The effects of diet, physical activity, psychosocial variables, and home environment on weight status of children who reside in a low-income rural area.

by

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A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
December 8, 2012

Keywords: elementary children, obesity, nutrition, accelerometers

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Abstract

The purpose of this investigation was to determine the effect of diet, physical activity, psychosocial variables, and environment on the weight status of children who reside in a low-income rural area. One hundred fifty seven 3rd – 6th graders, from one elementary school in Alabama participated in this study.

Measures included height, weight, and physical activity levels measured by accelerometry. Self-efficacy, social support, outcome expectations, perception of access to physical activity opportunities near the home, fruit and vegetable availability in the home, and fruits and vegetables consumption outside the school setting were assessed by questionnaires. Direct observation was used to record fruit and vegetable consumption during breakfast and lunch for two school days.

Children's activity levels were recorded for seven days. On average children met physical activity requirements (71 minutes of moderate and vigorous physical activity; MVPA) per day which was significantly related to children's weight status (p=0.016). Children who exhibited increased levels of physical activity had healthier weight. children's access to physical activity opportunities near the home was not significantly (p=0.963) related to their physical activity levels. Social support (p=0.722) and self-efficacy (p=0.386) did not significantly relate to children's weight status however, their outcome expectancies (p=0.033) did significantly relate to their weight status. Social support (p=0.531), self-efficacy (p=0.158) and outcome expectations (p=0.670) did not related to children's physical activity levels. In this study, children's fruit and vegetable consumption (p=0.514) was not significantly related to their

weight status and their access to fruits and vegetables (p=0.963) in the home environment was not significantly related to the consumption of fruits and vegetables. The results of this study showed that children's physical activity levels and their beliefs in their abilities to perform physical activity related tasks are related to their weight status.

Acknowledgments

First and foremost, I wish to say thank you to my family for all of your love, support, and encouragement because without you I would not have succeeded in Graduate School. To my parents Ray and Sue Daly, I say thank you for always encouraging me and for instilling in me that I can do anything if I put my mind to it. Without the two of you, this dream would have not have been possible. To my sister, Renee, and brother-in-law John for always bothering me to get my work done so I was not in school for the rest of my life and encouraging me through the whole process. Thank you also to their children Isaac, Jacob, Joseph and Jack for being my biggest fans. Thank you to my brother Jason who I went to when no one else understood what I was going through. Thank you for listening to me, understanding me, and telling me the truth about Graduate School. I am also grateful to my brothers Patrick and Ryan for being supportive in their own ways, Uncle Joe and Aunt Carol for always checking in; sending encouraging cards and telling me I can complete this even when I did not think it was possible. Thank you to my two cousins Maureen and Michael for being there for me when I needed them. Thank you to all my friends Remi Onifade, the Clay Family, the Bontrager Family, the Farney Family, Gina Manor, Renee Kline, Hilary Swihart, Alicia Mears, Faith Stefaniak, Lynn Unrea, and Jennifer Hummitzsch. Thank you to all of these people, who believed in me, encouraged me and supported me throughout the whole process.

To Dr. Danielle Wadsworth, thank you for being one of the best advisors a doctoral student could hope for. Most of all, you led me by example and instilled in me a work ethic and determination to succeed that will stay with me for years to come. Your willingness to spend countless hours teaching, advising, mentoring, feeding, providing shelter, supplying beverages, and guiding me is greatly appreciated. You have passed on your knowledge to me and I look forward to learning from you in the future. I extend this thanks to the entire Wadsworth family; John, Brady, Tucker, and my best friend Beth Ann for letting me live there while I completed my degree.

Thank you to Dr. Leah Robinson for being an awesome committee member and friend. Thank you for all your guidance and scientific contributions. Thank you for providing me with shelter for a few months. Without your help I would have not been able to survive my last few months at Auburn.

To Dr. Shannon, thank you for all your statistical wisdom and advice. I can positively say that without you I could have not completed this project. To Dr. Gropper, thank you for your nutrition advice and your careful eye that caught all my grammatical mistakes. To Dr. Rudisill, thank you for always believing in me and providing positive support throughout my time at Auburn. I could not ask for a better department head. You are the best! Finally, to Dr. Boudreaux, thank you for being my outside reader. Not only did you help with my dissertation, but you also have been a great friend and helped provide me with an assistantship through the veterinary college.

This dissertation would not have been possible without help from numerous graduate and undergraduate students. Thank you to Kip Webster, Dr. Maria Morera, Alexa Girard, Hannah Dohogne, Brandi Battiste, Joseph Antoni, Taylor Larson, and Dr. Sam Logan. Thank you for your assistance with data collection and recording. Dr. Nancy Gell, who was the best office mate a girl, could ask for. I cannot think of a better person to ask all my stupid questions! Even though you are in Seattle, you are the best ever! Dr. James “Old” McDonald, thank you for being like a second father to me while I have been in Auburn and always bothering me.

Finally, I would like to thank the College of Veterinary Medicine. The CVM provided me with an assistantship to pay my way through graduate school. Within this program I made many friends that became and will forever be a part of my family. Thank you Nancy Morrison, Dr. Vicky van Santen, Shelly Aono, Gina Williams, Natalie Royer, Dr. Joanna Hyland, Teresa Logiotatos, Dr. Bruce Smith, Dr. Emily Graff and Sherry Compton. Without all of you and your encouragement I would have missed home a lot more and may have not made it. You all were like a second family to me. Thank you for being there. I could not have completed this dissertation alone. There is an old proverb that it takes a whole village to raise a child, and in this case it did take a whole village to help earn my degree. To everyone at Auburn who touched my life during graduate school, thank you for helping me along my path and bringing me to where I am today. Thank you all.

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Chapter I

Introduction

In the United States, obesity is the second leading cause of preventable disease and death only surpassed by smoking (Wang & Lobstein, 2006). The prevalence of obesity is increasing in almost all industrialized countries along with several low-income and non-industrialized countries. In the United States from the 1970s to the end of the 1990s obesity rates tripled (Wang & Lobstein, 2006). According to the Center of Disease control and Prevention (CDC; 2012) more than one third of children (2 to 19 years) in the United States are overweight or obese (17% obese). This increase in weight parallels an increase in chronic conditions and other health-related complications that are commonly seen in adult populations. These complications include but are not limited to type 2 diabetes, asthma, sleep apnea, and gall-bladder diseases (Ebbeling, Pawlak, & Ludwig, 2002). Along with adults, obesity in childhood can cause hypertension, dyslipidemia, chronic inflammation, increased blood clotting tendency, endothelial dysfunction, and hyperinsulinemia (Ebbeling, Pawlak, & Ludwig, 2002). Children who are obese in their preschool years are more likely to be obese in adolescence and adulthood and to develop diabetes, hypertension, hyperlipidemia, asthma, and sleep apnea (Dalbey, 2008; Patterson et al., 2004; Tai-Seale & Chandler, 2003). In addition, studies indicate higher rates of obesity in rural populations compared to urban populations (Dalbey, 2008; Patterson et al., 2004; Tai-Seale & Chandler, 2003). With childhood obesity on the rise there is considerable interest in understanding the determinants of obesity. Previous research shows that youth physical activity levels (Brusseau et al., 2011), various psychosocial variables (Bandura, 1986a), children's environments in terms of access to physical activity opportunities and access to nutrient dense foods (Sallis, Prochaska, & Taylor 2000), and nutritional intake (St Onge, Keller, & Heymsfield, 2003) affect a child's current weight status.

National initiatives suggest that children should participate in at least 60 minutes of daily physical activity (National Association for Sport and Physical Education, 2011). This guideline is also recommended by the CDC (2010) in order for children to improve overall health, increase fitness strengthens bones and muscles, maintain a healthy weight, and reduce the risk of chronic health diseases. However, a majority of elementary school aged students are not meeting this recommendation. Approximately 42% of children aged 6-11 years participate in 60 minutes of physical activity per day (48% of boys and 35% of girls; Troiano et al., 2008).

In addition to physical activity participation, food consumption contributes also to a child's weight status. Healthy foods include fruits, vegetables, whole grains, legumes, low-fat dairy products, fish, poultry, and lean meats. Fruits, vegetables, and fish are often inadequately consumed by children and adolescents (Gidding et al., 2005). Children aged 8-13 years should consume approximately 2 cups of fruits, 1.5 cups of vegetables, 5 ounces of protein, 3 cups of milk, and 5 ounces of grains. Fruits and vegetables are especially important for optimal growth, weight management, and chronic disease prevention (*Healthy People 2010*; USDHHS, 2010 & USDA, 2011). The national *Healthy People 2020* fruit objective and vegetable objective are designed to increase the proportion of fruit to 75% and ≥3 servings of vegetables to 50%, respectively (*Healthy People 2020*) for Americans aged at least 2 years consuming daily ≥2 servings of. A study examining food intake showed that in 2000 only 5% of 7–14 year old children met the national recommendations for servings of fruit (St Onge, Keller, & Heymsfield, 2003). Further evidence shows that 75% of rural African American adults do not meet the dietary recommendations for fruit and vegetable intake (Liu, Bennett, Harun, & Probst, 2008; McClelland et al., 1998) and that rural residents' diets are high in fatty and sugary foods and low in fruits and vegetables (Crooks, 2000; Liu, Bennett, Harun, & Probst, 2008; Stroehla, Malcoe, & Velie, 2005).

Social cognitive theory (SCT) provides a framework to examine the complex interplay between personal, environmental and behavioral factors that affect a child's current weight status (Bandura, 1986a). Social cognitive theory specifies a core set of determinants, the mechanism through which they work, and the optimal ways of translating this knowledge into effective health practices. At the core of SCT theory is the reciprocal interplay between the environment and personal factors, suggesting that intervention or change in one variable will affect other variables.

According to SCT, determinants of physical activity participation and food consumption in elementary school aged children include environmental variables, social variables (influence from family, peers and social culture influences) and personal variables (self-efficacy and outcome expectations). Environmental variables refer to the physical environment or the actual built environment and include accessibility to physical activity opportunities, access to fruits and vegetables and built environment characteristics, such as safety, availability of sidewalks, and availability of parks and green spaces. In addition to the actual built environment, a person's perception of the built environment, referred to as the situational environment in SCT, affects a person's participation in physical activity and consumption of healthy foods. A person environment may not be conducive for physical activity. Their environment also may not have healthy food choices available in the local grocery or convenience stores possibly leading to poor nutrient intake.

Humpel et al., (2002) and Saelens, Sallis, and Frank (2003a) concluded that people are more active in neighborhoods offering recreational facilities, a mixture of land uses, connected streets, higher residential density, and enjoyable scenery. While the availability of a supportive physical environment may not in itself be sufficient to promote activity, it is likely to enhance individual targeted strategies (Bauman, Sallis, Dzewaltowski, & Owen 2002; Brownson, Haire-Joshu, & Luke, 2006; CDC 2006; Giles-Corti & Donovan, 2002; Jeffery & Utter, 2003; Kahn et al., 2002; Matson-Koffman, Brownstein, Neiner, & Greaney, 2005; Moore, Roux, Nettleton, & Jacobs, 2008; Sallis, Bauman, & Pratt, 1998). For these reasons, environmental features such as the lack of physical activity opportunities in neighborhoods have been hypothesized to be important contributors to physical activity at the population level (Brownson, Haire-Joshu, & Luke, 2006; Humpel, Owen, & Leslie, 2002; Jackson, 2002; Jeffery & Utter, 2003; Moore, Roux, Nettleton, & Jacobs, 2008; Popkin, Duffey, & Gordon-Larson, 2005) and may explain disparities in leisure-time physical activity by race/ethnicity and socioeconomic position (CDC, 1988-2003 & 1994-2004; Moore et al., 2008). Non-Hispanic blacks, Hispanics, and people with lower education levels are often less physically active than whites and those with higher education (Arriaza, 1998; CDC, 1988-2002 & 1994-2004; Moore et al., 2008). Differences in the availability of recreational resources across residential environments could contribute to these disparities (Moore et al., 2008). At least two U.S. studies found fewer parks, sports fields, fitness clubs, and trails in low-income neighborhoods than in more affluent ones, suggesting that low-income youth may face barriers to physical activity (Estabrooks, Lee, & Gyurcsik, 2003; Sallis & Glanz, 2006). Access to outdoor play areas is important because time spent outdoors has a strong relationship to children’s physical activity (Boldeman et al., 2011; Sallis et al., 2000).

Environmental influences that affect eating behaviors include the changing nature of the food supply; increased reliance on foods consumed away from home; food advertising, marketing, and promotion; and food prices (French, Story, & Jeffery, 2001; St Onge, 2003). The physical environment dictates the supplies of facilities and their accessibility and thus influences how well and easy the latent demand can be realized. With this shift in economic welfare has come a shift toward more secure food supplies and increased nutrient-dense and energy-dense diets; reduced energy expenditure in transportation; and more leisure time, especially inactive leisure time (Montiero, Conde, Lu, & Popkin, 2004; Must, Dallal, & Dietz, 1991; Poskitt, 1995; Reddy et al., 2003; United Nations, 2001; Walker, Gaskin, Powell, & Bennett, 2002; Wang & Lobstein, 2006). Furthermore, children consume more energy when meals are eaten in restaurants than at home (Ebbeling, Pawlak, & Ludwig, 2002) possibly because restaurants tend to serve larger portions of energy dense foods (Ebbeling, Pawlak, & Ludwig, 2002). Expanding portion sizes also appear to be contributing to the obesity epidemic (Sallis& Glanz, 2006**;** Young & Nestle, 2003). Better access to supermarkets and other retail stores that provide access to healthful food products is associated with better diets for adults (Bodor et al., 2008; Larson, Story, & Nelson, 2009; Morland, 2002; Moore, Roux, Nettleton, & Jacobs, 2008; Sturm & Datar, 2011). Sturm (2011) et al., found that relative food prices influenced consumption patterns, particularly higher prices for fruit/vegetables predicted lower frequency of fruit/vegetable consumption and higher dairy prices predicted lower frequency of milk consumption. Low-income, minority and rural neighborhoods tend to have less access to supermarkets, and low-income urban neighborhoods have more small stores (Larson, Story, & Nelson, 2009; Sturm & Datar, 2011).

Social variables such as influence from families and peers have been found to be associated with children's obesity status. Research has shown that parent-child interactions, the home environment and social support from parents can affect behaviors related to risk of obesity, such as physical activity participation and nutrition behaviors (Ebbeling, Pawlak, & Ludwig, 2002; Reynolds et al., 1990). For example in girls, parental modeling of physical activity and of sedentary behavior is associated with their activity levels, their sedentary habits and a greater likelihood of being overweight in girls. Reynolds et al., (1990) found that parents who play with their children regularly and provide transportation to activities have more active children. Pugliese and Tinsley's (2007) data meta-analysis revealed that children are two times more likely to be active with supportive parents compared to children with unsupportive parents. They also found that parental encouragement, instrumental (e.g. transportation and providing access to equipment), and modeling behaviors all demonstrated significant positive relations with children's and adolescents' physical activity levels.

Self-efficacy, a person's judgment of their personal capabilities to organize or execute any type of performance (Bandura, 1986a) has been linked to physical activity participation (Hay, 1992; Pender, Bar-O, Wilk, & Mitchell, 2002). Self-efficacy beliefs are a product of value placement or outcome expectancies and expected outcomes of a behavior (outcome expectations). Unless people believe they can produce desired effects by their actions, they have little incentive to act or to persevere in the face of difficulties and setbacks. Motivators must be founded on the belief that one has the power to produce desired changes by one's actions. Self-efficacy has been shown to increase physical exercise (Pender, Bar-O, Wilk, & Mitchell, 2002), suggesting that exercise self-efficacy may improve following positive experiences of physical activity. This is important since self- efficacy is strongly predictive of future levels of physical activity (Hay, 1992) Self-efficacy is also a predictor of perceptions of exercise, independent of the actual nature of the exercise itself. For example, in a sample of girls aged 8 to 15 years, those with lower self-efficacy rated a cycling task as harder regardless of their actual energy expenditure (Pender, Bar-O, Wilk, & Mitchell, 2002).

Because of the long-term health consequences of childhood obesity, prevention of obesity in children and adolescents is a public health priority (Wang, 2006). The United States Department of Health and Human services (2012) suggests that changes in food habits, decline in physical activity and increases in sedentary behavior are a few of the many contributing factors to childhood obesity. Reducing childhood obesity will require effective prevention strategies that focus on environments, promoting physical activity, and a healthy diet. Various researchers have examined the influence of children's physical activity or dietary behaviors on obesity; however, modifiable psychosocial and environmental determinants of physical activity behavior, environmental determinants of dietary behaviors and how these factors relate to each other and obesity are not well understood (Bauman et al., 2002). Therefore, we are limited in the understanding of these factors on childrens' obesity levels (Welk & Schaben, 2004).

Statement of Purpose

The purpose of this investigation was to determine the effect of diet, physical activity, psychosocial variables, and environment on the weight status of children who reside in a low-income rural area.

Research Questions and Hypotheses

Research Question #1: What is the relationship between a child's access to home and recreational physical activity opportunities and their physical activity behavior?

Hypothesis #1: Children with greater access to home and recreational physical activity opportunities will have a greater accumulation of moderate and vigorous physical activity (MVPA) over seven days.

Research Question #2: What is the relationship between a child's access to fruits and vegetables in the home and nutritional intake?

Hypothesis # 2: Children with greater access to fruits and vegetables in the home will have greater fruit and vegetable intake identified by direct observation and the Child's Nutrition Questionnaire.

Research Question #3: What is the relationship between MVPA and weight status?

Hypothesis #3: Children who have higher levels of MVPA over seven days will demonstrate a negative relationship with obesity.

Research Question #4: What is the relationship between fruit and vegetable intake and obesity?

Hypothesis #4: Children who consume higher amounts of fruits and vegetables will demonstrate a negative relationship with obesity.

Research Question #5: What is the relationship between psychosocial variables (social support, self-efficacy and outcome expectations) and obesity?

Hypothesis #5: Children who demonstrate higher levels of social support, self-efficacy and realistic expectations will demonstrate a negative relationship with obesity.

Research Question #6: What is the relationship between psychosocial variables (social support, self-efficacy and outcome expectations) and MVPA?

Hypothesis #6: Children who demonstrate higher levels of social support and self-efficacy, realistic expectations will demonstrate a higher level of MVPA accumulated over seven days.

Definition of Terms

Built Environment - Neighborhoods, roads, buildings, food sources, and recreational facilities in which people live, work, are educated, eat, and play.

Daily step counts: The average number of steps accumulated throughout the day (Beighle & Pangrazi, 2006).

Energy Expenditure – Internal heat produced from external work (kcal/min/kg).

Metabolic equivalent (MET): A unit of measurement that describes the energy expenditure of different qualifications of physical activity. For example, one MET is the resting metabolic rate during which no activity is performed (Ainsworth et al., 2000).

Moderate-intensity physical activity: Bodily movement that results in energy expenditure of 3-6 METS (Haskell et al., 2007).

Physical Activity: Bodily movement produced by skeletal muscles that requires energy expenditure (World Health Organization, 2011).

Obesity – Having excess body fat

Obese – Accumulation of fat that may have adverse effect on health

Overweight – More body fat than optimally healthy

Rural Environment - Less than 20,000 population dense countries in the United States outside the metropolitan areas.

Vigorous-intensity physical activity- Bodily movement that results in energy expenditure of greater than 6 METS (Haskell et al., 2007).

Weight Status- Defined as normal (≤84th percentile), overweight (85th to 94th percentile) or obese (≥ 95th percentile) based on CDC growth charts for children 2 aged and up (CDC, 2009).

Limitations

Limitations associated with this study included:

1. Only school day (i.e. breakfast and lunch) food consumption was observed.

2. Additional nutritional intake was evaluated by a subjective measure and children may have difficulty recalling foods they consumed previously.

