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ABSTRACT OF THESIS

EXAMINING THE RELATIONSHIP BETWEEN WEIGHT, FOOD INSECURITY, FOOD STAMPS, AND PERCEIVED DIET QUALITY IN SCHOOL-AGED CHILDREN

A paradox exists between food insecurity and obesity. Childhood obesity has tripled in the past three decades. This study aimed to understand the relationships between food insecurity, poverty income ratio, food stamps usage, perceived diet quality, and weight status in children. A child's weight status is determined by many different factors and this study investigated several of these aspects. It was found that the family's poverty index ratio had the greatest effect on a child's BMI, but household food security status, ethnicity, and the perceived inability to serve balanced meals were all found to be statistically significant when considering a child's BMI.

KEYWORDS: Food Security, Food Stamp Program, Obesity, Diet Quality, Children.

Elizabeth Lucas Marshall

May 05, 2010

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CHILDREN

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THESIS

Elizabeth Lucas Marshall

The Graduate School

University of Kentucky

2010

EXAMINING THE RELATIONSHIP BETWEEN WEIGHT, FOOD INSECURITY,
FOOD STAMPS, AND PERCEIVED DIET QUALITY IN SCHOOL-AGED
CHILDREN

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Sciences
College of Agriculture
at the University of Kentucky

By

Elizabeth Lucas Marshall

Lexington, KY

Director: Dr. Mary Roseman MBA, RD, LD, Professor

Lexington, Kentucky

2010

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Chapter One

Food security is defined as access by all people at all times to enough food for an active, healthy life. In contrast, food insecurity implies a restricted access to adequate food sources. More specifically, food insecurity has been defined by Anderson (1990) as having “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (p. 1598). Individuals can be considered food insecure without hunger or, in more severe cases, food insecure with hunger (Anderson, 1990). Hunger has been defined as “the recurrent and involuntary lack of access to food” (Anderson, 1990). In 2006, 35.5 million people lived in food-insecure households and 12.6 million of these individuals were children (Nord, 2007).

Furthermore, 41.1% of low-income households with children are food insecure (Nord, 2007). Food insecurity in children has been linked to lower general health status, more mental health and behavioral problems, and greater incidence of illness (Alaimo et al., 2001; Weinreb et al., 2002). In addition, food insecurity has also been shown to compromise mental, physical, and behavioral status across the age spectrum (Champagne et al., 2007; Nord & Prell, 2007).

It has been found that food insecurity and poverty have been linked to poor nutrition (Bhattacharya et al., 2004; Basiotis et al., 2004). Research also confirms that there are higher rates of obesity in the low-income population (Dinour et al., 2007; Olson et al., 2007; Dietz, 1995). Along with the rest of the population, childhood obesity rates have tripled in the past three decades (Dinour et al., 2007).

Research has shown that food security measures are a reliable indicator of household wellbeing (Nord & Prell, 2007). When households experience food insecurity a number of strategies are employed to manage hunger. These may include reducing food intake, decreasing meal frequency or volume, or relying on low-cost, energy-dense foods (Webb et al, 2004; Drewnowski & Specter, 2004). By applying these strategies, the food insecure are establishing disordered eating habits. These approaches can affect nutritional outcomes and might affect the risk of overweight and obesity (Webb et al, 2004; Drewnowski & Specter, 2004).

These numerous and complex issues have led to an increase need to better

understand links between food insecurity, poverty, nutrition assistance programs, diet, and weight status in children. It is of utmost importance to assess the effectiveness of food assistance programs in fighting food insecurity. This study aims to understand the relationships between these variables and their affect on weight status in school-aged children.

Statement of the Problem

Childhood obesity has tripled in the past three decades (Dinour et al., 2007). There are numerous and complex issues that interact together to explain this drastic increase. This has strengthened the need to better understand links between food insecurity, poverty, nutrition assistance programs, diet quality, and weight status in children.

Statement of the Purpose of Study

The purpose of this study is to examine the relationships between weight status, PIR, food stamp usage, food insecurity, and perceived diet quality in school-aged children. A greater understanding of how poverty, food stamp usage, food insecurity, overweight status and dietary quality of children affect one another will provide health professionals and policy makers with the information necessary to best serve specific subgroups and society at large.

Objectives

Research has been limited on the topics of poverty, household food insecurity, food stamp usage, diet quality in children, and childhood obesity. Therefore, there is still much to learn about the complex associations between all of these variables. The present study will utilize data collected in the National Health and Nutrition Examination Survey (NHANES) of families with school-aged children between the years 2005-2006, to:

1. Measure the level of food insecurity in impoverished families with children receiving food assistance versus those families not receiving food assistance.
2. Examine the relationship between food insecurity and weight status.
3. Determine the relationship between food insecurity and perceived diet quality.
4. Investigate the relationship between food assistance programs and

weight status.

5. Determine the relationship between food assistance programs and perceived diet quality.

Research Questions

1. As poverty levels increase, do families with children have greater food insecurity?
2. Is there greater severity of food insecurity in families that do not receive food assistance?
3. Do children in families with greater severity of food insecurity have higher body mass indexes (BMIs)?
4. Do children in families with greater severity of food insecurity have lower perceived diet quality?
5. Do children in families not receiving food assistance have higher BMIs than those receiving food assistance?
6. Do children in families not receiving food assistance have lower perceived diet quality than those receiving food assistance?

Justification

Based on the extensive review of the literature, further study and comprehension regarding the relationships between food stamp usage, food insecurity, weight status of school age children, and perceived diet quality of families is critically needed. A thorough exploration of these topics in this research project will help identify additional links and advance the knowledge and understanding of these issues. As previously mentioned, the paradox between obesity and low income exists. Specifically, children from low-income, food insecure households need assistance in many areas of their lives; this research project will help identify specific issues where understanding and assistance is needed.

Assumptions and Limitations of Study

Since NHANES is such a unique dataset, several considerations need to be taken into consideration when utilizing this data. One of the most critical issues deals with the lack of access to geographical information. This problem can hinder any application of the results to smaller scales rather than a national scale. Therefore, this study is

representative of the United States as a whole and no specific subgroups. Similarly, in order to protect subject confidentiality, since NHANES data is publicly available data, it does not contain certain “identifiable” information (e.g., subject address, date of birth).

Whenever using a questionnaire as a research method, there are several assumptions that are accepted. First, it is assumed that the questionnaire is a valid and reliable tool that measures what it is intended to evaluate. Secondly, it is assumed that the participants are answering the subjective questions truthfully. The acceptance of these two assumptions allows the results of this study to be considered accurate.

Chapter Two

Review of Literature

Childhood obesity has tripled in the past three decades, increasing from 6.5%-18.8% in children aged 6-11 and from 5.0%-17.4% in adolescents aged 12-19 years (Dinour et al., 2007). Many different theories have been proposed as to why there has been such a drastic increase in obesity rates, most including increased food consumption and decreased activity (Cutler et al., 2003). Food choices are determined by a multitude of factors such as accessibility, options, and preferences. When children encounter difficulties in food availability, especially nutritious options, negative consequences can occur.

Even though the increase in weight status has been thoroughly studied, limited research has been conducted on the relationships between food insecurity, household income, the Food Stamp Program, perceived diet quality, and weight status. This review will start with the broader topics of food stamps and food insecurity. Next, it will examine what effects these two larger topics have been found to have on children's weight status and the caregiver's perception of diet quality in the child's home. After reviewing previous studies, the support is apparent that more understanding is needed regarding the relationship between food stamp participation, food insecurity, perceived diet quality and weight status in children.

Food Assistance Programs

The U.S. Department of Agriculture administers fifteen food and nutrition assistance programs that provide access to food, resources, and diet education to needy individuals. Of these programs, the Food Stamp Program (FSP) is the largest, spending 30 billion dollars and reaching more than 27 million individuals per month in 2006 (Landers, 2007). The FSP is an entitlement program, meaning that anyone who meets eligibility guidelines pertaining to income, work, and immigration status can receive benefits. Once an individual is deemed eligible, they can choose to participate. Participation rates have followed economic cycles closely (Landers, 2007). In 2005, 65% of eligible people received Food Stamp benefits (Landers, 2007).

Households are eligible to receive food stamps if they have gross and net incomes below 130% and 100% of the poverty threshold respectively (Landers, 2007). In 2007,

the poverty level for a family of four was \$20,650 (Hofferth & Curtin, 2005). As a family's income rises, the amount of FSP benefits that they are eligible for declines FSP recipients receive debit cards on a monthly basis that they can use to purchase qualifying foods and non-alcoholic beverages. The average monthly household benefit in 2007 was \$94.06 per person (Landers, 2007).

Since food stamp recipients can use their benefits to purchase a wide variety of foods and beverages, the most nutritious items are not always chosen. Therefore, USDA implemented food stamp nutrition education programs in 1992. Local agencies can decide how to provide this education to their population. These services have ranged from individual counseling sessions to group classes to social marketing campaigns (US General Accounting Office, 2007). These educational offerings are meant to meet the FSP's goals of decreasing food insecurity while increasing participants' nutritional status.

Children and food assistance programs.

Children are the largest proportion of recipients in the Food Stamp Program (Ploeg et al., 2007). In recent years it has been calculated that approximately 50% of the Food Stamp recipient population are children (Ploeg et al., 2007). Children that benefit from the Food Stamp Program not only improve their access to food, but they can increase other aspects of their life as well. Research has shown that starting FSP participation when young was associated with approximately a 3-point greater improvement in reading and mathematics score in girls as compared with those stopping FSP participation during that period (Frongillo et al., 2006). The benefits from receiving food stamps can go beyond nutritional gains and reach overall well being for a child.

