EXAMINING THE RELATIONSHIPS AMONG FOOD INSECURITY, OBESITY, STRESS AND EMOTIONAL EATING AMONG LOW INCOME WOMEN

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EXAMINING THE RELATIONSHIPS AMONG FOOD INSECURITY, OBESITY, STRESS AND EMOTIONAL EATING AMONG LOW INCOME WOMEN

by

Kristi Lynn Lewis Lofton

Abstract of a Dissertation
Submitted to the Graduate Studies Office
of The University of Southern Mississippi
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for the Degree of Doctor of Philosophy

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ABSTRACT

EXAMINING THE RELATIONSHIPS AMONG FOOD INSECURITY, OBESITY, STRESS AND EMOTIONAL EATING AMONG LOW INCOME WOMEN

by

Kristi Lynn Lewis Lofton

May 2007

The relationship between food insecurity and obesity is a complex issue that has become the subject of research and policy debate. Numerous studies have been published attempting to describe the relationship between food insecurity and obesity; however, causation and potential mechanisms to better understand the relationship have not been established. Therefore, the purpose of this study was to examine the hypothesized relationships among food insecurity, obesity, stress and emotional eating and to determine if stress and emotional eating serve as moderating mechanisms for the food insecurity and obesity phenomenon.

A cross-sectional study consisting of a survey of 636 participants in two regional Headstart centers in South Mississippi was utilized to address the study objectives. The survey instrument consisted of a 7-item Food Security Scale, the 10-item Perceived Stress Scale, and the 25-item Emotional Eating Scale. In addition, BMI calculated from measured height and weight was used for classifying weight status. Demographic variables included self-reported heights and weights, perceived weight status, age, educational level, income, race, number of members living in the household, marital status and participation in
food assistance programs. Analyses of the data revealed 84 percent of the participants were African American; approximately 53 percent had either a high school education or less; more than 75 percent of participants earned less than $20,000 annually, while 87 percent lived in a household with at least five members. Single female head of household made up 60.5 percent of the households. A chi-square test of independence comparing women’s perceptions to actual weight classification was significant ($\chi^2 (N = 631, df = 9) = 93.22, p < .000$) and further examination revealed that among participants, 45.4% of the women who perceived their weight status as normal were overweight and 76.6% of women who perceived their weight status as overweight were obese. Only 13.9 percent of obese participants perceived their weight accurately. Other interesting findings revealed approximately one-third (32.6 percent) of the participants reported fully food secure households. 26.4 percent of the participants were food insecure without hunger. The rate of food insecurity with hunger was 9.5 percent, more than twice the national average (3.9 percent).

Multiple linear regression and moderation analyses were used to predict linear relationships between food insecurity, perceived stress, emotional eating and BMI of the female participants (n=636). Among independent variables, perceived stress was the sole predictor of BMI [$F (1,634) = 4.14, p = .042, R^2 = .006$]. There was no moderation noted between food insecurity, perceived stress, and emotional eating in relationship to BMI. Further investigation examining food insecurity, stress, emotional eating and obesity using qualitative research approaches to explore coping strategies and ethnic and cultural differences in
eating behaviors may provide a more in-depth understanding of behaviors related to obesity.
EXAMINING THE RELATIONSHIPS AMONG OBESITY, FOOD INSECURITY, PERCEIVED STRESS AND EMOTIONAL EATING

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A Dissertation
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CHAPTER I
INTRODUCTION

Amid technological and medical advances, obesity and food insecurity are two multidimensional challenges affecting the health of our society today. Overweight and obesity have evolved into a national epidemic (United States Department of Health and Human Services [US DHHS], 2001a; US DHHS, 2001b). Overweight and obesity are broadly defined as excess body weight resulting from excessive energy intake and a reduction in physical activity (Hedley et al., 2004). Despite an increase in research and treatment for obesity and obesity-related illnesses, the prevalence of obesity is expected to continue to rise among all population groups (Ogden et al., 2006).

Concurrently, food insecurity has been recognized as a serious social and public health problem in the United States (U.S.) (Nord, Andrews, & Carlson, 2006). Food insecurity affects individuals and households who are unable to acquire safe and affordable food by socially acceptable means. Constrained resources and the inability to obtain enough food can eventually lead to hunger (Anderson, 1990; Hamilton et al., 1997). Since 1995, local, regional and national monitoring systems have been used to appraise the severity of food insecurity and evaluate interventions. Research examining the impact of food insecurity over the last decade provides some evidence that the risk of food insecurity experiences results in negative mental and physical health consequences, reduced quality of life and lower educational achievement among

While overweight and obesity rates are high among all ethnic and socioeconomic groups, higher prevalence of overweight and obesity in low-income populations has produced some concerns about the coexistence of food insecurity. Increases in the prevalence of overweight and obesity are mirrored by similar increases in the number of households that experienced food insecurity from 2000 to 2004 (Nord et al., 2006). Although overweight and obesity have been associated with excessive food intake and food insecurity with an insufficient food supply, research indicates that both can exist paradoxically among individuals within the same household (Townsend et al., 2001). A few studies examined the relationship between food insecurity and obesity. One cross-sectional study revealed that food insecurity and obesity coexist in low income women in households with children (Crawford et al., 2004). Low income women in households that were moderately food insecure were more likely to be overweight than women in food secure households (Adams et al., 2003; Basiotis & Lino, 2003; Olson, 1999; Townsend et al., 2001). More research is needed to identify factors related to both overweight/obesity and food insecurity among women in low-income households to examine plausible mechanisms connecting the two, and to develop solutions to the consequences that evolve from these conditions. Because food insecurity is a target of federal food and nutrition assistance programs, research in this area may also affect public policy associated with these programs.
**Obesity**

Over the past 30 years, obesity has become a major public health problem, affecting both adults and children, and the prevalence of obesity is expected to continue to increase. Data from the 2003 and 2004 National Health and Nutrition Examination Surveys (NHANES) indicate that an estimated 66.3 percent of adults aged 20 years and older are overweight and of these, 32.2 percent are obese (Ogden et al., 2006). The impact of obesity puts a tremendous strain on health, healthcare costs and quality of life. According to the *Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*, the healthcare cost of treating obesity-related disorders in the U.S. in 2000 was more than $117 billion (US DHHS, 2001b). Body Mass Index (BMI) has become a standard method of weight status to determine overweight and obesity in research. The National Institutes of Health classifies BMI of 30 kg/m² or more as obese (Moyad, 2001). Morbidity for health conditions associated with overweight and obesity increases as BMI increases above 20 kg/m², increasing the risks of developing arthritis, dyslipidemia, low self-esteem and depression, type 2 diabetes, cardiovascular disease, some cancers, pulmonary complications such as asthma and sleep apnea, and hypertension (CDC National Center for Health Statistics [CDC NCHS], 2004).

Despite the widespread prevalence of obesity, disparities exist between gender and ethnic groups. NHANES data from 1999-2002 showed that 33 percent of women and 28 percent of men were obese (CDC NCHS, 2004). For all ethnic groups, women experience higher obesity rates than men. Rates of
overweight/obesity are higher among African American women and Mexican American women than non-Hispanic Caucasian women. No differences were noted among men of various ethnic groups (CDC NCHS, 2004; Hedley et al., 2004).