3. Children did not know they were being observed for breakfast and lunch, however, the presence of an observer may have caused children to change their eating habits. Observers were present in the cafeteria one week prior to data collection to reduce reactivity.

Delimitations

The delimitations of this study were:

1. Participants were 3rd through 6th grader elementary school-aged children enrolled in a rural school located in a, Southeast town in the United States.
2. Participants could not have an acute illness, such as a cold, during time of data collection.

Chapter II

Review of Literature

The purpose of this dissertation study was to examine the effects of diet, physical activity, psychosocial variables, and environment on weight status of children who reside in a low-income rural area. In particular, this study looked at children's fruit and vegetable consumption, home environment, psychosocial variables, as well as MVPA in determining weight status of elementary school children. The purpose of this literature review is to describe and provide evidence for the choice of population, the variables of the study and the methodology employed for the study. Topics included in this literature review include physical activity rates of children, opportunities for physical activity nutrition, reports of food consumption, nutrition opportunities, psychosocial variables and environment.

Obesity Introduction

In the United States, obesity is the second leading cause of preventable disease and death only surpassed by smoking (Wang & Lobstein, 2006). Obesity can be defined as a condition of abnormal or excessive fat accumulated in adipose tissue to an extent in which it may cause health to be impaired (WHO, 1995). According to Wang and Lobstein (2006), the prevalence of obesity is increasing in almost all industrialized countries along with several low-income countries. In the United states from 1970s to the end of the 1990s obesity has tripled (Wang & Lobstein, 2006). According to the USDA (2011) more than one third of children (2 to 19 years) in the US are overweight or obese (17% obese) and more than two-thirds of adults are overweight or obese. Seventy-two percent of men and 64% of women are overweight or obese with one-third of adults being obese (Flegal, Carroll, Ogden, & Curtin, 2010). In the state of Alabama, 36% of children are overweight or obese (Ogden et al., 2010). As it relates to the prevalence of overweight and obese children, National Health and Nutrition Examination Survey (NHANES) data indicate that 26.9% of boys and girls ages 2 – 19 years are obese while 31.7% are overweight. According to the CDC (2003-2004), childhood obesity continues to be a leading public health concern that disproportionately affects low-income and minority children. Findings also indicate a higher prevalence of unhealthy body mass index (BMI) in certain racial groups for adults and children. Nationally, Hispanic (36.1%), Mexican American (35.7%), and non-Hispanic Black (34.9%) children demonstrate a higher prevalence of obesity compared to non-Hispanic Whites (25.6%; WHO, 2002). For children, McMurray and colleagues (1999) found that children from rural areas in North Carolina have a 55% greater risk of obesity that could lead to an increase risk of chronic diseases.

The increase in weight parallels an increase in chronic conditions and other health-related complications that are commonly seen in adult populations (Ebbeling, Pawlak, & Ludwig, 2002). These complications can include type II diabetes, asthma, sleep apnea, and gall-bladder diseases (Ebbeling, Pawlak, & Ludwig, 2002). Along with adults, obesity in childhood can cause hypertension, dyslipidemia, chronic inflammation, increased blood clotting tendency, endothelial dysfunction, and hyperinsulinaemia (Ebbeling, Pawlak, & Ludwig, 2002). Children who are obese in their preschool years are more likely to be obese in adolescence and adulthood and to develop diabetes, hypertension, hyperlipidemia, asthma, and sleep apnea (Ebbeling, Pawlak, & Ludwig, 2002). Risk of obesity-related complications can differ by ethnic origin and as a result of cultural factors. Black and Hispanic youths in the USA, for example, are at greater risk for type II diabetes and cardiovascular disease than their white counterparts (Ebbeling, Pawlak, & Ludwig, 2002). Obesity only partly explains this racial disparity, since fasting serum insulin concentration and prevalence of the insulin resistance syndrome remain much higher in minority youths after statistical adjustment for BMI or adiposity (Ebbeling, Pawlak, & Ludwig, 2002).

Evidence linking physical activity and chronic disease risk reduction has spurred interest in further research about how childhood physical activity patterns track into adulthood. Combating childhood obesity is a public health priority because obesity during childhood and adolescence are most likely to become overweight or obese adults (Jaballas et al., 2011). Guo and colleagues (1994) demonstrated that 20% of overweight boys become overweight adults and 33% of boys that are overweight between 8 to 13 years of age become obese adults. It has also been noted that children who are overweight more than once during early childhood (between 2 and 5 years of age) were five times more likely to be overweight by the age of 12 (Nader et al., 2006).

Because of the long-term health consequences of childhood obesity, prevention of obesity in children and adolescents is a public health priority (Wang & Lobstein, 2006). The United States Department of Health and Human services (USDHHS; 2000) suggests that changes in food habits, decline in physical activity and increases in sedentary behavior are a few of the many contributing factors to childhood obesity. Reducing childhood obesity will require effective prevention strategies that focus on environments, promoting physical activity, and a healthy diet.

Physical Activity

Regular participation in physical activity has long been recognized as essential to normal development in children and in recent years promotion of physical activity in children and adolescents has become a recognized goal of public health authorities (Pate et al., 1997). Current recommendations state that school aged children should accumulate at least 60 minutes of physical activity per day of age appropriate physical activity on all or most days of the week (NASPE, 2004). Children should participate in several bouts of physical activity lasting 15 minutes or more each day. Extended periods (periods of 2 or more hours) of inactivity are discouraged for children especially during the daytime hours (NASPE, 2004).

Physical Activity Rates for Children and Adolescents

The need to understand where and how much physical activity children accumulate has become increasingly important in the development, implementation, and evaluation of interventions targeting physical activity (Brusseau et al., 2011). The updated international literature indicates that we can expect among children, 1) boys to average 12,000 to 16,000 steps/day and girls to average 10,000 to 13,000 steps/day; and, 2) adolescents to steadily decrease steps/day until approximately 8,000-9,000 steps/day are observed in 18-year olds and 3) a large percent of children do not meet physical activity recommendations (Tudor-Locke, Johnson, & Katzmarzyk, 2010). Controlled studies of cadence show that continuous MVPA, walking produces 3,300-3,500 steps in 30 minutes or 6,600-7,000 steps in 60 minutes in children 10-15 years can help children achieve the recommended steps per day. Across studies, 60 minutes of MVPA in primary/elementary school children appears to be achieved, on average, within a total of 13,000 to 15,000 steps/day in boys and 11,000 to 12,000 steps/day in girls. For adolescents (both boys and girls) 10,000 to 11,700 steps may be associated with 60 minutes of MVPA (Tudor-Locke et al., 2010).

Recent research has focused on physical activity prevalence rates for elementary students. NHANES is one of the largest efforts in the United States to collect a variety of health-related information. In 2003-2004 NHANES conducted a health examination across the United States. For the physical activity data all participants over 6 years of age wore an Actigraph accelerometer for seven days. From the NHANES data Toriano et al.'s (2000) determined that, 10.5% boys and 19.1% girls did not meet the requirements for MVPA. Using the NHANES Actigraph data, Troiano et al., (2008) described the physical activity levels of 597 children between the ages of 6 to 11 years old. Boys and girls spent approximately 95.4 and 75.2 minutes, respectively, in MVPA on a daily basis. This suggests that 42% of children in this age range meet the daily physical activity recommendation of 60 minutes (48% of boys and 35% of girls). Further data from 2003-2004 NHANES titled the Youth Media Campaign Longitudinal Survey (YMCLS), examined a national representative survey among children aged 9-13 years. This survey indicated that 61.5% of children do not participate in an organized physical activity during the non-school hours, 22.6% do not engage in any free-time physical activity. Data from NHANES (2005-2006) examined total steps per day to measure physical activity levels. Boys and girls aged 6-11 years (n = 915) accumulated approximately 13,000 and 12,000 steps per day, respectively (Tudor-Locke, Johnson, & Katzmarzyk, 2010). Similar total steps per day were reported by Beighle & Pangrazi (2006) for 1st through 6th grade children (boys: 13,348, girls: 11,702), 1st through 3rd grade children (Le Masurier et al., 2005; boys: 13,110, girls: 11,120), 4th through 6th grade children (Le Masurier et al., 2005; boys: 13,631, girls: 11,125), and 10-11 year olds (Johnson et al., 2010; boys: 12,853, girls: 10,409).

A 2008 British Health Survey found that approximately 32% of boys and 24% of girl's ages 2-15 years achieved the government's recommendation for physical activity (e.g. at least 60 minutes of moderate intensity physical activity each day). Overall, 95% of boys and girls had participated in some kind of physical activity in the last seven days. The responses indicated that children averaged 10.0 hours of physical activity for boys and 8.7 hours of physical activity for girls in the week prior to completing the survey. Levels of physical activity among girls declined with age, from a mean of 35% among 2 year olds to 12% among 14 year olds. On average, boys and girls acquired similar amounts of light activity. Overall, boys spent 85 minutes per day and girls spent 61 minutes per day on average in MVPA. MVPA decreased from 124 minutes among boys and 101 minutes among girls ages 4 to 7 years, to 52 minutes among boys and 28 minutes among girls ages 12 to 15 years (Craig, Mindell, & Hirani, 2009). According to Strauss, Rodzilsky, Burack, and Colin (2001) children (10-16 years old) spent only 12 to 13 minutes per day involved in vigorous physical activity. Hinkley et al., (2008), and Miles (2007) reported that boys in the United States tend to be more active than girls, and there is a decline in physical activity as children reach adolescence, a tendency that is more prevalent in girls. Collectively, these studies demonstrate that a majority of children in the United States do not meet physical activity recommendations at a young age and physical activity participation declines with age.

In global terms, children from the United States participate in less physical activity than other countries. Beets et al., (2010) reviewed 43 studies from 13 countries results and indicated that children of Australia and New Zealand are the most active followed by several European countries (Belgium, Czech Republic, France, Greece, Sweden, Switzerland, and the United Kingdom). Their analysis revealed that children of the United States take significantly less steps (1,839 less) per day than other countries specifically the Western Pacific Region. This is a concern because children's' physical activity levels can serve as a foundation for a lifetime of regular physical activity patterns (Goran, Reynolds, & Lindquist, 1999). Therefore, childhood is an opportune time to intervene on activity pattern development (Maziak, Ward, & Stoclton, 2007; Teachman & Brownell, 2001).

Researchers have examined physical activity levels during separate parts of the day in an effort to better understand physical activity participation (Beighle et al., 2006). In a review of 31 studies, physical activity levels of the separated school day were described for children between the ages of 6 to 18 years (Tudor-Locke et al., 2009). In this review activity was divided into habitual activity, school day activity, physical education (PE) class activity, recess activity, out of school activity, weekend activity, and vacation activity. On average boys took more steps than girls and 8 to 9 year olds took more steps than any other age groups. During the school day boys averaged 6700-7600 (42-49% of daily steps) steps and girls averaged 4900-6100 steps (41-47% of their daily steps). PE accounted for 8.7-23.7% and 11.4-17.2% of daily steps for boys and girls respectively. In this review recess accounted for about 8-11% of daily steps for both boys and girls and a lunch break averaging 15 minutes of free play resulted in 15-16% of children's daily step count. Out of school activity step count averaged 58-60% for boys and girls with a significant increase with age, in step count, pertaining to out of school activity. Weekend activity resulted in an average of 12,000 -13,000 steps per day for boys and 10,000-12,000 steps per day for girls.

Brusseau et al., (2011) described physical activity levels of fourth and fifth grade students during the total day, out-of-school, in-school, and during lunch, recess, and physical education. For the entire sample, children engaged in approximately 12,027 steps per day, which is similar to steps reported from NHANES data (Tudor-Locke, Johnson, & Katzmarzyk, 2010). Children engaged in 63.3% of daily steps outside of school, 37.9% at school, 12.6% at lunch, 8.9% at recess, and 13.5% during physical education. Boys accumulated more steps than girls during every segment of the day (see Brusseau et al., 2011 for details). This approach has also been used in 6th grade students (Tudor-Locke et al., 2006). A key finding was that boys took significantly more steps than girls during release time segments (i.e., recess, lunchtime, after school), with the exception of before-school steps, but boys and girls took the same number of steps during structured PE classes. Further, boys took similar numbers of steps during both recess and PE (despite the former being 15 min shorter), yet girls took 400 fewer steps at recess (release time) compared with PE (structured time). Stated another way, compared with recess, PE contributed relatively more (yet still modestly) to girls daily physical activity; both segments contributed equally (and modestly) to boys daily physical activity. All of these statements must be interpreted with the caveat that variance in behavior was great within these small segments. This is further supported by Brusseau et al. (2011), which reported that in less structured activity times (i.e. lunch and recess) boys were significantly more active than girls. This may suggest that organized and semi-structured physical activity opportunity during these times may be needed to increase the physical activity of girls. Both recess and lunchtime physical activity opportunities provide important opportunities for children to be active. Nearly 21% of the daily activity of children takes place during these time segments, demonstrating their importance for this population (Brusseau et al., 2011).

Opportunities for Physical Activity

Children can become more active through modes of active transportation such as (a) walking or riding a bicycle (Babey, Hastert, Huang, & Brown, 2009; Frank, Kerr, Chapman, & Sallis, 2007; Handy, Boarnet, Ewing, & Killingsworth, 2002; McMillan, 2007; Timperio et al., 2006; Tudor-Locke, Ainsworth, & Popkin, 2001), (b) physical education in school (Haug, Torsheim, Sallis, & Samdal, 2008; Sallis et al., 2001; Wechsler, Devereaux, Davis, & Collins, 2000), and (c) recreational activities such as playing outside and participating in sports (Sallis et al., 2000; Sener, Copperman, Pendyala, & Bhat, 2008). Although, walking and cycling as active transportation is an effective strategy in urban areas, rural areas offer less street connectivity or distances to destinations may be too far. Of these opportunities, getting children to play outside and in outdoor settings is especially recommended because outdoor recreation is the strongest correlate of children's physical activity (Godbey, 2009).

During most of the daylight hours children are in the school setting and it has been found that children accumulate more steps in a day when they participate in free play such as recess or are provided green space (Bolderman et al., 2011; Tudor-Locke et al., 2006). Some elementary schools however, do not have a recess period or green space but may provide children with a physical education (PE) class. Elementary schools often provide PE class and unstructured free play time (i.e. recess) to children. One of the goals of PE and recess is to promote engagement in physical activity. In a multicenter study, McKenzie et al., (1995) examined physical activity levels of third grade children during PE. A typical PE lesson lasted approximately 29.5 minutes and children engaged in 5.2 vigorous and 10.6 moderate-to-vigorous minutes of physical activity per lesson. Scruggs (2007) reported that 5th grade boys and girls accumulated 2,517 (78 steps/min) and 1,816 (58 steps/min) steps, respectively, per 30 minute PE class. Ridgers, Stratton, and Fairclough (2006) conducted a review of studies that examined recess physical activity levels of 4-12 year old children. The range of minutes children engaged in MVPA was 2.8 to 24 minutes for boys and 2.7 to 18.4 minutes for girls. This suggests that for boys and girls, approximately 4.5% to 40% of physical activity during recess contributed to the recommended 60 minutes of physical activity per day.

Time spent outdoors has also been shown to have a strong relationship in children's physical activity levels (Sallis et al., 2000). Access to parks and involvement in sports programs has also been shown to directly affect a child's physical activity levels (Hoefer et al., 2001; Sallis et al., 1992b). Kemperman & Timmermans, (2011) identified links between various elements of the built environment and physical activity. Bolderman & Timmermans, (2011) findings support the idea that green and varied outdoor environments increases children's physical activity. They concluded if a child is permitted to be outdoors that outdoor environments with a high play potential during a 7 hour school day can increase a child's step count by 1500-2000 steps. Humpel et al., (2002) and Saelens, Sallis, and Frank (2003a), concluded that people are more active in neighborhoods offering recreational facilities, a mixture of land uses, connected streets, higher residential density, and enjoyable scenery. They also found that feeling safe had potentially the largest effect on participation levels in physical activities.

Kemperman & Timmermans, (2011) found the link between home travel distance and out of the home recreational activity type indicated 14% of the activities took place within about a half a mile of the child's residence, 15% was within a half a mile to a mile radius and 52% of the activities took place within a mile and a half of children's residence. Activities that are performed more often within the direct environment of the residence are general leisure activities (e.g., playing outside), social contacts, and walking. This latter activity includes walking and biking trips in the immediate living environment. Social contacts and walking also are conducted at some distance from home as suggested by the significantly larger percentage for distance over 6 miles. This may involve visits to friends and family that live in other municipalities/cities. Sporting and community/club activities typically take place within a radius up to 6 miles.

Regular participation in physical activity has long been recognized as essential to normal development in children (Pate et al., 1997), however, a majority of children do not meet daily recommendations, particularly children residing in the United States (Beets et al., 2010). The need to understand where and how much physical activity children accumulate has become increasingly important in the development, implementation, and evaluation of interventions targeting physical activity (Brusseau et al., 2011) to prevent obesity and chronic disease.

Nutrition

Good nutrition contributes to overall health and reduces the risk of obesity (Gidding et al., 2005). The American Heart Association (Gidding et al., 2005; Lichtenstein et al., 2006) recommends that childrens' (≥ 2 years) diets should primarily include fruits and vegetables, whole grains, low-fat and nonfat dairy products, beans, fish, and lean meat. Children should also have low intakes of saturated and trans fats, cholesterol, and added sugar and salt. Fruits, vegetables, and fish are often inadequately consumed by children and adolescents (Gidding et al., 2005). Because the major sources of saturated fat and cholesterol in children's diets are full-fat milk and cheese and fatty meats, use of low-fat dairy products and lean cuts of meat in appropriate portion sizes will be critical in meeting dietary needs and nutrient requirements (Gidding et al., 2006; Peterson & Sigman-Grant, 1997). Fish is an important food with growing evidence of potential benefit. However, consumers may have difficulty in distinguishing among several health messages about fish consumption (Gidding et al., 2006).

Dietary Guidelines 2010 indicates the amount of calories children should consume depending on activity levels (Table 1; myplate.gov).

Table 1. Daily Dietary Guidelines for Children								
		Grains	vegetables	Fruits	Dairy	Protein	Estimated	Empty
		Recommended Amounts					Calories	Calories
	Age							
Children	4-8 years old	5 ounce equivalents*	1½ cups**	1 to 1 ½ cups[#]	2 ½ cups	4 ounce equivalents[@]	1200-1400	120
Boys	9-13 years old	6 ounce equivalents*	2½ cups**	1 ½ cups[#]	3 cups	5 ounce equivalents[@]	1800	160
Girls	9-13 years old	5 ounce equivalents*	2 cups**	1 ½ cups[#]	3 cups	5 ounce equivalents[@]	1600	120

My plate.gov

*	1 slice of bread, 1 cup of ready-to-eat cereal, or ½ cup of cooked rice, cooked pasta, or cooked cereal can be considered as 1 ounce equivalent from the Grains Group.
**	1 cup of raw or cooked vegetables or vegetable juice, or 2 cups of raw leafy greens can be considered as 1 cup from the Vegetable Group
#	1 cup of fruit or 100% fruit juice, or ½ cup of dried fruit can be considered as 1 cup from the Fruit Group. The following specific amounts count as 1 cup of fruit
@	1 ounce of meat, poultry or fish, ¼ cup cooked beans, 1 egg, 1 tablespoon of peanut butter, or ½ ounce of nuts or seeds can be considered as 1 ounce equivalent from the Protein Foods Group.

