |
-



Fruits (Fresh, Frozen or Canned)

- | Yes | No | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Apples |
| <input type="checkbox"/> | <input type="checkbox"/> | Applesauce |
| <input type="checkbox"/> | <input type="checkbox"/> | Berries (strawberry, blueberry, blackberry) |
| <input type="checkbox"/> | <input type="checkbox"/> | Oranges |

- Grapes
- Bananas
- Mangoes
- Melon
- Peaches/Nectarines
- Pears
- Plantains
- Canned Fruits or Fruit Cocktail
- Other (please list)



Meat (Fresh or Frozen)

- | Yes | No | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Lean or Extra Lean Ground Beef |
| <input type="checkbox"/> | <input type="checkbox"/> | Regular Ground Beef |
| <input type="checkbox"/> | <input type="checkbox"/> | Sausage |
| <input type="checkbox"/> | <input type="checkbox"/> | Bacon |
| <input type="checkbox"/> | <input type="checkbox"/> | Eggs |
| <input type="checkbox"/> | <input type="checkbox"/> | Lunch meat (such as bologna, turkey, ham, corned beef) |
| <input type="checkbox"/> | <input type="checkbox"/> | Hot Dogs |
| <input type="checkbox"/> | <input type="checkbox"/> | Pork (such as pork chops, fat back, or chittlins) |
| <input type="checkbox"/> | <input type="checkbox"/> | Chicken (such as chicken leg, wings, nuggets, or chicken breast) |
| <input type="checkbox"/> | <input type="checkbox"/> | Tuna Fish (canned) |
| <input type="checkbox"/> | <input type="checkbox"/> | Fresh Fish or fish sticks |
| <input type="checkbox"/> | <input type="checkbox"/> | Other (please |
- list) _____

Snacks and Crackers

- | Yes | No | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Chips (includes potato and corn chips, cheese curls) |
| <input type="checkbox"/> | <input type="checkbox"/> | Pretzels |
| <input type="checkbox"/> | <input type="checkbox"/> | Crackers |
| <input type="checkbox"/> | <input type="checkbox"/> | Granola Bars |
| <input type="checkbox"/> | <input type="checkbox"/> | Candy |
| <input type="checkbox"/> | <input type="checkbox"/> | Pudding/Jell-O |
| <input type="checkbox"/> | <input type="checkbox"/> | Fruit Snack (like fruit roll) |
| <input type="checkbox"/> | <input type="checkbox"/> | Other (please |
- list) _____



Beans

- | Yes | No | |
|--------------------------|--------------------------|-----------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | Dried peas, beans, or lentils |
| <input type="checkbox"/> | <input type="checkbox"/> | Canned beans |
| <input type="checkbox"/> | <input type="checkbox"/> | Refried beans or chili with beans |
| <input type="checkbox"/> | <input type="checkbox"/> | Other (please |
- list) _____

Beverages

- | Yes | No | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Regular Soda |
| <input type="checkbox"/> | <input type="checkbox"/> | Diet Soda |
| <input type="checkbox"/> | <input type="checkbox"/> | Bottled/ Filtered Water |
| <input type="checkbox"/> | <input type="checkbox"/> | Fruit Juice (20% juice or more) |
| <input type="checkbox"/> | <input type="checkbox"/> | Fruit Juice (Less than 20% juice) |
| <input type="checkbox"/> | <input type="checkbox"/> | Iced tea or lemonade |
| <input type="checkbox"/> | <input type="checkbox"/> | Kool-Aid Hugs Punch or orange or grape drink |
| <input type="checkbox"/> | <input type="checkbox"/> | Other (please |
- list) _____



Thank you for completing the Home Food Inventory!

APPENDIX C:
Household Food Security

Following are some statements people have made about their food situations. Please indicate how the statement applied to your household in the last 12 months.

1. We worried whether our food would run out before we got money to buy more.
 - Often true
 - Sometimes true
 - Never true
 - Don't know

2. The food that we bought just didn't last and we didn't have money to get more.
 - Often true
 - Sometimes true
 - Never true
 - Don't know

3. We couldn't afford to eat balanced meals.
 - Often true
 - Sometimes true
 - Never true
 - Don't know

4. We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food.
 - Often true
 - Sometimes true
 - Never true
 - Don't know

5. We couldn't feed our children a balanced meal because we couldn't afford that.
 - Often true
 - Sometimes true
 - Never true
 - Don't know

6. My/our children are not eating enough because we couldn't afford enough food.
 - Often true
 - Sometimes true
 - Never true
 - Don't know

7. In the last 12 months, since this time last year, did you or any other adult in you household ever cut the size of your meals or skip meals because there wasn't enough money for food?
 - Yes
 - No
 - Don't know

8. In the last 12 months, did you eat less than you felt you should because there wasn't enough money to buy food?
- Yes
 - Now
 - Don't know
9. In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?
- Yes
 - Now
 - Don't know
10. In the last 12 months, did you lose weight because you didn't have enough money for food?
- Yes
 - Now
 - Don't know
11. In the last 12 months, did you or another adult in you household ever not eat for a whole day because there wasn't enough food?
- Yes
 - Now
 - Don't know

Glossary

3SLS- Three-stage least squares regression for simultaneous equations model

ANOVA- One-way analysis of variance

BMI- body mass index

CDC- Centers for Disease Control

CSFII - Continuing Surveys of Food Intakes by Individuals

CVD- cardiovascular disease

FFR- fast food restaurant

HEI- Healthy Eating Index

HFI- Home Food Inventory

HTN- hypertension

KAB- Nutrition Knowledge, Attitudes and Behaviors Questionnaire

MMR- Moderated multiple regression analyses

NFCS- Nationwide Food Consumption Survey

NHANES- National Health and Nutrition Examination Survey

NHLBI - National Heart, Lung, and Blood Institute

PTHM - the Poppleton/The Terraces/Hollins Market

SCT- Social Cognitive Theory

SD- standard deviation

SES- Socioeconomic status

SoFAA- calories from solid fats, alcoholic beverages, and added sugars

USDA- United States Department of Agriculture

Bibliography

- ACS, American Cancer Society. (2008). *Cancer Facts and Figures for African Americans 2007-2008*. Atlanta, GA.: American Cancer Society.
- ADA, American Diabetes Association. (2008). *African American and Diabetes Facts*. Alexandria, VA: American Diabetes Association.
- AHA, American Heart Association. (2007a). *Heart Facts 2007: All Americans*.: American Heart Association.
- AHA, American Heart Association. (2007b). *Heart Facts 2007: African Americans*: American Heart Association
- APA, American Psychology Association. (2008). Socio-cognitive Retrieved May 29, 2008 from Reference.com website from Wikipedia, the free encyclopedia: <http://www.reference.com/browse/wiki/Socio-cognitive>
- CDC, Centers for Disease Control and Prevention. (2005). YRBSS Youth Online: Comprehensive Results, Dietary Behaviors. Retrieved February 18, 2008, from Centers for Disease Control and Prevention, Youth Risk Behavior Surveillance System: <http://apps.nccd.cdc.gov/yrbss/QuestYearTable.asp?ByVar=CI&cat=5&quest=508&loc=BA&year=2005>
- DHHS, U.S. Department of Health and Human Services. (November 2000). *Healthy People 2010: Understanding and Improving Health*. 2nd ed.
- ERS/USDA. (2008). *Food Security in the United States: Measuring Household Food Security*. Retrieved from <http://www.ers.usda.gov/Briefing/FoodSecurity/measurement.htm>.
- IOM, Institutes of Medicine. (2005). *Childhood Obesity in the United States: Facts and Figures*. Retrieved from <http://www.iom.edu/Object.File/Master/22/606/FINALfactsandfigures2.pdf>.
- NRC, National Academy Press. (1993). *Diet and Health: Implications for reducing chronic disease risk*. (5th ed. ed.). Washington, DC: National Academy Press, National Research Council, Committee on Diet and Health
- USDA, US Department of Agriculture. (2000a). *Healthy People 2010: Understanding and Improving Health*. Retrieved from <http://www.healthypeople.gov/Document/word/Volume2/19Nutrition.doc>.