Many factors influence risks for overweight and obesity other than dietary consumption and energy expenditure. Obesity evolves from an interaction of genetic, metabolic, environmental, and psychosocial factors that exist among all ethnic, gender and age groups. Although genetic traits play a large role in determining susceptibility to becoming overweight and obese, other factors such as personal characteristics, environment, cultural attitudes, and financial situations affect weight gain and subsequent health consequences (US DHHS, 2001b). There is a need for research to explore all of the dimensions associated with obesity and to develop, implement and evaluate the effectiveness of interventions to alleviate obesity. Further examination of behavioral, environmental, societal, and economic factors is needed to influence health policy, allocation of resources, and health education (US DHHS, 2001a; US DHHS, 2001b).

**Food Security/ Food Insecurity**

Considered to be the "hidden crisis," (Center on Hunger and Poverty and Food Research and Action Center, 2003) food insecurity and hunger are serious problems plaguing America, drawing interest and ongoing concern. Although the U.S. is considered to be one of the richest nations in the world, and most Americans are able to acquire enough food to sustain health, poverty and hunger
still exist. Food security is defined by Anderson (1990) as “having the assured access and availability to enough nutritious food for all people to maintain and achieve an active healthy life” (p. 1575). During 2005, 89.0 percent of U.S. households were reported as food secure, indicating that most households in the U.S. had consistent access to enough food for healthy living (Nord et al., 2006).

Food insecurity occurs when “availability of nutritious, adequate and safe foods is limited or uncertain or when ability to acquire acceptable foods in socially acceptable ways becomes limited and/or uncertain” (Anderson, 1990; p.1560). The most recent data reported by Nord and colleagues (2006) indicate that 11.0 percent (12.6 million) of American households were food insecure at some time during the calendar year 2005. Results indicated that these households were concerned about adequate resources to acquire food, could not afford to eat balanced meals, and may have cut portions or even skipped meals at some time during this 12-month period.

Food insecurity exists as a managed process that ranges from anxiety about the household food supply and utilization of food management and eating strategies to prevent hunger to a break-down of coping strategies resulting in the occurrence of hunger in one or more members of the household (Radimer, Olson, & Campbell, 1990; Radimer, Olson, Greene, Campbell, & Habicht, 1992). The most severe form of food insecurity occurs during episodes. Hunger is defined as “the uneasy or painful sensation caused by a lack of food” (Anderson, 1990; p.1576). In 2005, 4.4 million (3.9%) Americans were reported as food insecure with hunger (Nord et al., 2006). The accessibility of nutritionally
adequate foods decreases with increased severity of food insecurity (Kendall, Olson, & Frongillo, 1996). The occurrence of food insecurity in the U.S. varies by household characteristics such as the gender of head of household (female-headed households experience higher rates), presence of children (higher rates with children present), and geographic region of the country (southern region of the U.S. has highest rates). Households that are classified as food insecure with or without hunger may also experience the condition as a recurring phenomenon one or more times during a year (Nord et al., 2006; Nord, Andrews, & Winicki, 2002).

Comparable to the negative health effects of obesity, food insecurity has been associated with poorer physical and mental health, and with increased risk of chronic diseases such as cardiovascular disease and diabetes (Pheley, Holben, Graham, & Simpson, 2002; Stuff et al., 2006). Food insecurity also affects the health and quality of life of the elderly. The conditions associated with food insecurity among the elderly in the U.S. include poorer dietary intake and diminished nutritional and health status compared to elderly who are food secure (Lee & Frongillo, 2001).

**Food Insecurity and Obesity Paradox**

The relationship between food insecurity and obesity is a complex issue that has recently become the subject of research and policy debate. Amidst a food environment that is perceived as highly accessible and affordable, research indicates that food insecurity and obesity occur paradoxically (Frongillo, Rauschenbach, Olson, Kendall, & Colmenares, 1997; Townsend et al., 2001).
Inadequate food intake and hunger are associated with clinical manifestations of nutritional deficiencies and physical symptoms associated with starvation. Conversely, overweight and obesity are commonly perceived to be associated with excessive food consumption and inactivity (Anderson, 1990). Despite the economic prosperity in the U.S., food insecurity and obesity exist among individuals in the same low income household (Olson, 1999; Wilde & Peterman, 2006). In 1995, Dietz presented a case report of a 7-year-old obese girl whose household experienced episodic food shortages and hunger. The mother's account described household food shortages in spite of receiving food assistance and Aid for Families with Dependent Children. Inadequate financial resources prevented the mother from purchasing foods needed to reduce her daughter's weight. Dietz (1995) suggested that a paradoxical relationship between food insecurity and obesity could exist because increased consumption of inexpensive energy dense foods resulted in an increase in body mass. He proposed a need for more research to explore this relationship between hunger and obesity and the need for research that will inform and influence public policy to reduce both hunger and obesity (Dietz, 1995).

Many similarities exist between food insecurity and obesity. Both conditions exhibit the highest prevalence in women (Hedley et al., 2004; Olson, 1999). Higher prevalence of both conditions is also associated with low socioeconomic status (Chang & Lauderdale, 2005; Rose, 1999) and both conditions are reported highest among ethnic minorities (Adams et al., 2003; Hedley et al., 2004). Food insecurity and obesity have also been reported to
occur simultaneously in the same individuals as well as among members within the same household, particularly when food insecurity is classified as mild to moderate in nature (Frongillo et al., 1997; Townsend et al., 2001). However, food insecurity alone has not been found to be associated with overweight and obesity when other factors such as income, education, ethnicity or other variables are controlled (Laraia, Siega-Riz, & Evenson, 2003; Stuff et al., 2006) or when food insecurity is persistent or severe (Jones & Frongillo, 2006; Townsend et al., 2001). These findings suggest other factors occur in conjunction with food insecurity and may play a role in the food insecurity-obesity paradox.

Stress and Emotional Eating as Moderators of the Food Insecurity and Obesity Paradox

Behavioral functions, such as making food choices, can be impacted by psychosocial factors such as stress. Stress has been defined as the demands between individuals and their internal and external environment that influence behavior (Lazarus, 1966). Individuals' cognitive appraisal or perception of their experiences as stressful depends on whether they perceive the experience as exceeding either their resources or their ability to cope (Lazarus & Folkman, 1984). Eating in response to stress has been well-documented in the health and psychology literature (Arnow, Kenardy, & Agras, 1995; Ganley, 1989; Timmerman & Acton, 2001). The inability of individuals to satisfy needs successfully may be perceived as a stressor and individuals may engage in emotional eating as an alternative to fulfill their needs (Timmerman & Acton, 2001). Emotional and stress responses to life events have been associated,
either directly or indirectly, with abnormal eating behaviors and have been reported to affect food consumption and body weight (Greeno & Wing, 1994; Macht & Simons, 2000). Stress, as a psychosocial factor, has been identified as one of the predictors of relapse and overeating among dieters (Moyad, 2001).