Low-income children also have the advantage of utilizing the National School Lunch and Breakfast program to help overcome the lack of food in their homes (Nord, 2007). Therefore the nutritional outcomes of school-aged children might not be as closely related to limited household resources as adults. Yet even with these benefits many children are still experiencing food insecurity on a daily basis (Nord, 2007). The Food Stamp Program was intended to reduce poor nutrition; however it might actually encourage overeating and weight gain. Even though food stamps have been found to increase household food expenditures, previous research has not clearly determined if receiving food stamps increases the nutritional quality of diets of food stamp recipients.

Food Insecurity

Food security and hunger are very subjective concepts to the individuals that experience them on a sporadic or daily basis. At a minimum, it is defined as access by all people at all times to enough food for an active, healthy life (Anderson, 1990). In contrast, food insecurity implies a restricted access to adequate food sources. Specifically, food insecurity has been defined by Anderson (1990) as having “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (p. 1598). In 2006, 35.5 million people lived in food-insecure households and 12.6 million of these individuals were children (Nord, 2007).

Food insecurity can be compared to food security, which is defined as “access by all people at all times to enough food for an active, healthy life” (Anderson, 1990). Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods and (2) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing or other coping strategies)” (Anderson, 1990, p. 1598). Even with these detailed definitions, assessing and measuring access to food has been found to be a difficult task.

Characteristics of food insecure households.

In 2006, 10.9% of all U.S. households were food insecure at some time during the year. This statistic increased to 15.6% among households with children and 17.1% in the children themselves (Nord, 2007). Bhattacharya et al. (2004) also found that food insecurity is most prevalent in families with children. This study found that in 2004, the prevalence of food insecurity with hunger was much higher among food stamp participant households (18.6%) than among low-income, nonparticipant households (10.1%). The strong self-selection effects have explained this, since families choose to receive food stamp benefits (Wilde, 2007).

Data from 2007 found that households whose income was below 100% of the poverty line (\$2,167 gross income for a family of four) the percentage of food insecurity jumped to 36.3%. Also, the region of the South, at 12.3% food insecurity, had the highest percentage of households with food insecurity among the four regions of the United States For those reasons, it has been concluded that low-income households with

children experience food insecurity at a rate higher than the average household (Nord, 2007).

Certain characteristics put a household at a higher risk of being food insecure. Some of these characteristics include: lower household income, lower educational level, having three or more children in the household, and a single mother with children (Nord, 2007). Previous studies have found several immediate consequences of household food insecurity such as irregular food supply, disturbed eating patterns, and poor diet quality (Bhattacharya et al., 2004; Alaimo et al., 2001; Basiotis et al., 2006, Casey et al., 2006). Some long-term consequences from food insecurity are decreased nutrient intake and compromised health status in adults (Bhattacharya et al., 2004).

Food insecurity and negative outcomes.

Food insecurity has correlations with several negative consequences other than obesity. For example, it has been found that children in households judged to be food insufficient have been noted to have lower general health status, more negative physical symptoms, more mental health and behavioral problems, and more academic difficulties (Casey et al., 2006). Individuals suffering from food insecurity also have higher odds of reporting “poor/fair health” and “suffering from depression and distress” (Champagne et al., 2007).

Another negative consequence of being food insecure is the academic deficiencies that can develop in the children of a household. Results from the Early Childhood Longitudinal Study-Kindergarten Cohort found that food insecurity was predictive of poor developmental progress in children before controlling for other variables (Jyoti et al., 2005).

Associations between food insecurity and diet.

A recent study that used NHANES data found that food insecurity is predictive of poor nutritional outcomes in adults. However, this relationship was not found to be true in children. This same study also found that the lowest rates of serum nutrients were found in children who were not considered poor, but reported food insecurity (Bhattacharya et al., 2004). These results might suggest that food assistance to the poor does help improve nutritional outcomes in children.

Another characteristic that has been found linked to childhood obesity is the intake

of fruits and vegetables. Previous studies have found a negative correlation between fruit and vegetable intake and obesity (Rennie et al., 2005; Quan et al., 2000). According to the USDA guidelines a child should daily consume 2½ cups of vegetables and 1½ cups of fruits based on an 1800 calorie per day plan (USDA, 2005). Recent research studies have found that only 6-20% of children and adolescents nationwide ate five or more servings of fruits and vegetables per day (Pesa & Turner, 2001; Nystrom et al., 2005; Reynolds et al., 2000). Whereas another national study reported about two-thirds of youth ages 12-19 consumed less than one serving of fruit a day and almost one-third consumed less than one serving of vegetables a day (USDA, 2006).

A study found that families who have more fruits and vegetables at home have children who eat more fruits and vegetables. This study found an increase or decrease in a child's intake of certain foods was controlled by the availability of that food in the home (Reinaerts, 2006). Therefore, if food insecurity hinders fruit and vegetable availability in the home, then children from those households might not be meeting daily fruit and vegetable recommendations. A study completed by Basiotis and colleagues in 2004 compared Healthy Eating Index (HEI) scores of individuals with incomes $\leq 100\%$ of the poverty threshold with that of individuals from more affluent households with incomes $\geq 184\%$ of the poverty threshold. The former participants had a HEI of 65.0 (out of 100) and a variety score of 8.2 (out of 10) while the latter had a mean overall HEI score of 61.7 with a score of 7.0 for variety component.

In a study that used NHANES, Bhattacharya (2004) found that poverty and food insecurity effects on diet are dependent upon the individuals' age. This study found that poverty is predictive of poor nutrition among preschool children; however food insecurity does not have a strong correlation to nutritional status for this age group. Among school age children, neither poverty nor food insecurity was found to be associated with nutritional outcomes. Conversely, among adults and the elderly, both food insecurity and poverty were predictive (Bhattacharya, 2004). These results could be explained as the protective power of adults over children in food insecure households or the effectiveness of other food assistance programs tailored to children.

Weight Status Classification and Rates

The most common classification of overweight and obesity in the U.S. is by a

person's body mass index. BMI is calculated by dividing a person's weight in kilograms by their height in meters squared. A BMI of 25-29.9 is considered overweight, whereas a BMI of 30 or greater is considered obese. BMI is a well-accepted indicator of body fatness and defines weight categories that may lead to health problems. Obesity is a major risk factor for cardiovascular disease, certain types of cancer, and type 2 diabetes (CDC, 2009).

BMI classifications for children and teens differ from the adults with the use of BMI-for-age. The BMI for a child is still the same as an adult's, being a number calculated from a child's weight and height. However, for children and teens, BMI is age- and sex-specific and is often referred to as BMI-for-age. The classifications are also different for children and teens. Childhood overweight is considered as a BMI at or above the 85th percentile and lower than the 95th percentile and childhood obesity is a BMI at or above the 95th percentile for children of the same age and sex (CDC, 2009). Obesity has doubled, from 15.0%-32.2%, from the 1970's until the current decade, in the general American adult population (Ogden et al., 2006). While it is apparent that obesity rates have drastically increased in the United States, the reasons are less clearly understood. The most basic understanding of this phenomenon was described in results from a study completed by Cutler et al. (2003). It seems that a combination of increasing caloric intake while reducing activity levels has caused an increase in the obesity rates.

Weight status in children.

Similar to adult obesity rates, the increasing prevalence of childhood obesity has reached an alarming rate. Childhood obesity has tripled in the past three decades, increasing from 6.5%-18.8% in children aged 6-11 and from 5.0%-17.4% in adolescents aged 12-19 years (Dinour et al., 2007). This pandemic puts overweight children at a disadvantage since obesity affects both somatic and psychosocial health; obese children are stigmatized and have a decreased health-related quality of life (Williams et al., 2005). Overweight children are also at an increased risk to develop high blood pressure, dyslipidemia, and type 2 diabetes (Dietz, 1998; Weinreb et al., 2002). Additionally, the cost of childhood obesity is increasing. For youth 6 to 17 years of age, obesity-associated annual hospital

costs increased more than three-fold, from \$35 million from 1979 to 1981 to \$127 million from 1997 to 1999 (Wang & Dietz, 2002).

Furthermore, overweight children are more likely to become obese adults than children of normal weight (Kalavainen et al., 2007). Growing up in a poor household has also been found to increase the risk of overweight and obesity in adulthood (Olson et al., 2007).

More directly, two studies have shown a varied relationship between weight and socioeconomic status for children (Wang, 2001; Wang & Zhang, 2006). However, a study completed by Hofferth and Curtin (2003) found that this relationship might be the strongest for children in the low-to-moderate income families rather than low-income families, meaning that low-to-moderate income children are more likely to be obese.

Food stamp participation and weight status.

The association between food stamp participation and weight status has been thoroughly researched in adults. However, studies comparing these two variables for children are not as prevalent but are increasing. The various studies focusing on relationship between program participation and weight report widely differing results depending on gender, age, timeframe, and ethnicity (Webb et al., 2008; Gibson, 2003; Gibson, 2004; Ploeg et al., 2007).

One study found that adults that had participated in the FSP in the past 12 months had significantly higher BMI's than non-participants (Webb et al., 2008). Other studies have associated participation in the FSP with food insecurity and overweight. Several studies have concluded that women and girls participating in the FSP, both short and long term, were positively associated with overweight. For example, no such correlation has been found between FSP participation and men, but a negative correlation was found in boys aged 5-11 (Gibson, 2003; Gibson, 2004). A report from USDA's Economic Research Service found that as the national level of obesity raises, the weight variances between food stamp recipients and non-recipients is nullified. The associations between weight status and FSP participation were found to be inconsistent and varied by race and ethnicity (Ploeg et al., 2007).