- USDA, US Department of Agriculture. (2000b). *Nutrition and Your Health: Dietary Guidelines for Americans, 2000. 5th ed.* Retrieved from <http://www.cnpp.usda.gov/Publications/DietaryGuidelines/2000/2000DGProfessionalBooklet.pdf>.
- USDA, US Department of Agriculture. (2005). *Dietary Guidelines for Americans, 2005.* Retrieved from <http://www.health.gov/DietaryGuidelines/dga2005/document/default.htm>.
- AbuSabha, R., & Achterberg, C. (1997). Review of self-efficacy and locus of control for nutrition- and health-related behavior. *J Am Diet Assoc, 97*(10), 1122-1132.
- Affenito, S. G., Thompson, D. R., Barton, B. A., Franko, D. L., Daniels, S. R., Obarzanek, E., et al. (2005). Breakfast consumption by African-American and white adolescent girls correlates positively with calcium and fiber intake and negatively with body mass index. *J Am Diet Assoc, 105*(6), 938-945.
- Alaimo, K., McDowell, M., Briefel, R. R., Bischof, A. M., Caughman, C. R., Loria, C. M., et al. (1994). Dietary intake of vitamins, minerals, and fiber of persons ages 2 months and over in the United States: Third National Health and Nutrition Examination Survey, Phase 1, 1988-91. *Adv Data, 14*(258), 1-28.
- Alwitt, L. F., & Donley, T. D. (1997). Retail stores in poor urban neighborhoods. *Journal of Consumer Affairs, 31*(1), 139-164.
- Anderson, E. S., Winett, R. A., & Wojcik, J. R. (2007). Self-regulation, self-efficacy, outcome expectations, and social support: Social Cognitive Theory and nutrition behavior. *Ann Behav Med, 34*(3), 304-312.
- Anderson, S. A. (1990). Core indicators of nutritional state for difficult to sample populations *J. Nutr., 120*, 1557S-1600S.
- Ashiabi, G. S., & O'Neal, K. K. (2007). Is household food insecurity predictive of health status in early adolescence? A structural analysis using the 2002 NSAF data set. *California Journal of Health Promotion, 5*(4), 76-91.
- Atkinson, N. L., & Gold, R. S. (2002). The promise and challenge of eHealth intervention. *Am J Health Behav, 26*(6), 494-503.
- Babbie, E. (2001). *The Practice of Social Research* (9th ed.). Belmont, CA: Wadsworth/Thomson Learning.
- Baker, E. A., Schootman, M., Barnidge, E., & Kelly, C. (2006). The role of race and poverty in access to foods that enable individuals to adhere to dietary guidelines. *Prev Chronic Dis [serial online], July 3*(3), 1-11.

- Ball, K., MacFarlane, A., Crawford, D., Savige, G., Andrianopoulos, N., & Worsley, A. (2008). Can social cognitive theory constructs explain socio-economic variations in adolescent eating behaviours? A mediation analysis. *Health Educ. Res.*, cyn048.
- Baltimore City Department of Planning. (2001 December). *Census News 2000 #1 Population and Race*: Baltimore City Department of Planning.
- Baltimore City Results and Indicators Report: Stable and Economically Independent Families. (2006). Retrieved 2/18/08, from Baltimore City Data Collaborative: <http://www.baltimorekidsdata.org/>
- Bandura, A. (1986). *Social Foundations of Thought and Action*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Baranowski, T., Cullen, K. W., & Baranowski, J. (1999). Psychosocial correlates of dietary intake: advancing dietary intervention. *Annual Review of Nutrition*, 19, 17-40.
- Baranowski, T., Perry, C. L., & Parcel, G. S. (1997). *How individuals, environments, and health behavior interact: Social Cognitive Theory* (2nd ed. ed.). San Francisco, CA: Jossey-Bass.
- Basiotis, P. P., Carlson, A., Gerrior, S. A., Juan, W. Y., & Lino, M. (2002). *The Healthy Eating Index: 1999-2000*. Retrieved from <http://www.cnpp.usda.gov/publications/HEI/HEI99-00report.pdf>.
- Befort, C., Kaur, H., Nollen, N., Sullivan, D. K., Nazir, N., Choi, W. S., et al. (2006). Fruit, vegetable, and fat intake among non-Hispanic black and non-Hispanic white adolescents: Associations with home availability and food consumption settings. *J Am Diet Assoc*, 106(3), 367-373.
- Beydoun, M. A., & Wang, Y. (2009). Parent-child dietary intake resemblance in the United States: Evidence from a large representative survey. *Soc Sci Med*, 68(12), 2137-2144.
- Bhattacharya, J., Currie, J., & Haider, S. (2004). Poverty, food insecurity, and nutritional outcomes in children and adults. *Journal of Health Economics*, 23(4), 839-862.
- Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (2000). *Guide to measuring household food security, revised 2000*. Retrieved from <http://www.fns.usda.gov/fsec/FILES/FSGuide.pdf>.
- Birch, L. L., & Fisher, J. O. (1998). Development of eating behaviors among children and adolescents. *Pediatrics*, 101(Supplement), 539-549.

- Black, M. M. (2008). Adolescent home food availability (pp. personal conversation). Baltimore, MD.
- Black, M. M., Hager, E., Le, K., Anliker, J., Arteaga, S. S., DiClemente, C., et al. (in press). Challenge! A mentorship model of health promotion and obesity prevention among urban, Black adolescents. *Pediatrics*, *126*(3).
- Black, M. M., Hager, E. R., Merry, B. C., & Quigg, A. M. (2008). *Food security: Ensuring the health of Baltimore's babies*. Baltimore: Growth and Nutrition Division, Department of Pediatrics, University of Maryland School of Medicine.
- Black, M. M., Siegel, E. H., Abel, Y., & Bentley, M. E. (2001). Home and videotape intervention delays early complementary feeding among adolescent mothers. *Pediatrics*, *107*(5), e67-e75.
- Block, D., & Kouba, J. (2006). A comparison of the availability and affordability of a market basket in two communities in the Chicago area. *Public Health Nutrition*, *9*(7), 837-845.
- Block, J. P., Scribner, R. A., & DeSalvo, K. B. (2004). Fast food, race/ethnicity, and income: A geographic analysis. *Am J Prev Med*, *27*(3), 211-217.
- Bodor, J. N., Rose, D., Farley, T. A., Swalm, C., & Scott, S. K. (2007). Neighbourhood fruit and vegetable availability and consumption: The role of small food stores in an urban environment. *Public Health Nutrition*, *11*(4), 413-420.
- Boumtje, P. I., Huang, C. L., Lee, J.-Y., & Lin, B.-H. (2005). Dietary habits, demographics, and the development of overweight and obesity among children in the United States. *Food Policy*, *30*(2), 115-128.
- Boutelle, K. N., Birkeland, R. W., Hannan, P. J., Story, M., & Neumark-Sztainer, D. (2007). Associations between maternal concern for healthful eating and maternal eating behaviors, home food availability, and adolescent eating behaviors. *J Nutr Educ Behav*, *39*(5), 248-256.
- Bowman, S. A., Gortmaker, S. L., Ebbeling, C. B., Pereira, M. A., & Ludwig, D. S. (2004). Effects of fast-food consumption on energy intake and diet quality among children in a national household survey. *Pediatrics*, *113*(1), 112-118.
- Briefel, R. R., & Johnson, C. L. (2004). Secular trends in dietary intake in the US. *Annu Rev of Nutr*, *24*(1), 401-431.
- Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by Nature and Design*. Cambridge, MA: Harvard University Press.