The food insecurity and obesity relationship may be explained by food insecurity experiences associated with stress and in turn the subsequent impact of stress on eating behavior. Individuals in food insecure households may be more vulnerable to negative psychological effects such as feelings of anxiety, loss of control, family dysfunction, and psychological impairment (Hamelin, Beaudry, & Habicht, 2002). Individuals from households that experience food insecurity have reported anxiety and preoccupation with food (Connell, Lofton, Yadrick, & Rehner, 2005; Radimer et al., 1990; Radimer et al., 1992). These stress-related food insecurity experiences may prompt individuals to develop food-related behaviors such as emotional eating when food is in adequate supply, which may contribute either directly or indirectly to overweight and obesity. Connell and colleagues (2005) found that children who had experienced food insecurity reported eating as much food as possible when food was available in anticipation of not having sufficient food later. While this study did not measure perceived stress among the children, their accounts of the experience of food insecurity suggested that stress was commonly related to the family’s food situation and influenced eating behaviors (Connell et al., 2005). It is theoretically plausible that in situations of mild food insecurity when low-cost energy dense food is available, that emotional eating in response to the stress of
uncertain resources occurs. Studies are only recently beginning to emerge exploring the relationship between food insecurity and stress.

Two studies have documented a relationship between scores on self-reported mental health status and food insecurity with poorer mental health status being positively associated with food insecurity (Pheley et al., 2002; Stuff et al., 2004). Siefert and colleagues (2004) used data from the Women's Employment Panel Study to examine the relationship between food insecurity, measured as food insufficiency, and physical and mental health of African American and white welfare recipients. They found that women who reported food insecurity in the 1998 panel were significantly more likely to meet diagnostic screening criteria for recent major depression. These studies used food security as the predictor variable and mental health or depression scores as the outcome variable of interest, assuming that food insecurity occurred prior to the development of poor mental health status or depression. There was no direct measure for perceived stress, a notable limitation in these studies.

More recently, researchers used data from the Pregnancy, Infection, and Nutrition cohort study to investigate whether psychosocial factors such as stress could be predictors of food insecurity. They included perceived stress, trait anxiety, depression, self-esteem, mastery, and locus of control as psychosocial predictors in a logistic regression model of food insecurity. While all the psychosocial variables, except depression, had joint influence on reported food security status, perceived stress was found to be the predominant indicator. The authors noted that women who perceived more stress in their lives were more
likely to experience food insecurity (Laraia, Siega-Riz, Gundersen, & Dole, 2006). This study combined with those of Stuff et al. (2004) and Pheley et al. (2002) provide valuable insight into the food insecurity-stress relationship, but did not address how this association possibly relates to the relationship between stress and eating behavior.

An early study of food insecurity and food consumption among low-income women indicated that as food insecurity experiences worsened, scores on an eating disorders questionnaire increased. However, causation between food insecurity and disordered eating was not established, and psychosocial factors such as perceived stress were not measured in this study (Kendall et al., 1996). Indeed, most studies of food insecurity and food consumption have focused on nutrient intakes or food group intakes rather than eating behaviors (Cristofar & Basiotis, 1992; Dixon, Winkleby, & Radimer, 2001; Rose & Oliveira, 1997; Tarasuk & Beaton, 1999). Eating behaviors impact food group and nutrient intakes. Since many studies suggest that eating behaviors associated with obesity can be influenced by stress or other psychosocial factors, and stress has been related to food insecurity, it is important to investigate whether relationships among these variables exist.

Statement Of Problem

Examining relationships among food insecurity, obesity, stress and emotional eating may identify plausible mechanisms for the food insecurity and obesity phenomenon. The objective of this study is to examine potential relationships among food insecurity, stress, emotional eating and obesity.
Because the literature suggests that the food insecurity-obesity relationship exists primarily among women, the proposed study assesses these relationships within a sample of low-income women using a moderation analysis model (See Model in Appendix A).

Research Questions

1. Does food insecurity predict BMI?
2. Does perceived stress predict BMI?
3. Does emotional eating predict BMI?
4. Do perceived stress and emotional eating moderate the association between food insecurity and BMI?

Assumptions

1. Adults who elect to participate in this study participate or have household members who participate in one or more food assistance programs.
2. Participants are residents of counties that are in South Central Mississippi.
3. Participants answer survey questions openly and honestly.
4. Instruments measured concepts that they were intended to measure.

Justification

The research provided by this study is an important step in efforts to understand the impact of food insecurity on health and well-being of low-income populations. There is a need for longitudinal data related to food insecurity to help assess relationships among food insecurity, overweight/obesity and participation in food assistance programs (Jones & Frongillo, 2006). This study
may serve to provide pertinent information for longitudinal research in food insecurity.

During the 2005 fiscal year, the U.S. Department of Health and Human Services spent 6.1 billion on local Head Start projects and support activities that served 909,608 low-income children and their families. Of those, 34.1% were families living in the southern region of the U.S. (US DHHS, 2006a). This makes Head Start an effective and efficient setting for studying relationships among food insecurity, obesity and eating behaviors in parents or guardians. The overall goal of Head Start is to increase school readiness of young children from low-income families by providing early childhood education, child development, and comprehensive health and social services to children and their families. This research could provide valuable information for the health and social service component of Head Start. The local Head Start programs participating in this research study are committed to improving the well-being not only of children attending the centers, but of the parents as well. Results from this research may be used by policy makers, social service providers and Head Start administrators to explore programs that could ameliorate food insecurity and overweight. In addition, other researchers in the region or in the field of food insecurity could use the results of this study to further explore factors associated with overweight/obesity or other health outcomes in relation to food insecurity that may be amenable to intervention.
Definitions

*Emotional Eating*

Excessive eating or overeating is eating in response to negative emotional states such as anxiety, depression, and anger. Emotional states serve as an antecedent to uncontrolled eating episodes and the inability to satisfy needs functions as a stressor prompting individuals to engage in emotional eating behaviors (Van Strien, Schippers, & Cox, 1995).

*Food Security*

Access by all people at all times to enough food for an active, healthy life and includes: the ready availability of nutritionally adequate and safe foods; the assured ability to acquire foods in socially acceptable ways (without resorting to emergency food assistance, scavenging, stealing, and other coping strategies). Food secure individuals show no or minimal evidence of food insecurity (Anderson, 1990).

*Food insecurity*

Limited or uncertain availability of nutritionally adequate and safe food, or the ability to acquire acceptable foods in socially acceptable ways (Anderson, 1990).

*Food insecurity without hunger*

Households express concern about the availability of food and make adjustments to household management strategies, including purchasing cheaper food items and reduced quality of diets (Bickel, Nord, Price, Hamilton, & Cook, 2000).
Food insecurity with moderate hunger

Households in which food intake for adults in the household has been reduced to an extent that adults have repeatedly experienced the physical sensation of hunger (Bickel et al., 2000).