One theory of how food stamp benefits could encourage weight gain is that food stamps allow recipients to spend more money on food than they otherwise would, resulting in more food to eat. One study found that food stamp participants consumed

significantly more meat and had a higher fat intake than non-food stamp recipients; while non-food stamp individuals consumed more dairy foods and fruit (Cason et al., 2002). Wilde et al. (2001) found that not only did food stamp participants consume more meat and fat, but they also consumed more added sugars but no more fruits, vegetables, grains, or dairy products. Even though food stamp participants receive benefits to combat hunger, it might not result in improved diet quality.

It has also been suggested that adult participants develop disruptive eating behaviors due to the monthly distribution of food stamps. Results from a study completed by Zezza et al. (2008) provide greater insight into this subject. It was found that dietary behaviors of men and women receiving food stamps were very different from the dietary habits of food secure individuals. The food stamp recipients had significantly fewer meals than non-recipients; however they chose higher energy-dense items. Consequently, the total energy intakes between the two groups were not different even though their behaviors were different (Zezza et al., 2008). These altered dietary habits are the result of a pattern called the “food stamp cycle” where individuals rotate between periods of binging and restriction, which can lead to over-consumption when food is available (Townsend et al., 2001).

Paradox between food insecurity and weight status.

A major paradox has also emerged in recent studies associating food insecurity with obesity. This connection seems illogical since food insecurity is associated with under-consumption whereas obesity is associated with over-consumption (Dinour et al., 2007). Dietz (1995) was one of the first researchers to suggest a correlation between food insecurity and obesity; proposing that during times of food shortages family members consume foods that are energy dense and then overindulge in times of plenty.

Due to these types of disordered eating patterns, many children from low-income homes could develop negative attitudes and behaviors towards food. Other stressful or harmful food experiences in their homes could also add to such behaviors. These negative attitudes could become engrained in the child’s mind and might affect them in their adult lives. It has been proposed that an overweight adult’s current behavior of food shopping, preparation, and eating practices are influenced by childhood experiences (Olson et al., 2007). This relationship could explain why food insecurity in childhood might be related

to obesity in adult life.

Childhood eating and health behaviors are also directly related to maternal education and health practices. In a family setting, any type of additional financial strain or stress about food security has been found to have a negative impact on a child's weight status (Lohman et al., 2009). This study looked at 1,011 adolescents aged 10-15 years and their mothers in families with incomes below 200% of the poverty line found that an increase in maternal stressors amplified a food insecure adolescent's probability of being overweight or obese. This study found that it was not the act of being food insecure that led to the increased chance of being overweight, but the additional stress that such factors added to the family dynamics (Lohman et al., 2009).

Another hypothesis as to why there is a correlation between food insecurity and obesity suggests that since energy-dense foods are associated with low costs, they may promote over-consumption of energy which can lead to weight gain. This study found that if someone needs to maintain adequate energy intake on a limited income, they might select lower-quality diets, consisting of high-energy, inexpensive foods (Dinour et al., 2007). The poor might also lack the necessary education to make healthful food decisions when faced with numerous food choices.

Food security and weight status.

Studies on food insecurity and obesity vary considerably. Previous studies have shown a correlation between food insecurity and obesity in women, but the same has not been found in men or children (Laraia et al., 2004). Wilde & Peterman (2006) found that women in households that were marginally food secure and food insecure without hunger were significantly more likely to be obese compared with women in households that were fully food secure. However, this positive relationship was not found to be true for women that were categorized as food insecure with hunger. Similarly, in a study completed by Webb et al. (2008), it was found that of food insecure respondents, only those classified with hunger had BMI in the underweight category.

It has been suggested that the correlation between food insecurity and obesity is not as strong in children because of parental protection, where adults will forgo eating to protect the children from experiencing hunger (Dinour et al., 2007). To support this suggestion, a study completed by Martin and Ferris (2007) found that food insecure adults were

significantly more likely to be obese as those who were food secure; whereas being food insecure did not increase odds of a child being overweight. Conversely, kids with family incomes below 100% of the poverty line were half as likely to be overweight compared to their peers with higher incomes.

Additional research using NHANES data of 2,516 children between the ages of 8 and 17 in households with annual incomes below 200% of the poverty line found that food insecure children were no more likely to be obese than their food-secure counterparts across all measures of obesity (Gundersen et al., 2009). Similar findings of 1,031 adolescents found no significant differences in the prevalence of at risk of overweight and overweight between food secure and food insecure children. However, food insecurity and overweight coexisted among the low-income children; 25% of the food insecure children were overweight (Gundersen et al., 2008).

Age groups also reported different findings. Bhattacharya et al. (2004) found that food insecurity was related to higher BMI's in children 2-5; however it was found that children 6-11 had lower BMI's than their food secure peers. In contrast to the previous results, data from the Early Childhood Longitudinal Study-Kindergarten Cohort found that children from consistently food insecure households had a 0.35 kg/m² greater increase in BMI and a 0.65 kg greater gain in weight over a 3 year period compared with children from consistently food secure households (Jyoti et al., 2005). After reviewing these varied results, it is clear that additional researched is needed in the areas of childhood weight status, poverty, food security, and food stamp usage.

Support for Study

Limited research has been conducted on the topics of food insecurity, income, the Food Stamp Program, diet quality in children, and childhood obesity. Some studies have looked at these topics individually, while others have researched various combinations. However, there is still much to learn about the associations between all of these issues. Each of these subjects is complex in itself; the multiple relationships add even greater intricacy. It is important to better comprehend these relationships in order to increase the understanding of the needs of children. By gaining more knowledge about the topics in this proposed study, we will add further awareness regarding the unique challenges and needs of the population.

While several studies on these issues have been completed on adults, few studies have been done on children. By learning how each of these variables positively or negatively affects children, it will be beneficial in addressing problems and developing programs that can aid in improving these critical issues in children. A good understanding of the association between diet, overweight and food insecurity also has many important public health and policy implications, particularly for the management and prevention of childhood obesity and nutrition assistance programs. Gaining information on these connections will be beneficial when creating policies regarding food stamps and food stamp education. Obviously the goal of the FSP is to increase needy individuals' access to food, but a secondary goal is to improve the individual's overall health by increasing diet quality. If these goals are not being met, then certain policies may need to be revised to better meet the needs of the participants.

Furthermore, the results of this study will provide a deeper understanding of the problems faced by children in low-income, food insecure households. By learning more about this population's particular concerns, better strategies can be put in place to empower these families to overcome their situation-specific difficulties. In addition, these findings can help provide a basis for predicting future health issues that could arise with food insecurity, poor diet quality, and obesity.

Chapter Three

Methodology

This study aimed to research the connections between poverty income level, food stamp usage, food insecurity, child's weight status, and perceived diet quality in families of school-aged children. A greater knowledge of how these variables affect one another will supply health professionals and policy makers with the information necessary to best serve specific subgroups and society at large. The research design, methodology, and predicted analysis approach will be covered to provide a greater understanding of this study's projected direction.

Research Design and Methodology

For the purpose of this study, secondary analysis of data from the NHANES 2005-2006 was conducted. The NHANES includes a series of cross-sectional surveys that provide nationally representative information on the nutrition and health status of U.S. households. Since 1999, NHANES has been a continuous survey, occurring in two-year cycles (CDC, 2005). This study utilized the 2005/06 survey series.

The NHANES questionnaire collects both quantitative and qualitative data. However, based on the questions used for this research, this study was considered to be quantitative non-experimental research. The descriptive research method used was correlational research examining correlations between the previously mentioned variables.

Subjects

NHANES uses a complex, multistage, probability sampling design. The sampling procedure consists of four stages rather than a simple random sample. In the first stage, primary sampling units are selected; for example single counties or several neighboring counties. The second stage then divides primary sampling units into segments, which are then broken down into households in the third stage. Finally, individuals are drawn at random from these households to participate in NHANES. On average, 1.6 persons are selected from each household (CDC, 2008). This type of sampling design is used to select participants that are representative of the civilian, non-institutionalized U.S.

population. Oversampling of certain population subgroups does take place to increase the precision of health status indicator estimates for these groups (CDC, 2008).

Data Collection

Survey participants are first interviewed in the home and then complete a physical examination in a mobile examination center. The physical exam generally takes place within 1 to 2 weeks after the in-home interview. The specially designed and equipped examination centers allow for greater standardization of measurements, as well as a more private setting for interviews. The household interviews are conducted using a computer-assisted personal interview methodology. All of the data collection in the mobile examination center is automated. Complete descriptions of the NHANES sample design, interview procedures, and physical examination methods conducted have been published elsewhere (CDC, 2005c).

Variables

All households with school-aged children were examined using the following variables: 1) age of children in household, 2) household PIR, 3) body mass index (BMI) of children in household, 4) food stamp usage of household, 5) food security of household and 6) perceived quality of diet of children in household. Specifically, this proposed study's analysis will examine all households with school age children **between** 6 years, 0 months of age to 17 years, 11 months of age.

1. **Poverty income ratio** was analyzed using the U.S. Census Bureau poverty income ratio (PIR). The PIR compares a household's income to the family's appropriate poverty threshold level (CDC, 2007a). PIR values below 1.3 were considered to be in the low PIR category, values between 1.3-3.0 were considered to be in the moderate PIR category, while PIR values 3.0 or greater were considered to be in the high PIR category.
2. For **BMI**, the height and weight data of the child are converted to a BMI-for-age: children with a BMI of <5% were categorized as underweight, 5.0-84.9% were normal weight, ≥85% but <95% were risk for overweight, and ≥95% were overweight (CDC, 2007b).