- Brug, J., Kremers, S. P., van Lenthe, F., Ball, K., & Crawford, D. (2008). *Environmental determinants of healthy eating: in need of theory and evidence*. Paper presented at the Proceedings of the Nutrition Society, Dundee, Scotland.
- Brug, J., van Lenthe, F. J., & Kremers, S. P. J. (2006). Revisiting Kurt Lewin: How to gain insight into environmental correlates of obesogenic behaviors. *Am J Prev Med*, 31(6), 525-529.
- Burghardt, J., Gordon, A., Chapman, N., Gleason, P., & Fraker, T. (1993). *The School Nutrition Dietary Assessment Study: School food service, meals offered, and dietary intakes*. Princeton, NJ: Mathematica Policy Research, Inc.
- Campbell, E. Q. (1969). Adolescent Socialization. In D. Goslin (Ed.), *Handbook of Socialization Theory and Research* (pp. 821-856). Chicago: Rand McNally College Publishing Co.
- Cheadle, A., Psaty, B. M., Curry, S., Wagner, E., Diehr, P., Koepsell, T., et al. (1991). Community-level comparisons between the grocery store environment and individual dietary practices. *Prev Med*, 20(2), 250-261.
- Chilton, M., Chyatte, M., & Breaux, J. (2007). The negative effects of poverty and food insecurity on child development. *Indian J Med Res*, 126, 262-272.
- Chou, S., Rashad, I., & Grossman, M. (2008). Fast-food restaurant advertising on television and its influence on childhood obesity. *Journal of Law and Economics*, 51, 599-799.
- Choudhry, K., & Rahmanou, H. (2007). *Childhood obesity in Baltimore City: Assessment and recommendations to the Baltimore City Health Commissioner*: John F. Kennedy School of Government, Harvard University.
- Clayton, D., & Gill, C. (1991). Covariate measurement errors in nutritional epidemiology: effects and remedies. In B. M. Margetts & M. Nelson (Eds.), *Design Concepts in Nutritional Epidemiology* (pp. 97-99). New York: Oxford University Press.
- Cole, N., & Fox, M. K. (2008). *Diet quality of American school-aged children by school lunch participation status: Data from the National Health and Nutrition Examination Survey, 1999-2004*. Retrieved from <http://www.fns.usda.gov/oane>.
- Cook, J. T., Frank, D. A., Levenson, S. M., Neault, N. B., Heeren, T. C., Black, M. M., et al. (2006). Child food insecurity increases risks posed by household food insecurity to young children's health. *J. Nutr.*, 136(4), 1073-1076.

- Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues*. Boston, MA: Houghton Mifflin Company.
- Cozby, P. C. (2003). *Methods in Behavioral Research* (7th ed.). New York, NY: McGraw-Hill Higher Education.
- Crespo, P. S., Perera, J. A. P., Lodeiro, F. A., & Azuara, L. A. (2007). Metabolic syndrome in children. *Public Health Nutrition*, *10*(10A), 1121-1125.
- Crockett, S. J., Potter, J. D., Wright, M. S., & Bacheller, A. (1992). Validation of a self-reported shelf inventory to measure food purchase behavior. *J Am Diet Assoc.*, *92*(6), 694-697.
- Croll, J. K., Neumark-Sztainer, D., & Story, M. (2001). Healthy eating: What does it mean to adolescents? *Journal of Nutrition Education*, *33*(4), 193-198.
- Cromer, B., & Harel, Z. (2000). Adolescents: At increased risk for osteoporosis? *Clinical Pediatrics*, *39*(10), 565-574.
- Cullen, K. W., & Zakeri, I. (2004). The youth/adolescent questionnaire has low validity and modest reliability among low-income African-American and hispanic seventh- and eighth-grade youth. *J Am Diet Assoc.*, *104*(9), 1415-1419.
- Cusatis, D. C., & Shannon, B. M. (1996). Influences on adolescent eating behavior. *J Adolesc Health*, *18*(1), 27-34.
- Dausch, J. G., Story, M., Dresser, C., Gilbert, G. G., Portnoy, B., & Kahle, L. L. (1995). Correlates of high-fat/low-nutrient-dense snack consumption among adolescents: Results from two national health surveys. *Am J Health Promot.*, *10*(2), 85-88.
- Demeter, L. A. (2006). *Maryland chronic diseases and their risk factors: A statewide perspective, 2004 data*. Retrieved from http://www.fha.state.md.us/pdf/cdp/Chronic_Diseases-2004.pdf.
- Diez-Roux, A. V., Nieto, F. J., Caulfield, L., Tyroler, H. A., Watson, R. L., & Szklo, M. (1999). Neighbourhood differences in diet: The Atherosclerosis Risk in Communities (ARIC) study *J Epidemiol Community Health*, *53*, 55-63.
- Dodson, J., Hsiao, Y.-C., Kasat, M., Murray, L., Nguyen, N., Richards, A., et al. (2008). Formative research for a healthy diet intervention among inner-city adolescents: The importance of family, school and neighborhood environment. *Ecology of Food and Nutrition*, (in press).

- Duffey, K. J., Gordon-Larsen, P., Jacobs, J. D. R., Williams, O. D., & Popkin, B. M. (2007). Differential associations of fast food and restaurant food consumption with 3-y change in body mass index: the Coronary Artery Risk Development in Young Adults Study. *Am J Clin Nutr*, 85, 201-208.
- Edmonds, J., Baranowski, T., Baranowski, J., Cullen, K. W., & Myres, D. (2001). Ecological and socioeconomic correlates of fruit, juice, and vegetable consumption among African-American boys. *Prev Med*, 32(6), 476-481.
- Elder, J. P., Lytle, L., Sallis, J. F., Young, D. R., Steckler, A., Simons-Morton, D., et al. (2007). A description of the social-ecological framework used in the trial of activity for adolescent girls (TAAG). *Health Educ. Res.*, 22(2), 155-165.
- Evans, A. E., Wilson, D. K., Buck, J., Torbett, H., & Williams, J. (2006). Outcome expectations, barriers, and strategies for healthful eating: A perspective from adolescents from low-income families. *Fam Community Health*, 29(1), 17-27.
- FactFinder, A. (2008). *2006 American Community Survey Data Profile Highlights: Baltimore*. Retrieved from http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=ChangeGeoContext&geo_id=16000US2404000&geoContext=&street=&county=baltimore&cityTown=baltimore&state=04000US24&zip=&lang=en&sse=on&ActiveGeoDiv=&useEV=&pctxt=fph&pgsl=010&submenuId=factsheet_1&ds_name=ACS_2006_SAFF&ci_nbr=null&qtr_name=null®=null%3Anull&keyword=&industry=.
- Fahlman, M. M., Dake, J. A., McCaughtry, N., & Martin, J. (2008). A pilot study to examine the effects of a nutrition intervention on nutrition knowledge, behaviors, and efficacy expectations in middle school Children. *J Sch Health*, 78(4), 216-222.
- Fahlman, M. M., McCaughtry, N., Martin, J., & Shen, B. (2010). Racial and socioeconomic disparities in nutrition behaviors: Targeted interventions needed. *J Nutr Educ Behav.*, 42(1), 10-16.
- Feskanich, D., Rockett, H. R. H., & Colditz, G. A. (2004). Modifying the Healthy Eating Index to assess diet quality in children and adolescents. *J Am Diet Assoc*, 104(9), 1375.
- Feunekes, G. I. J., de Graaf, C., Meyboom, S., & van Staveren, W. A. (1998). Food choice and fat Intake of adolescents and adults: Associations of intakes within social networks. *Prev Med*, 27(5), 645-656.