Children should consume about 5 to 6 ounces of grains with half their grains coming from whole grains. Vegetables and fruits should cover at least half of a child's food plate. They need to consume 1½ to 2½ cups of varied vegetables a day and 1 to 1½ cups of fruits (myplate.gov). Dairy products (2½ to 3 cups) should consist of low-fat or fat free and calcium rich options. Children should consume 4 to 5 ounces daily of protein that comes from lean meats or vegetarian options.

Children's nutrition is particularly important because of the vital role proper nutrition plays throughout the lifespan (Flegal et al., 2010). Children today are consuming excessive calories and low nutrients (Flegal et al., 2010). The Dietary Guidelines for Americans (7th Edition, 2010) has placed a strong emphasis on reducing calorie consumption and increasing physical activity. For young sedentary children, the amount of total energy intake that can come from foods used purely as a source of energy, 100 to 150 calories, is less than that provided by a usual portion size of most low-nutrient-dense snacks and beverages (Gidding et al., 2005).

With increasing activity, this discretionary calorie amount may increase to 200 to 500 calories, depending on the age and gender of the child and their level of physical activity (Gidding et al., 2005; Appendix A). The message portrayed by appendix A is clear: to be sedentary, have a nutritionally adequate diet, and to avoid excessive caloric intake in a contemporary society is difficult (Van Horn et al., 2005).

Low intakes of fruits and vegetables have been linked to increased risks of cardiovascular disease (John et al., 2002; Rogers and Sharp, 1997), stroke (Kaumudi et al., 1999), some cancers, and various diseases that follow a low socioeconomic gradient (James et al., 1997; Lahmann et al., 2000; O'Dea & Caputi, 2001; Paeratakul et al., 2002; Siskind et al., 1992). Fruits and vegetables are especially important in children for optimal growth, weight management, and chronic disease prevention (Healthy People, 2010).

Fruits and non-starchy vegetables may protect against excessive weight gain because of their low energy density, high fiber content, and low glycemic index. Moreover, inadequate consumption of fruits and vegetables has been associated with obesity-related morbidities such as cardiovascular disease (Bazzano, He, & Ogden, 2002; Gidding et al., 2006; Joshipura, 2001) and diabetes (Gidding et al., 2006; Joshipura, 2001). According to Gillman et al., (2000), the food and nutrient profiles of subjects who ate fast food closely reflect dietary patterns among children who infrequently eat dinner with their families. These children consume fewer fruits and vegetables, more fried food and soda, more saturated and trans-fat, higher glycemic load, and less fiber and micronutrients (Gidding et al., 2006).

Reports of food consumption for Children and Adolescents

Approximately 20% of children and adolescents reported low-fat milk as the type of milk usually consumed (Kit, Carroll, & Ogden, 2011). Two-percent milk was reported as the type of milk usually consumed by 45.4% of children and adolescents (Kit, Carroll, & Ogden, 2011). Non-Hispanic black and Hispanic children and adolescents reported low-fat milk as their usual milk type less frequently than their non-Hispanic white counterparts (Kit, Carroll, & Ogden, 2011). Children and adolescents in higher-income categories reported low-fat milk as their usual milk type more frequently than children in lower-income categories (Kit, Carroll, & Ogden, 2011). A study from 2000, Brady et al., showed that only 5% of 7–14 year old children met the national recommendations for servings of fruit and 9% met the recommendations for dairy (Brady et al., 2000; St Onge, Keller, & Heymsfield, 2003;). In 2009, discretionary fat and added sugar, assessed as the quantity of added fat and sugar as well as the amount of sugar and fat consumed if the higher-fat and higher-sugar version of a food was chosen, accounted for 46% of total daily energy intake (Brady et al., 2000; St Onge, Keller, & Heymsfield, 2003).

From its origins in the 1950s, fast food has grown into a dominant dietary pattern among children in the United States today (Bowman et al., 2004; Nestle, 2002; Schlosser, 2001).

Consumption of fast food by children increased a remarkable fivefold from 2% of total energy in the late 1970s to 10% of total energy in the mid-1990s (Bowman et al., 2004; Guthrie, 2002). The number of fast food restaurants more than doubled from 1972 to 1995 and as of 2004 totals an estimated 247,115 nationwide (Bowman et al., 2004; Technomic, 2002). The number of fast-food outlets increased from about 30,000 in 1970 to 140,000 in 1980, and fast-food sales increased by about 300% (French, Harnack &Jeffery, 2000; Paeratakul et al., 2003). More recent estimates show that in 2001, there were about 222,000 fast food locations in the United States, generating sales of more than $125 billion (Paerarakul et al., 2003*)*. Fast food pervades virtually all segments of society including local communities, public schools, and hospitals (Bowman et al., 2004; Cram et al., 2002; Levine, 1999; Zive et al., 2002).

Children and adolescents who eat fast food consume an average of 187 kcal per day more than those who did not (Bowman et al., 2004; Schmidt et al., 2005). Several dietary factors inherent to fast food may cause excessive weight gain such as massive portion size, high energy density, palatability (appealing to primordial taste preferences for fats, sugar, and salt), high content of saturated and trans fat, high glycemic load, and low content of fiber (Bowman, 2002; Ebbeling, Pawlak, & Ludwig, 2002). Children who ate fast food, compared with those who did not, consumed more sugar-sweetened beverages, less milk, and fewer fruits and non-starchy vegetables. It seems that, as children age, fast food consumption increases (St Onge, Keller, & Heymsfield, 2003). This increase can be balanced by a proportional decrease in energy from other, more nutritious foods such as fruits and vegetables, milk, and grains, or it may simply be an addition to an already balanced diet (St Onge, Keller, & Heymsfield, 2003).

A survey of 4,746 students 11 to 18 years of age reported that about 75% ate at a fast-food restaurant during the week before the survey (French et al., 2001; Paeratakul et al., 2003). The same survey showed that fast-food use was associated with higher intakes of fried potato, hamburger, pizza, and soft drink, and lower intakes of fruits, vegetables, and milk. One-half of preschool children consume soft drinks, but 64.1% and 82.5% of school-age children and adolescents, respectively, do so (Harnack, Stang & Story, 1999; St Onge, Keller, & Heymsfield, 2003). In 1970, money spent on foods eaten away from home accounted for 25% of total food spending; by 1999 it had reached a record 47% of total food spending (Clauson, 1999; Kennedy, Blaylock & Betsey, 1999; Paeratakul et al., 2003). This study shows that fast food, not including other foods eaten away from home (eg, at school cafeterias), may contribute to high intake of energy, fat, sodium, carbonated soft drinks, and fried potato, and low intake of milk, fruits, vegetables, dietary fiber, and some vitamins (Paeratakul et al., 2003).

Nutrition opportunities

School lunch and breakfast

The National School Lunch Program (NSLP) and the School Breakfast Program (SBP) are federally assisted meal programs open to public or nonprofit schools and residental child care instuitutons. NSLP and SBP provide nutritionally balanced, low cost or free lunches to children daily. The lunches and breakfasts must follow the Dietary Guidelines for Amercians, which state that no more than 30% of a child's calories come from fat, and less than 10% from saturated fat. School lunches must also provide children with one-third of the recommended dietary allowances (RDA) and school breakfast must provide one-fourth of the RDA of protein, vitamin A, vitamin C, iron, calcium, and calories. School lunches must also meet Federal nutrition requirements but specific food selection and how the foods are prepared are decided by the school districts.

Any child at a participating school may purchase a meal through the NSLP and the SBP. Children from families with incomes at or below 130 percent of the poverty level are eligible for free meals. Those with incomes between 130 percent and 185 percent of the poverty level are eligible for reduced-price meals, for which students can be charged no more than 40 cents. (For the period July 1, 2010, through June 30, 2011, 130 percent of the poverty level is $28,665 for a family of four; 185 percent is $40,793.)

Children from families with incomes over 185 percent of poverty pay a full price, though their meals are still subsidized to some extent. Local school food authorities set their own prices for full-price (paid) meals, but must operate their meal services as non-profit programs. After school snacks are provided to children on the same income eligibility basis as school meals.

The National School Lunch Act in 1946 created the modern school lunch program, though USDA had provided funds and food to schools for many years prior to that. About 7.1 million children were participating in the NSLP by the end of its first year, 1946-47. By 1970, 22 million children were participating, and by 1980 the figure was nearly 27 million. In 1990, over 24 million children ate school lunch every day. In Fiscal Year 2009, more than 31.3 million children each day got their lunch through the National School Lunch Program. Since the modern program began, more than 219 billion lunches have been served. The NSLP cost $9.8 billion in fiscal year 2009 (http://www.fns.usda.gov/cnd/lunch/AboutLunch/NSLPFactSheet.pdf).

Determinants of Obesity, Physical Activity and Diet

With childhood obesity on the rise there is considerable interest in understanding the determinants of youth physical activity and nutrition behavior, since these behaviors contribute to weight status (Welk & Schaben, 2004). Determinants of youth physical activity include physical activity: opportunities within school, the environment, demographics, and psychosocial variables. For the purpose of this study, determinants of obesity, physical activity and diet will be assessed utilizing a Social Cognitive Theory (SCT) framework. SCT outlines a complex interplay between personal, environmental and behavioral factors (Bandura, 1986a). At the core of SCT theory is the reciprocal interplay between the environment and personal factors, suggesting that intervention or change in one variable will affect other variables. Environment consists of three factors; social environment, physical environment and situational environment.

Social environment includes influence from family, peers and social culture influences. Physical environment refers to the actual built environment and includes accessibility to physical activity opportunities and built environment characteristics (i.e. safety, availability of sidewalks, and lighting). Situational environment is a person's perception of the built environment.

SCT specifies a core set of personal determinants, the mechanism through which they work, and the optimal ways of translating this knowledge into effective health practices. The core personal determinants include knowledge of health risks and benefits of different health practices, perceived self-efficacy that one can exercise control over one's health habits, outcome expectations about the expected costs and benefits for different health habits, the health goals people set for themselves and the concrete plans and strategies for realizing them, and the perceived facilitators and social and structural impediments to the changes they seek (Bandura, 2004). This theory posits a multifaceted causal structure in which self-efficacy beliefs operate in concert with cognized goals, outcome expectations, and perceived environmental impediments and facilitators in the regulation of human motivation, action, and well-being. This approach addresses the socio-structural determinants of health, as well as, the personal determinants. The factors singled out in the various theories overlap with subsets of determinants in social cognitive theory. The application of SCT to childhood obesity research suggests that psychosocial constructs such as self-efficacy, beliefs about physical activity, and social support may influence physical activity participation and nutrition behavior, as well as, the environmental constraints placed on food and physical activity resources (Trost et al., 1999)

Psychosocial

Psychosocial variables have been shown to affect a child's physical activity levels and nutritional influences. In a review Sallis et al., (2000) found 15 psychosocial variables related to obesity levels, and of these 15 variables 11 appeared in three or more studies. The 11 variables include perceived barriers, intension to be physically active, preference for physical activity, body image, self-esteem, attitude towards sweating, perceived beliefs, self-efficacy, perceived competence and attitude. In 2009, Crimi et al., also found that psychosocial variables are important to children's physical activity levels. Crimi et al. (2009) found nine variables, similar to Sallis et al. (2000), associated with children's physical activity levels. These nine variables include perceived competence, intention, barriers, parental support, direct help from parents, support form significant others, program/facility access, opportunities to be active and time spent outdoors. These findings are similar to Sallis et al. (2000) because all these variables have a moderate correlation but a meaningful relationship to children's physical activity levels. Similar results were reported by Brustad (1996), Schaben et al., (2006), and Welk et al., (2003), however there were fewer variables, perceived physical activity competence, attraction to physical activity and parental support. Trost et al., (1999) had similar findings stating that there was a significant association between physical activity self-efficacy and objectively measured physical activity behavior. Trost et al., (1999), did, however, state that in moderate physical activity of boys, physical activity self-efficacy was the strongest independent predictor of daily participation in MVPA. Thus it appears that self-efficacy and beliefs along with social support are primary psychosocial determinants of physical activity.

Self-efficacy

Accumulating research indicates that the behavior-specific cognition of self-efficacy, or level of perceived competence, is one of a number of promising determinants of physical activity among youth (Garcia et al., 1995; Garcia, Pender, Antonakos, & Ronis, 1998; Sallis, Prochaska, & Taylor, 2000). Self-efficacy expectations are defined in social cognitive theory as beliefs persons have in their capability to successfully execute a given behavior (Bandura, 1998). Information about self-efficacy is gleaned from mastery experiences, observation of others, social persuasion, and interpretations of physiological arousal with mastery experiences being the most potent source of efficacy information. Efficacy-enhancing interventions have been found to increase physical activity among children (Stone, McKenzie, Welk, & Booth, 1998).

Bandura 1998, states efficacy belief is a major basis of action. Self-efficacy beliefs are linked to value placement or outcome expectancies and expected outcomes of a behavior (outcome expectations). Self-efficacy is concerned with a person's judgment of their personal capabilities to organize or execute any type of performance (Bandura, 1986a). Unless people believe they can produce desired effects by their actions, they have little incentive to act or to persevere in the face of difficulties and setbacks. Motivators must be founded on the belief that one has the power to produce desired changes by one's actions.

People's beliefs in their self-efficacy can be developed by four main sources of influence: mastery experiences, vicarious experiences, verbal persuasion, and emotional factors. According to Bandura (1994) the most effective way of creating a sense of strong self-efficacy is through mastery experiences. Success helps to increase one's self-efficacy whereas failure undermines it especially if the failures occur before some self-assurance has been established. Bandura (1994) states the second source of influence on self-efficacy is through the vicarious experiences provided by others. Seeing people similar to oneself succeed by sustained efforts raises the observers' beliefs that they to have the capability to master comparable activities in order to succeed. The third way of strengthening people's beliefs according to Bandura (1994) is verbal persuasion whether it is internal or external. People who are persuaded verbally possess the capabilities to master the given activity. Successful self-efficacy builders do more than convey positive appraisals of capabilities. They structure situations for themselves or others in ways that brings success and avoids placing them in situations where they are likely to fail. People also rely partly on their emotional state in judging their capabilities. They interpret their stress reactions and tension as signs of inefficacy. In activities involving strength and stamina, people judge their fatigue, aches and pains as signs of physical debility. Mood also affects judgments of their personal efficacy. Positive mood enhances perceived self-efficacy, whereas a negative mood diminishes perceived self-efficacy (Bandura, 1998).

Social-cognitive research has identified self-efficacy for physical activity, the confidence to be able to be physically active, as a strong determinant of physical activity among children, youth and adults (Binns et al., 2009; Fein et al., 2004; Pan et al., 2009; Ryan & Dzewaltowski, 2002; Shields et al., 2008; Trost et al., 1999). For example, the willingness to adopt an exercise program was found to be strongly influenced by an individual's self-efficacy (Blanchard et al., 2007; Dutton et al., 2009). Good self-efficacy for physical activity was further demonstrated to be negatively correlated with body weight (Dutton et al., 2009; Jaser et al., 2009). Increasing attention has focused on understanding the effects of exercise self-efficacy on the actual experience of exercise, particularly perception of effort, and the reciprocal effect of perception of effort on subsequent exercise self-efficacy (McAuley & Courneya, 1992; Rudolph & McAuley, 1996). Self-efficacy theory posits that higher self-efficacy is associated with less perception of effort in coping with a challenging task. Efficacious individuals may make better use of the skills that they have or immerse themselves more fully in the task so that perceptions of effort are lessened regardless of level of ability (Bandura, 1998).

Self-efficacy and social norms for eating fruits and vegetables at school lunch were related to lunch FV consumption. Fruit self-efficacy was significantly related to fruit consumption. Vegetable self-efficacy was positively related to low-fat vegetable consumption, and negatively related to the consumption of high-fat vegetables (Thompson, Bachman, Baranowski & Cullen, 2007).

Outcome Expectancies (Beliefs)

Health behavior is also affected by the outcomes people expect their actions to produce. Furthermore, beliefs, labeled at outcome expectancies in SCT, is closely related to self-efficacy. Outcome expectations take several forms including physical outcomes, social reactions, self-evaluation, and motivation. Physical outcomes include plausible and aversive effects of the behavior. A person's behavior outcome can be influenced by social reaction. The social approval or disapproval of a specific behavior produces a reaction determining if a person will continue a behavior or cease that behavior. The social approval or disapproval can influence a person to have positive or negative reactions to one's health behavior or health status. Therefore, the person will adjust accordingly to regulate their behavior. They will do things to satisfy their self-worth and satisfaction to avoid the dissatisfaction of others (Bandura, 2004).

Eccles (2005) proposes different dimensions of value: utility value (usefulness), intrinsic value (liking or enjoying), and attainment value (importance of doing well). In some earlier work, children's perceived value was found to be unrelated to their fitness-related physical activity behavior (Dempsey et al., 1993; Kimiecik et al., 1996). However, Eccles and Harold (1991) did find value to be significantly associated with children's self-reported sport participation. In more recent work, task value has been found to predict task choice as well as persistence and engagement in sport and physical education (Gao, Lodewyk, & Zhang, 2009; Xiang, McBride, & Bruene, 2004, 2006). There is data to support the notion that children's level of physical activity is enhanced when they hold a positive constellation of beliefs regarding physical activity and their participation in it (Edwardson & Gorely, 2010).

Social Support

A recent meta-analytic review revealed that the odds of being an active child or adolescent are almost two times greater with supportive versus unsupportive parents (Alderman, Benham-Deal & Jenkins, 2010; Pugliese & Tinsley, 2007). Parental encouragement, instrumental (eg, transportation and providing access to equipment), and modeling behaviors all demonstrated significant positive relations with children's and adolescents' physical activity levels. Recent meta-analytic findings suggest a stronger association for parents with young children's relative to young adolescents' physical activity (Alderman, Benham-Deal & Jenkins, 2010; Pugliese &

Tinsley, 2007). In addition, Brustad (1996), Crimi et al., (2009), Schaben et al., (2006), and Welk et al., (2003) all reported parental influence to be positively correlated with children's physical activity levels. In line with SCT their results indicate that social support from parents has been related to children's physical activity in a number of studies. Parent-child interactions and the home environment can affect behaviors related to risk of obesity (Ebbeling, Pawlak, & Ludwig, 2002). Family life has changed a lot over the past two decades, with trends towards eating out and greater access to television than previously (Ebbeling, Pawlak, & Ludwig, 2002). Children consume more energy when meals are eaten in restaurants than at home (Ebbeling, Pawlak, & Ludwig, 2002) possibly because restaurants tend to serve larger portions of energy dense foods (Ebbeling, Pawlak, & Ludwig, 2002). Expanding portion sizes also appear to be contributing to the obesity epidemic (Lisa 2002; Sallis & Glanz 2006). The home environment seems to have an important function in children's physical activity and obesity risk in a number of ways. For example, in girls, parental modeling of physical activity and of sedentary behavior is associated with activity levels, their sedentary habits and a greater likelihood of being overweight.

The opportunities that parents provide at home for sedentary pursuits are also important. Parents can influence children's physical activity by implementing rules regarding physical activity and sedentary pursuits. Parents can also have a practical role in supporting children's physical activity through encouragement to participate and by providing transportation to sporting activities (Finn, Johannsen & Specker, 2002).

In addition, children of less active parents take fewer steps than those with more active parents (Craig et al., 2010) and children are more likely to engage in leisure time physical activity settings with various family formations. Quarmby and Dagkas (2010) indicated that children view physical activity important, especially when encouraged by the parents. Children with a two-parent home receive greater encouragement to be active than children from a single parent home (Quarmby and Dagkas 2010). Collectively, these findings suggest a moderate to strong relationship between parents' and young children's physical activity patterns (Alderman, Benham-Deal & Jenkins, 2010). As parents and children age, however, the association between their physical activity behaviors wanes (Alderman, Benham-Deal & Jenkins, 2010).