3. The variable of **food stamp usage** was measured by household. It included a NHANES specific question regarding if the family has received food stamps in the past 12 months.
4. Another variable **was food security**. The NHANES asked 18 questions on food security to create a Household Food Security Scale. The U.S. Census Bureau developed this 18-item scale in 1995. NHANES uses the full USDA 18-item measure that has been verified to be an accurate measure of household food security (Nord et al., 2008). NHANES separates primary household participant's responses to the 18 questions into 4 categories: food secure, moderate food insecurity, low food insecurity, and very low food insecurity.
5. **Perceived diet quality** was accessed using two specific questions from NHANES. These two questions were: "Were you ever unable to serve balanced meals?" and "Did you rely on low-cost foods?". A single adult answered these questions for the entire household. For this study, by answering, "Yes" to these questions, a participant's perceived diet quality will qualify as being affected.

Demographic Characteristics

Descriptive characteristics were determined for the sample. These included gender, age, PIR, and ethnicity. The participants' ages were simply defined by year. PIR was divided into three categories: low (<1.3), moderate (1.3-3.0) and high (>3.0). Ethnicity was divided into four categories that included African American, Hispanic, White, and Other.

Method of Data Analysis

The statistical analyses of the data were performed using SAS software, version 9.2 (SAS Institute Inc., Cary, NC, USA). Descriptive statistics were calculated for the total sample, by ethnicity (White, African American, Hispanic, and Other), by gender, and by PIR. To test for the statistical significance of differences, chi-square tests were used.

Logistic regression models were estimated to assess the association between childhood obesity and food insecurity, food stamp usage, PIR, and perceived diet quality while controlling for other factors. All statistical tests were performed at a significance level of $\alpha=.05$.

Chapter Three

Results

Descriptive Statistics of Study Sample

A description of study sample is provided in Table 1. Of the 2,849 households with characteristics that met the study's criteria, 2,791 household observations were usable for the analysis. Observations that were unusable contained missing data. From the survey sample 31.8% were African American, 36.3% were Hispanic, 26.1% were White, and 5.8% were classified as Other.

Forty percent of households were considered to be low income. Of the rest of the respondents, 32% were considered to be moderate income, and 28% percent were considered to be high income. From the 40% that were low income, meaning they were eligible for federal nutrition assistance through the Food Stamp Program based on income alone, only 22% were receiving food stamps at the time of the survey.

Sixty-six percent of the sample was considered to have full food security. From the other observations it was found that 10% had marginal food security, 16% had low food security, and 8% had very low food security. Respondents classified as marginal, low or very low food security had significantly higher rates of obesity than those classified as food-secure. Rates of obesity were found to be 27.5%, 26.3%, 31.3%, and 19.5% respectively (p -value < 0.0001).

From our sample size, 6% were considered to be underweight, 57% were considered to be normal weight, 15% were considered to be overweight and 22% were considered to be obese. BMI did not differ among gender but did differ among ethnicities. Participants classified as African American or Hispanic were much more likely to be categorized as obese than those classified as Other or White, 22% and 28% compared to 12% and 16% respectively. The Other ethnicity group had a much greater percentage of underweight participants at 10% compared to 6% of African Americans, 6% of Hispanic, and 5% of White participants.

Food Security and Poverty Income Ratio

The results of the Mantel-Haenszel chi-square analysis found that as family's PIR decreased food insecurity significantly increased (p -value < 0.0001). Only 4% of the

high PIR families were categorized as having either low or very low food security whereas 20% of the moderate PIR families and 44% of the low PIR families were categorized as having low or very low food security. However, having full food security was the highest category for all three PIR distinctions with 43% percent of the low, 68% of the moderate, and 94% percent of the high being classified as such. This information is depicted in Table 2 and Graph 1.

Poverty levels and food insecurity were found to not be independent of one another. This relationship did not differ between ethnicities, age, or gender. The Pearson Correlation was found to be -0.4380, meaning that, as one variable increased there was a strong correlation for the other variable to decrease.

Food Security and Food Stamps

A chi-square analysis found that families that had not received food stamps in the past 12 months were significantly more likely to have higher food security and were more likely to fall into the full food security category (72.8%) than families that had received food stamps in the past 12 months (41.8%). Of the families that had not received food stamps in the past 12 months, 10% were found to have marginal food security, 12% were found to have low food security and 5% were found to have very low food security. Of families that had received food stamps in the past 12 months, 11% were found to have marginal food security, 30% were found to have low food security, and 17% were found to have very low food security. This information is illustrated in Graph 2 and Graph 3. Based on a correlation coefficient of 0.2961, a family receiving food stamps in the past year was more likely to experience higher levels of food insecurity.

An analysis was conducted between food stamp eligible participants in the low-income group (PIR less than 1.3) to determine if there are associations between families receiving food stamps and food insecurity compared to other low-income individuals that chose not to receive food stamps. Households that received food stamps were more likely than other low-income households to experience greater levels of food insecurity. The correlation coefficient of 0.1263 was smaller than when looking at all PIR levels.

Food Security and BMI

A chi-square analysis indicates that the highest rate of obesity came from the very low food secure category with 31.3% of the children in the group being categorized as

obese ($p < 0.0001$). This is compared to 26.3% obesity in the low food secure, 27.5% obesity in the marginal food secure, and 19.5% obesity in the full food secure groups. When looking at the normal weight category the biggest difference was seen between the full food security category at 59.8% and the very low food security category at 46.1%. This data can be found in Graph 4 and Table 3.

Most of the contribution to the chi-square test is from the fact that there were more than expected in the obese category for the marginal, low, and very low food security classifications. When examining by ethnicity, the correlation coefficients for Hispanic and White are slightly less than that for the African American group (0.0857 and 0.0766 versus 0.0961), but within standard error. The overall correlation coefficient was found to be 0.0952.

Food Security and Perceived Diet Quality

A chi-square analysis comparing household food security status and certain predictors of the perceived quality of a child's diet found that as food security decreased, the perceived diet quality also decreased. A very strong positive correlation was found with perceived food insecurity based on "not being able to feed a child a balanced meal" (0.7850) and having to "rely on low cost foods for meals" (0.8452).

Of the children categorized as low food security, 57% came from households that stated they were unable feed their children balanced meals and 81% of the children came from households that relied on low cost foods. Of the subjects that were categorized as having very low food security, 95% percent stated they were unable to feed their children balanced meals and that same number relied on low cost foods. This information can be found in Graphs 5 and 6 and Tables 4 and 5.

Food Stamps and BMI

A chi-square analysis found that the variables of a family receiving food stamps in the last 12 months and a child's BMI are not independent ($p < 0.0001$). Twenty percent of participants were in the obese category for children not receiving food stamps whereas 28.9% of participants were in the obese category for children receiving food stamps. Most of the contribution to the chi-square test is from the fact that there were many more participants in the obese category for those receiving food stamps compared to those not receiving food stamps. The other weight categories of underweight, normal weight and

overweight were relatively similar between the two groups. The Pearson Correlation coefficient was found to be 0.0821. This data is illustrated in Graph 7 and Table 3.

When looking at only the low PIR category, meaning all food stamp eligible families, the relationship between receiving food stamps and BMI was found to be statistically significant (p-value=0.0313; correlation coefficient=0.0653) for the low PIR category and BMI. There were some slight differences in the relationship between food stamp usage and BMI in ethnic groups. The Other and Hispanic ethnicities' correlation coefficients (0.13 and 0.10 respectively) were slightly larger than the White and African American and coefficients (0.07 and 0.05 respectively).

Food Stamps and Perceived Diet Quality

A chi-square analysis found that children from families receiving food stamps have a statistically significant lower perceived quality of diet than children from families not receiving food stamps (p< 0.0001). Forty-one percent of families receiving food stamps stated they relied on low-cost foods compared to 16% of families not receiving food stamps. 34% percent of families that receive food stamps stated they were unable to serve balanced meals compared to twelve percent of families not receiving food stamps. Graph 8 and Graph 9 show these findings.

The Fisher's Exact Test was used for this comparison and the p-values were highly significant (on the order of 10^{-32}) for both relationships between food stamps and relying on low cost foods and between food stamps and the inability to serve balanced meals. Therefore, food stamps and these two variables are extremely related. The Pearson Correlation coefficient was found to be 0.2757 for food stamps and relying on low cost foods and it was 0.2370 for food stamps and the inability to serve balanced meals.

When looking at only the food stamp eligible population (low PIR category) there was still a positive relationship between receiving food stamps and having a decreased perceived diet quality. There were slight differences in the correlation coefficients between ethnic groups, but only as to the strength of the relationship. The coefficient was slightly less for African Americans and Hispanic ethnicities and the strongest correlation was found in the White group for both questions.

Logistic Regression

As shown in Table 6, a logistic regression analysis was conducted in order to

control for all variables in the model. Statistically significant were found between BMI and PIR category ($p=0.0049$), ethnicity ($p=0.0277$), food security status ($p=0.0467$), food security and ethnicity ($p<0.0001$), food security and perceived diet quality (balanced meal) ($p=0.0117$), and perceived diet quality (balanced meal) and ethnicity ($p=0.0414$).

Children with low or moderate PIR categories were more likely to have a higher BMI than children in the high PIR category. The low-income likelihood estimate was 0.1102 and the moderate-income likelihood estimate was 0.1088 with the high PIR category as the reference. African American (0.6877) and Hispanic (1.0952) children were more likely to have a higher BMI than White children whereas Other (-2.6602) children were more likely to have a lower BMI.