- Field, A. E., Peterson, K. E., Gortmaker, S. L., Cheung, L., Rockett, H., Fox, M. K., et al. (1999). Reproducibility and validity of a food frequency questionnaire among fourth to seventh grade inner-city school children: Implications of age and day-to-day variation in dietary intake. *Public Health Nutrition*, 2, 293-300.
- Fisher, B. D., & Strogatz, D. S. (1999). Community measures of low-fat milk consumption: Comparing store shelves with households. *Am J Public Health*, 89(2), 235-237.
- Flournoy, R. (2006). Healthy foods, strong communities: Fresh fruits and veggies are good for more than just your health. *PolicyLink*. Retrieved from www.policylink.org/Research/HealthyFood.
- Ford, E. S., & Mokdad, A. H. (2001). Fruit and vegetable consumption and diabetes mellitus incidence among U.S. adults. *Prev Med*, 32(1), 33-39.
- Forshee, R. A., & Storey, M. L. (2006). Demographics, not beverage consumption, is associated with diet quality. *Int J Food Sci Nutr*, 57(7/8), 494-511.
- French, S. A., Story, M., & Jeffery, R. W. (2001). Environmental influences on eating and physical activity. *Annual Review of Public Health*, 22(1), 309-335.
- French, S. A., Story, M., Neumark-Sztainer, D., Fulkerson, J. A., & Hannan, P. (2001). Fast food restaurant use among adolescents: Associations with nutrient intake, food choices and behavioral and psychosocial variables. *International Journal Of Obesity And Related Metabolic Disorders*, 25(12), 1823-1833.
- Fulgoni, V., Nichollis, J., Reed, A., Buckley, R., Kafer, K., Huth, P., et al. (2007). Dairy consumption and related nutrient intake in African-American adults and children in the United States: Continuing Survey of Food Intake by Individuals 1994-1996, 1998, and the National Health and Nutrition Examination Survey 1999-2000. *J Am Diet Assoc*, 107(2), 256-264.
- Galvez, M. P., Morland, K., Raines, C., Kobil, J., Siskind, J., Godbold, J., et al. (2007). Race and food store availability in an inner-city neighbourhood. *Public Health Nutrition*, 11(6), 624-631.
- Garson, D. (2008). Data imputation for missing values. *StatNotes* Retrieved January 16, 2009, from <http://faculty.chass.ncsu.edu/garson/PA765/missing.htm>
- Gibson, E. L., Wardle, J., & Watts, C. J. (1998). Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. *Appetite*, 31(2), 205-228.

- Gillis, L. J., & Bar-Or, O. (2003). Food away from home, sugar-sweetened drink consumption and juvenile obesity. *Journal Of The American College Of Nutrition*, 22(6), 539-545.
- Gillman, M. W., Rifas-Shiman, S. L., Frazier, A. L., Rockett, H. R. H., Camargo, C. A., Field, A. E., et al. (2000). Family dinner and diet quality among older children and adolescents. *Arch Fam Med.*, 9, 235-240.
- Gilmer, M. J., Speck, B. J., Bradley, C., Harrell, J. S., & Belyea, M. (1996a). Perception of Peers Health Behavior Scale.
- Gilmer, M. J., Speck, B. J., Bradley, C., Harrell, J. S., & Belyea, M. (1996b). What Others Believe Scale.
- Gilmer, M. J., Speck, B. J., Bradley, C., Harrell, J. S., & Belyea, M. (1996). The Youth Health Survey: Reliability and validity of an instrument for assessing cardiovascular health habits in adolescents. *J Sch Health*, 66(3), 106-111.
- Glanz, K., Basil, M., Maibach, E., Goldberg, J., & Snyder, D. (1998). Why Americans eat what they do: Taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *J Am Diet Assoc*, 98(10), 1118-1126.
- Goodwin, D. K., Knol, L. K., Eddy, J. M., Fitzhugh, E. C., Kendrick, O., & Donohue, R. E. (2006). Sociodemographic correlates of overall quality of dietary intake of US adolescents. *Nutrition Research*, 26(3), 105-110.
- Granner, M. L., Sargent, R. G., Calderon, K. S., Hussey, J. R., Evans, A. E., & Watkins, K. W. (2004). Factors of fruit and vegetable intake by race, gender, and age among young adolescents. *J Nutr Educ Behav*, 36(4), 173-180.
- Guenther, P. M., Juan, W. Y., Lino, M., Hiza, H. A., Fungwe, T., & Lucas, R. (2008). *Diet quality of low-income and higher income Americans in 2003-04 as measured by the Healthy Eating Index-2005*.
- Guenther, P. M., Juan, W. Y., Reedy, J., Britten, P., Lino, M., Carlson, A., et al. (2007). *Diet quality of Americans in 1994-96 and 2001-02 as measured by the Healthy Eating Index-2005*. Retrieved from <http://www.cnpp.usda.gov/Publications/NutritionInsights/Insight37.pdf>.
- Guenther, P. M., Krebs-Smith, S. M., Reedy, J., Britten, P., Juan, W. Y., Lino, M., et al. (2006). *Healthy Eating Index 2005 Fact Sheet*. Retrieved from <http://www.cnpp.usda.gov/Publications/HEI/healthyeatingindex2005factsheet.pdf>.

- Guenther, P. M., Reedy, J., Krebs-Smith, S. M., & Reeve, B. B. (2008). Evaluation of the Healthy Eating Index-2005. *J Am Diet Assoc*, 108(11), 1854-1864.
- Guenther, P. M., Reedy, J., Krebs-Smith, S. M., Reeve, B. B., & Basiotis, P. P. (2007). *Development and evaluation of the Healthy Eating Index- 2005: Technical Report*. Retrieved from <http://www.cnpp.usda.gov/HealthyEatingIndex.htm>.
- Guthrie, J. F., Lin, B. H., & Frazao, E. (2002). Role of food prepared away from home in the American diet, 1977-78 versus 1994-96: Changes and consequences. *J Nutr Educ Behav*, 34, 140-150.
- Hager, E. R., & Treuth, M. S. (2007). Familial determinants of overweight and physical activity behavior change among urban African American adolescents. Unpublished Doctoral dissertation. Doctoral dissertation, Johns Hopkins University.
- Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate Data Analysis* (5th edition ed.). Upper Saddle River, NJ: Prentice Hall.
- 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.
- Harris, K. M., Gordon-Larsen, P., Chantala, K., & Udry, J. R. (2006). Longitudinal trends in race/ethnic disparities in leading health indicators from adolescence to young adulthood. *Arch Pediatr Adolesc Med*, 160(1), 74-81.
- Heald, F. P. (1992). Fast food and snack food: Beneficial or deleterious. *J Adolesc Health*, 13(5), 380-383.
- Heany, J., & Hayes, T. (1997). Redlining food: How to ensure community food security. *Food First/ Institute for Food and Development Policy*. Retrieved from www.foodfirst.org/node/1452
- Hedley, A. A., Ogden, C. L., Johnson, C. L., Carroll, M. D., Curtin, L. R., & Flegal, K. M. (2004). Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA*, 291(23), 2847-2850.
- Hersey, J., Anliker, J., Miller, C., Mullis, R. M., Daugherty, S., Das, S., et al. (2001). Food shopping practices are associated with dietary quality in low-income households. *Journal of Nutrition Education*, 33, S16-S26.