Built Environment

Impact of Built Environment on Physical Activity

The built environment consists of the neighborhoods, roads, buildings, food sources, and recreational facilities in which people live, work, are educated, eat, and play. The way the built environment is created can affect many daily decisions about physical activity. Whether people walk to work or school, eat frequently at fast-food restaurants, or take their children to parks may depend in part on how neighborhoods are built (Sallis & Glanz, 2006). Built environments affect children's weight by shaping both their eating habits and their physical activity. The physical environment dictates the supplies of facilities and their accessibility and thus influences how well and easy the latent demand can be realized.

The role played by the home and local neighborhood environments have recently received attention in the literature as two potentially potent sources of influence. A growing body of evidence suggests that aspects of the local neighborhood environment may also be an important influence on children's physical activity. Much existing research has focused on adults and is cross-sectional. It shows, for example, that street connectivity, mixed land use, population density and perceived aesthetics of a neighborhood are associated with walking. Kemperman and Timermans (2011) determined that people are more active in neighborhoods that offer recreational facilities, a mixture of land uses, connected streets, higher residential density, and enjoyable scenery.

Although the data available regarding the relation between neighborhood environment and children's physical activity are limited, a recent review concluded that access to recreational facilities and schools, the presence of sidewalks and controlled intersections, and access to destinations and public transport were positively associated with physical activity participation among children (Sallis & Glanz, 2006). A more recent review showed that active travel by children and adolescents is positively associated with social interactions, the presence of facilities that support travel, urban form, shorter route length and road safety (Sallis & Glanz, 2006). Few studies have examined associations between the neighborhood environment and children's obesity risk. These cross-sectional studies have found positive associations for heavy traffic and parental concern about traffic with overweight and obesity in 10–12 years olds (Sallis & Glanz, 2006). Recent studies using objective measures of total physical activity have found that residents of high-walkable neighborhoods get one hour more of physical activity each week and are 2.4 times more likely to meet physical activity recommendations than residents of low-walkable neighborhoods (Sallis & Glanz, 2006; Saelens, Sallis & Frank, 2003a). Perceptions of heavy traffic, a lack of public transit, a lack of street-crossing aids, the need to cross several roads, and a lack of nearby recreational facilities were all linked to lower rates of active transportation (Sallis & Glanz, 2006). Furthermore, adolescent boys were more active when they lived near pedestrian-oriented shopping areas whereas, girls were more active when streets were less connected, suggesting that low-traffic residential streets and cul-de-sacs may be play areas for some young people (Sallis & Glanz, 2006).

Walking and cycling to school are of particular interest because both require substantial energy expenditures on a daily basis (Sallis & Glanz, 2006; Tudor-Locke, Ainsworth & Popkin, 2001). And, indeed, studies have found that children who walk to school are more physically active than those who travel to school by car, although no study could be identified that linked walking with weight status (Cooper et al., 2003; Sallis & Glanz, 2006). However, active commuting rates are low, ranging from only 5 to 14 percent (John et al., 2005; Sallis & Glanz, 2006). Low-walkable suburban development patterns, such as the lack of sidewalks, long distances to schools, and the need to cross busy streets with fast-moving traffic, appear to create barriers to active commuting to school (Sallis & Glanz, 2006).

Impact of Built Environment on Nutrition

Environmental influences that affect eating behaviors include the changing nature of the food supply; increased reliance on foods consumed away from home; food advertising, marketing, and promotion; and food prices (French, Story & Jeffery, 2001; St Onge, Keller, & Heymsfield, 2003). With this shift in economic welfare has come a shift toward more secure food supplies and increased nutrient-dense and energy-dense diets; reduced energy expenditure in transportation; and more leisure time, especially inactive leisure time (Montiero, Conde, Lu, & Popkin, 2004; Must, Dallal, & Dietz, 1991; Poskitt, 1995; Reddy et al., 2003; Walker, Gaskin, Powell, & Bennett, 2002; Wang & Lobstein, 2006).

Disparities in food availability, identified as “food desserts”, exist, in particular for rural low-income areas. The foods available in low-income neighborhoods are of lower quality (Merchant et al., 2007; Zenk et al., 2006), cost more, and have less variety, than foods available in more wealthy neighborhoods, because larger suppliers tend to target higher income consumers (Merchant et al., 2007; Moore & Diez Rouz, 2006). Healthy foods such as fruits and vegetables, poultry, fish and whole grain cost more compared with less healthy alternatives which may promote obesity such as refined grain, French fries, bakery products, and snacks containing high sugar and fat (Drewnowski & Damon, 2005; Merchant et al., 2007). Likewise, low-income neighborhoods have fewer facilities for recreational physical activity; the presence of facilities in neighborhoods is directly correlated with individual physical activity and BMI (Gordon-Larsen et al., 2006; Merchant et al., 2007).

Better access to supermarkets and other retail stores that provide healthful food products is associated with better diets for adults (Bodor et al., 2008; Larson, Story, & Nelson, 2009; Moore, Roux, Nettleton, & Jacobs, 2008; Morland et al., 2002b; Sturm & Datar, 2011). Sturm et al., (2011) found that relative food prices influenced consumption patterns, particularly higher prices for fruit/vegetables predict lower frequency of fruit/vegetable consumption and higher dairy prices predict lower frequency of milk consumption. Low-income, minority and rural neighborhoods tend to have less access to supermarkets, and low-income urban neighborhoods have more small stores (Larson, Story, & Nelson, 2009; Sturm, 2011). Because convenience foods and restaurant meals are typically higher in energy and fat and lower in valuable nutrients than meals prepared at home, frequent consumption of such food increases the chances of obesity in children and adolescents, as well as, in adults (Sallis & Glanz, 2006). A lack of access to and the high cost of fruits, vegetables, and other nutritious foods may keep children from consuming them. For example, people or families who make less money, are less educated, or work less prestigious jobs have diets that do not meet recommendations, especially in fruits and vegetables (Winkler, 2006). Low-income and minority neighborhoods not only have less access to healthful foods but also may face higher food costs (Sallis& Glanz, 2006).

Ecob & Macintyre (2000) determined that in the United Kingdom people residing in deprived areas have significantly lower nutrient intake regardless of their socioeconomic status compared to individuals in a privileged area. The USDA (2010) also reported that increased accessibility to grocery stores or supermarkets increases the consumption of fruits and vegetables. In 2002b, Morland, in a multi-level study showed that a presence of a grocery store in an underprivileged town significantly increased the chances that African American residents met the fruit and vegetable recommendations.

Mushi-Brunt et al., (2007b) findings revealed that children who lived in low income neighborhoods (where more grocery stores were available and closer to one's home) ate more fruit and vegetable servings per day than did children in higher income neighborhoods, which had fewer grocery stores. This finding is consistent with those found in studies of adult populations. Rose and Richards 2004 found that distance to grocery stores was inversely associated with household fruit and vegetable use (Mushi-Brunt et al., 2007b; Rose & Richards, 2004). A seminal study conducted by Morland and colleagues (2002b) identified an association between fruit and vegetable intake and supermarket density which was most pronounced among African American adults (Morland et al., 2002b; Mushi-Brunt et al., 2007b). Although not statistically significant, the finding that children in households where the distance to the nearest grocery store was less than one mile consumed fewer fruits and vegetables indicates that there are other important factors associated with fruit and vegetable intake. These factors may include personal factors such as taste preferences (Brady et al., 2000) and environmental factors such as parent's food purchase perceptions and behaviors (Mushi-Brunt et al., 2007b) and household availability (Cullen et al., 2003; Mushi-Brunt et al., 2007b; Rasmussen et al., 2006).

Rural Environment

One definition of a "rural" population according to the United States Department of Agriculture (USDA; 2011) includes a rural population is less than 20,000 population dense countries outside the metropolitan areas (Dalbey, 2008; Heimlich & Anderson, 2001). The USDA (2011) also states that approximately 20 percent of the population and about 80 percent of the land area make up the rural community. Lindberg and Halasinski (2005) state about 2,300 of the 3,086 counties in the US are rural (Dalbey, 2008). From a land use and development point of view, rural America encompasses both towns and small cities, as well as, working lands, farms, prairies, forests, and rangelands. In rural American, beyond the city or town, land is used primarily for the production and extraction of resources, and for recreations and tourism. Obesity causing environments are thought to promote high energy intake through the greater availability and low price of energy-dense foods (Hickson et al., 2011; Poston & Foreyt, 1999; Swinbum Egger & Raza, 1999), to discourage physical activity through the lack of resources for exercise and because of safety concerns (Burdette Wadden & Whitaker, 2006; Hickson et al., 2011; Nelson & Wood, 2009), and to contain urban design and transportation features that limit opportunities to walk in daily life (Booth Pinkston & Poston, 2005; Frank Andersen & Schmid, 2004; Hickson et al., 2011).

Studies indicate higher rates of obesity in rural populations than urban populations (Dalbey, 2008; Patterson et al., 2004). There is evidence that obesity in children and adolescents who reside in rural places outpaces their urban and suburban counterparts (Dalbey, 2008; Tai-Seale & Chandler, 2003). McMurray and colleagues (1999) found that rural youth has a 55% increased risk of obesity compared with urban counterparts. A number of factors account for the rural-urban differences such as healthcare, changing employment types, school setting and income levels (Dalbey, 2008; Howley, Howley & Shamblen, 2001; Patterson et al., 2004; Tai-Seale & Chandler, 2003). In addition, poverty and education are inversely related to obesity and to a child's BMI (Nesbitt et al., 2004). Public health professionals and researchers have begun to recognize that conventional development patterns and land use policies are playing an important role in the trends of rising obesity rates (Dalbey, 2008; Jackson & Kochtitzky, 2002). The increasing obesity rate according to the *Health, United States, 2005* overlaps with a number of evident changes over the past 45 years or so, including increased suburbanization, fragmented land development patterns, separated uses and increased dependence on the automobile as the main mode of transportation (Duany, Plater-Zyberk & Speck, 2000; Frank Engelke & Schmid, 2003; Hayden, 2002; Jackson, 1985). Also, people tend to exercise less in outlying suburbs because there is a further distance to malls, schools and places of employment as residences increases. Compact, walkable, mixed-use communities are supportive of an active lifestyle. This layout provides residents to be less dependent on an automobile and more reliant on public transportation for everyday activities. However, this is not the situation available for rural America (Dalbey, 2008).

It is well documented that health disparities exist between rural and urban residents in the United States (Pearson & Lewis, 1998; Reis et al., 2004; Shores, Moore & Yin, 2010). With limited access to preventive health services and quality health care, rural residents have a higher risk of many lifestyles diseases including heart disease, high blood pressure, type 2 diabetes, obesity and cancer (Eberhart & Pamuk, 2004; Shores, Moore & Yin, 2010). Previous research has also indicated that physical activity levels among rural residents were significantly lower than those among urban residents (Guthold et al., 2008; Leitzmann et al., 2007; Shores, Moore & Yin, 2010). Both obesity and type 2 diabetes disproportionately affect minority populations, especially African Americans and Hispanics of all ages. The problem is more severe in boys and in African American and Mexican American girls (Ogden et al., 2006).

About 75% of rural African American adults do not meet the dietary recommendations for fruit and vegetable intake (Liu, Bennett, Harun, & Probst, 2008; McClelland et al., 1998). It has also been shown that rural residents' diets are high in fatty and sugary foods and low in fruits and vegetables (Crooks, 2000; Liu, Bennett, Harun, & Probst, 2008; Stroehla, Malcoe & Velie, 2005). The dietary habits of rural African Americans are exacerbated by a lack of nutrition professionals and educations programs available to rural residents, particularly school-based programs geared toward children, due to lack of resources (Heneghan & Malakoff, 1997; Liu, Bennett, Harun, & Probst, 2008; Omar, Coleman & Hoerr, 2001). Convenience stores markedly outnumber supermarkets or grocery stores in rural areas. At these stores, healthy, low fat foods are less likely to be available than at larger stores, and more expensive when available (Liese et al., 2007; Liu, Bennett, Harun, & Probst, 2008).

Rural adults are also more likely to have poor health outcomes due to low socioeconomic status and reduced access to healthcare (Eberhardt et al., 2001), which would increase their risks of obesity-related health conditions (Casey et al., 2008). This study found that obesity was related to frequency of use of specific food outlets that may encourage overeating, such as buffets, cafeterias, and fast food restaurants (Casey et al., 2008). Obese rural adults reported living in communities that were not "activity-friendly" or supportive of physical activity (Casey et al., 2008). Characteristics of the perceived physical activity environment associated with obesity among this sample included the perception that the community was not pleasant for physical activity. Thus, both physical activity environments and patterns of use of food environments were related to obesity among rural adults (Casey et al., 2008). Food environment characteristics per se were not related to weight status in the present study (Casey et al., 2008).

While the availability of supermarkets is associated with a decreased prevalence of being overweight and obese, the availability of grocery stores and convenience stores is associated with an increased prevalence of being overweight and obese among residents (Morland, Diez Roux & Wing, 2006). An analysis revealed that, after adjustment, the prevalence of obesity and overweight was lowest in areas that had only supermarkets and in areas that had a combination of supermarkets and grocery stores (Morland, Diez Roux & Wing, 2006). Prevalence was highest in areas with grocery stores and convenience stores only. In lower population density townships, closer proximity between a child's residence and a large, brand-name supermarket was a risk factor for being overweight (Lui et al., 2007). These associations remained significant even after controlling for individual-level socio-demographics and median family income of the surrounding area (Lui et al., 2007).

Though there were relatively few disparities in perceived access to healthful food options in the community between low and high educated rural adults, those with a high school education or less reported lower access to a large selection of fruits and vegetables and were more likely to report often shopping at convenience stores (Casey et al., 2008). They also reported more often eating at buffets and cafeterias (Casey et al., 2008). Perhaps individuals with less education, also likely to have lower incomes, were attracted to buffets and cafeterias because of convenience or greater perceived value (Casey et al., 2008).

The local food environment, (Carter & Swinburn, 2004; Cummins & Macintyre, 2006; Hickson et al., 2011; Lake & Townshend, 2006; Morland & Evenson, 2009) particularly the availability of inexpensive, energy-dense, high-fat, and low dietary micronutrient (e.g., fiber, magnesium, and potassium) foods, as proxied by the availability of fast food, (Jeffery et al., 2006; Morland & Evenson, 2009; Prentice & Jebb, 2003; Spence et al., 2009) is one aspect that has received increasing attention, especially in low-income and minority communities. Fast food restaurants availability was greater in more densely populated areas and in neighborhoods of lower socio-economic status and with a higher percentage of African American residents. Greater fast food restaurants availability was associated with higher energy intake in men and women younger than 55 years, even after adjustment for socioeconomic factors. However, no consistent associations have been found between fast food restaurants availability and BMI, waist circumference and other dietary factors (Larson, Story, & Nelson, 2009; Timperio et al., 2008). Whereas, other studies have reported inverse relations of fruit and vegetable intake (Larson, Story, & Nelson, 2009; Timperio et al., 2008) and poorer diets (Moore et al., 2009; Morland, Wing & Diex Roux, 2002a) with fast food restaurant densities.

Summary

Because of the long-term health consequences of childhood obesity, prevention of obesity in children and adolescents is a public health priority (Wang & Lobstein, 2006). Utilizing a SCT framework, reducing childhood obesity will require effective prevention strategies that focus on environments, promoting physical activity, psychosocial variables, and a healthy diet. Current research shows that a majority of children do not meet physical activity and nutrition recommendations. Furthermore, children in rural areas consume fewer fruits and vegetables, more fried food and soda, more saturated and trans-fat, higher glycemic load, and less fiber and micronutrients (Gidding et al., 2006). Physical activity participation and consumption of fruits and vegetables are affected by the built and social environment. Specifically, access to physical activity opportunities and access to healthy foods, along with social support from parents may influence obesity during childhood. (Alderman, Benham-Deal & Jenkins, 2010; Pugliese &

Tinsley, 2007). Finally, children's level of physical activity is enhanced when they hold a positive constellation of beliefs regarding physical activity and belief that they are physically competent.

Researchers have examined the influence of diet or the influence of physical activity participation on children's weight status. However, studies have not examined these two factors together, along with the influence of the environment and psychosocial variables (Bauman et al., 2002) therefore we are limited in the understanding of these influences on children's obesity levels (Welk & Schaben, 2004). Reducing childhood obesity will require effective prevention strategies that focus on environments, promoting physical activity, and a healthy diet. Therefore, the purpose of this project was to determine the effect of diet, physical activity, psychosocial variables, and environment, on weight status of children who reside in a low-income rural area.

Chapter III

Methods

The purpose of this investigation was to determine the effect of diet, physical activity, psychosocial variables, and environment on the weight status of children who reside in a low-income rural area. This chapter presents the methodology for the study including an overview of research design, participant recruitment and selection criteria, instrumentation for data collection, research procedures, and data analysis.

Setting and Participants

The data for this cross-sectional study was collected in a small, rural elementary school in Alabama. The primary school grades K - 6 comprised of 322 students (48% males). The average school size in Alabama is 486 students. African American children (81.4%) are the predominant racial/ethnic group that attend this school. Eighty percent of the students enrolled in this school are eligible for free lunch while 9% are eligible for reduced lunch. The median household income of the families of children in the school is $30,000 USD.

For the study, 3^{rd}-6^{th} graders enrolled in the school served as target population. A recruitment letter and consent/assent forms were distributed to the parents/legal guardians of each child. Parental consent and child assent were obtained in accordance with the project protocol approved by the Institutional Review Board (10-053MR1003) at Auburn University.

Measures and Definitions

Data (height, weight, physical activity, food consumption and surveys) were collected in the schools from February 2011 to May 2012 by trained student personnel. Racial classification and date of birth information were collected from school records.

Anthropometric Measures

Height was measured to the nearest 0.1 centimeter using Digital Medical Scales (Seca Floor Scale 769, SECA Corp. Hanover, MD). The measurement of height was conducted with shoes, coats, and other heavy outerwear removed. Children were instructed to keep their shoulders in the relaxed position, their arms hanging freely and their head aligned in Frankfurt plane. This scale was also used to record body weight, which was measured to the nearest 0.1 kg. BMI (body mass index) was calculated as: (weight (kg) / [height (m)^2]). BMI percentiles were classified according to the Centers for Disease Control (CDC; 2009) classification's age- and sex-specific BMI cutoff points for 'normal weight' (84th percentile and below), 'overweight' (85th to 94th percentile) and 'obese' (95th and above).

Physical Activity Measurements

Objective measures of physical activity behavior were obtained using Actical Accelerometers (Philips Respironics, Respironics Inc. Murrysville, PA); accelerometry-based activity monitors are commonly used methods for assessing free-living physical activity (Welk & Schaben, 2004; Welk & Schaben, 2004). The Actical is lightweight (17.5 grams), waterproof, multidirectional, and has a storage capacity up to 64k memory, which is about 44 days of continuous measurement using 1-min recording epochs. The monitors are initialized and downloaded using a serial port computer interface, with the resulting data exportable as text or excel files. The Acticals are multidirectional, recording movement in all planes not just up and down. The collected data can be evaluated minute by minute or per activity bout, day or week, or for the total time the device is worn. In this study, minute by minute activity counts were used to assess physical activity levels. Acticals provide calculated energy expenditure values, as Active Energy Expenditure (AEE) in Kilocalories and total energy expenditure is Metabolic Equivalents per Time (METs) in kilocalories/min/kg. The software reports values and average value per minute of activity count, energy expenditure and duration at each intensity level (sedentary, light, moderate, and vigorous) every minute, hour, day, and total recording period. A mechanical shaker study found that Acticals had the best intra- and inter-device reliability of three devices (Actical, ActiGraph, and RT3; Bassett & John, 2010; Esliger & Tremblay, 2006). The Actical has been shown to be reliable and valid, when worn on the waist, ankle, or wrist with the waist being preferred.