Participants from the full food security (-2.0265) and low food security (-0.7548) categories were less likely to have a higher BMI than children from the very low food security category. Only participants in the marginal food security (0.3866) category were more likely to have a higher BMI than the very low food security children. When the variables for food security and the ability to feed a balanced meal interact, those who perceived they are unable to feed a balanced meal and are in the full food security category (1.0791) are more likely to be overweight than those that cannot feed a balanced meal and have marginal, low or very low food security. Those that perceived they cannot feed a balanced meal and have marginal food security (1.1248) are the most likely to have lower body mass indexes.

When analyzing food security and ethnicity, low food secure Hispanics (0.9357) and low food secure African Americans (0.6504) were the most likely to have the highest BMI compared to other food security and ethnicity combinations. Food security categories of marginal (-2.3476) and low (-2.7126) from the Other ethnicity group were the most likely to have the lowest BMI.

Table 1. Descriptive Statistics for Demographics, Food Security, and Weight Status in NHANES 2005-2006 of Children 6 years, 0 months to 17 years, 11 months.

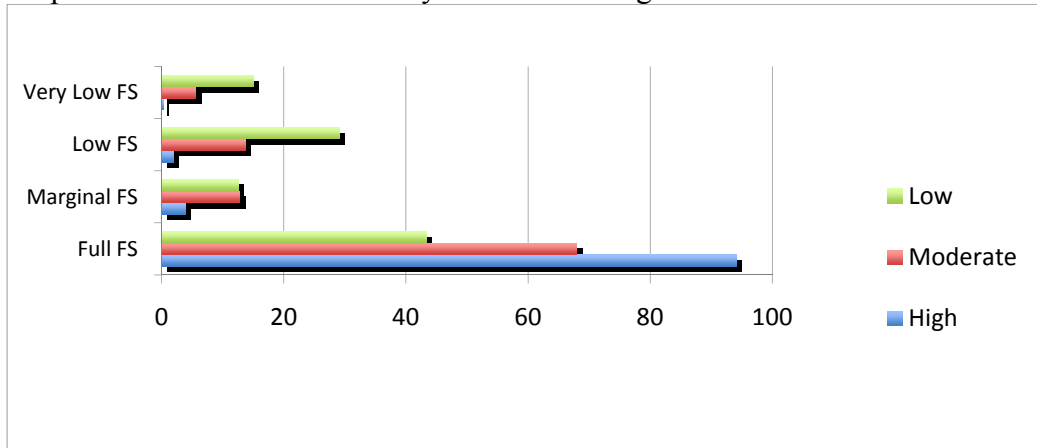
TOTAL (N =2849)	% TOTAL
Age in years	
6	7.4
7	6.1
8	6.6
9	6.8
10	7.2
11	6.2
12	10.3
13	9.7
14	9.2
15	10.5
16	10.5
17	9.7
Gender	
Female	50.5
Male	49.5
Ethnicity	
African American	31.8
Hispanic	36.3
White	26.1
Other	5.8
Poverty Income Ratio (PIR)	
Low (PIR <1.3)	39.7
Moderate (1.3 > PIR < 3.0)	32.0
High (PIR > 3.0)	28.4
Household Food Security	
Very Low Food Security	7.7
Low Food Security	16.3
Marginal Food Security	10.1
Full Food Security	65.9
Child Weight Status	
Underweight (BMI < 5 th %)	5.9
Normal Weight (5 th % ≥ BMI < 85 th %)	56.6
Overweight (BMI ≥ 85 th % < 95 th %)	15.2
Obese (BMI ≥ 95 th %)	22.3

Table 2. Comparison of participants' food security status and poverty income ratio.

PIR*	Full FS	Marginal FS	Low FS	Very Low FS
Low	43.3%	12.6%	29.1%	15.0%
Moderate	68.0%	12.8%	13.6%	5.6%
High	94.0%	3.8%	1.9%	0.3%
Total	65.9%	10.1%	16.3%	7.7%

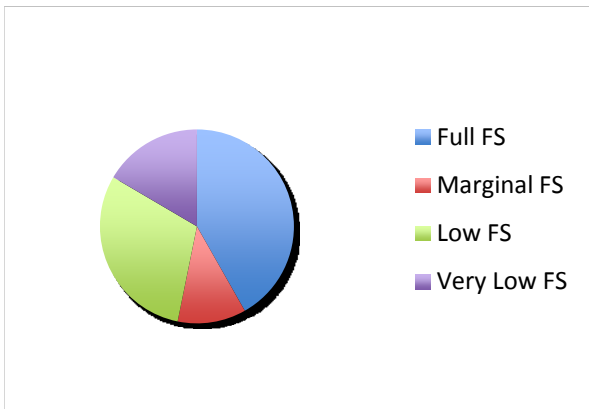
* Low PIR <1.3, moderate PIR 1.3-3.0, high PIR >3.0

Graph 1. Household food security status according to PIR*.

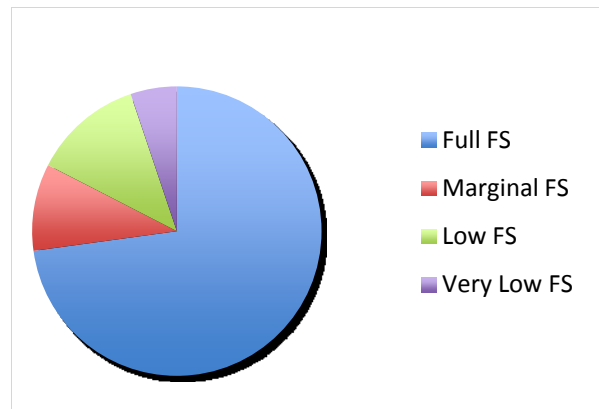


*Low PIR <1.3, moderate PIR 1.3-3.0, high PIR >3.0

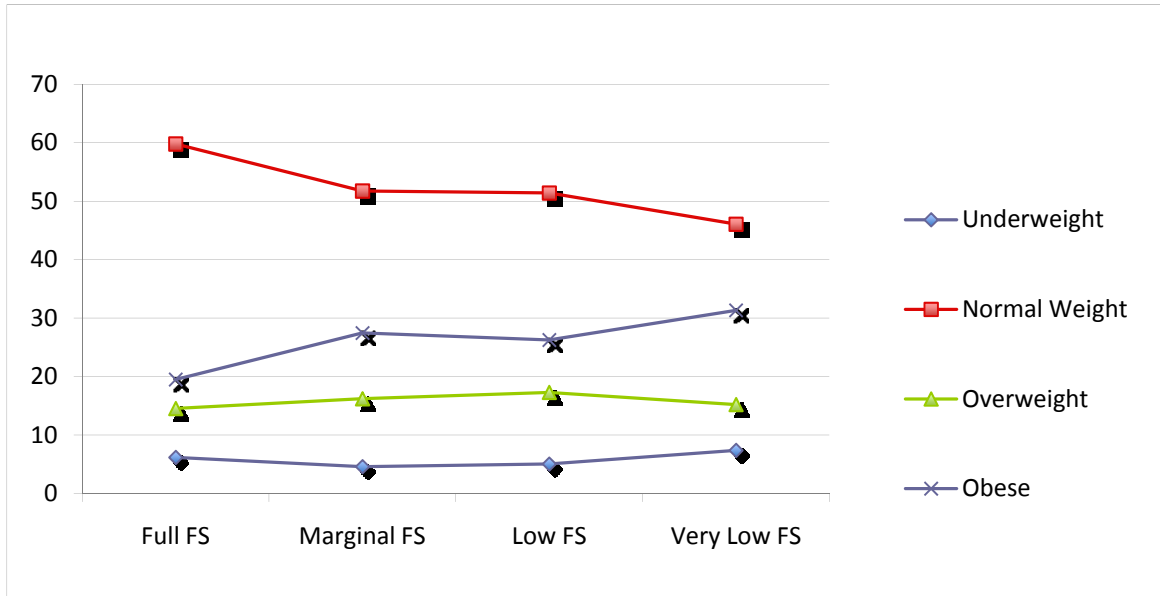
Graph 2. Household food security status of participants receiving food stamps.



Graph 3. Household food security status of participants not receiving food stamps.



Graph 4. Variation of weight status* explained by household food security status.



*Underweight: <5% BMI-for-age, Normal weight: 5% BMI-for-age <85%, Overweight: ≥85% BMI-for-age < 95%, Obese: ≥95% BMI-for-age.

Table 3. Descriptive statistics of weight status* according to participation in food stamp program and household food security status.

	Underweight	Normal Weight	Overweight	Obese
Food Stamp Usage				
Yes	4.82	51.61	14.63	28.94
No	6.23	58.07	15.31	20.39
Food Security Status				
Very Low FS	7.37	46.08	15.21	31.34
Low FS	5.03	51.42	17.29	26.26
Marginal FS	4.58	51.76	16.20	27.46
Full FS	6.16	59.81	14.53	19.50

*Underweight: <5% BMI-for-age, Normal weight: 5% BMI-for-age <85%, Overweight: ≥85% BMI-for-age < 95%, Obese: ≥95% BMI-for-age.

Table 4. Descriptive statistics of responses to perceived diet quality question regarding inability to feed balanced meals by household food security status.

	NO		YES	
	Number	%	Number	%
Full FS*	1841	100	0	0
Marginal FS*	271	95.76	12	4.24
Low FS*	198	43.52	257	56.48
Very Low FS*	11	5.07	206	94.93

*FS = food security

Graph 5. Percentage of households' responses to question regarding inability to serve balanced meals by food security status.