Food insecurity with severe hunger

Households with children in which the children's food intake has been reduced and children are likely to experience the uneasy or painful sensation of hunger. Adults in the household have repeatedly experienced more extensive reductions in food intake (Bickel et al., 2000).

Food insufficiency

Refers to an inadequate amount of food intake due to the lack of money or resources. Food insufficiency differs from food insecurity in that food insufficiency is characterized by the quantity component of food insecurity and does not measure quality, uncertainty or the psychological components of food insecurity. It is also closely related to the concepts of hunger (Alaimo, Briefel, Frongillo, & Olson, 1998).

Hunger

The uneasy or painful sensation caused by a recurrent or involuntary lack of food and is a potential, although not necessary, consequence of food insecurity. Over time, hunger may result in malnutrition (Anderson, 1990, p.1576).

Overweight

Refers to increased body weight in relation to height, when compared to standards of acceptable or desirable weight. Desirable body weight standards
are established most frequently in research by calculating Body Mass Index (BMI), which represents weight levels associated with the lowest overall risks to health and varies by age. Individuals with a BMI of 25.0 to 29.9 are classified as overweight (CDC NCHS, 2004).

**Obesity**

Obesity is a disease characterized by high amounts of body fat or adipose tissue in relation to lean body mass. The amount of body fat includes the distribution of fat throughout the body and the size of the adipose tissue deposits. Individuals with a BMI of 30.0 or greater are classified as obese (CDC NCHS, 2004).

**Stress**

An external demand which requires an individual to alter his/her usual behavior patterns as a means to cope with the demand. Stress or stressors may foster positive or negative efforts to cope with external demands and with emotional reactions. The term stress is used interchangeably with anxiety and depression (Lazarus, 1966).

**Perceived Stress**

A state of being in which situations in an individual's life are appraised as stressful events (Cohen, Kamarck, & Mermelstein, 1983).
CHAPTER II
REVIEW OF LITERATURE

*Obesity*

The prevalence of obesity is expected to continue to increase and is likely to devastate the current healthcare system (Flegal et al., 2002; US DHHS, 2001b), according to nationally representative data from the National Health and Nutrition Examination Survey [NHANES] which monitors the prevalence of overweight and obesity. NHANES data collected between 1960 and 1980 showed little variation in the rates of overweight for adults. However, rates for overweight doubled over the last twenty years, suggesting that changes in the environment may have promoted an increase in caloric consumption and/or a reduction in energy expenditure during this period of time (Hedley et al., 2004). NHANES data from 2003-2004 show that nearly 66 million adults 20 years and older are obese. Overweight status rates have also increased among children and adolescents. Results from the 2003-2004 NHANES suggest that over 12.5 million children and adolescents ages 2-19 years were overweight (Ogden et al., 2006).

*Defining Overweight and Obesity*

Overweight and obesity are diseases characterized by an excessive accumulation of body weight, generally including excess weight from muscle, bone, and/or body water. However, obesity is more distinctively defined as having an abnormally high proportion of body fat. Overweight and obesity evolve from an interaction of genetic, metabolic, environmental, and psychosocial
factors, but are believed to occur as a result of an energy imbalance (Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, 1998). However, many factors influence risks for overweight and obesity other than an imbalance in dietary energy consumption and energy expenditure. As previously stated, genetic traits play a large role in determining susceptibility to becoming overweight and obese as well as other factors such as personal characteristics, environment, cultural attitudes and financial situation also are issues that affect weight gain and its health consequences (CDC, 2004; US DHHS, 2001b).

Overweight and obesity status are calculated utilizing the Body Mass Index (BMI). BMI is defined as weight (in kilograms) divided by the square of the height in meters (kg/m²) and BMI values for adults are classified as underweight, normal, overweight, and obese. According to the National Institutes of Health, a BMI less than 18.5 kg/m² is considered underweight; and BMI values between 18.5 kg/m² and 24.9 kg/m² are considered as normal weight status, whereas BMI values between 25 kg/m² and 29.9 kg/m² are classified as overweight. BMI values of 30 kg/m² or more is classified as obese. Although other methods are used to measure weight status, BMI has been one of the universally accepted methods for defining overweight and obesity status and it correlates with adiposity in epidemiological and empirical investigations (Moyad, 2001).

Health Consequences of Overweight and Obesity

Morbidity for health conditions associated with overweight and obesity
increases as BMI values increases above 20 kg/m² for many diseases such as diabetes, coronary heart disease, high blood cholesterol, stroke, hypertension, gallbladder disease, osteoarthritis, sleep apnea and some forms of cancer. Obesity is also associated with pregnancy complications, social stigmatization and psychological disorders such as depression and emotional distress (CDC, 2004; Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults, 1998; US DHHS, 2001b). These conditions affect both children and adults (CDC, 2004).

Prevalence of Overweight and Obesity

Overweight and obesity exist among all gender, ethnic and age groups. Despite the widespread prevalence of obesity, disparities exist among gender and ethnic groups. Women have higher obesity rates than men. Between 1999 and 2004, the obesity rate among women was 33.2 percent with no significant changes reported over the six-year period. Although the rates for men significantly increased during this period, the prevalence of obesity among men was 31.2 percent (Ogden et al., 2006). Among minority groups, the prevalence of overweight and obesity continues to be highest for women, children, and adolescents. During 2003–2004, almost 58 percent of non-Hispanic African American women aged 40 to 59 years were obese compared to about 38 percent of non-Hispanic Caucasian women of the same age (Ogden et al., 2006). There were higher rates of obesity for African American women and Mexican American women than non-Hispanic Caucasian women; however, there were no ethnic differences noted among men. Among children and adolescents, Mexican
American boys had the highest rate of overweight across ethnic groups, whereas non-Hispanic white girls had the lowest rates of overweight (Ogden et al., 2006).

Rates of overweight and obesity are also highest for individuals and families with low-income, and for individuals in households with less parental education, particularly and among individuals in ethnic minority families (Must, Gortmaker, & Dietz, 1994). The relationship between overweight/obesity rates and household income differs by ethnicity and by gender and higher socio-economic status (SES) does not bestow the same benefits for all groups (Gordon-Larsen, Adair, & Popkin, 2003). Higher rates of overweight and obesity were more likely to occur in women (Zhang & Wang, 2004) and inverse relationships between BMI and SES in industrialized countries (Sobal & Stunkard, 1989). Obesity rates have been found to be inversely related to SES, with the burden of obesity affecting individuals with limited resources, racial/ethnic minorities, and the poor in the U.S. (US DHHS, 2001). Must and associates (1994) examined the risk factors for obesity among young adults 16–28 years of age. In this study, poverty and low parental education were associated with obesity in Caucasian and Hispanic women, but not in African American women or any men (Must et al., 1994). Household income and overweight varies by ethnicity and gender. Gordon-Larsen, Adair, & Popkin (2003) examined the extent to which race/ethnic differences in household income and education account for disparities in overweight prevalence among Caucasian, African American, Hispanic, and Asian adolescents. Overweight prevalence declined as family income increased in Caucasian girls, while
prevalence for overweight was lowest for African American girls in middle-income households and highest among those from households with low or high family income. In another study, Crawford et al. (2004) found that men with high-income earnings were more likely to be overweight than men living below the poverty line, however, men with incomes below the poverty line were more likely to be obese. Among women, those with an income below the poverty line were more likely to be overweight and obese compared to women living in the highest income group (Crawford, 2004).