Each child wore an accelerometer for seven days. At the start of the week each child received a calibrated accelerometer which was fastened to the right ankle with a secured strap. Each accelerometer was attached Monday morning during breakfast and removed the following Monday. Once the accelerometers were removed, data from the device were downloaded to a computer. Actical software version 2.12 was utilized to examine counts per 15-second epochs. The Actical software then averages the 15-second epoch activity counts into minute activity counts per day. The one-minute activity counts were then added together to form one number which was children's activity levels. Cut points for moderate physical activity were $\geq$1800 counts and $<$4300 counts, and for vigorous physical activities were $\geq$4300 counts (Puyau et al., 2002). The outcome variables from the accelerometer were time spent in moderate physical activity per day, time spent in vigorous physical activity per day, and steps per day. Data were only analyzed on children who wore the accelerometer for a minimum of three days and at least 8 hours per day.

Psychosocial variables

Psychosocial determinants of the physical activity surveys were taken from multiple surveys designed by Saunders et al., (1997). In this study, five of Saunders et al., (1997) surveys were relevant to this study. The selected five surveys provided an understanding of children's beliefs regarding physical activity outcomes, social support, self-efficacy, and the environmental determinants of children's physical activity.

The theory of reasoned action and social cognitive theory provided the theoretical foundations for the instruments of this study. First, instruments previously used and tested with adolescents and adults were identified. The beliefs scale was taken from the ‘‘beliefs about consequences of participating in’’ physical activity from the ‘‘attitude toward the behavior’’ component of the theory of reasoned action (Ajzen & Fishbein, 1980). This component also corresponds to the ‘‘outcome expectations” component of social cognitive theory (Bandura, 1986b). The scale contains 16-items. The 12-item self-efficacy scale, taken from social cognitive theory (Bandura, 1986b), includes confidence in overcoming barriers to physical activity in children (Sallis et al., 1992b). The eight-item social influences scale included items addressing perceived expectations of others from the theory of reasoned action (Ajzen & Fishbein, 1980), as well as social modeling from social cognitive theory (Bandura, 1986b). For all three scales the original instruments went through a series of four pilot tests conducted in a classroom setting with fifth-grade students demographically similar to the study population (Saunders et al., 2007). The initial pilot test indicated that the fifth-grade children had difficulty with understanding the five-point scales, wording of some items, and administration length. Changes made to the original instruments during the first pilot test included selecting age-appropriate words, simplifying rating scales (from five-point to two-point scales), and putting instruments in a visually more appealing format (larger print, wider margins). Although the reduction from a five-point to a dichotomous (yes or no) scale sacrifices variance, such modifications may be necessary to obtain meaningful self-report data from preadolescents (Ware, 1989). The subsequent three pilot tests refined and reduced the size of the instruments by eliminating items that children did not understand. If children indicated more yes answers compared to no then they demonstrated higher levels of social support, beliefs, and self-efficacy.

In addition, students completed a series of single items designed to measure hypothesized social and physical environmental determinants of physical activity behavior. These included access to sporting and/or fitness equipment at home (one question on a Likert type scale), access to play areas (two questions on a Likert type scale), safety (one question on a Likert type scale), and involvement in community physical activity organizations (one question on a dichotomous scale and two questions on a choice of frequencies). These items were modified from measures used in the National Children and Youth Fitness Study (Ross et al., 1987) and the 1990 Youth Risk Behavior Survey (Heath et al., 1994). The environmental determinant survey is consistent with Bandura's concept of the physical and social environment (Bandura, 1986a).

A trained research assistant read each survey aloud to each subject during the week immediately following physical activity monitoring. Children were taken to a semi-private hallway where they had one on one interaction with the research assistant.

Nutrition variables

Child Nutrition Questionnaire

Information regarding dietary patterns can be obtained from tools measuring nutrient intake, analyses are cumbersome, time consuming and costly (Kristal, Shattuck, & Henry, 1990), particularly when measuring large subject numbers as required in population-based projects. The Child Nutrition Questionnaire was designed to measure dietary patterns that have been known to increase the risk of positive energy balance, and food behaviors attitudes, environments and knowledge of school children. The Child Nutrition Questionnaire is one of seven program specific questionnaires developed within the obesity prevention project to ensure thorough evaluation of process and outcome elements. The obesity prevention program reviewed the prevalence of overweight and obese in Australian children and adolescents in two national samples, 10 years apart, using the new standard international definitions of the International Obesity Task Force Childhood Obesity Working Group (Magarey, Daniels, & Boulton, 2001). This project was developed to measure changes specific to the key nutritional aims of the project and was based on similar tools used in other parts of Australia. A key distinction of this questionnaire from others is that, it provides information on both (a) dietary patterns of interest to childhood obesity researchers and (b) behaviors, attitudes, environments and knowledge associated with healthy eating. Wilson et al. (2008) determined the reliability and relative validity of a child nutrition questionnaire which simultaneously measures dietary patterns known to increase the risk of positive energy balance, and food behaviors, attitudes, environments and knowledge in school children (10-16 years old). Internal reliability for healthy behavior and fruit and vegetable score using Cronbach alpha was above 0.70; 0.50 for vegetable attitude 0.74 and 0.80 for fruit attitude (children's attitudes towards fruits). Relative validity was assessed using the Spearman correlation. Wilson et al. (2008) Spearman correlation's values ranged between 0.34-0.48. There are 14 questions with a variable number of items. A range of response options are used including five-point Likert scales and a choice of frequencies relating to either usual or recent (previous/current day) intake. After modification, all scores analyzed were found to have reasonable to good internal consistency. Test retest-reliability was good for all scores except fruit and vegetable knowledge. Relative validity was lower but still determined as acceptable for all scores, based on comparisons to results in similar studies. For this study, the variables of interest were the food frequency questions relating to children's fruit and vegetable intake along with parental support to encourage a healthy diet. A trained research assistant read the Child Nutrition Questionnaire out loud to each subject during the week immediately following physical activity monitoring. Children were taken to a semi-private hallway where they had one on one interaction with the research assistant.

Direct Observation

Direct observation of dietary intake is a method often used to overcome the inability of young children to recall the foods eaten over the course of a day (Ball et al., 2007; Baranowski et al., 2002; Caballero et al., 2003; Graves & Shannon, 1983; Gittlesohn et al.., 1994). Children's food intake during breakfast and lunch at school was documented by a trained observer. Each research assistant observed 2-4 children per meal for the entire length of each eating period (approximately 30 minutes for breakfast and 30 minutes for lunch). Children were observed two times a day for two days. Children did not know they are being observed. However, if children did not eat breakfast they were asked if breakfast was consumed at home or if they did not eat breakfast. A picture of a completed "typical" tray was taken before breakfast or lunch, and portion sizes, types of foods served, and serving sizes were acquired from the lunchroom staff and documented before each meal. The researcher recorded what foods were eaten, left on the tray, traded, kept for later snacking, or brought into the cafeteria. Once children were done eating they were asked to leave the tray on the table where a picture was taken of the remaining food. Each picture was time stamped. Based on the pre/post picture and observer information an estimate was made on the amount (0, ¼, ½, ¾, or all) of fruits and vegetables consumed.

Each researcher was trained for a period of 10 hours by reviewing old cafeteria food charts, learning the different types of foods, reviewing portion sizes, learning the utensils used in a cafeteria, how to record foods, how to not interact with children, and a visit to an elementary school cafeteria to learn a little about what goes on behind the serving lines. Five people were trained by two researchers for a total of seven observers. Each researcher practiced observing children in grades (e.g. 2^{nd} grade) outside of those used for this study. The researchers practiced observing and recording until 90% inter observer reliability was achieved. This indicates that each researcher practiced observing until his or her observations had a 90% or greater accuracy with the trained researcher (Hancock & Mueller, 2010). Appendix I (see page 131) shows forms used during these observations. Observers located themselves inconspicuously within six feet of the lunch table and restricted their contact with the students. Each observer monitored two to four children at a time, estimating the amount of fruits and vegetables that were eaten, left on the tray, traded, kept for later snacking, or brought into the cafeteria. For those children that brought their lunch the observer estimated the amounts of all foods in each child's lunch bag as well as foods given away, discarded, left on the table, received in trade, and remaining at the end of the meal. For all children, the amount of fruits and vegetables remaining was subtracted from the amount initially contained in the lunch bag (accounting for any food added or lost) to obtain the amount consumed. Appendix H details each step for observations.

Table 2 shows the schedule for one cohort. Prior to the week before the Actical was worn, children who provided consent were measured for height and weight. In addition, observers were present in the lunch room to acclimate children. The data collection process lasted for 15 weeks.

Table 2. Timeline of Data Collection for Cohort 1.

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Attach Acticals	Observe breakfast and lunch.	Observe breakfast and lunch. CNQ	Observe breakfast and lunch. CNQ	Observe breakfast and lunch. CNQ
Week 2	Remove and download acticals Attach Acticals to Cohort 2.	Observe breakfast and lunch. CNQ Cohort 2 Complete Psy Surveys Cohort 1.	Observe breakfast and lunch. CNQ Cohort 2 Complete Psy Surveys Cohort 1.	Observe breakfast and lunch. CNQ Cohort 2 Complete Psy Surveys Cohort 1.	Observe breakfast and lunch. CNQ Cohort 2 Complete Psy Surveys Cohort 1.

Child Nutrition Questionnaire - CNQ

Analysis

All statistical analyses were analyzed with the SPSS/PSAW Statistics 18 and SPSS Amos (IBM Corporation; Somers, NY). Descriptive statistics were used to describe the sample in terms of obesity levels, PA levels, fruits and vegetables consumption, self-efficacy, social support, outcome expectations and the environment. All significance tests were based at 0.05 a priori.

Structural equation modeling was chosen as the most appropriate procedure for examining the possible causal relationships among the variables identified as possibly having an effect on obesity levels of elementary school children. Structural equation modeling is used to examine the direct and indirect effects amongst variables.

The full path model to be tested was as follows (Figure 1): Physical activity was hypothesized to influence obesity directly; whereas the physical environment was hypothesized to directly influence physical activity levels and was indirectly related to obesity. Fruit and vegetable consumption was hypothesized to influence obesity directly; whereas the nutrition environment was hypothesized to directly influence fruit and vegetable consumption and was indirectly related to obesity. Psychosocial variables (Self-Efficacy, Social Support and Beliefs) were hypothesized to directly influence a child's physical activity levels and obesity. Obesity was measured by weight and height and defined as BMI age specific percentiles. Physical activity was measured with accelerometers and defined as time spent in MVPA. Nutrition was measured with direct observation and food frequency questionnaires and defined as the number of fruits and vegetables consumed per day. Psychosocial variables include beliefs (outcome expectations), social support and self-efficacy and measured by scores on questionnaires. Environment Access for nutrition was measured with the Child Nutrition Questionnaire and defined as access to fruits and vegetables at home. Environmental access for physical activity was measured by a questionnaire and defined as access to physical activity equipment at home (eg. jump ropes, basketballs, etc.).

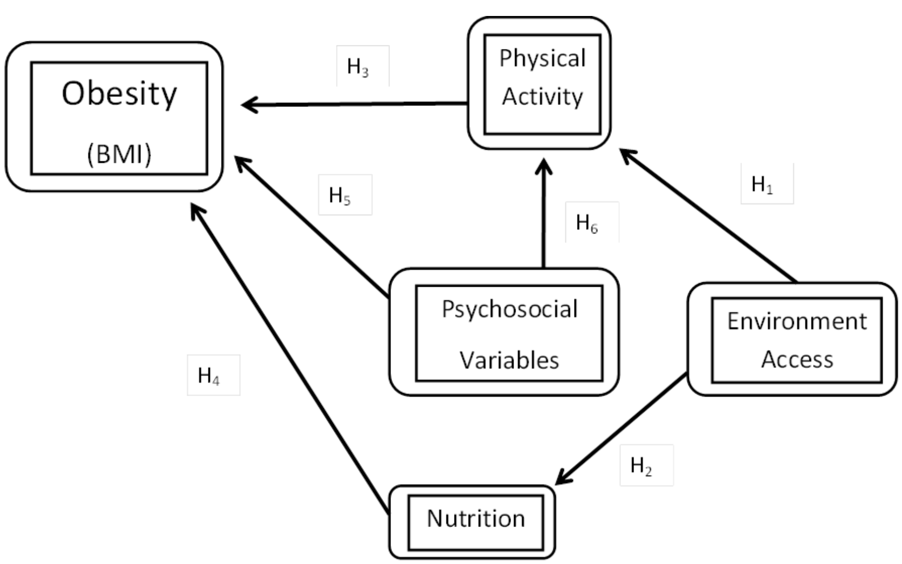

Figure 1. Structural equation model

Although structural equation modeling was the preferred method of analysis, the conditions were not appropriate to use structural equation modeling in the current study. More specifically, the sample size was marginal and the correlations among the indicator variables were weak. This study analyzed 153 children with complete data, and this contributed to an insufficient structural equation model. Minimum sample size guidelines recommended for maximum likelihood estimates of 5 cases per parameter (Hancock & Mueller, 2010) or ten per every free parameter estimated (Schreiber et al., 2006). Using these guidelines, a minimal sample size of 160 was required (Hancock & Mueller, 2010). This minimum sample size also assumes that indicator variables are correlated within the model. The only variables that were correlated within the proposed model were those in support of the physical activity construct. No other indicator contained variables that correlated. Since the conditions for structural equation modeling were not met, an alternate data analysis was used and the hypothesis questions were reworded to accommodate the change in statistical analysis. These changes are described below.

Alternative Data Analysis

Data analyses were conducted using Statistical Package for the Social Sciences, version 18.0 (SPSS, Inc., Chicago, IL). Descriptive statistics were calculated for age, height, weight, BMI, MVPA and the sum of fruit and vegetable consumption. Pearson correlations were used to determine the strength of linear dependence between two variables. A one-way analysis of variance (ANOVA) was used to determine differences in weight status by age and sex. Linear regression was used to determine the relationship between BMI and two or more predictors. Predictor variables with a Pearson correlation greater than .60 were entered into the regression equation (Salkind, 2004). Potential predictor variables included moderate physical activity, vigorous physical activity, fruit and vegetable score, as well as the psychosocial variables (three surveys). Specific analysis for each question is listed in Table 3.

Table 3. Data analysis for each research question

Research Question	Analysis	Variables
What is the relationship between a child's access to home and recreational physical activity opportunities and their physical activity behavior?	Descriptive statistics Linear Regression	Access to physical activity equipment and access to extracurricular physical activity opportunities
What is the relationship between a child's access to fruits and vegetables in the home and nutritional intake?	Descriptive statistics Linear Regression	Access to fruits and vegetables in the home environment
What is the relationship between MVPA and weight status?	Linear regression Pearson Correlation	MVPA measures from Actical over 4 days
What is the relationship between fruit and vegetable intake and obesity?	Linear regression Pearson Correlation	Observed and survey fruit and vegetable intake
What is the relationship between psychosocial variables (social support, self-efficacy and outcome expectations) and obesity?	Linear regression Pearson Correlation	Surveys for social support, beliefs, and self-efficacy
What is the relationship between psychosocial variables (social support, self-efficacy and outcome expectations) and MVPA?	Pearson Correlation Linear Regression	MVPA

Chapter IV

Results

The purpose of this investigation was to determine the effect of diet, physical activity, psychosocial variables, and the environment, on weight status of children who reside in a low-income rural area. This chapter presents the results of the study relative to the research questions of interest.

One hundred and seventy children were initially recruited for participation in this study. One hundred percent of children returned signed parental consent forms and provided assent to participate in this study. One participant who provided parental consent and assent was not included in this study, because parental consent was withdrawn. Twelve were eliminated due to broken or lost Acticals. The final sample size was 153. See table 4 for the overall demographics of the study population.

Table 4. Demographics

	Mean (SD)
Age	10.3 (1.3)
Height (inches)	57.55 (4.3)
Weight (pounds)	115.45 (41.5)
Race (%)	
Black	83.6
Hispanic	12.5
White	3.9
Sex (%)	
Male	46.7
Female	53.3
Grade (%)	
3	21.1
4	23.0
5	27.6
6	28.3

Grade and Weight Status

The mean age of all subjects was 10.3 (SD=1.3) years. Average BMI was 21.8 kg/m^2 (SD=6.6 range 3.64 – 53.32), and the mean BMI percentile was in the normal weight status

(71.9th percentile) determined by age, height and weight (SD=29.2 range .10 – 99.80). See Table 5 for the overall weight status percentiles and Table 6 for BMI by age and sex.

Table 5. Overall BMI percentage

	Percentage
Normal	49.3
Overweight	17.1
Obese	33.6

Table 6. BMI Measures

	(n)	Normal (n)		Overweight (n)		Obese (n)	
		Males	Females	Males	Females	Males	Females
3rd Grade	32	10	7	4	3	4	4
4th Grade	35	8	13	1	2	5	6
5th Grade	42	9	9	2	6	7	9
6th Grade	43	10	9	6	2	5	11
Total	153	37	38	13	13	21	30

A one-way ANOVA was used to determine if there was a significant difference in weight status and sex and grade. The ANOVA determined there was no significant difference between boys and girls and weight status (p=0.191). However, there was a significant difference between grade levels and weight status (p=0.008; table 7). A LSD post hoc identified a significant difference between 3rd grade and 4th grade (p=0.002) as well as 4th grade and 6th grade (p=0.011; table 8). This indicates that as children age they are more likely to be overweight or obese.

Table 7. ANOVA summary for BMI and Grade

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	521.875	3	173.958	4.043	0.008
Within Groups	6583.596	153	43.030		
Total	7105.471	156			

Table 8. Posthoc analysis for BMI difference by grade

By Grade	*M* difference	Standard Error	*p*-value	Effect Size (Eta^2)
BMI				
3-4	-1.096	1.551	0.481	
3-5	-2.859	1.526	0.063	
3-6	-4.844	1.518	0.002*	0.389
4-5	-1.763	1.459	0.229	
4-6	-3.748	1.451	0.011*	0.555
5-6	-1.985	1.423	0.165	

Physical Activity

Time spent in physical activity were calculated from Actical activity counts. The Actical recorded activity counts every fifteen seconds, then the fifteen-second counts were averaged into one-minute activity counts by the Actical software. An excel file for each day was exported and condensed from 1440 minutes of activity counts to daily vigorous, moderate, light and sedentary activity. Predetermined cut points were as follows: moderate (> 1801- ≤ 4299), vigorous (≥ 4300), light (> 201 - ≤ 1800) and sedentary (< 200; Puyau et al., 2002). Time spent in MVPA was combined for analysis. Finally, the average for three weekdays and one weekend day was calculated. According to Penpraze et al. (2006) three weekdays and one weekend day are sufficient (r ≥0.60) reliabilities for estimates of total physical activity for children. If a child had less than four days of complete data his or her data was eliminated, 10 children were eliminated because of incomplete data from the analysis. For all children the first and last days were excluded from the analysis because children did not wear the device for the entire 24 hours (1440 minutes). Since it was impossible to attach all Acticals at the same time, children's activity started recording at various times in the morning. Acticals were attached on Monday and removed the following Monday. Many of children did not have data for Sunday because they had removed the device. Friday's data was not included in the analysis because most Fridays were not representative of their normal activity levels (i.e. shortened PE or shortened schedule). For a day to be included in the analysis children needed to have worn the device for the full day (greater than 8 hours). The day also needed to represent a typical day of activity. For example children did not wear the device over Easter weekend. They did not have school on Friday and Easter week is not representative of a typical weekend for most children. Therefore, Tuesday, Wednesday, Thursday and Saturday was used in the data analysis. Figure 2. displays the days that were included and excluded from analysis.