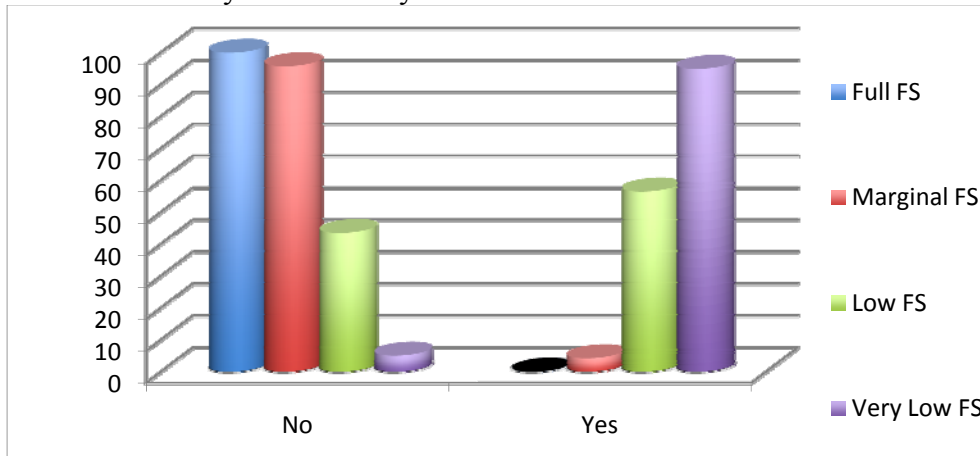
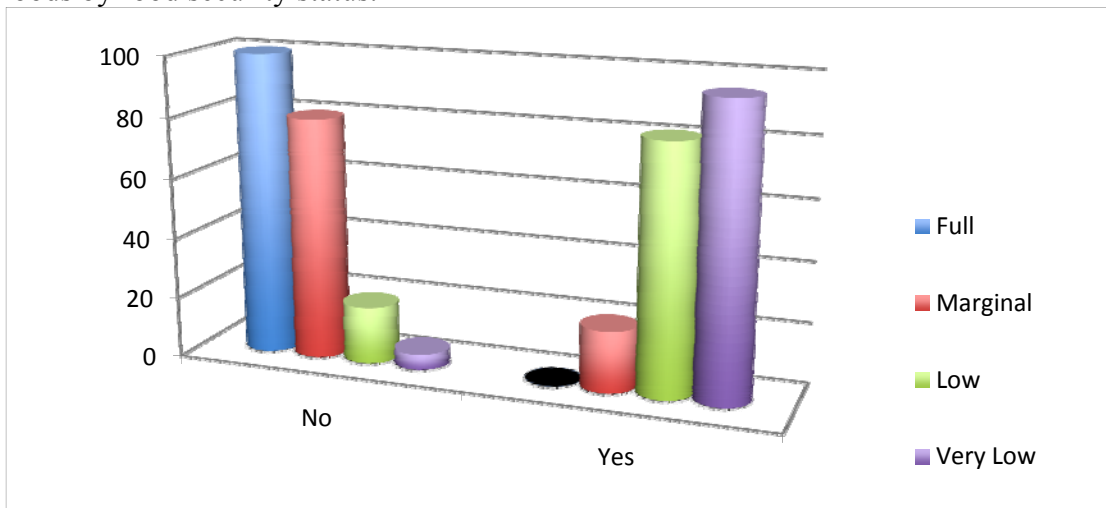


Table 5. Responses to question regarding relying on low cost foods by household food security status.

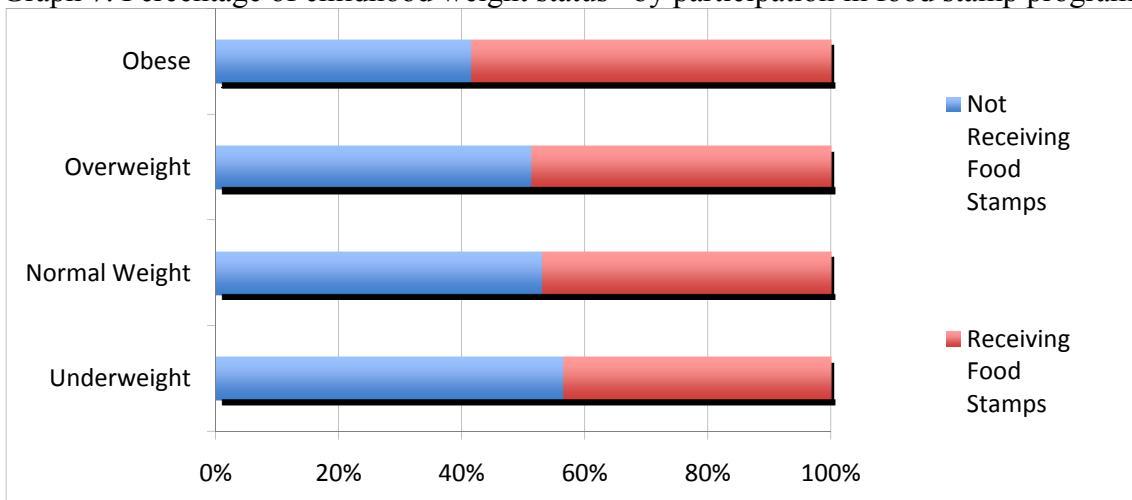
	NO		YES	
	Number	%	Number	%
Full FS*	1841	100	0	0
Marginal FS*	226	79.86	57	20.14
Low FS*	86	18.90	369	81.10
Very Low FS*	11	5.07	206	94.93

*FS = food security

Graph 6. Percentage of households' responses to question regarding relying on low cost foods by food security status.

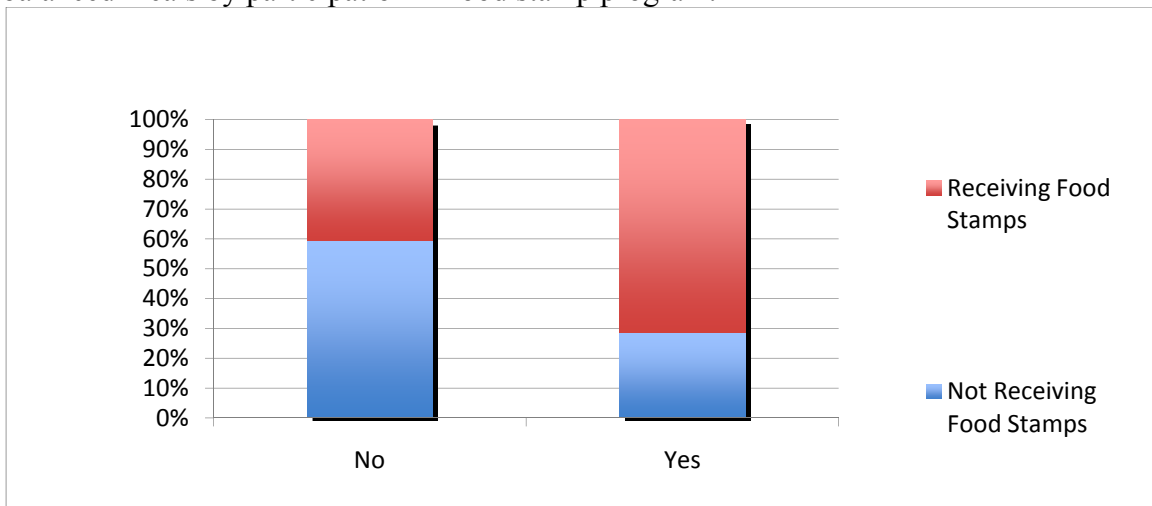


Graph 7. Percentage of childhood weight status* by participation in food stamp program.



*Underweight: <5% BMI-for-age, Normal weight: 5% BMI-for-age <85%, Overweight: ≥85% BMI-for-age < 95%, Obese: ≥95% BMI-for-age.

Graph 8. Percentage of households' responses to question regarding inability to serve balanced meals by participation in food stamp program.



Graph 9. Percentage of households' responses to question regarding relying on low cost foods by food security status.

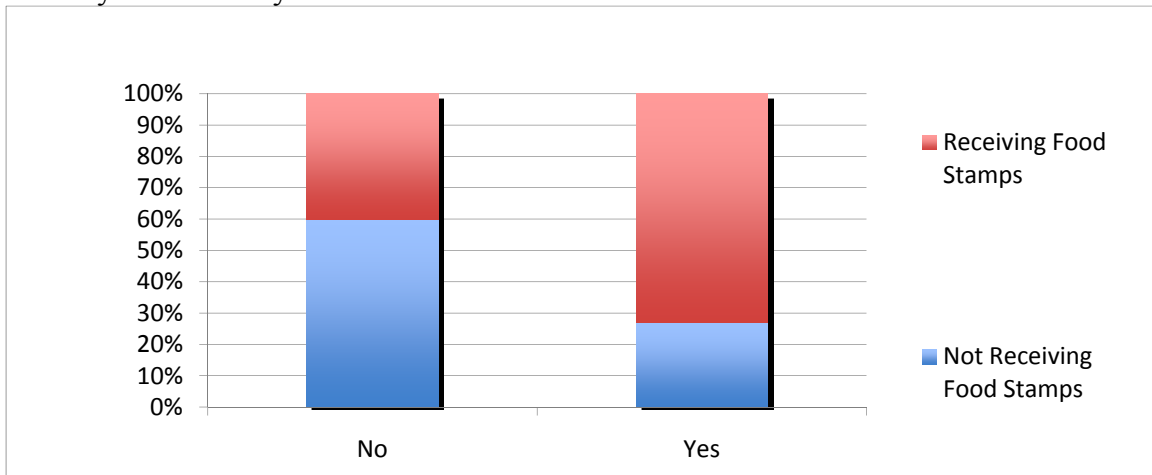


Table 6. Adjusted odds ratios (OR) of logistic regression analysis for the associations between predictor variables and BMI.