- Hoag, C. (2008, July 30, 2008). South L.A. going on a diet of no new fast food restaurants: City council tries to lure more healthy restaurants to area. *San Francisco Chronicle*. Retrieved from <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/07/30/BAKO121M77.DTL>
- Horowitz, C. R., Colson, K. A., Hebert, P. L., & Lancaster, K. (2004). Barriers to buying healthy foods for people with diabetes: Evidence of environmental disparities. *Am J Public Health, 94*(9), 1549-1554.
- Hurley, K., Oberlander, S., Merry, B., Wroblewski, M. M., Klassen, A. C., & Black, M. M. (2008). The HEI and YHEI are unique, non-redundant measures of diet quality among low-income, African-American adolescents. *J. Nutr., 139*(2), 359-364.
- Jago, R., Baranowski, T., Baranowski, J., Cullen, K., & Thompson, D. (2007). Distance to food stores & adolescent male fruit and vegetable consumption: mediation effects. *International Journal of Behavioral Nutrition and Physical Activity, 4*(1), 35.
- Jago, R., Baranowski, T., & Baranowski, J. C. (2007). Fruit and vegetable availability: A micro environmental mediating variable? *Public Health Nutrition, 10*(7), 681-689.
- Jenkins, S., & Horner, S. D. (2005). Barriers that influence eating behaviors in adolescents. *Journal Of Pediatric Nursing, 20*(4), 258-267.
- Johnson, R. K., Johnson, D. G., Wang, M. Q., Smiciklas-Wright, H., & Guthrie, H. A. (1994). Characterizing nutrient intakes of adolescents by sociodemographic factors. *J Adolesc Health, 15*(2), 149-154.
- Joshiyura, K. J., Hu, F. B., Manson, J. E., Stampfer, M. J., Rimm, E. B., Speizer, F. E., et al. (2001). The effect of fruit and vegetable intake on risk for coronary heart disease. *Ann Intern Med, 134*, 1106-1114.
- Kant, A. K. (2003). Reported consumption of low-nutrient-density foods by American children and adolescents: Nutritional and health correlates, NHANES III, 1988 to 1994. *Arch Pediatr Adolesc Med, 157*(8), 789-796.
- Kay, L. F. (2007, August 9, 2007). City-owned building condemned for safety violations: A-rab ponies must move from stable *Baltimore Sun*.
- Kennedy, E. T., Ohls, J., Carlson, S., & Fleming, K. (1995). The Healthy Eating Index: Design and applications. *J Am Diet Assoc, 95*(10), 1103-1108.

- Kimm, S. Y. S., Barton, B. A., Obarzanek, E., McMahon, R. P., Sabry, Z. I., Waclawiw, M. A., et al. (2001). Racial divergence in adiposity during adolescence: The NHLBI Growth and Health Study. *Pediatrics*, *107*(3), e34-.
- Kington, R. S., & Smith, J. P. (1997). Socioeconomic status and racial and ethnic differences in functional status associated with chronic diseases. *Amer J Public Health*, *87*(5), 805-810.
- Klein, A. (2002). Baltimoreans are hungry for supermarkets. *Baltimore Sun*.
- Klein, D. J., Aronson Friedman, L., Harlan, W. R., Barton, B. A., Schreiber, G. B., Cohen, R. M., et al. (2004). Obesity and the development of insulin resistance and impaired fasting glucose in Black and white adolescent girls: A longitudinal study. *Diabetes Care*, *27*(2), 378-383.
- Kretchmer, N., Beard, J. L., & Carlson, S. (1996). The role of nutrition in the development of normal cognition. *Am J Clin Nutr*, *63*(6), 997S-1001.
- Kronsberg, S. S., Obarzanek, E., Affenito, S. G., Crawford, P. B., Sabry, Z. I., Schmidt, M., et al. (2003). Macronutrient intake of Black and white adolescent girls over 10 years: The NHLBI Growth and Health Study. *J Am Diet Assoc*, *103*(7), 852-860.
- Kuczarski, R. J., Ogden, C. L., & Guo, S. S. (2002). *2000 CDC Growth Charts for the United States: Methods and development*. Retrieved from http://www.cdc.gov/nchs/data/series/sr_11/sr11_246.pdf.
- Langevin, D. D., Kwiatkowski, C., McKay, M. G., Maillet, J. O. S., Touger-Decker, R., Smith, J. K., et al. (2007). Evaluation of diet quality and weight status of children from a low socioeconomic urban environment supports "at risk" classification. *J Am Diet Assoc*, *107*(11), 1973-1977.
- Larson, N. I., Neumark-Sztainer, D. R., Story, M. T., Wall, M. M., Harnack, L. J., & Eisenberg, M. E. (2008). Fast food intake: Longitudinal trends during the transition to young adulthood and correlates of intake. *Journal of Adol Health*, *43*(1), 79-86.
- Larson, N. I., Story, M., Wall, M. M., & Neumark-Sztainer, D. (2006). Calcium and dairy intakes of adolescents are associated with their home environment, taste preferences, personal health beliefs, and meal patterns. *J Am Diet Assoc*, *106*(11), 1816-1824.
- Lee, S., & Reicks, M. (2003). Environmental and behavioral factors are associated with the calcium intake of low-income adolescent girls. *J Am Diet Assoc*, *103*(11), 1526-1529.