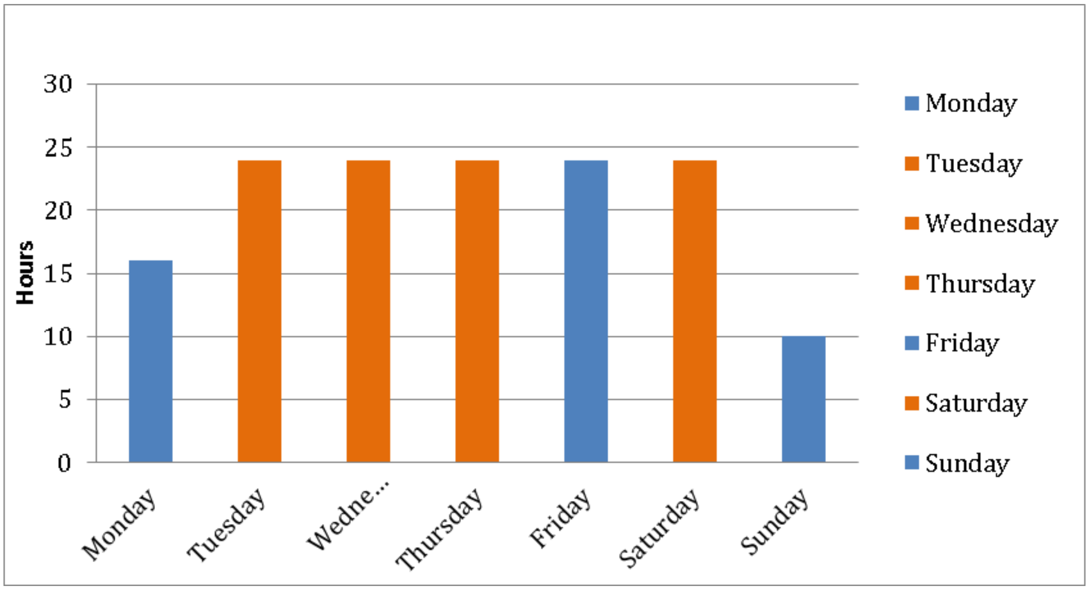

Figure 2. Days included in data analysis for accelerometer data. Orange represents the days children wore the Acticals that were included in analysis.

Descriptive factors were used to determine the average minutes of moderate, vigorous, sedentary and light activity over four days (3 weekdays and 1 weekend day). Over the four-day period (5760 minutes) children averaged 71.12 ± 38.99 minutes of moderate, 18.65 ±23.69 minutes of vigorous, 267.11 ± 119.80 minutes of light activity and 1045.80 ±167.29 minutes of sedentary activity. See Table 10 for overall activity levels and Table 11 for activity levels by grade and sex. An ANOVA determined differences in the average minutes of moderate, vigorous, sedentary, and light activity by grade and sex. Alpha level was set at 0.05 a priori.

Table 9. Overall Activity

	Minutes	Minimum Range	Max Range	Standard Deviation
MVPA	90.11	0.75	547.50	58.71
Sedentary	1046.80	270.50	1422.75	167.29
Light	18.65	5.50	963.50	23.69

Table 10. Activity Levels by grade and sex

	3rd Grade		4th Grade		5th Grade		6th Grade	
	M	F	M	F	M	F	M	F
Moderate	101.13	74.16	71.48	70.96	64.71	75.56	64.42	51.38
Vigorous	32.35	12.27	16.75	16.68	16.40	25.75	15.83	11.40
Sedentary	1012.56	1041.23	1046.95	1044.13	989.39	953.10	1134.19	1146.60
Light	299.81	305.63	278.73	298.76	258.76	263.81	228.12	225.88

There was a significant difference between MVPA (*p*= 0.023), sedentary physical activity (*p*= <0.001), light physical activity (*p*= 0.030) and Grade (Table 11).

Table 11. Difference in activity levels by grade

		Sum of Squares	df	Mean Square	F	Sig.
MVPA	Between Groups	32437.426	3	10812.475	3.274	0.023
	Within Groups	505329.397	153	3302.807		
	Total	537766.823	156			
Sed	Between Groups	645667.421	3	215222.474	9.094	0.000
	Within Groups	3620849.816	153	23665.685		
	Total	4266517.237	156			
Light	Between Groups	123812.779	3	41270.926	3.062	0.030
	Within Groups	2062414.829	153	13479.835		
	Total	2186227.608	156			

To determine where the difference existed between grades a LSD post hoc was performed. The post hoc analysis indicated there was a significant difference (p= <0.04) between 3rd grade and 6th grade for moderate activity (table 13). This analysis showed that as children age they have increases in the amount of sedentary behavior and decreases in physical activity levels. Fifth graders were an exception and spent less time in sedentary behavior compared to 3rd and 4th graders. Third grade students had significantly more activity compared to sixth grade students.

Third graders also accumulated less sedentary activity than sixth graders. Table 12 displays the *p*-values between grades and physical activity levels.

Table 12. Posthoc analysis for physical activity difference by grade

By Grade	*M* Difference	Standard Error	*p*-value	Effect size (Eta^2)
Moderate				
3-4	18.157	9.240	0.051	
3-5	18.417	8.865	0.039 *	0.20
3-6	31.584	8.820	<0.001 *	0.40
4-5	.261	8.647	0.976	
4-6	-13.427	8.601	0.121	
5-6	-13.167	8.196	0.110	
Vigorous				
3-4	6.855	6.768	0.237	
3-5	1.818	5.533	0.743	
3-6	9.999	5.505	0.071	
4-5	-5.037	5.397	0.352	
4-6	3.413	5.369	0.559	
5-6	8.180	5.116	0.112	
Sedentary				
3-4	-20.156	38.021	0.597	
3-5	56.447	36.476	0.124	
3-6	-115.439	36.292	0.002 *	0.59
4-5	76.602	35.578	0.033 *	0.22
4-6	-95.284	35.389	0.008 *	0.46
5-6	-171.886	33.724	<0.001 *	0.55
Light				
3-4	11.602	28.697	0.687	
3-5	40.703	27.531	0.141	
3-6	75.381	27.392	0.007 *	0.27
4-5	29.101	26.853	0.280	
4-6	63.779	26.711	0.018 *	0.21
5-6	34.678	25.454	0.175	

Nutrition

For fruit, children received what coincided with the weekly menu. The menu choices for a week were apples, plums, canned peaches, bananas and oranges. Vegetables provided a little more variety. In the cafeteria during lunch, children received canned peas and carrots, canned mixed vegetables, canned carrots, lima beans, pork and beans, canned potato chunks, canned broccoli and cauliflower, canned corn, salad, coleslaw, and canned spinach. The only fresh vegetable the child received was a salad and that was offered approximately once a week. Only one option was provided for fruits and vegetables regardless of preference. Fruit and vegetable consumption was a composite of the mean of fruit and vegetable consumption observed over two days and the responses from Children's Nutrition Questionnaire which assessed fruit and vegetable consumption at home. An ANOVA determined differences in the amount of fruit and vegetable consumed by grade and sex. Table 13 displays the mean amounts of fruit and vegetable intake. There was no difference between grade or sex for the amount of fruit and vegetable intake over a two-day period.

Table 13. Means of Fruit and vegetable intake by serving

	3 Grade		4 Grade		5 Grade		6 Grade	
	M	F	M	F	M	F	M	F
Fruit intake	0.625	0.518	0.607	0.797	0.365	0.449	0.741	0.458
Vegetable intake	0.347	0.268	0.354	0.310	0.583	0.589	0.494	0.307
F&V intake	0.972	0.786	0.961	1.107	0.948	1.038	1.235	0.765

Determinants of physical activity, diet, and obesity

Descriptive factors were used first to determine the average scores for each survey between boys and girls. Table 14 displays the means of each psychosocial survey. A Multivariate analysis of variance (MANOVA) was conducted to determine the differences for each psychosocial survey (social support, belief survey, and self-efficacy) by grade and sex. The results showed that there was not a significant difference between grade and sex for scores on the psychosocial variables.

Table 14. Psychosocial survey

	3 Grade		4 Grade		5 Grade		6 Grade	
	M	F	M	F	M	F	M	F
Self-Efficacy	9.611	9.500	9.857	8.952	9.444	9.895	9.667	10.136
Belief	12.778	12.143	13.000	11.905	11.889	12.125	12.190	12.409
Social Support	5.611	5.429	6.071	6.333	6.000	6.000	5.333	5.409

Research Question #1: What is the relationship between a child's access to home and recreational physical activity opportunities and their physical activity behavior?

Hypothesis #1: Children with greater access to home and recreational physical activity opportunities will have a greater accumulation of MVPA over seven days.

The physical activity environment consisted of one survey; containing four questions pertaining to children access to physical activity opportunities such as parks, playgrounds, and recreational facilities (Cronbach's Alpha 0.730; Hancock & Mueller, 2010). The maximum score for this survey is 20; children averaged 14.41 ± 3.68. A linear regression was conducted to assess the impact of children's access to physical activity equipment on their MVPA levels (*p*=0.963), sedentary activity (*p*=0.349) and light activity (*p*=0.191). Table 15 displays the model summary for each model and table 16 shows the *p* values and standard errors for each model. The hypothesis that children with greater access to home and recreational physical activity opportunities will have a greater accumulation of MVPA over seven days was not upheld.

Table 15. Physical activity levels in relation to access to physical activity equipment

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
MVPA	0.004[a]	0.000	-0.006	58.90175
Sed	0.075[a]	0.006	-0.001	165.43951
Light	0.105[a]	0.011	0.005	118.10881

Table 16. Significance between activity levels and access to physical activity equipment

	p-value	Standard Error
MVPA		
Environmental physical activity opportunity score	0.963	2.733
Sedentary		
Environmental physical activity opportunity score	0.349	7.677
Light		
Environmental physical activity opportunity score	0.191	5.481

Research Question #2: What is the relationship between a child's access to fruits and vegetables in the home to their actual fruit and vegetable intake?

Hypothesis # 2: Children with greater access to fruits and vegetables in the home will have greater fruit and vegetable intake identified by direct observation and the Child's Nutrition Questionnaire.

Access to fruits and vegetables in the home and school environment, not including lunches or breakfast, survey consisted of four different questions with a possible score of 20 (Cronbach's Alpha 0.750; Hancock & Mueller, 2010). A high score reflects negative access to fruit and vegetable environment, whereas a low score of 4 reflects a positive influence on access to the fruit and vegetable environment. The fruit and vegetable intake was observed during school breakfast and lunch along with a survey to account for the fruits and vegetables consumed outside of school breakfast and lunch. The survey was scored and then converted into servings per day. Table 17 displayed how the survey was scored. The amount of fruits and vegetables consumed was recorded in cups. A linear regression (Table 18 & 19) determined there was not a significant relationship (p=0.963) between access to fruits and vegetables at home (M=8.78 SD=2.83) and consumption of fruits and vegetables over a two day period (M=0.50 SD=0.34). Over a two-day period children consumed about 0.58 cups of fruit and 0.41 cups of vegetables. The hypothesis that children with greater access to fruits and vegetables in the home will have greater fruit and vegetable intake was not upheld.

Table 17. Scoring of each response

	Reported Consumption	Reduced to servings
Fruit	0	0
	1	1
	2-3	2
	4-5	3
	6-15	4
Vegetable	0	0
	1-3	1
	4-6	2
	7-9	3
	10-25	4

Table 18. Fruit and vegetable intake in relation to access

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.037[a]	0.001	-0.005	0.33842

Table 19. Significance between access to fruits and vegetables and fruit and vegetable intake

	p-value	Standard Error
F&V intake		
F&V Environment	0.963	2.733

Research Question #3: What is the relationship between MVPA and weight status?

Hypothesis #3: Children who have higher levels of MVPA over seven days will demonstrate a negative relationship with obesity (BMI).

The regression analysis determined that MVPA (p=0.016; Table 20) and sedentary activity (p=0.016) were significantly related to weight status (R^2 = 0.233; table 21). With increased MVPA children's weight BMI decreases, whereas increases in sedentary behavior showed increases in a child's BMI. Table 20 displays the values of physical activity levels and their relationship to BMI. The hypothesis that children who have higher levels of MVPA over seven days will demonstrate a negative relationship with obesity was upheld.

Table 20. Significance between activity level and weight status

	p-value	SE	Effect Size (Eta^2)
MVPA	0.016	0.026	0.717
Light	0.582	0.004	
Sedentary	0.016	0.026	0.962

Table 21. Physical activity in relation to BMI

Model	R	R^2	Adjusted R^2	Standard Error of Estimates
1	0.233	0.054	0.030	6.65

Research Question #4: What is the relationship between fruit and vegetable intake and obesity?

Hypothesis #4: Children who consume higher amounts of fruits and vegetables will demonstrate a negative relationship with weight status (BMI).

Fruit and vegetable intake measured in cups (*M*=0.50; SD 0.34) and obesity levels were measured as normal, obese (33.6%) or overweight (17.1%). The linear regression (table 22 & 23) determined that children's fruit and vegetable intake did not significantly (*p*=0.514; SE 1.604) contribute to children's weight status. The hypothesis that children who consume higher amounts of fruits and vegetables will demonstrate a negative relationship with obesity was not upheld.

Table 22. BMI in relation to fruit and vegetable consumption

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
BMI	0.052[a]	0.003	-0.004	6.76133

Table 23. Significance between weight status and consumption of fruits and vegetables

	p-value	Standard Error
BMI		
F&V consumption	0.514	1.604

Research Question #5: What is the relationship between psychosocial variables (social support, self-efficacy and outcome expectations) and obesity?

Hypothesis #5 Children who demonstrate higher levels of social support, self-efficacy and realistic expectations will demonstrate a negative relationship with obesity.

Each child was read three different surveys pertaining to psychosocial variables. The social support survey contained eight yes or no questions with a possible positive high score of eight (Cronbach's alpha 0.705). The higher the child scored on the survey the greater social support he or she had from family and peers. The belief survey contained 16 yes or no questions with a possible high score of 16 (Cronbach's alpha 0.674). The higher the child scored on this survey the greater he or she believed they could be physically active. The self-efficacy survey contained 12 questions with a possible high score of 12 (Cronbach's alpha 0.671). A higher score indicates the child had an increased likelihood of overcoming perceived barriers. Linear regression was used to determine the relationship between each survey and children's BMI. Results (table 24 & 25) indicated that there was no relationship between social support survey (p=0.722) and self-efficacy survey (p=0.386) and BMI. However, there was a significant relationship between beliefs (p=0.033) and BMI. The hypothesis that children who demonstrate higher levels of social support, and self-efficacy was not upheld. However, the hypothesis that children who demonstrate realistic expectations will demonstrate a negative relationship with obesity was upheld. Meaning if children have realistic expectation they will have a decreased weight status.

Table 24. BMI in relation to psychosocial variables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Social Support Survey	0.029[a]	0.001	-0.006	6.76787
Self-Efficacy Survey	0.070[b]	0.005	-0.002	6.75418
Belief Survey	0.171[c]	0.029	0.023	6.67139

Table 25. Significance between weight status and psychosocial variables

	p-value	Standard Error	Effect Size (Eta^2)
BMI			
Social support Survey	0.722	0.302	
Self-Efficacy Survey	0.386	0.298	
Belief Survey	0.033*	0.244	0.055

Research Question #6: What is the relationship between psychosocial variables (social support, self-efficacy and outcome expectations) and MVPA?

Hypothesis #6: Children who demonstrate higher levels of social support, self-efficacy, and realistic expectations will demonstrate a higher level of MVPA accumulated over seven days.

Results from the linear regression determined that there was no significant different between psychosocial surveys and MVPA. There was also no significant difference between the surveys and light or sedentary activity. Table 26& 27 displays the statistical output of the three surveys in relation to MVPA, sedentary and light physical activity. The hypothesis that those who demonstrate higher levels of social support, self-efficacy and realistic expectations will demonstrate a higher level of MVPA accumulated over seven days was not upheld.

Table 26. Physical activity levels in relation to psychosocial variables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
MVPA	0.116[a]	0.013	-0.006	58.88586
Sed	0.154[a]	0.024	0.004	165.00826
Light	0.216[a]	0.046	0.028	116.72497

Table 27. Statistical description of psychosocial surveys

	p-value	Standard Error
MVPA		
Social Support	0.531	2.834
Belief	0.670	2.350
Self-efficacy	0.158	2.890
Sedentary		
Social Support	0.265	7.941
Belief	0.635	6.586
Self-efficacy	0.074	8.099
Light		
Social Support	0.378	5.617
Belief	0.196	4.659
Self-efficacy	0.009	5.729

Chapter V

Discussion

Childhood obesity is a health epidemic in the United Sates and is projected to increase over time (Stevens, 2010; Budd &Volpe, 2006; Chatterjee, Blakely, & Barton, 2005). There are many factors that influence childhood obesity. These factors include physical activity levels (Brusseau et al., 2011), various psychosocial variables (Bandura, 1986a), children's environments in term of access to physical activity opportunities and nutrient dense foods (Sallis, Prochaska, & Taylor, 2000), and nutritional intake (St Onge, Keller, & Heymsfield, 2003). The primary purpose of this dissertation was to determine the effect of diet, physical activity, psychosocial variables, and environment on the weight status of children who reside in a low-income rural area. This section will present a discussion regarding the physical activity patterns, fruit and vegetable intake, social support, outcome expectations, self-efficacy, and environmental access in regards to children's weight status along with relevant findings, strengths and limitations of the dissertation, potential directions for future research, conclusions, partial implications and key messages.

Physical activity rates for children and adolescents

Primary/elementary school children are recommended to accumulate at least 60 minutes of MVPA throughout the day (CDC, 2011; NASPE, 2004). This can be an accumulation of several bouts of physical activity throughout the day (NASPE, 2004). The National Association for Sport and Physical Educations (2004) recommends that children should also not exceed more than two consecutive hours of physical inactivity (i.e. sedentary behavior) in the daytime hours. For this study, minute-by-minute MVPA was recorded and accumulated throughout the day. The results of the current study showed that children were accumulating on average 71 minutes of MVPA (boys 95 minutes and girls 85 minutes of MVPA) per day suggesting that this population is exceeding the 60 minutes of MVPA requirements. It is important to note that this time was average minutes accumulated throughout the day not bouts of activity.

In 2003-2004 NHANES conducted a health examination across the United States. For the physical activity data all participants over six years of age wore an Actigraph accelerometer for seven days. Using the NHANES Actigraph data, Troiano et al. (2008) suggests that boys and girls spent approximately 95.4 and 75.2 minutes per day in MVPA respectively. From the NHANES data Troiano described, this study coincides with the average minutes spent in MVPA for boys (95.5 minutes) and girls (84.7 minutes). Toriano et al.'s data determined that, 10.5% boys and 19.1% girls were not meeting the requirements for MVPA. For this study, 10.5% boys and 18.4% girls did not meet the requirements for MVPA, which coincides with data from NHANES.

The boys and girls in this study, averaged approximately 17.5 hours per day of sedentary time including sleep hours. Strauss et al. (2001) determined that children are largely sedentary about 10.5 hours during the waking hours. This study indicated that the physical inactivity of this population did significantly relate to children's weight status. This outcome is representative of previous findings, which indicate that physical inactivity is an important contributor to obesity (Trost, et al., 1999). The data from Trost et al. (1999) study determined that children who accumulated decreased amounts of physical activity had increased weight status. This study also showed that children's physical activity levels had a greater contribution to weight status than the other factors such as environment, psychosocial variables, and fruit and vegetable intake.

Previous research has shown that children who spend less time in MVPA were more likely to be obese that their active counterparts (Anderson et al., 1998; Hernandez, 1999; Mazaik, 2007). Kimm et al., 2005 determined that in girls, decreased activity levels during adolescence were negatively related to their BMI levels. It has also been shown that reduced activity and increases in participation of inactive behaviors such as TV/screen time, unavailability of playgrounds, school curricula and neighborhood structure and safety have all contributed to childhood obesity (Anderson et al., 1998; Hernandez, 1999; Mazaik, 2007).