*The Cost of Overweight and Obesity*

Obesity has put a tremendous strain on health and healthcare costs. The cost of treating obesity-related disorders in the U.S. in 2000 was more than $117 billion (US DHHS, 2001b). Finkelstein, Fiebelkorn and Wang (2004) used data from the 1998 Medical Expenditure Panel Survey and the Behavioral Risk Factor Surveillance System (BRFSS) to develop an econometric model to predict medical expenditures attributable to obesity. Both surveys included data on individuals' height and weight, insurance status and sociodemographic characteristics (race/ethnicity, gender, education). They reported that Medicaid enrolled a more obese population and incurred a greater obesity-attributed cost than private insurers. Of all obesity-related expenditures in 2003, 50 percent were compensated by Medicare and Medicaid (Finkelstein et al., 2004). The magnitude of obesity-related medical expenses should foster more support from policy makers, state and local government agencies and communities for prevention programs and interventions to diminish obesity rates.
Overweight and obesity are complex disorders caused by multiple factors including an imbalance between dietary energy intake and energy expenditure with greater energy intake and reduced energy expenditure contributing to weight gain over time. An imbalance in energy intake and expenditure among individuals is also determined by a complexity of other factors such as genetics, environment and behaviors (US DHHS, 2001a, US DHHS, 2001b) related to obesity. Current research lacks consistent methods to accurately assess energy intake and expenditures, including physical activity, body composition, fat distribution, and behavioral psychological factors. There is a need for more obesity research to explore all of the dimensions associated with the development of obesity and to develop, implement and evaluate the effectiveness of interventions to alleviate obesity. Further examination of behavioral, environmental, societal, and economic factors is needed to influence health policy, allocation of resources, and health education (Gordon-Larsen et al., 2003; US DHHS, 2001b). While a thorough examination of factors is beyond the scope of this literature review, the role of food insecurity and stress in relation to obesity will be considered below. Before considering the relationship between food insecurity and obesity, it is necessary to describe food insecurity as a contemporary phenomenon in the U.S.

Food Security/ Food Insecurity

Issues associated with hunger and access to nutritious, affordable food in the U.S. have been examined for more than seventy-five years. In 1946, The National School Lunch Program was established to provide nutritional assistance
and improve the health of children, particularly boys, as a result of poor health status of young men rejected by the military draft in World War II. Despite these efforts, extreme hunger and malnutrition were still noted in the 1960's when poverty and hunger received national media attention. Food assistance programs were modified and expanded to include the use of surplus farm commodities to meet the nutritional needs of at-risk populations (Gunderson, 2003). The National School Lunch program expanded to include the School Breakfast Program in 1966 and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in 1972. These programs were developed to support the nutritional growth and development of low-income pregnant and breastfeeding women, infants, and children who were at nutritional risk (Gunderson, 2003; Habicht, Pelto, Frongillo, & Rose, 2004). By the 1980's, poverty levels declined compared to those in the 1960s, and federal funds to support assistance programs were cut in response to a growing national debt.

Concerns about food accessibility and the impact of income constraints on food acquisition remained a focus for policymakers, healthcare professionals and researchers. In 1984, a task force was formed under the Reagan Administration to define the components of hunger in medical and/or common terms and establish a conceptual framework to evaluate the effectiveness of food assistance programs (Anderson, 1990). There was a need for comprehensive surveillance of nutritional and dietary status of the U.S. population that included the coverage of ethnic, low-income, and selected gender and age groups that could be at increased risk for adverse health effects associated with poor
nutrition. Researchers and policy makers also recognized the need for defining and interpreting nutrition and health monitoring data into national objectives to serve as guidelines and activities to improve health (Anderson, 1990).

In 1990, the Life Sciences Research Office published the results of an Expert Panel on Core Indicators of Nutritional State for Difficult-to-Sample Populations that provided the current operational definition for food insecurity. Food security is defined as having the assured access and availability to enough nutritious food to maintain and achieve an active healthy life (Anderson, 1990; p. 1575). The definition has been used to describe the experiences associated with hunger and was expanded to include food restriction, the lack of resources to acquire food, as well as the need for assessment at the community, household and individual levels (Anderson, 1990).

Simultaneously, Radimer, Olson and Campbell's (1990) qualitative research efforts testing the proposed levels described by the Expert Panel expanded the understanding of food insecurity and identified major dimensions and components of hunger as indicators for assessment and monitoring (Radimer et al., 1990). Radimer and associates conducted semi-structured interviews to construct and evaluate indicators of hunger with 32 women who had participated in food assistance programs in rural and urban areas of New York. The interviews contained questions addressing hunger and the participants' description of their hunger situations. Additional questions focused on identifying reasons for hunger situations, identifying eating patterns and emotional reactions, and perceived physical symptoms associated with hunger, coping strategies,
employment and family characteristics and participation in social services. Interviews were transcribed and categorized into themes to accurately represent the respondents' account of hunger experiences. Two levels of hunger emerged: the individual level and the household level with four components to describe the concepts of hunger. Hunger, at the individual level, the quantitative and the qualitative components include problems with insufficient food intake and account for a reduction in food quality and create nutritional inadequacy. The psychological component describes feelings of deprivation and anxiety caused by a lack of food choice; and the social component describes the disruption of the usual eating pattern due to constrained resources. At the second level, household food insecurity was described as a managed process by which individuals and households experience different components of food insecurity at different times and at different degrees based on the household's ability to cope. Compromises in the quality and quantities of the women's dietary intakes were noted first. Quantity of the household food supply was conserved at the expense of food quality in order to protect children in the household. Changes in the quantity and quality of children's dietary intake did not occur until later, demonstrating the most severe form of food insecurity. Anxiety and uncertainty about the sufficiency of the household food supply is associated with the psychological component. At the social component, food is acquisitioned in socially unacceptable ways after the depletion of the household food supply. This component of the hunger concept has been found to occur based on the severity of the experience. Food insecure experiences may, to an extent, happen
repeatedly and may also be predictable and controllable (Campbell & Desjardins, 1989; Radimer et al., 1990; Radimer et al., 1992).