- Let's Move Campaign. (2010). America's move to raise a healthier generation of kids. Retrieved June 21, 2010, from <http://www.letsmove.gov/about.php>.
- Lewis, L. B., Sloane, D. C., Nascimento, L. M., Diamant, A. L., Guinyard, J. J., Yancey, A. K., et al. (2005). African Americans' access to healthy food options in south Los Angeles restaurants. *Am J Public Health, 95*(4), 668-673.
- Ludwig, D. S., Peterson, K. E., & Gortmaker, S. L. (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity: A prospective, observational analysis. *The Lancet, 357*(9255), 505-508.
- Lytle, L. A. (2002). Nutritional issues for adolescents. *J Am Diet Assoc., Supplement 102*(3), S8-S12.
- Mackey, E. R., & La Greca, A. M. (2007). Adolescents' eating, exercise, and weight control behaviors: Does peer crowd affiliation play a role? *J. Pediatr. Psychol., 32*(1), 13-23.
- Margetts, B. M. (1991). Basic issues in designing and interpreting epidemiological research. In B. M. Margetts & M. Nelson (Eds.), *Design Concepts in Nutritional Epidemiology* (pp. 24-26). New York: Oxford University Press.
- McCullough, M., Feskanich, D., Rimm, E., Giovannucci, E., Ascherio, A., Variyam, J., et al. (2000). Adherence to the dietary guidelines for Americans and risk of major chronic disease in men. *American Journal of Clinical Nutrition, 72*, 1223-1231.
- McCullough, M., Feskanich, D., Stampfer, M., Rosner, B., Hu, F., Hunter, D., et al. (2000). Adherence to the dietary guidelines for Americans and risk of major chronic disease in women. *American Journal of Clinical Nutrition, 72*, 1214-1222.
- Mendoza, J. A., Drewnowski, A., Cheadle, A., & Christakis, D. A. (2006). Dietary energy density is associated with selected predictors of obesity in U.S. children. *J. Nutr., 136*(5), 1318-1322.
- Merry, B., Oberlander, S., Hurley, K., & Black, M. M. (2008, April). *Cancer-related dietary risks among African American adolescents*. Paper presented at the 11th Biennial Symposium on Minorities, the Medically Underserved, and Cancer, Washington, DC.
- Mitchell, M. K. (1997). *Nutrition Across the Life Span*. Philadelphia: W.B. Saunders Company.

- Mitola, A. L., Papas, M. A., Le, K., Fusillo, L., & Black, M. M. (2007). Agreement with satisfaction in adolescent body size between female caregivers and teens from a low-income African-American community. *J. Pediatr. Psychol.*, *32*(1), 42-51.
- Molaison, E. F., Connell, C. L., Stuff, J. E., Yadrick, M. K., & Bogle, M. (2005). Influences on fruit and vegetable consumption by low-income Black American adolescents. *J Nutr Educ Behav*, *37*(5), 246-251.
- Moore, L. V., & Diez Roux, A. V. (2006). Associations of neighborhood characteristics with the location and type of food stores. *Am J Public Health*, *96*(2), 325-331.
- Morland, K., & Filomena, S. (2007). Disparities in the availability of fruits and vegetables between racially segregated urban neighbourhoods. *Public Health Nutrition*, *10*(12), 1481-1489.
- Morland, K., Wing, S., & Diez Roux, A. (2002). The contextual effect of the local food environment on resident's diets: The Atherosclerosis Risk in Communities Study. *Am J Public Health*, *92*(11), 1761-1767.
- Morland, K., Wing, S., Diez Roux, A., & Poole, C. (2002). Neighborhood characteristics associated with the location of food stores and food service places. *Am J Prev Med*, *22*(1), 23-29.
- Munoz, K., Krebs-Smith, S., Ballard-Barbash, R., & Cleveland, L. (1997). Food intakes of US children and adolescents compared with recommendations. *Pediatrics*, *100*(7), 323-329.
- Must, A., Jacques, P. F., Dallal, G. E., Bajema, C. J., & Dietz, W. H. (1992). Long-term morbidity and mortality of overweight adolescents; A follow-up of the Harvard Growth Study of 1922 to 1935. *N Engl J Med*, *327*(19), 1350-1355.
- Neter, J., & Wasserman, W. (1974). *Applied Linear Statistical Models: Regression, Analysis of Variance, and Experimental Designs*. Homewood, Illinois: Richard D. Irwin, Inc.
- Neumark-Sztainer, D., Story, M., Hannan, P. J., & Croll, J. (2002). Overweight status and eating patterns among adolescents: Where do youths stand in comparison with the Healthy People 2010 objectives? *Am J Public Health*, *92*(5), 844-851.
- Neumark-Sztainer, D., Story, M., Perry, C., & Casey, M. A. (1999). Factors influencing food choices of adolescents: Findings from focus-group discussions with adolescents. *J Am Diet Assoc.*, *99*(8), 929-937.

- Neumark-Sztainer, D., Wall, M., Perry, C., & Story, M. (2003). Correlates of fruit and vegetable intake among adolescents. Findings from Project EAT. *Prev Med*, 37(3), 198-208.
- Ng-Mak, D. S., Dohrenwend, B. P., Abraido-Lanza, A. F., & Turner, J. B. (1999). A further analysis of race differences in the National Longitudinal Mortality Study. *Am J Public Health*, 89(11), 1748-1751.
- Nicklas, T. (2004). Assessing diet quality in children and adolescents. *J Am Diet Assoc.*, 104(9), 1383-1384.
- Nielsen, S. J., Siega-Riz, A. M., & Popkin, B. M. (2002). Trends in food locations and sources among adolescents and young adults. *Prev Med*, 35(2), 107-113.
- Niemeier, H. M., Raynor, H. A., Lloyd-Richardson, E. E., Rogers, M. L., & Wing, R. R. (2006). Fast food consumption and breakfast skipping: Predictors of weight gain from adolescence to adulthood in a nationally representative sample. *J Adolesc Health*, 39(6), 842-849.
- Nord, M., Andrews, M., & Carlson, S. (2007). *Household food security in the United States, 2006*. Retrieved from <http://www.ers.usda.gov/publications/err49/>.
- Nord, M., Andrews, M., & Carlson, S. (2008). Household food security in the United States, 2007. *Economic Research Report (ERR-66)*. Retrieved from <http://www.ers.usda.gov/publications/err66/>
- O'Dea, J., & Wilson, R. (2006). Socio-cognitive and nutritional factors associated with body mass index in children and adolescents: Possibilities for childhood obesity prevention. *Health Educ. Res.*, 21(6), 796-805.
- Obesity and cardiovascular disease risk factors in black and white girls: the NHLBI Growth and Health Study. (1992). *Am J Public Health*, 82(12), 1613-1620.
- Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA*, 295(13), 1549-1555.
- Paeratakul, S., Ferdinand, D. P., Champagne, C. M., Ryan, D. H., & Bray, G. A. (2003). Fast-food consumption among US adults and children: Dietary and nutrient intake profile. *J Am Diet Assoc*, 103(10), 1332-1338.
- Pajares, F. (2006). Self-efficacy during childhood and adolescence: Implications for teachers and parents. In F. Pajares & T. Urdan (Eds.), *Self-Efficacy Beliefs of Adolescents* (pp. 345-355). Greenwich, Connecticut: IAP Information Age Publishing, Inc.