	BMI		
	OR	SE	P value
Ethnicity			
African American	0.69	21.54	0.0277
Hispanic	1.10	21.54	
Other	-2.66	65.60	
White (referent)	---	---	
Gender			
Female			<0.0001
Male			
Poverty Income Ratio			
Low	0.11	0.06	0.0049
Moderate	0.11	0.06	
High (referent)	---	---	
Unable to serve balanced meals			
Yes			<0.0001
No			
Household Food Security Status			
Very Low (referent)	---	---	0.0467
Low	-0.75	21.53	
Marginal	0.39	21.54	
Full	-2.03	21.54	
Received Food Stamps			
Yes (referent)	---	---	0.9698
No	1.62	43.06	

*Underweight: <5% BMI-for-age, Normal weight: 5% BMI-for-age <85%, Overweight: ≥85% BMI-for-age < 95%, Obese: ≥95% BMI-for-age.

Chapter Four

Discussion

Introduction

The purpose of this study was to examine the relationships between household food security status, food stamp usage, PIR, child's weight status, and perceived quality of diet. Through the statistical techniques of chi-square and linear regression analysis the associations between the said variables was ascertained. A child's weight status is determined by many different factors and this study investigated several of these aspects. It was found that the family's PIR had the greatest effect on a child's BMI, but household food security status, ethnicity and the perceived inability to serve balanced meals were all found to be statistically significant when considering a child's BMI.

Food Security and Poverty Income Ratio

A negative correlation was found between PIR and household food security status, meaning that as the PIR increased, food insecurity decreased. One startling finding was that over half of the participants from the low PIR category experienced some type of food insecurity even though the low PIR category participants qualify for a variety of food assistance programs. Therefore it seems that the low PIR families need a great amount of aid and either food assistance programs alone cannot meet their needs or they are not taking advantage of the assistance programs.

The largest contribution to the finding of significance came from there being a high number of responses in low PIR category that fell into the low and very low food security categories, while there were very few responses from the high PIR group that fell into those two specified food security categories. Several individuals from the moderate PIR category also experienced some form of low food security. This demonstrates the fact that not qualifying for food assistance programs does not mean that the family perceives they have adequate access to food. The overall negative relationship is generally understood since as a family's income increases then their ability to secure enough food for their household should also increase.

These results are similar to previous research completed on Finnish subjects by Lahteenkorv and Lahelma (2001). They found that low household income, recent

unemployment and economic problems in childhood were all predictors of food insecurity in adulthood. This demonstrates that as economic problems increase one's ability to obtain a steady source of food decreases and they begin to worry about not having enough food. Both physiological and psychological factors play a role in food insecurity, therefore as economic stressors increase food insecurity increases as well.

Food Security and Food Stamps

It was hypothesized that if a family received food stamps then the occurrence of food insecurity would decrease; however, this study found the opposite to be true. Families that had not received food stamps in the past 12 months were found to be more food secure and were much more likely to fall into the full food security category than families that had received food stamps in the past 12 months. This finding is surprising due to the fact that the main goal of the Food Stamp Program is to "increase food security and reduce hunger in partnership with cooperating organizations by providing children and low-income people access to food, a healthful diet, and nutrition education in a manner that supports American agriculture and inspires public confidence" (Bickel et al., 2000).

Over half of the food stamp recipients in this study experienced some level of food insecurity in their daily lives. This finding agrees with results from a study completed in 2004, in which over 66% of food stamp recipient households with children still experienced food insecurity (Oberholser & Tuttle, 2004). Similarly, Gorman et al. (2006) found that low-income individuals that received food stamps experienced higher severity of food insecurity. Possibly food stamps alone do not meet families' need for an assured food supply. It is unsure from this study if these families were not receiving a large enough amount of support, if the benefits were not being utilizing appropriately, or a combination of the two scenarios.

This research study found a positive correlation between food stamps and food security. Therefore, if the family had received food stamps in the past year it was found that they were more likely to experience higher levels of food insecurity. This finding could be explained by the fact that receiving food stamps is a self-selection type of assistance once a family qualifies. Therefore, as a family becomes more food insecure then the family might choose to receive food assistance whereas they might have forgone

the benefits if they had access to food.

A comparison was also made between low-income participants that received food stamps and low-income participants that did not receive food stamps. Similar to the results that analyzed all income levels; low PIR participants that did not receive food stamps were less likely to have food insecurity than low PIR participants that received food stamps. The self-selection process and the desperate need to secure food access could explain this occurrence. These results differ from a previous study by Hofferth (2004) that found that low-income children that do not receive food stamps were more likely to be food insecure. Similarly, a study by Jones and Frongillo (2006) found that food stamps act as a mediator of food insecurity by increasing access to foods and decreasing changes in weight.

The current study found that the majority of low-income households that receive food stamps experience some sort of food insecurity. This number is similar to previous research completed in 2000 that found that 42% of low-income households with children experienced food insecurity at some level (Nord et al., 2000). These findings draw a question to why the Food Stamp Program is not providing adequate coverage to protect against food insecurity (Wilde, 2007; Nord et al., 2005; Fox et al., 2004). Much research has been done on the topics of food security and food stamp usage; however, conflicting research findings make it difficult to draw a clear conclusion on the effect that receiving food stamps has on a household's food security status.

This study's findings suggest that households that receive food stamps experience greater levels of food insecurity. The findings from this study add new information to the literature by providing a contrasting view of the relationship between food stamp participation and a household's food security status. In agreement with some past literature (Wilde, 2007), households that participate in food assistance programs experience food insecurity more often than households that do not participate in food assistance programs. Possibly it is the severity of food insecurity that encourages families to participate in the food assistance program in the first place. This theory has been noted several times before in the literature (Fox et al., 2004; Nord, 2004).

Food Security and BMI

This study found that household food security was associated with a higher

prevalence of obesity among school-aged children. The act of being food insecure could have many effects on a child's weight status. This finding suggests that as a family becomes more food insecure, the members might rely more on low-cost, high-calorie foods. By consuming energy-dense foods a child could take in too many calories which could lead to an increase in weight. The experience of food insecurity could also prompt children to overindulge in times of plenty.

The association of food security and weight status found in this study is similar to earlier research conducted using NHANES data (Casey et al., 2006), which found that household food insecurity was significantly associated to weight status. Kaiser (2002) completed another study that found similar results in Mexican-American children. Dubois et al., 2006 also found a positive correlation in pre-school children. In adults, Wilde and Peterson (2006) found significant associations between intermediate food insecurity and obesity in both men and women.

However, these findings conflict with previous research completed by Rose and Bodor (2006) that used the Early Childhood Longitudinal Study- Kindergarten Cohort and found there was a negative association for young children between food security and weight status. Several other studies have also found either no association or negative associations between these two variables in children (Bhattacharya et al., 2004; Jones et al, 2003; Alaimo et al, 2001; Gundersen et al., 2008; Gundersen et al., 2009).

Several authors have argued that the varied results in previous research are due to too small of sample sizes or using an incomplete food security scale (Casey et al., 2006; Rose & Bodor (2006). In response to those concerns, the sample size in this study comes from a large, nationally representative sample of school-aged children. Secondly, NHANES uses the full USDA 18-item measure that has been verified to be an accurate measure of household food security (Nord et al., 2008).

The association found between household food security status and a child's BMI could be explained by many different factors. Some suggestions include strategies such as reducing meal frequency or obtaining foods from emergency sources (Drewnowski & Spector, 2004). One of the more commonly described reasons is that of the low cost of energy dense foods (Champagne et al., 2007). Their research confirmed that the energy density of the diet from a food secure individual is significantly lower than that of a food

insecure individual. The high rates of obesity found in food insecure households in this study certainly increase the association between the food insecurity and obesity paradox.

Food Security and Perceived Diet Quality

Previous research studies that have looked at the associations between food security status and diet quality have used the measure of the US Department of Agriculture Health Eating Index (Champagne et al., 2007; Basiotis and Lino, 2003; Bhattacharya et al., 2004). These studies consistently found that food insecurity in adults was associated with lower scores on the Healthy Eating Index. However, Bhattacharya et al. (2004) found that associations between food insecurity and nutritional outcomes vary among age groups and they found no associations between these two variables in school aged children.

When individuals experience food insecurity, their diets can be compromised in many different ways. The nutrient quality and variety of the foods eaten can decrease due to limited funds. When changes like these take place it can often lead to a higher intake of calories from energy-dense foods. Drewnowski & Spector (2004) found that energy-dense foods are less expensive than higher-nutrient foods. They also found that food insecurity is associated with lower food expenditures and low fruit and vegetable consumption. Since food insecurity was also found to have a strong association with a family's PIR in this study, it could explain why limited funds could lead to food insecurity, which in turn could lead to decreased perception of diet quality.

The current study was the first to be found in the literature to use the specific questions regarding balanced meals and low-cost foods to determine the parent's/caregiver's perception of the household's diet quality. These two questions attempt to examine the psychological side of perceived diet quality rather than the physiological side of adequate nutrient intake. By answering 'yes' to either of these questions it would seem an individual is stating that there is a compromised quality of their diet in one way or another.

It was found that household food security status and perceived diet quality have a strong correlation. Not a single participant categorized as fully food secure responded "yes" to either "unable to serve balanced meals" and "relies on low cost foods". This finding implies that being food secure is likely to increase balanced meals that are

comprised of more nutritious foods. This finding can help explain previous research that found that household food insecurity has been associated with lower nutrient intake (Kendall et al, 1996).