The U.S. Food Security Survey Module (FSSM) was developed in 1994 to measure the prevalence of household food insecurity and hunger and to provide clear documentation about food security not captured by traditional income and poverty measures (Bickel et al., 2000). The FSSM is sponsored by the United States Department of Agriculture (USDA) and is administered as an annual survey by the U.S. Census Bureau as a supplement to the monthly Current Population Survey (CPS). The FSSM is an 18-item survey that asks questions about household experiences and behaviors that have been associated with food insecurity. In addition, data on food expenditures, and the use of food assistance programs is collected. Based on the number of affirmative responses to the 18 food security items, households are classified as food secure, food insecure without hunger, and food insecure with hunger. Households that have 0-2 affirmative responses are coded as food secure, households with 3-7 affirmative responses and are coded as food insecure without hunger. Households in the food insecure with hunger or moderate food insecure category respond affirmatively to 8-12 questions, and households with 13-18 affirmative responses categorize households into the food insecure with hunger category, the most extreme form of food insecurity. (Bickel et al., 2000; Habicht et al., 2004; Nord et al., 2006). Food security and food insecurity with and without hunger have been monitored in the U.S. using the 18-item FSS for more than a decade. Survey results provide valuable information for policy makers and service providers to
identify populations, subgroups or regions with severe conditions and allocate scarce resources (Bickel et al., 2000).

During 2005, 89.0 percent of U.S. households were food secure, indicating that most households in the U.S. had consistent access to enough food for healthy living (Nord et al., 2006). Poverty and hunger still exist although the U.S. is considered to be one of the world’s richest nations and most Americans are able to acquire enough food to sustain health. Anxiety, an inability to access and manage enough food, and hunger are conditions experienced by many American households. Food insecurity occurs when “availability of nutritious, adequate and safe foods is limited or uncertain or when the ability to acquire acceptable foods in socially acceptable ways becomes limited and/or uncertain” (Anderson, 1990). The most recent data indicate that 11.0 percent (12.6 million) of American households were food insecure at some time during the year in 2005. These data suggest that these households were concerned about inadequate resources to acquire food and could not afford to eat balanced meals at some time during a 12-month period or had to make adjustments in the types/amounts of foods eaten to the point that someone in the household experienced hunger (Nord et al., 2006). The most severe form of food insecurity occurs when episodes of hunger are experienced. Food insecurity with hunger accounted for 3.9 percent (4.4 million) of the 11.0 percent of Americans that were food insecure during 2005 (Nord et al., 2006).

The occurrence of food insecurity in the U.S. varies by household characteristics such as race/ethnicity, the gender of the head of household, and
the number of individuals in the household. In 2005, rates of food insecurity without hunger were substantially higher than the national average for households with children (15.6 percent vs. 8.7 percent). Households with children headed by a single woman (30.8 percent), African American households (22.4 percent) and Hispanic households (17.9 percent) had the highest rates of food insecurity without hunger. The prevalence of food insecurity with hunger followed a similar pattern with regard to race, ethnicity and household composition as food insecurity without hunger. Food insecurity with hunger was higher than the national average of 3.9 percent among families with children headed by a single woman (8.7 percent) or a single man (5.5 percent), women or men living alone (5.1 and 5.8 percent, respectively), African Americans (8.6 percent) and Hispanics (5.3 percent). Geographically, food insecurity was more common among those living in metropolitan and rural areas than suburban areas, and in Southern states of the U.S. (Nord et al., 2006).

Households that are food insecure without or with hunger may also experience these conditions as a recurring phenomenon one or more times during a year (Nord, Andrews, & Winicki, 2002; Nord et al., 2006). In the U.S., food insecurity experiences such as reduction in food intake and alterations in eating patterns are usually occasional or episodic but are not usually chronic. Questions on the FSSM assess households' food security status by asking whether a condition, experience or behavior related to food insecurity occurred during a 12-month period. Households are classified as food insecure if they report affirmative responses to three or more food insecure conditions as
occurring “often” or “sometimes” to questions 1-3 and 11-13, “almost every month” or “some months but not every month” to questions 5, 10, 17, and “yes” to the other questions. Households (11.0 percent) that were food insecure at some time during 2005 were food insecure (11.0 percent) in 6 months during the year. During the 30-day period ending in mid-December 2005, 5.9 percent were food insecure (Nord et al., 2006). Households without children are classified as having food insecurity with hunger if they report six or more food insecure conditions. Households with children are classified as having very low food security if they report eight or more food insecure conditions, including conditions experienced by adults and children. Households with children are further classified as having very low food security among children if they report five or more food insecure conditions by responding affirmatively to five or more of questions 11-18.

Food insecure conditions, behaviors, and experiences are well documented in the literature. Households that experience food insecurity with or without hunger may compromise food quantity and food quality by consuming less expensive foods, consuming meals with essential nutrients below the recommended daily allowances and by consuming less fruits and vegetables (Casey, Szeto, Lensing, Bogle, & Weber, 2001; Connell, Yadrick, Hinton & Su, 2001; Hamelin, Habicht, & Beaudry, 1999).

Connell, Yadrick, Hinton and Su (2001) conducted a study to better understand food insufficiency in Southern states and examine the impact of food assistance programs and food insufficiency in this population. Data for this study
were taken from NHANES III to assess food insufficiency and use of federal food assistance programs among adults (n = 7,197) from 1988-1994 in the Southern region of the U.S. Participants were classified as food insufficient if the respondent affirmed that household food supply was “sometimes” or “often” not enough to eat. Participation in either the Food Stamp Program (FSP) or WIC was determined from responses to the family interview questionnaire. Of the 7,197 individuals in the study, 6.3 percent were classified as food insufficient. Those reporting food insufficiency were more often a minority race (50.7 percent), female-headed households (50.6 percent), had a larger household size, or had less than high school education (53.1 percent). Those who were classified as food insufficient were poorer than those not reporting being food insufficient were. The average PIR was significantly higher among respondents not participating in any food assistance programs (1.9) compared to those participating on one (0.98) or two programs (0.71). Many respondents reporting food insufficiency were not eligible to participate in food assistance programs. The results of this study conclude that many households in the Southern region of the U.S. experience food insufficiency and alter quantity and quality of their household food supply. For this reason, further exploration on participation in food assistance programs and other methods of coping with food insufficiency is needed.