For this dissertation study, children's activity levels played a greater role in determining weight status over fruit and vegetable consumption. This could be due to several reasons. First, there was a lack of variance in fruit and vegetable consumption. In this study, regardless of weight status very few of children consumed adequate amounts of fruits (seven children) or vegetables (four children). If more children would have been meeting the recommendations results may have shown that those children meeting the recommendations had a lower weight status. Second, casual observation of the accelerometer data showed that a majority of physical activity was accumulated during school hours with a majority of the activity during their scheduled physical education period. During physical education children were allotted 50 minutes of semi-structured physical activity lessons that consisted of skill development, game play and engaging in moderate-to-vigorous physical activity. Children of normal weight status may have been able to engage in more physical activity due to social, cultural or physical factors associated with participation in physical education and activity before, during and after school. Even though children are meeting physical activity recommendations it appears that physical activity above the recommendations may be needed to decreases the obesity rates and see positive outcome as it relates to weight status. Finally, participation in physical activity could have been limited by their weight status because weight factors into the energy cost of participating in physical activity. Meaning a heavier person exerts more effort to move their body through space, which may result in higher levels of vigorous activity.

Opportunities for physical activity

Children can be physically active outside of the school environment through active modes of transportation (walking to the store) or recreational activities (participating in a sport). Getting children to play outside or in an outdoor setting is the strongest correlate to children's physical activity levels (Godbey, 2009). Access to parks and involvement in sports programs has also been show to directly affect children's physical activity levels (Hoefer et al., 2001; Sallis et al., 1992a). In addition, if a child is permitted to be outdoors with a high play potential (access to green space, equipment) higher step counts can be accumulated (1500-2000 steps per day; Bolderman et al., 2011).

In this study, children were asked a series of questions pertaining to their access to physical activity opportunities outside of school. For example, how close they lived to a recreational facility, if they could walk in their neighborhood or if they had access to physical activity equipment (balls, jump ropes, hula hoops etc.). This study determined that there was no significant relationship between the opportunities to be physical activity and children's actual physical activity levels. Some children reported having access to sports equipment at home or having a safe neighborhood where they could be outside to walk or play while other children reported they did not have a safe neighborhood to be physically active outside nor did they have the equipment to be active. This could mean that children may have not known whether or not they actually have an environment at home that would support physical activity. Their environments were not assessed for this study so it cannot be determined if children had an environment conducive for promoting physical activity. The insignificant relationship between environment and physical activity levels is not consistent with previous findings. Previous research indicates that children who have access to recreational facilities and outdoor play are more likely to be physically active than those children that do not have access (Sallis & Glanz, 2006). The lack of a significant relationship could be because children are achieving the recommended amount of physical activity during the school day so the lack of access to physical activity in the home environment is not a factor for this population. Some children arrived at school 45 minutes before the day started and were able to accumulate physical activity by walking, depending on the cafeteria supervisor for the day. Some teachers would allow children to be social, walk around, and talk while others would rush children in to eat and as soon as children were done eating they were told to leave the cafeteria. Once breakfast was over children were able to be mobile in the classroom if the classroom teacher was present. If their classroom teacher was not at school children were required to sit quietly in the hallway supervised until the classroom teacher arrived. Therefore, many of children's waking hours (6:45 am to 3:00 pm) were spent at school, which may account for the home environment not factoring into daily MVPA levels. Also, children may not have access to equipment at home therefore they are more active at school. On a scale of one to eight; eight having full access to an environment adequate for promoting physical activity and one indicating the environment was not suitable for promoting physical activity children of this study reported their environments were in the middle of adequate and not adequate to promote physical activity (M = 3.82; SD = 1.7). Another factor could have been children's parents may not be home from work when the child arrives home and children have to stay indoors until the parents return home from work. Also, the child could have a supportive environment but a family member would not take them to the parks or recreational facilities where children could participate in physical activities. On the weekends, only one day was taken into consideration for the analysis and it was averaged with the weekdays to get an overall average. However, on Saturday's children were still meeting the recommendations for physical activity (77 minutes MVPA). This meaning even though children are reporting their environments as not always equipped to promote physical activity they are still finding ways to be physically active and meet the current recommendations.

Reports of food consumption for children and adolescents

Fruits and vegetables should cover at least half of children's plate. They should be consuming 1½ to 2½ cups of varied vegetables in a day and 1 to 1½ cups of fruits (myplate.gov). Children in this study were comparable with children in previous research for fruit and vegetable consumption. Only seven children out of 153 met the fruit recommendations and four out of 153 children met the vegetable recommendations. On average children in this study were consuming approximately 0.58 cups of fruit and 0.41 cups of vegetables on a daily basis which is half a cup below the recommended amount of fruit and a cup below the recommendations for vegetables. However, this is in line with previous findings. Many children in this study were not consuming any fruits (33.6%) or vegetables (40.7%) at home. Brady et al. 2000, Mushi-Brunt et al. (2007b), and the United States Department of Health and Human Services reported that children were not meeting the recommendations for fruits and vegetables, with only 5% consuming the recommended fruits and 20% vegetables per day. In this study, fruit and vegetable consumption over a two-day period did not relate to children's weight status. This could be due to lack of variation for fruit and vegetable consumption. In this study, 93% of children were not meeting the recommended requirements for fruits and vegetables. A more diverse variation of fruit and vegetable consumption or lack of consumption might show a greater contribution to weight status. Children in this study ate breakfast and lunch at school during the day. If children ate all of the fruits and vegetables provided to them from school for one day they would still not meet daily recommendations for fruits and vegetables. Children were not served at school the amount of fruits and vegetables recommended on a daily basis. The Healthy School Lunches program states that in order for children to meet USDA guidelines the average school meal, analyzed weekly, must: contain no more than 30 percent of calories from fat; contain no more than 10 percent of calories from saturated fat; and provide one-third of the Dietary Reference Intakes (DRIs) for calories, protein, vitamin A, vitamin C, iron, and calcium. Therefore, fruits and vegetables need to be consumed outside the breakfast and lunch school environment in order for children to meet daily recommendations.

Throughout the course of this study only three children brought a lunch to school. One child brought lunch from home every day. The other two children only packed a lunch on one observation day and purchased school lunch on the second observation day. All of the third graders ate breakfast either at school or at home. However, 29 4th graders, 25 5th graders and 22 6th graders did not eat breakfast at either school or at home. This indicates that 76 children did not eat breakfast over the course of this study. By not eating breakfast these children are increasing the chances of not being able to meet fruit and vegetable requirements. The school breakfast program never provided a vegetable however; they always offered a fruit in the form of a four-ounce carton of orange juice. In this study, children consumed on average more fruits than vegetables. This could be due to the fruit juice provided at breakfast. If a vegetable was an option for breakfast children may have increased their daily vegetable intake.

The school lunch program always had a fruit and a vegetable that was offered, although the variety of offerings was limited. For lunch every day, children were served a fourth of a cup of fruit and a third of a cup of vegetables. Neither fruits nor vegetables were offered for purchase towards the end of lunch nor were extras requested by children in the lunch lines. If children requested more fruits and vegetables in the lunch line they would have been charged extra. Children were able to purchase extra snacks such as ice-cream sandwiches or chips but they did not have a fruit or vegetable option. The healthiest option they had was a fruit Popsicle. Fruit provided during school lunch included fresh (i.e. apples, bananas, etc.) and canned options and vegetable options included primarily canned options, with only salad as the fresh vegetables. Anecdotal evidence suggests that requests for other fruit and vegetable choices had been made; however, requests have not been accommodated. Participants often were heard negatively discussing the fruit and vegetable options and teachers commented that it was very obvious what children liked and did not like. Because this school has a 90% free or reduced lunch population many of these children cannot afford to bring a lunch, therefore children do not have any choice but to eat or not eat the selections provided regardless of enjoyment. Children may consume more fruits and vegetables if their preferences were incorporated into the menu. The lack of choice could be due to lack of budget, access, lack of knowledge on how to provide and prepare non-canned food items and narrow knowledge of food items in thinking all food is acceptable and should be consumed without complaints.

Nutrition opportunities

The foods available in low-income neighborhoods are of lower quality (Merchant et al., 2007; Zenk et al., 2006), cost more, and have less variety than foods available in more wealthy neighborhoods, because larger suppliers tend to target higher income consumers (Merchant et al., 2007 & Moore, Roux, Nettleton, & Jacobs, 2008). Healthy foods such as fruits and vegetables, poultry, fish and whole grains cost more compared with less healthy alternatives which may promote obesity such as refined grains, French fries, bakery products, and snacks containing high sugar and fat (Merchant et al., 2007; Drewnowski & Damon, 2005). However, good nutrition contributes to overall health and reduces the risk obesity (Gidding et al., 2005) whereas less healthly alternatives may contrubute to increased weight status.

This study indicated that children's access to fruits and vegetables does not have a relationship to their consumption of fruits and vegetables. Children reported low access to fruits and vegetables at home and consumption at home was low as well. Low fruit and vegetable intake has been shown in children and has been linked to cardiovascular disease (John et al., 2002; Rogers and Sharp, 1997), stroke (Kaumudi et al., 1999), some cancers, and various diseases that follow a low socioeconomic gradient (James et al., 1997; Lahmann et al., 2000; O'Dea & Caputi, 2001; Paeratakul et al., 2002; Siskind et al., 1992). Fruits and vegetables are especially important in children for optimal growth, weight management, and chronic disease prevention (Healthy People 2010; USDHHS & USDA, 2012). Children ate most of their meals at school which could contribute to the lack of consuming fruits and vegetables at home. Children may have thought they acquired the adequate amount at school and did not see it necessary to eat fruit or vegetables at home possibly due to lack of knowledge regarding current recommendations. Children also may have not had access to fruits and vegetables at home because their parents do not know the importance of fruits and vegetables, do not know what to buy, do not have the money, or do not like fruits and vegetables; therefore the parents do not purchase fruit or vegetables. Families may not know the importance of fruits and vegetables therefore they do not know what to buy or how to prepare fruits and vegetables. Therefore, families may buy foods that are easy to prepare and cost less than fruits and vegetables. This population is from a low socioeconomic area, and according to previous research, may have less access to quality foods (Merchant et al., 2007; Zenk et al., 2006). Towards the end of the month some children reported not eating dinner in the home and reasons why were not gathered for this study. If children did not always get a meal at home chances of consuming adequate amounts of fruits and vegetables in a day was decreased. With a more diverse population such as varying socio-economic status, urban verse rural, or different races access to fruits and vegetables outside school may vary. These factors may contribute to the fruit and vegetable availability provided to children thus helping them to meet recommended requirements.

Psychosocial

The application of SCT to childhood obesity research suggests that psychosocial constructs such as self-efficacy, beliefs about physical activity, and social support may influence physical activity participation and nutrition behavior, as well as, the environmental constraints placed on food and physical activity resources (Trost et al., 1999). Psychosocial variables have been shown to have a meaningful relationship to children's physical activity levels (Sallis, Prochaska & Taylor, 2000). In this study, three variables (self-efficacy, beliefs, and social support) were used to determine the relationship with physical activity as well as weight status. These three variables where selected because they consistently are reported as primary psychosocial determinants of physical activity in children (Trost et al., 1999).

Self-efficacy expectations are defined in social cognitive theory as beliefs a person has in their capabilities to successfully execute a given behavior (Bandura, 1998). For this study children were asked a series of eight questions pertaining to their capabilities of successfully executing various behaviors. Fisher et al. (2010) determined that girls' self-efficacy scores were not related to their physical activity levels but boys' self-efficacy scores were related to their physical activity levels. Other research states self-efficacy in SCT and positive beliefs about physical activity were significantly higher in children who met guidelines for physical activity than those who did not meet requirements (Trost et al., 1999). Self-efficacy is one of a number of promising determinants of physical activity among youth (Garcia et al., 1995; Garcia, Pender, Antonakos, & Ronis, 1998; Sallis, Prochaska, & Taylor, 2000). Overall, in this study, children had a high self-efficacy score (M=9.59; SD=1.8; on a 12 points scale) meaning children had high perception of executing any given behavior relating to physical activity. These children believed that they could perform various physical activity tasks if presented with the task. However, self-efficacy, for this study, did not significantly influence children's physical activity levels or their weight status unlike SCT where self-efficacy should influence a child's behavior. According to Bandura (1986a) self-efficacy is affected by past performance accomplishments, vicarious experiences, verbal persuasion and psychosocial responses. For example, at this school physical education was held daily for 50 minutes. Children may have been able to participate in a multitude of activities that would have increased their confidence to perform tasks, as well as, observe others perform tasks successfully. Furthermore, physical education may have provided an opportunity for children to engage in physical activity in a safe non-judgmental environment. Although this data was not gathered as part of this study, casual observations of accelerometer data showed that children did accumulate MVPA during physical education. During this time children may have participated in a multitude of activities that would have increased their self-efficacy; however this did not affect their daily participation in physical activity.

Beliefs or outcome expectancies are another component of social cognitive theory. Outcome expectancy as previously mentioned takes various forms including physical outcomes, social reactions, self-evaluation, and motivation. Physical outcomes include plausible and aversive effects of the behavior. The social approval or disapproval of a specific behavior produces a reaction determining if a person will continue a behavior or cease that behavior. The social approval or disapproval can influence a person to have positive or negative reactions to one's health behavior or health status and the person will adjust accordingly to regulate their behavior. Individuals will do things to satisfy their self-worth and satisfaction to avoid the dissatisfaction of others (Bandura, 2004). In this study, children were asked a serious of 16 questions related to outcome expectancies (beliefs). This psychosocial variable was the only variable that significantly contributed to children's weight status yet had no significant relationship with their physical activity levels. In this study, children who believed they had capabilities to control their weight or be healthy were more likely to actually be of a normal weight. However, beliefs were not a valid indicator for helping children to be more physically active. Children may believe they are capable of performing a task however when confronted with the task decide to not perform the task. They might be nervous their peers, educators or family would be critical of the individual's performance. The child may also be shy and not want to perform the task in front of others but the child could be capable of performing the task when people are not around. According to Bandura (1998) children believing they can perform a task and not actually performing the task is common. The child may believe he or she can perform the task but their self-efficacy is low therefore they will not perform said task. The stronger the instilled self-efficacy, the more likely the child will perform a task (Bandura, 1998). Also, according to Bandura (1998) children could have a high belief in their capabilities in performing a task but they do not place a high value on the performance of the task therefore they do not do it. A lack of value expectations could also account for high self-efficacy scores, but lack of relation to behavior.

Social support in this study was a survey pertaining to children's support system at home (family and friends). Social Support did not contribute to children's weight or participation in MVPA. In this study, children may have believed they had a support system but in reality their parents or peers were not very encouraging of physical activity behaviors. Children may perceive their parents to be supportive but in actuality the parents do not take them to park or recreational facilities. By the parents or peers being supportive of other tasks children may have believed that support would be transferred to physical activity behaviors and in reality it does not and the family or peers are not supportive of physical activity behaviors. It has been shown that children with supportive parents are more likely to be physically active (Alderman, Benham-Deal & Jenkins, 2010 & Pugliese & Tinsley, 2007) than those children who have unsupportive parents. This was an eight-question survey pertaining to children's social support system at home. Overall, children appeared to have high social support from the home environment. Children may have the support at home to be active but they do not want to participate in the activities despite the support. Strauss et al. (2001) also found that children's moderate physical activity did not correlate with social support (influences), belief or self-efficacy; however Strauss et al. (2001) did not provide an explanation as to why his findings contradict previous research. Sallis et al. (1998) did show parental support was consistently related to adolescent physical activity. The parents may support children according to children but they may not have the means to actually take children to recreational facilities or they may not interact with children as much as children think they do. The uncorrelated relationship among parental support and physical activity could be due to not enough direct assistance to support their children's physical activity (Sallis et al., 1998). For this study only the child's beliefs were related to their weight status but none of the psychosocial variables were related to physical activity levels. Children's participation in MVPA was inversely related to their weight status. Children that had increased

MVPA levels had decreased weight status. It is unclear as to why the psychosocial variables did not relate to physical activity levels and only beliefs related to weight status.

Summary

The results of this study showed that children from a low socio-economic rural community have higher rates (50.7%) of obesity. However, even with these higher rates of obesity it was determined that a majority of children were meeting MVPA requirements. Those children that have higher MVPA levels have decreased weight status compared to their peers who were not meeting the recommendations for physical activity on a daily basis. Previous research (Troiano et al., 2008) states that children who are inactive have increased weight status compared to their active peers. This study aligns with previous research that physical inactivity is a contributing factor to obesity levels, and increased inactivity contributes to obesity. In looking at the break down of obesity by grade this study also supported previous research (Flegal, Carroll, Ogden, & Curtin, 2010) that as children age their physical inactivity levels increase as well as obesity rates. The third grade children, in this study, participated in more MVPA than their sixth grade peers and had lower levels of obesity.

Previous research (Sallis et al., 2000) has stated that increased physical activity levels are related to children's psychosocial variables. This study looked at children's self-efficacy, social support, and outcome expectancies (beliefs) in relation to the child's weight status along with their physical activity levels. For this study, children's psychosocial variables did not relate to their physical activity levels and only their outcome expectancies related to their weight status.

Finally, this study measured children's fruit and vegetable consumption and determined if children's consumption of fruits and vegetables related to their weight status. Previous research has stated that increased fruit and vegetable consumption is related to decreased weight status. However, in this population children did not meet the recommendations for fruits and vegetables. Their consumption of fruits and vegetables did not significantly relate to their weight status possible due to their lack of consumption by all participants. Children reported low access to fruits and vegetables in the home, indicating children may not have had fruits and vegetables at home to consume. Children's home environment did not significantly relate to their actual consumption of fruits and vegetables. Reason as to why fruits or vegetables were not consumed in the home environment was not assessed, in this study, but may have been related to cost constraints, lack of knowledge or lack of fruit and vegetable food preference.

The overall results of this study indicated for a rural, low socio economic, community children's physical activity levels play a key role in their weight status.

Conclusions and Research Recommendations

Conclusions

1. MVPA levels are an important contributor to children's weight status. The higher the MVPA levels the greater chances the child will have a healthy weight status.
2. Children in rural, poor communities have low rates of fruit and vegetable consumption possibly due to lack of availability.
3. Children had overall fairly high self-efficacy, social support and outcome expectancies yet they do not relate to increased MVPA.
4. Children's beliefs were significantly related to their weight status but not their physical activity levels.
5. In a rural community, schools may begin to consider increasing fruit and vegetable availability during the school day. Currently, the offerings at school would not enable students to meet the recommended levels for fruits and vegetables.
6. For this population there were a high number of children that were meeting the physical activity recommendations. However, obesity rates were over 50%. Therefore, other factors such as objective assessments of the physical activity and nutrition environment,

genetics, health status, education levels of family, or the emotional state of children should be examined in relation to children's weight status.

Research Recommendations

1. Additional research is needed to understand the relationship between psychosocial variables and physical activity. This study examined three of the eight social cognitive theory variables. Further research should examine how additional psychosocial variables contribute to a child's weight status.
2. Future research should incorporate objective measures of the physical activity and nutrition environment. This study did not look at what is available in the community (e.g. parks, recreational facilities, farmers markets), the availability of an after school program, opportunities for children to play a sport outside the school setting, or the connectivity of the neighborhoods.
3. Future research is needed to determine the relationship between fruits and vegetables and weight status. It is known that increased fruits and vegetables leads to a decreased weight status but this population did not confirm that research. This study did not get an accurate example of what is being consumed in the home environment, what was being purchased by the families, what grocery stores the family shopped at and what fruit and vegetable selections were available for the families to purchase at the grocery store. Future research should incorporate these measures.
4. Overall, additional research needs to be conducted with a more diverse larger sample to determine how each of these variables affects one another. A larger sample will allow for advanced statistical analysis, such as a structural equation modeling, to determine an appropriate model for intervention. A more diverse sample would enable researchers to determine potential moderators (i.e. sex, race, SES, community) and mediators (i.e. MVPA) of weight status in children.