- Pan, Y., & Pratt, C. A. (2008). Metabolic syndrome and its association with diet and physical activity in US adolescents. *J Am Diet Assoc*, *108*(2), 276-286.
- Patterson, R. E., Haines, P. S., & Popkin, B. M. (1994). Diet quality index: Capturing a multidimensional behavior. *J Am Diet Assoc*, *94*(1), 57-64.
- Pereira, M. A., Jacobs, D. R., Jr., Van Horn, L., Slattery, M. L., Kartashov, A. I., & Ludwig, D. S. (2002). Dairy consumption, obesity, and the insulin resistance syndrome in young adults: The CARDIA Study. *JAMA*, *287*(16), 2081-2089.
- Pereira, M. A., Kartashov, A. I., Ebbeling, C. B., Van Horn, L., Slattery, M. L., Jacobs, J. D. R., et al. (2005). Fast-food habits, weight gain, and insulin resistance (the CARDIA study): 15-year prospective analysis. *The Lancet*, *365*(9453), 36-42.
- Pirouznia, M. (2001). The association between nutrition knowledge and eating behavior in male and female adolescents in the US. *Int J Food Sci Nutr*, *52*, 127-132.
- Pollitt, E., & Mathews, R. (1998). Breakfast and cognition: An integrative summary. *Am J Clin Nutr*, *67*(4), 804S-813.
- Popkin, B. M., Zizza, C., & Siega-Riz, A. M. (2003). Who is leading the change? U.S. dietary quality comparison between 1965 and 1996. *Am J Prev Med*, *25*(1), 1-8.
- Poppleton/The Terraces/Hollins Market Health Profile 2008*. (2008 October). Baltimore, MD: Baltimore City Health Department and Johns Hopkins Bloomberg School of Public Health Sommer Scholars Program.
- Powell, L. M., Auld, M. C., Chaloupka, F. J., O'Malley, P. M., & Johnston, L. D. (2007). Associations between access to food stores and adolescent body mass index. *Am J Prev Med*, *33*(4, Supplement 1), S301-S307.
- Powell, L. M., Chaloupka, F. J., & Bao, Y. (2007). The availability of fast-food and full-service restaurants in the United States: Associations with neighborhood characteristics. *Am J Prev Med*, *33*(4, Supplement 1), S240-S245.
- Quintos, J. B., Muzumdar, H., George, M., Mercado, A. B., Lu, H., Sternberg, A., et al. (2006). The prevalence of metabolic syndrome in inner city obese African-American youth. *Pediatr Endocrinol Rev*, *Dec. 3*(Suppl. 4), 571-575.
- Raghuveer, G., Le, J., Spencer, M., McCrary, D., Zhang, D., & Jie, C. (2008). *Obese kids' artery plaque similar to middle-aged adults*. Paper presented at the American Heart Associations Scientific Sessions 2008. Retrieved from <http://americanheart.mediaroom.com/index.php?s=43&item=558>

- Rampersaud, G. C., Pereira, M. A., Girard, B. L., Adams, J., & Metz, J. D. (2005). Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *J Am Diet Assoc*, 105(5), 743-760.
- Reidpath, D. D., Burns, C., Garrard, J., Mahoney, M., & Townsend, M. (2002). An ecological study of the relationship between social and environmental determinants of obesity. *Health & Place*, 8(2), 141-145.
- Reinhardt, W. C., & Brevard, P. B. (2002). Integrating the Food Guide Pyramid and Physical Activity Pyramid for positive dietary and physical activity behaviors in adolescents. *J Am Diet Assoc*, 102(3 Suppl), S96-99.
- Renna, F., Grafova, I. B., & Thakur, N. (2008). The effect of friends on adolescent body weight. *Econ Hum Biol*, 6(3), 377-387.
- Resnicow, K., Yaroch, A. L., Davis, A., Wang, D. T., Carter, S., Slaughter, L., et al. (2000). Go Girls!: Results from a nutrition and physical activity program for low-income, overweight African American adolescent females. *Health Educ Behav*, 27(5), 616-631.
- Rhee, K. (2008). Childhood overweight and the relationship between parent behaviors, parenting style, and family functioning. *Annals AAPSS*, 615, 12-37.
- Riediger, N. D., Shooshtari, S., & Moghadasian, M. H. (2007). The influence of sociodemographic factors on patterns of fruit and vegetable consumption in Canadian adolescents. *J Am Diet Assoc*, 107, 1511-1518.
- Rinderknecht, K., & Smith, C. (2004). Social Cognitive Theory in an after-school nutrition intervention for urban Native American youth. *J Nutr Educ Behav*, 36, 298-304.
- Rockett, H. R. H., Berkey, C. S., Field, A. E., & Colditz, G. A. (2001). Cross-sectional measurement of nutrient intake among adolescents in 1996. *Prev Med*, 33, 27-37.
- Rockett, H. R. H., Breitenbach, M., Frazier, A. L., Witschi, J., Wolf, A. M., Field, A. E., et al. (1997). Validation of a youth/adolescent food frequency questionnaire. *Prev Med*, 26, 808-816.
- Rodwell Williams, S. (2000). The Assessment of Nutritional Needs. In B. Worthington-Roberts & S. Rodwell Williams (Eds.), *Nutrition Throughout the Life Cycle*, 4th ed. New York: McGraw-Hill Higher Education.

- Rose-Jacobs, R., Black, M. M., Casey, P. H., Cook, J. T., Cutts, D. B., Chilton, M., et al. (2008). Household food insecurity: Associations with at-risk infant and toddler development. *Pediatrics*, *121*(1), 65-72.
- Rose, D., & Richards, R. (2004). Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. *Public Health Nutrition*, *7*(8), 1081-1088.
- Sallis, J., & Owen, N. (1997). *Ecological Models* (2nd ed.). San Francisco, CA: Jossey-Bass.
- Salvy, S. J., Romero, N., Paluch, R., & Epstein, L. H. (2007). Peer influence on pre-adolescent girls' snack intake: Effects of weight status. *Appetite*, *49*(1), 177-182.
- Savage, J. S., Fisher, J. O., & Birch, L. L. (2007). Parental influence on eating behavior: Conception to adolescence. *J Law Med Ethics*, *35*(1), 22-34.
- Savoca, M. R., Arcury, T. A., Leng, X., Bell, R. A., Chen, H., Anderson, A., et al. (2009). The diet quality of rural older adults in the South as measured by Healthy Eating Index-2005 varies by ethnicity. *J Am Diet Assoc*, *109*(12), 2063-2067.
- Scharper, J. (2010, June 14, 2010). Zoning for zucchini. *Baltimore Sun*, pp. 1, 17.
- Schmidt, M., Affenito, S. G., Striegel-Moore, R., Khoury, P. R., Barton, B., Crawford, P., et al. (2005). Fast-food intake and diet quality in Black and white girls: The National Heart, Lung, and Blood Institute Growth and Health Study. *Arch Pediatr Adolesc Med*, *159*(7), 626-631.
- Schunk, D. H., & Meece, J. L. (2006). Self-efficacy development in adolescence. In F. Pajares & T. Urdan (Eds.), *Self-Efficacy Beliefs of Adolescents* (pp. 81-83). Greenwich, Connecticut: IAP Information Age Publishing, Inc.
- Shannon, C., Story, M., Fulkerson, J. A., & French, S. (2002). Factors in the school cafeteria influencing food choices by high school students. *J Sch Health*, *72*(6), 229-234.
- Sharfstein, J. (2008 October). *Baltimore City Health Status Report, 2008*. Baltimore, MD: Office of Epidemiology and Planning, Baltimore City Health Department.
- Simon, P. A., Kwan, D., Angelescu, A., Shih, M., & Fielding, J. E. (2008). Proximity of fast food restaurants to schools: Do neighborhood income and type of school matter? *Prev Med, In Press, Corrected Proof*.