Casey et al. (2001) examined a sample of 5,669 children (ages 0-17 years) and 3,790 households from the Continuing Survey of Food Intakes by Individuals (CSFII), from 1994 to 1996 in order to evaluate characteristics of
children living in food insufficient households and compare food and nutrient intakes of children classified as overweight and underweight. CSFII data contained the results of household interviews in which at least one adult in the household was asked to complete survey questions about education, employment, income, food assistance program participation, food expenditures, food insufficiency status and other food-related practices. Dietary recalls were completed by children aged 6-11 years with the assistance of an adult household member and adolescents aged 12-17 years completed their own dietary intake assessment. Proxy interviews were conducted to obtain dietary intake of children younger than 6 years. Questions about height, weight, television viewing, exercise, and health status were also included. Food insufficiency was noted in 2.2 percent of all households sampled with 3.0 percent in households with children and 7.5 percent in low-income families with children. Food insufficient households with children averaged 5.5 days of not having enough food to eat within the last month before the interview. Food insufficient respondents (92.8 percent) reported that reasons for food insufficiency were associated with participation in food assistance programs and lack of money. When compared with the higher-income food sufficient households, children in the low-income food insufficient households consumed fewer calories ($P = .05$) and total carbohydrates ($P = .004$), but had a higher cholesterol intake ($P = .02$). The low-income food insufficient group included more overweight children ($P = .04$), consumed less fruits ($P = .04$), and spent more time viewing television.
Hamelin and associates (1999) conducted a descriptive study to identify household and social implications of food insecurity and address coping practices of food acquisitions and management during food insecure conditions. A sample of 98 adults from households in urban and rural Québec City participated in semi-structured interviews on manifestations, strategies and risk factors associated with household food acquisition and household food preparation. Participants also completed a sociodemographic questionnaire and a French version of the Radimer/Cornell hunger and food insecurity questionnaire. Data from interviews were recorded, transcribed, analyzed, and coded into statements and themes to describe food insecurity experiences. Seventy-seven of the 98 households were classified as food insecure. The manifestations of food insecurity in these households fit into two categories. The core characteristics of food insecure experiences were related to a set of actions and reactions experienced by the household, including physical manifestations of hunger and illness. Thirty of the 77 food insecure households reported physical pain and illness as a result of hunger. Psychological manifestations were associated with anxiety and stress related to being constrained against social norms and values. The second manifestation relates to actions and reactions to the first level of food insecurity. The consequences at the household level often interacted with the environment to which the household belongs. Households experiencing food insecurity with hunger result in interactions that are labeled as social implications. This level of manifestation includes disrupted household dynamics and distorted strategies to acquire and manage food. More than 50 of
the 98 households were classified into a third area of manifestations or consequences associated with a variety of sociofamilial perturbations. These consequences included household members' modifying eating patterns and behaviors, and consumption of meals that were not complete or balanced. The findings from these studies show low-income individuals are at an increased risk for poor nutrition and are less likely to practice dietary behaviors associated with reduced risk of chronic diseases (Casey et al., 2001; Connell et al., 2001; Hamelin et al., 1999).

**Food Insecurity & Obesity**

Food insecurity and obesity both contribute to poorer mental and physical health and increase the risk of chronic diseases such as cardiovascular disease and cancer (US DHHS, 2001; Mississippi Delta Nutrition Intervention Research Consortium, 2004; Pheley et al., 2002). However, food insecurity and obesity represent opposing images of food consumption (Flegal et al., 2002). Traditionally, clinical manifestations of hunger are perceived to be nutritional deficiencies associated with starvation while overweight and obesity are commonly perceived to be associated with excessive consumption and inactivity. The increasing prevalence of obesity has prompted many policymakers to question its coexistence with food insecurity among the same low-income population subgroups (Olson, 1999). As previously discussed, Dietz (1995) presented a case report of a 7-year-old obese girl whose household experienced episodic food shortages and hunger described the first example of the obesity and food insecurity paradox. In spite of receiving food assistance and Aid for
Dependent Children (AFDC), the mother’s account of household food shortages prevented her from purchasing foods needed to reduce her daughter’s weight. This case report served as a catalyst for studies over the next decade to assess the impact of food insecurity on indicators, risk factors, and behaviors associated with health. Since that time, research examining food insecurity and obesity assessed multiple factors including dietary behaviors, diet quality and costs, and metabolic, physiological and psychosocial adaptations (Frongillo et al., 1997; Jones, 2006; Olson, 1999; Townsend et al., 2001); age and gender (Adams et al., 2003; Alaimo, Olson, & Frongillo, 2001; Basiotis & Lino, 2003); and socioeconomic status (SES) (Chang & Lauderdale, 2005). These studies will be described below.

A number of studies show strong associations between food insecurity and overweight and obesity in women. Frongillo et al. (1997) examined the relationships among food insecurity, income and nutritional consequences within a sample of 193 women aged 20 – 39 years with children in a rural county in New York. Regression analysis was used to examine the relationships of disordered eating and frequency of fruit and vegetable consumption with food insecurity and BMI. BMI was significantly higher for women in food insecure households (28.2 kg/m²) than for women in food secure households (25.6 kg/m²), controlling for height, income, education, marital status, and employment. More women in the household food insecure group (37 percent) had a BMI >29 kg/m² (obese) as compared to 26 percent of women in food secure households. Women in food insecure households with severe hunger did not differ from
women in the food secure households on BMI and obesity, indicating the possibility of a curvilinear relationship between the severity of food insecurity and BMI.

Similar results were found in a study by Townsend and colleagues (2001) which examined the relationship between food insecurity and overweight using data from the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII). A higher prevalence of overweight (BMI>27.3 kg/m²) was observed among food insecure women than among those who were food secure (p<0.0001, n = 4509). No relationships were observed for men (p= 0.44, n = 4970). Prevalence for overweight among women (p = 915) in mildly (48.3 percent) and moderately food insecure (52 percent) categories was significantly higher compared to women in the food secure (41 percent) group. Food insecurity continued to be a significant predictor of overweight (p<0.01) after controlling for race/ethnicity, age, food assistance participation, income, exercise and television viewing (Townsend et al., 2001).

Adams and associates (2003) evaluated the relationship between food insecurity and obesity (BMI ≥ 30 kg/m²) using data from the 1998 and 1999 California Women's Health Survey. After controlling for race/ethnicity, income, education, country of birth, general health status and walking, food insecurity with hunger was associated with increased risk of obesity in women. Women who were food insecure without hunger (31.0%) were more likely to be obese than women who were food secure (16.2%). In contrast to the two aforementioned studies, the prevalence of obesity increased with the severity of food insecurity in
non-Hispanic Blacks, Hispanics and Asians, but did not increase as food insecurity became more severe in non-Hispanic Caucasian women. Asian, non-Hispanic Black and Hispanic women who were food insecure without hunger were 47 percent more likely to be obese compared to their food secure counterparts. Those who were food insecure with hunger were 2.8 times more likely to be obese. There was no significant increase in obesity among non-Hispanic women who reported to be food insecure with hunger or those who reported to be food secure.

Crawford and associates (2004) studied the relationship between food insecurity and overweight status in a group (n = 516) of low-income Latino mothers and their children aged 3 to 6 years, in two California counties. Measured heights and weights of the mothers and their children were used to calculate BMI. Approximately 51 percent of Latino mothers who were food insecure with hunger were obese (BMI > 30) compared to 33.3 percent of mothers who were food secure (p < .05). Increase in the severity of food insecurity also increased the probability that the mother was overweight. There was no relationship noted between household food insecurity and risk of overweight among Latino children.

Basiotis and Lino (2003) utilized NHANES III data from 1988-1994 to investigate the relationship between food insufficiency and overweight in women ages 19 to 55 who lived with either a companion or other household members. Food insufficiency, in this study, referred to women reporting that their household sometimes or often did not have enough to eat. The prevalence of overweight
(BMI $\geq 25$ kg/m$^2$) was significantly higher among women in food insufficient households (58 percent) compared to women who were from households that reported being food sufficient (47 percent). There was no significant difference between groups in obesity rates (BMI $\geq 30$ kg/m$^2$).