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Appendix A

Estimated amounts of calories[a] needed to maintain calorie balance for various gender and age groups at three different levels of physical activity. The estimates are rounded to the nearest 200 calories. An individual's calorie needs may be higher or lower than these average estimates.

Gender/ Activity level[b]	Male/ Sedentary	Male/ Moderately Active	Male/ Active	Female[c]/ Sedentary	Female[c]/ Moderately Active	Female[c]/ Active
Age (years)						
2	1,000	1,000	1,000	1,000	1,000	1,000
3	1,200	1,400	1,400	1,000	1,200	1,400
4	1,200	1,400	1,600	1,200	1,400	1,400
5	1,200	1,400	1,600	1,200	1,400	1,600
6	1,400	1,600	1,800	1,200	1,400	1,600
7	1,400	1,600	1,800	1,200	1,600	1,800
8	1,400	1,600	2,000	1,400	1,600	1,800
9	1,600	1,800	2,000	1,400	1,600	1,800
10	1,600	1,800	2,200	1,400	1,800	2,000
11	1,800	2,000	2,200	1,600	1,800	2,000
12	1,800	2,200	2,400	1,600	2,000	2,200
13	2,000	2,200	2,600	1,600	2,000	2,200
14	2,000	2,400	2,800	1,800	2,000	2,400
15	2,200	2,600	3,000	1,800	2,000	2,400
16	2,400	2,800	3,200	1,800	2,000	2,400
17	2,400	2,800	3,200	1,800	2,000	2,400
18	2,400	2,800	3,200	1,800	2,000	2,400

a. Based on Estimated Energy Requirements (EER) equations, using reference heights (average) and reference weights (healthy) for each age-gender group. For children and adolescents, reference height and weight vary. For adults, the reference man is 5 feet 10 inches tall and weighs 154 pounds. The reference woman is 5 feet 4 inches tall and weighs 126 pounds. EER equations are from the Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002.

b. Sedentary means a lifestyle that includes only the light physical activity associated with typical day-to-day life. Moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life. Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.

c. Estimates for females do not include women who are pregnant or breastfeeding.

Source: Britten P, Marcoe K, Yamini S, Davis C. Development of food intake patterns for the MyPyramid Food Guidance System. J Nutr Educ Behav 2006;38(6 Suppl):S78-S92.

Appendix B

Date ____________________ ID Code _______________________

Grade:____________________________ Teacher_____________________________________

Your Name ____

Your Birth Date ____

How old are you?

______ 8

______ 9

______ 10

______ 11

______ 12

______ 13

______ 14

______ 15 or older

I am a:

______ Girl ______ Boy

Height:___________________________________

Weight:___________________________________

After each question, put a check by the answer that describes you the best. There are no wrong answers.

The first question is about your health. How would you describe your health?

1. My health right now is:

______ Good ______ OK ______ Not So Good

The next question is about your physical shape. Are you in good shape physically?

2. My physical shape is:

______ Good ______ OK ______ Not So Good

Appendix C

Beliefs

Please put a check by “Yes” or “No” for each of the following sentences. “Yes” means that you agree with the sentence. “No” means that you do not agree with the sentence. There are no wrong answers. Put a check by what you think. Remember that physical activity is any play, game, sport, or exercise that gets you moving and breathing harder.

If I were to be physically active most days …

1.	It would help me spend more time with my friends.	______ Yes	______ No
2.	It would make me get hurt.	______ Yes	______ No
3.	It would help me be healthy.	______ Yes	______ No
4.	It would cause pain and muscle soreness.	______ Yes	______ No
5.	It would help me control my weight.	______ Yes	______ No
6.	It would help me look good to others.	______ Yes	______ No
7.	It would help me work out my anger.	______ Yes	______ No
8.	It would make me tired.	______ Yes	______ No
9.	It would give me energy.	______ Yes	______ No
10.	It would make me embarrassed in front of others.	______ Yes	______ No
11.	It would be fun.	______ Yes	______ No
12.	It would help me make new friends.	______ Yes	______ No
13.	It would get or keep me in shape.	______ Yes	______ No
14.	It would make me more attractive to the opposite sex.	______ Yes	______ No
15.	It would be boring.	______ Yes	______ No
16.	It would make me better in sports.	______ Yes	______ No

Total Score___________/16

Appendix D

Social support

Please put a check by "Yes" or "No" for each of the following sentences. "Yes" means that you agree with the sentence. "No" means that you do not agree with the sentence. Remember that physical activity can be any play, game, sport, or exercise that gets you moving and breathing harder. There are no wrong answers.

1. My family thinks I should be physically active. ______ Yes ______ No

2. Someone in my family has offered to be physically active with me in the past 2 weeks. ______ Yes ______ No

3. Someone in my family has encouraged me to be physically active in the past 2 weeks. ______ Yes ______ No

4. Someone in my family has been physically active with me in the past 2 weeks. ______ Yes ______ No

5. My friends think I should be physically active. ______ Yes ______ No

6. A friend has offered to be physically active with me in the past 2 weeks. ______ Yes ______ No

7. A friend has encouraged me to be physically active in the past 2 weeks. ______ Yes ______ No

8. A friend has been physically active with me in the past 2 weeks. ______ Yes ______ No

Total Score___________/8

Appendix E

Self-efficacy

Please put a check by "Yes" or "No" for each of the following sentences. "Yes" means that you agree with the sentence. "No" means that you do not agree with the sentence. Remember that physical activity can be any play, game, sport, or exercise that gets you moving and breathing harder. There are no wrong answers.

1. I think I can be physically active most days after school. ______ Yes ______ No

2. I think I can ask my parent or other adult to do physically active things with me. ______ Yes ______ No

3. I think I can be physically active after school even if I could watch TV or play video games instead. ______ Yes ______ No

4. I think I can be physically active after school even if my friends want me to do something else. ______ Yes ______ No

5. I think I can ask my parent or other adult to sign me up for a sport, dance, or other physical activity program. ______ Yes ______ No

6. I think I can be physically active even if it is very hot or cold outside. ______ Yes ______ No

7. I think I can ask my best friend to be physically active with me. ______ Yes ______ No

8. I think I can ask my parent or other adult to get me the equipment I need to be physically active. ______ Yes ______ No

9. I think I can ask my parent or other adult to take me to a physical activity or sport practice ______ Yes ______ No

10. I think I can be physically active, even if I have a lot of homework. ______ Yes ______ No

11. I think I can be physically active even if I have to stay at home. ______ Yes ______ No

12. I think I have the skills I need to be physically active. ______ Yes ______ No

Total Score____________/12

Appendix F

Environment

How much do you agree with the following statements? **(CIRCLE ONE NUMBER FOR EACH ITEM)**	Disagree a lot	Disagree a little	Neither disagree nor agree	Agree a little	Agree a lot
1. At home there are enough **supplies and pieces of sports equipment** (like balls, bicycles, skates) to use for physical activity	1	2	3	4	5
2. There are **playgrounds, parks, or gyms** close to my home or that I can get to easily	1	2	3	4	5
3. It is **safe to walk or jog alone** in my neighborhood during the day	1	2	3	4	5
4. It is **difficult to walk or jog in my neighborhood** because of things like traffic, no sidewalks, dogs, or gangs.	1	2	3	4	5

At your school, are there supervised physical activity programs for all interested students? **(CIRCLE ONE NUMBER FOR EACH ITEM)**	No	Yes	Don't know
A. After School	0	1	2
B. On weekends	0	1	2
C. During the summer	0	1	2

PE and sport participation

5. During the past 12 months, how many sports teams run by your school did you play on? **(DO NOT INCLUDE PE CLASSES).**

O None
O 1 team
O 2 teams
O 3 teams

Appendix G

About fruits and vegetables you eat

1. On an average day do you eat vegetables?
(1 serve = 1 cup of salad vegetables, OR ½ a cup of cooked vegetables, OR 1 medium potato)

Tick one box

1. ☐ I don't eat vegetables
2. ☐ Less than 1 serve a day
3. ☐ 1-2 servings a day
4. ☐ 3-5 servings a day
5. ☐ More than 5 servings a day

2. On an average day do you eat fruit?
(1 serve = 1 medium piece, OR 2 small pieces of fruit e.g. mandarins or apricots, OR 1 cup of diced pieces)

Tick one box

1. ☐ I don't eat fruits
2. ☐ Less than 1 serving a day
3. ☐ 1-2 servings a day
4. ☐ 3-5 servings a day
5. ☐ More than 5 servings a day

3. **Below is a list of different types of fruits (fresh, canned or dried). For each fruit please indicate answer PART A and PART B.**

PART A: **Please show the child a picture of each item and then ask if they had that item yesterday. If they say yes ask the child if it was for breakfast, lunch or was it at home. Then tick the appropriate box.**

PART B: **Please indicate if you like this fruit by ticking the box that applies to you, for each fruit**

Tick one box in each row

	PART A		PART B		
Type of fruit	**I ate this fruit yesterday**	**I didn't eat this fruit yesterday**	**Never had it or don't know what it is**	**Yes I like this fruit**	**No I don't like this fruit**
	1	**2**	**3**	**4**	**5**
a. Apple	☐	☐	☐	☐	☐
b. Apricot	☐	☐	☐	☐	☐
c. Banana	☐	☐	☐	☐	☐
d. Grapes	☐	☐	☐	☐	☐
e. Kiwi fruit	☐	☐	☐	☐	☐
f. Mandarin	☐	☐	☐	☐	☐
g. Nectarine	☐	☐	☐	☐	☐
h. Orange	☐	☐	☐	☐	☐
i. Peach	☐	☐	☐	☐	☐
j. Pear	☐	☐	☐	☐	☐
k. Pineapple	☐	☐	☐	☐	☐
l. Plum	☐	☐	☐	☐	☐
m. Cantaloupe	☐	☐	☐	☐	☐
n. Strawberries	☐	☐	☐	☐	☐
o. Watermelon	☐	☐	☐	☐	☐

4. **Below is a list of different types of vegetables (fresh, canned or frozen). For each vegetable please answer PART A and PART B**

PART A: Please show the child a picture of each item and then ask if they had that item yesterday. If they say yes ask the child if it was for breakfast, lunch or was it at home. Then tick the appropriate box.

PART B: Please indicate if you like this vegetable by ticking the box that applies to you, for each vegetable

Tick one box in each row

	Part A		Part B		
Type of vegetable	**I ate this vegetable yesterday**	**I didn't eat this vegetable yesterday**	**Never had it or don't know what it is**	**Yes I like this vegetable**	**No I don't like this vegetable**
	1	**2**	**3**	**4**	**5**
a. Beans (green)	☐	☐	☐	☐	☐
b. Beets	☐	☐	☐	☐	☐
c. Broccoli	☐	☐	☐	☐	☐
d. Brussel sprouts	☐	☐	☐	☐	☐
e. Cabbage	☐	☐	☐	☐	☐
f. Bell peppers	☐	☐	☐	☐	☐
g. Carrot	☐	☐	☐	☐	☐
h. Cauliflower	☐	☐	☐	☐	☐
i. Celery	☐	☐	☐	☐	☐
j. Water chestnuts	☐	☐	☐	☐	☐
k. Corn	☐	☐	☐	☐	☐
l. Cucumber	☐	☐	☐	☐	☐
m. Eggplant	☐	☐	☐	☐	☐
n. Legumes (baked beans, chickpeas, lentils, kidney beans)	☐	☐	☐	☐	☐
o. Lettuce	☐	☐	☐	☐	☐
p. Mushroom	☐	☐	☐	☐	☐
q. Peas	☐	☐	☐	☐	☐
r. Potato	☐	☐	☐	☐	☐
s. French fries/potato wedges	☐	☐	☐	☐	☐
t. Pumpkin	☐	☐	☐	☐	☐

u. Spinach	☐	☐	☐	☐	☐
v. Sweet potato	☐	☐	☐	☐	☐
w. Tomato	☐	☐	☐	☐	☐
x. Zucchini	☐	☐	☐	☐	☐
y. Squash	☐	☐	☐	☐	☐
z. Greens	☐	☐	☐	☐	☐

What do you think about

5. How strongly do you agree or disagree with the following statements?

Tick one box in each row

	Strongly agree 1	**Agree** 2	**Not sure** 3	**Agree** 4	**Strongly disagree** *5*
c. In my home, vegetables are served at dinner most nights	☐	☐	☐	☐	☐
j. In my home fruit is available to eat at any time	☐	☐	☐	☐	☐
n. My parents encourage me to eat fruits and vegetables	☐	☐	☐	☐	☐
o. Most of my teachers encourage the students to eat fruits and vegetables	☐	☐	☐	☐	☐

Appendix H

Observation Procedures

1. Picture taken of premade breakfast or lunch tray.
2. Researchers locate children
3. Researchers record what foods are traded, brought into the cafeteria and what foods are taken out of the cafeteria
4. Children are asked to leave tray
5. Card with the child's code number is placed next to tray.
6. Aerial view picture of the finished tray is taken
7. Researcher discards the remains of the tray and cleans up for the child

Appendix I

Observation Note card

B or L   Date

What was the fruit?   What was the Vegetable?

F Left: 0   ¼   ½   ¾ $^{4}/_{4}$ V Left : 0   ¼   ½   ¾ $^{4}/_{4}$

What ELSE?

Appendix J

1. Picture taken of standard plate
2. Each observer assigned 2-4 children before children sat
3. Children asked to indicate when they finished eating lunch
4. Lunch observed
5. Children indicated they completed the meal
6. Picture was taken of the tray
7. Tray was throw away by observer

Appendix K

DEPARTMENT OF
KINESIOLOGY

AUBURN UNIVERSITY

COLLEGE OF EDUCATION

INFORMED CONSENT

PSYCHOSOCIAL AND PHYSIOLOGICAL DETERMINANTS OF PHYSICAL ACTIVITY AND CARDIOVASCULAR HEALTH IN PEDIATRIC POPULATIONS

I invite your child to participate in a research project that aims to discover the underlying factors that influence their participation in physical activity and cardiovascular (heart) health. The assessment measures will include descriptive information of *height, weight, sex, race, and date of birth* along with *waist circumference, daily physical activity behaviors, psychosocial influences toward physical activity, food consumption during school breakfast and lunch, and food frequency questionnaire.* A majority of the variables will be collected at the start of your child's physical education period in the physical education facility. The following assessment measures will be taken:

Descriptive measures include *height, weight, sex, race, and date of birth.* Height will be measured using a standard tape measure. Your child will be asked to stand with their back against a wall and height will be measured to the nearest centimeter. Your child will also stand on a standard scale to measure their weight to the nearest kilogram. Body Mass Index, will be calculated from the height and weight measures using the formula height divided by weight^2. Waist circumference will be assessed with a non-elastic plastic tape measure. Specifically, the tape measure will be placed around your child's waist (i.e., umbilical cord) in a standing position. All measurements will be taken in a private area.

Your child will be asked to report their sex, race, and date of birth.

Physical activity behaviors will be assessed with an Acticals accelerometer. Accerlerometers are small devices that measure the amount of movement. Acticals will be secured to the right ankle of the participants with a secured strap and worn for one full week for 24 hours. The acticals will measures your child's time spent in moderate physical activity per day, time spent in vigorous physical activity per day, t.ime spent sitting per day and steps per day.

Psychosocial influences will obtain an understanding of various factors that influence your child's participation in physical activity. Psychosocial influences will be assessed through three questionnaires. Questionnaire 1 will assess your child's intentions, beliefs, and self-efficiency toward physical activity. It is a 33-item questionnaire composed of yes and no questions. Questionnaire 2 is a 13-item scale that assesses family factors that encourages or discourages physical activity. Questionnaire 3 is an 8-item assessment that examines peer influences on your child's physical activity. These three assessments will take 15 – 20 minutes for your child to complete.

Nutrition Observations will obtain an understanding of your child's dietary consumption. Your child will be observed during the school day during breakfast and lunch to determine the amount and type of food consumed during a typical school day. The observer will not interfere with your child's her lunch or breakfast. Your child will also complete a 14 item nutrition survey about what foods he or she consumes outside the school day.

Parental/Guardian initials ____ ____

2050 Memorial Coliseum, Auburn, AL 36849-5323; Telephone: 334-844-4483; Fax: 334-844-1467
www.auburn.edu

Additionally, your child may be re-contacted and asked to participate in this project again if they have consented to participate in the project previously. Specifically, they will be contact with a letter either in the Fall or Spring of the academic year requesting that they participate in the follow-up assessments. You child must provide verbal assent to participate. If your child does not provide verbal assent, they will not participate in the follow-up assessments. The follow-up assessments will include: physical activity behaviors, weight status, cardiorespiratory fitness, resting blood pressure, cardiovascular biological markers, and psychosocial influences one time per academic year. This information is vital to the gaining a better understanding of health needs and the design of a school-, family-, and community-based lifestyle behavioral intervention program.

Potential Benefits: In terms of benefits, your child will receive a clinical assessment of their cardiovascular (heart) health. This information will be provided to each parent/guardian and the school nurse for your child's medical records. The school nurse will be available for a follow-up meeting with parents regarding the child cardiovascular (heart) health assessment. Each child will also receive a step count pedometer so that they can continue to monitor their physical activity after the project. Participants will obtain a better understanding of their physical activity behaviors along with the various psychosocial determinants that promote or impede their physical activity. Additionally, parents may request copies of any data collected for their child.

Foreseeable Risks and Discomforts: There are no foreseeable risks or discomforts associated with the physical activity, psychosocial questionnaires, cardiorespiratory fitness, and most of the cardiovascular risk factor assessment. However, minor risks might occur due to the data collection of biological markers and the investigators have taken the less invasive measures for the collection of biological markers. Participants may experience some discomfort (i.e., tenderness on the finger at the site of the finger prick). The school nurse, will be available to assist with the aspect of data collection and all steps will be taken to ensure minimum discomfort in each participant.

 Parental/Guardian initials ______

Please note that any child who expresses a desire to quit an assessment will be allowed to stop immediately. To preserve confidentiality, in any presentation or publication, your child's performance and responses will be reported as group result only. Any information obtained from the assessments may be used for educational purposes and publication. Unless otherwise notified by you, I plan to present the results at scientific conferences and publish the results in appropriate journals. In any presentation or publication, the data will remain anonymous.

Your decision whether or not to allow your child to participate will not jeopardize his/her future relations with Auburn University, the Department of Kinesiology, or Loachapoka School. Your child's performance or responses will in no way affect your child's standing with their educational institution/organization. At the conclusion of the assessments, a summary of group results will be made available to all interested parents and educators. Should you have any questions or desire further information, please call Dr. Leah E. Robinson at (334)844-8055 (phone)/lerobinson@auburn.edu and/or Dr. Danielle D. Wadsworth at 33-844-1836 (phone)/wadswdd@auburn.edu (email). You will be provided a copy of this form to keep.

For more information regarding your rights as a research participant you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED YOU MUST DECIDE WHETHER OR NOT TO ALLOW YOUR CHILD TO PARTICIPATE. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW YOUR CHILD'S PARTICIPATION.

Child's Name ______________________

Parent/Guardian Signature ______________________ Date ________

Investigator Signature ______________________ Date ________

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The Auburn University Institutional Review Board has approved this document for use from 2/8/12 to 3/9/13

Protocol # 10-053 MR 1003