- Sloane, D. C., Diamant, A. L., Lewis, L. B., Yancey, A. K., Flynn, G., Nascimento, L. M., et al. (2003). Improving the nutritional resource environment for healthy living through community-based participatory research. *J Gen Intern Med, 18*, 568-575.
- Snitker, S., Le, K. Y., Hager, E. R., Caballero, B., & Black, M. M. (2007). Association of physical activity and body composition with insulin sensitivity in a community sample of adolescents. *Arch Pediatr Adolesc Med, 161*(7), 677-683.
- Spear, B. A. (2000). Adolescent Nutrition: General. In B. Worthington-Roberts & S. Rodwell Williams (Eds.), *Nutrition Throughout the Life Cycle* (4th ed. ed.). New York: McGraw-Hill Higher Education.
- Spear, B. A. (2002). Adolescent growth and development. *J Am Diet Assoc, 102*(3 Suppl), S23-29.
- Spiotta, R. T., & Luma, G. B. (2008). Evaluating obesity and cardiovascular risk factors in children and adolescents. *Am Fam Physician, 78*(9), 1052-1058.
- Srinivasan, S. R., Myers, L., & Berenson, G. S. (2002). Predictability of childhood adiposity and insulin for developing insulin resistance syndrome (syndrome X) in young adulthood. *Diabetes, 51*, 204-209.
- Steffen, L. M., Jacobs, D. R., Jr., Murtaugh, M. A., Moran, A., Steinberger, J., Hong, C.-P., et al. (2003). Whole grain intake is associated with lower body mass and greater insulin sensitivity among adolescents. *Am. J. Epidemiol., 158*(3), 243-250.
- Steinberg, L. (2009). Should the science of adolescent brain development inform public policy? *American Psychologist, 64*(8), 739-750.
- Steinberg, L., Cauffman, E., Woolard, J., Graham, S., & Banich, M. (2009). Are adolescents less mature than adults? Minors' access to abortion, the juvenile death penalty, and the alleged APA "flip-flop". *American Psychologist, 64*(7), 583-594.
- Steinberger, J., & Daniels, S. R. (2003). Obesity, insulin resistance, diabetes, and cardiovascular risk in children: An American Heart Association scientific statement from the Atherosclerosis, Hypertension, and Obesity in the Young Committee (Council on Cardiovascular Disease in the Young) and the Diabetes Committee (Council on Nutrition, Physical Activity, and Metabolism). *Circulation, 107*(10), 1448-1453.
- Steinmetz, K. A., & Potter, J. D. (1996). Vegetables, fruit, and cancer prevention: A review. *J Am Diet Assoc, 96*(10), 1027-1039.

- Stevens, J., Cornell, C., Story, M., French, S., Levin, S., Becenti, A., et al. (1999). Development of a questionnaire to assess knowledge, attitudes, and behaviors in American Indian children. *Am J Clin Nutr*, *69*(suppl), S773-S781.
- Stevens, J., Story, M., Ring, K., Murray, D., Cornell, C., Juhaeri, J., et al. (2003). The impact of the Pathways intervention on psychosocial variables related to diet and physical activity in American Indian schoolchildren. *Prev Med*, *37*, S70-S79.
- Story, M., Kaphingst, K. M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review Of Public Health*, *29*, 6.1-6.20.
- Story, M., Neumark-Sztainer, D., & French, S. A. (2002). Individual and environmental influences on adolescent eating behaviors. *J Am Diet Assoc*, *102*(3 Suppl), S40-51.
- Sturdevant, M. S., & Spear, B. A. (2002). Adolescent psychological development. *J Am Diet Assoc.*, *Supplement 102*(3), S30-S31.
- UMD-SOM. (2008). *Challenge!* Retrieved February 23, 2008, from http://medschool.umaryland.edu/growth/challenge_program.asp
- Urban Dictionary: Chicken box. (2008). Retrieved November 26, 2008, from <http://www.urbandictionary.com/define.php?term=chicken+box>
- Variyam, J., & Blaylock, J. (1999). *Unlocking the mystery between nutrition knowledge and diet quality*. Retrieved from <http://www.ers.usda.gov/publications/foodreview>.
- Vartanian, L. R., Schwartz, M. B., & Brownell, K. D. (2007). Effects of soft drink consumption on nutrition and health: A systematic review and meta-analysis. *Am J Public Health*, *97*(4), 667-675.
- Videon, T. M., & Manning, C. K. (2003). Influences on adolescent eating patterns: the importance of family meals. *J Adolesc Health*, *32*(5), 365-373.
- Wang, M. C., Kim, S., Gonzalez, A. A., MacLeod, K. E., & Winkleby, M. A. (2007). Socioeconomic and food-related physical characteristics of the neighbourhood environment are associated with body mass index. *J Epidemiol Community Health*, *61*(6), 491-498.
- Wardlaw, G. M., & Smith, A. M. (2006). *Contemporary Nutrition: Issues and Insights* (6th ed.). New York: McGraw Hill

- Watters, J. L., Satia, J. A., & Galanko, J. A. (2007). Associations of psychosocial factors with fruit and vegetable intake among African-Americans. *Public Health Nutrition*, *10*(7), 701-711.
- Whiting, S., Vatanparast, H., Baxter-Jones, A., Faulkner, R., Mirwald, R., & Bailey, D. (2004). Factors that affect bone mineral accrual in the adolescent growth spurt. *J. Nutr.*, *134*(3), 696S-700S.
- Wiecha, J. L., Finkelstein, D., Troped, P. J., Fragala, M., & Peterson, K. E. (2006). School vending machine use and fast-food restaurant use are associated with sugar-sweetened beverage intake in youth. *J Am Diet Assoc*, *106*(10), 1624-1630.
- Williams, D. R., & Collins, C. (2001). Racial residential segregation: A fundamental cause of racial disparities in health. *Public Health Reports*, *116*(Sept/Oct), 404-416.
- Winkleby, M. A., Robinson, T. N., Sundquist, J., & Kraemer, H. C. (1999). Ethnic variation in cardiovascular disease risk factors among children and young adults: Findings from the Third National Health and Nutrition Examination Survey, 1988-1994. *JAMA*, *281*(11), 1006-1013.
- Wroblewski, M. M., Hurley, K., Oberlander, S., Merry, B., Black, M. M. (2010). The Healthy Eating Index 2005 is a good predictor of chronic disease risk in low-income, African-American urban youth. Manuscript in preparation.
- Xie, B., Gilliland, F. D., Li, Y.-F., & Rockett, H. R. H. (2003). Effects of ethnicity, family income, and education on dietary intake among adolescents. *Prev Med*, *36*(1), 30-40.
- Young, E. M., Fors, S. W., & Hayes, D. M. (2004). Associations between perceived parent behaviors and middle school student fruit and vegetable consumption. *J Nutr Educ Behav*, *36*(1), 2-12.
- Yu, C.H. (2008). Reliability of self-report data. Retrieved January 22, 2009, from <http://www.creative-wisdom.com/teaching/WBI/memory.shtml>
- Zenk, S. N., Schultz, A. J., Israel, B. A., Bao, S., & Wilson, M. L. (2006). Fruit and vegetable access differs by community racial composition and socioeconomic position in Detroit, Michigan. *Ethn Dis*, *Winter 16*(1), 275-280.
- Zenk, S. N., Schulz, A. J., Hollis-Neely, T., Campbell, R. T., Holmes, N., Watkins, G., et al. (2005). Fruit and vegetable intake in African Americans: Income and store characteristics. *Am J Prev Med*, *29*(1), 1-9.

Zimmerman, B. J., & Cleary, T. J. (2006). Adolescents' development of personal agency: The role of self-efficacy beliefs and self-regulatory skill. In F. Pajares & T. Urdan (Eds.), *Self-Efficacy Beliefs of Adolescents* (pp. 58-65). Greenwich, Connecticut: IAP Information Age Publishing, Inc.

Zive, M. M., Elder, J. P., Prochaska, J. J., Conway, T. L., Pelletier, R. L., Marshall, S., et al. (2002). Sources of dietary fat in middle schools. *Prev Med*, 35(4), 376-382.