Of the children categorized as low food security, over half came from households that perceived they were unable feed their children balanced meals and an even larger percentage of the children came from households that relied on low cost foods. This was even more prominent for households of school age children categorized as having very low food security, where a high percentage responded that they were unable to serve balanced meals and relied on low cost foods. By relying on low cost foods, the food insecure parent/caregiver is trying to stretch their food dollars further, however it is compromising the integrity of the family meals.

The finding of lower perceived diet quality as household food insecurity increases was found to be similar among all ethnic groups. A slight difference was noted with the high PIR group since the large majority of the responses fell into the full food security category. Overall the responses were similar between the questions regarding balanced meals and relying on low cost foods to feed children.

Food Stamps and BMI

The results from this study found that participants that receive food stamps are more likely to have a higher weight status. The main difference between the children that received food stamps and children that had not received food stamps was seen in the obese category. All other weight categories were relatively similar between the food stamp recipients and non food stamp recipients. When looking at only the low PIR category, meaning all food stamp eligible families, the relationship between receiving food stamps and BMI was found to be statistically significant for the low PIR category and BMI. This would suggest that food stamps are related to a child's BMI regardless of a child's income level.

The results from the current study agree with previous work completed by Gibson (2004) that used nationally representative data from the National Longitudinal Survey of Youth 1979 Child Sample. Gibson found that long-term participation in the Food Stamp Program was positively and significantly related to weight status in young girls (5-11 years). However, a significant negative relationship was found in young boys. There

was no relationship found in older children (12-18 years). While there are limited studies on children, other studies have reported a positive relationship between Food Stamp Program participation and weight in women (Gibson, 2003; Townsend et al., 2001) and in both adult genders (Webb et al., 2008).

This study's findings do differ from previous research that also used NHANES data (Bhattacharya & Currie, 2002), which found that there was no relationship in older children (12-16 years) between Food Stamp Program participation and weight status. These results also do not agree with previous studies completed by Gibson (2001), Jones et al. (2003), and Hofferth & Curtin (2005), which found no association or negative associations in similar studies in children of varying ages.

This study's findings suggest that families that receive food stamps are in a difficult situation when trying to feed their children. It could be theorized that they are receiving food stamps since their budget is strained, however they may be using food stamps on low cost foods to stretch the food dollar further. Past research has found that food price, rather than the nutritional value, is the main determinant when making food choices (Basiotis et al., 1998). By relying on low cost foods, children are exposed to more calorie-dense foods. Even though the food stamps should enable the purchase of nutritious foods, in some cases they are simply increasing the quantity of foods purchased (Fox et al., 2004).

Food Stamps and Perceived Diet Quality

Respondents from families that receive food stamps were more likely to answer yes to both measures of perceived diet quality used in this study, being unable to serve balanced meals and relying on low cost foods. It is understood that if a family is receiving food stamps that they might rely on low cost foods to increase the purchasing power of the grocery budget, however it is discouraging that receiving food stamps does not improve the capacity to serve balanced meals. One of the intentions of the food stamp program is to provide low-income families with the ability to provide healthier options to its members (Bickel et al., 2000).

It has been found that participants in the Food Stamp Program consume more meats, added sugars, and total fats than they would in the absence of the program, while their consumption of fruits, vegetables, grains, and dairy products is similar to non-

participants (Wilde et al., 2002). It seems that receiving food stamps simply enables a family to purchase more food rather than more nutritious food (Fox et al., 2004). If the low-income population relies on low cost foods, their meals might be comprised of high-fat and high-sugar options, since these are the cheapest sources of calories available (Drewnowski, 2003). If these items are the main components of their meals then possibly food stamp recipients were more likely to report that they were unable to serve balanced meals.

The results from this study also indicate that a small proportion of non-food stamp recipients are unable to provide balanced meals and rely on low cost foods. Even though these specific percentages were much lower than the food stamp recipients, it still illustrates the struggle that some experience when providing nourishment to their families. With almost a quarter of participants from this study relying on low cost foods and unable to serve balanced meals it is not hard to imagine why so many children struggle with issues of over consumption and weight.

The findings that respondents from families that receive food stamps were more likely to answer yes to both measures of perceived diet quality used in this study, being unable to serve balanced meals and relying on low cost foods, provides new data to literature. Assessing perceived diet quality from these two measures had not been found in the literature before. Therefore, by measuring the psychological aspect of not having balanced meals and relying on low-cost foods, it provides insight into the fact that food stamps cannot mediate possible effects that poverty has on a child's diet.

Limitations

Some limitations were found when conducting this study. One limitation was due to the actual NHANES data. Due to the cross-sectional data it is not possible for a conclusion to be drawn regarding causality between certain variables. Therefore this research merely states associations and not causal relationships. Also, it was not possible to examine the relationships with food insecurity specifically for the child in question. Food security is classified by households and the availability of food can be very different among the members in a household.

Finally, another limitation of this study was using two subjective measures to assess perceived diet quality. NHANES does not define "balanced" or "low-cost" to its

participants; therefore, each individual can evaluate those two measures using their own meaning of the terms. Even though this does take away from the objective measure of this variable, it also provides greater insight into the participant's diet knowledge, health attitudes, and health beliefs.

Chapter Six

Conclusion

Introduction

The main goal for this research was to investigate associations between household food security status, food stamp usage, child weight status and perceived diet quality.

NHANES provided a large sample of school aged children with measured heights and weights and the full 18-item USDA Food Security Scale. The major findings included the positive and significant relationships between food insecurity and child weight status and food stamp usage and child weight status. Significant relationships were also found between food security status, food stamp usage, PIR, and perceived quality of diet.

General Findings

It was examined whether household food security was associated with PIR, food stamp usage, weight status and perceived quality of diet in school-aged children. The current study found that there were statistically significant relationships between food insecurity and PIR, food stamp usage, weight status and perceived quality of diet. For that reason it can be recognized that the state of household food security plays a large role in relation to several other factors in a child's life. When a household is experiencing food insecurity it can affect the family in both physiological and psychological ways. Many distorted eating patterns can arise from food insecurity and these could lead to the need to utilize the Food Stamp Program, which may result in increased weight status and decreased perceived quality of diet.

Associations were also examined in school aged children between food stamp usage, weight status and perceived diet quality. Statistically significant associations were found between food stamp usage and weight status and food stamp usage and perceived diet quality. Since receiving food stamps is a self-selection process once a family qualifies, it seems that only the families with the greatest need chose to receive assistance. Once their limited resources necessitate participation in the Food Stamp Program, this study indicates that they are probably at an increased risk for food insecurity, decreased perceived diet quality, and changes in weight.

The concept of assessing perceived diet quality using two specific questions regarding balanced meals and low-cost foods has not been found before in the literature. By understanding an individual's perception of what they consider balanced and low cost, it provides insight into the mindset of varying levels of food security and food stamp recipients compared to non-food stamp recipients. This study found that perceived diet quality was lower in food stamp recipients and as food security decreased. This reveals that being food insecure not only decreases access to food but also access to quality food. Also, it shows that even if families receive food stamps, the assistance may not meet all of their household food needs.

In conclusion, the results from this study tend to lean towards the massive effect that poverty and the PIR have on childhood weight status and other health behaviors. Food insecurity is one of the driving forces that encourage a family to participate in the Food Stamp Program. It seems that once a family does not have adequate resources and needs to depend upon an outside source for access to food that their perception of diet quality can be compromised. They tend to rely on energy-dense rather than nutrient-dense foods. By relying on low cost foods, their meals tend to not be balanced which in turn could lead to an increase in weight.

Application for Future Research

Since this study used cross-sectional data it was not possible for a conclusion to be drawn regarding causality between certain variables. Therefore future research could study causal relationships rather than associations. Also, it was not possible to examine the relationships with food insecurity specifically for the child in question, only the household in question. For that reason it would be beneficial to use a dataset that would address specific child food security status and weight.

Applications for Dietetic Practice

From the results of this study it is concluded that food stamps do not resolve food insecurity in a select population. Therefore, dietetic professions and other community-based workers need to make a greater effort to seek out those in need of food and help provide opportunities for obtaining healthy options. It was also found that the household's perception of diet quality is negatively impaired by both household food insecurity and household food stamp usage. These findings illustrate the need for

nutrition and health education through the Food Stamp Program. This type of instruction could be very beneficial because it would be reaching families when they are most vulnerable to an increased or decreased weight status.

Appendix

BMI: is a statistical measurement, which compares a person's weight and height (CDC, 2009).

BMI-for-age: a number calculated from a child's weight and height. For children and teens, BMI is age- and sex-specific and is often referred to as BMI-for-age (CDC, 2009).

Childhood Obesity: a BMI at or above the 95th percentile for children of the same age and sex (CDC, 2009).

Childhood Overweight: a BMI at or above the 85th percentile and lower than the 95th percentile (CDC, 2009).

Food Insecurity: having limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (Anderson, 1990).

Food Security: Access by all people at all times to enough food for an active, healthy life. It includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods, and (2) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing or other coping strategies) (Anderson, 1990).

Hunger: the recurrent and involuntary lack of access to food (Anderson, 1990).

Poverty Income Ratio: People and families are classified as being in poverty if their income is less than their poverty threshold. If their income is less than half their poverty threshold, they are below 50% of poverty; less than the threshold itself, they are in poverty (below 100% of poverty); less than 1.25 times the threshold, below 125% of poverty, and so on. The greater the ratio of income to poverty, the more people fall under the category, because higher ratios include more people with higher incomes (US Census Bureau, 2009).

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