Two studies used data from the Behavioral Risk Factor Surveillance System (BRFSS) to examine the association between concern about food insecurity and obesity in adults 18 years and older. Van Eenwyk and Sabel (2003) used BRFSS data ($n = 17,371$) from 1995-1999 to compare BMI calculated from self-reported heights and weights to an affirmed “yes” to one question about concerns about having enough food in the household over a 30 day period. Participants who reported concern about food supply were more likely to be obese than those who did not report concerns (adjusted OR = 1.29; 95% CI = 1.04-1.83).

Laraia and associates (2006) used 1999 BRFSS data ($n = 3,945$) to examine the food insecurity and obesity paradox in Louisiana and New York. Unadjusted odds ratio revealed an association between concerns about food supply adequacy and obesity (BMI$\geq 35$ kg/m$^2$) in both states (Louisiana, OR = 2.20; 95% CI = 1.24, 3.90 and New York, OR = 2.23 (95% CI = 1.30, 3.84). However, after controlling for socioeconomic and demographic variables, the association was statistically insignificant. Although the two studies provided valuable information about the food insecurity and obesity relationship, both studies used self-reported measures to determine BMI and only one question to
assess food security status of the household, a significant methodological
limitation.

While the studies discussed support a potential relationship between food
insecurity and obesity, more research is needed to explore probable explanations
for this relationship (Jones, 2005; Van Eenwyk & Sabel, 2003). Evidence exist
that higher prevalence of overweight and obesity among food insecure women in
households with children, non-Hispanic Blacks, Hispanics, and low-income
households (Jones, 2005), while single heads of households with children have
the highest prevalence of food insecurity (Nord et al., 2006). However, the food
insecurity and obesity paradox has not been observed directly in children and
men (Townsend et al., 2001). Although little is known why low-income women in
the U.S. are more likely to be overweight or obese, examining food insecurity
may provide the necessary insight for this observation. Because studies
examined in this literature review were cross-sectional, causality between food
insecurity and obesity cannot be established (Jones, 2005; Townsend et al.,
2001).

While there are studies indicating a link between food insecurity and
obesity there is a gap in the literature related to factors that may explain this
relationship. Obesity and food insecurity share similar psychosocial or behavioral
factors that may explain their association. Most of the possible explanations are
associated with how these psychosocial and behavioral factors affect adults who
manage household resources and food supplies to cope with food insecurity
experiences (Jones, 2005; Olson, 1999; Townsend et al., 2001). Qualitative
research has described psychosocial factors associated with food insecurity as feelings of deprivation, depression, family dysfunction and poorer mental health (Connell et al., 2005; Hamelin et al., 2001; Radimer et al., 1992; Stuff et al., 2006). These psychosocial factors could be causing stress in food insecure individuals that may lead to changes in eating behavior. Research in the field of psychology has addressed the relationship between stress, eating and obesity.

Perceived Stress and Obesity

There is a growing body of evidence that environmental, social, and cultural factors influence individuals' perceptions of stress and may possibly increase risks for obesity. Stress is a psychosocial determinant documented in the literature to affect eating behaviors associated with obesity, and is one of many predictors of overeating (Moyad, 2001) among dieters. As defined by Lazarus (1966), stress can be an environmental demand that influences behaviors and is commonly associated with anxiety, conflict, frustration, defense mechanisms, emotions, and disaster. Individuals' cognitive appraisal or perception of a stressor depends on whether their stressful experiences are perceived as exceeding resources or the ability to cope (Lazarus & Folkman, 1984). Stressful circumstances and other factors influence eating behaviors, and therefore, possibly contribute to the psychosocial gradient associated with obesity (Rohrer & Rohland, 2004).

In the health and psychological literature, eating behavior and food choices are two of many health-related behaviors that may be responsive to stress or emotional well-being, either inadvertently or as a strategy for coping.
with stress (Arnow et al., 1995; Ganley, 1989; Laitinen, Ek, & Sovio, 2002; Lazarus & Folkman, 1984; Wardle, Steptoe, Oliver, & Lipsey, 2000). In stressful and emotionally charged situations, stress is commonly associated with loss of appetite, but in some individuals, stress is associated with increased appetite and weight gain (Arnow et al., 1995). Lack of food and resources are believed to contribute directly or indirectly to weight gain via maladaptive behaviors, such as poor eating habits (Glanz, Rimer, & Lewis, 2002), disordered eating (Bruch, 1978; Herman & Polivy, 1975), depression, and reduced physical activity (Coates et al., 2006; Hamelin et al., 1999; Jones, 2005). In research related to eating disorders, stress is a major contributor to excessive dietary intake related to obesity. Stress, in the context of eating disorders, is related to individual differences in weight or dietary restraint (Herman & Polivy, 1975; Polivy & Herman, 2002). This examination of stress and subsequent weight gain has led to a range of mechanisms proposed for the relationship of stress and eating behavior. Greeno and Wing (1994) conclude that there are two models of stress' relationship to eating behavior. A “general effects” model hypothesizes that stress may have a direct effect on appetite as opposed to the “individual effects” model, which identifies restrained eaters or individuals who overeat in response to stress. Eating in response to stress has been well-documented (Arnow et al., 1995; Ganley, 1989; Timmerman & Acton, 2001). Individuals, who are unable to satisfy needs successfully, may perceive their inability to cope as a stressor and engage in eating as an alternative to fulfill needs (Timmerman & Acton, 2001). During stressful events, individuals may consume more food, resulting in greater
caloric intake or consumption of energy-dense foods. The environmental impact of work-related stress may also increase the risks for obesity.

Studies examining work-related stress have an indirect relationship to obesity. High job demands and low support on the job are perceived as stressful and overeating may result as a means to cope which may eventually lead to weight gain (McCann, Warnick & Knopp, 1990; Overgaard, Gamborg, Gyntelberg, & Heitmann, 2006). Two key studies examine periods of high and low work-related stress and dietary intake. McCann et al. (1990) conducted a study to examine the effects of variation in workload on food intake and serum lipids with a small group of female office workers of a department store. Plasma lipids, dietary intake, and self-reported stress and workload were assessed in 14 employees. Data was collected twice, before major work deadlines (high workload) and once during a dormant period of work (low workload). Participants were asked to provide subjective estimates of stress and workload. Both perceived stress ($p < 0.05$) and perceived workload ($p < 0.01$) were greater during high workload than during low workload. During high workload, participants consumed more calories ($p < 0.05$), greater amounts of total fat ($p < 0.05$) and saturated fat ($p < 0.05$), and a greater percentage of calories from total fat ($p < 0.05$) than during low workload periods.

Wardle et al. (2000) evaluated associations between stress and daily food intake in relation to dietary restraint. Ninety staff members of a department store were assessed at four intervals over a 6-month period for measures of diet, weight, and perceived stress related to work. Work stress was indexed in terms
of the hours of work over the past 7 days, which provided an objective indicator of demand. Participants worked an average of 47 hours on the high-work-stress session compared with 32 hours on the low-work-stress session. The researchers compared the highest- and lowest-work-stress sessions in the longitudinal analysis, and examined the moderating effects of gender and restrained eating were examined. High-work-stress sessions were associated with higher energy and saturated fat and sugar intake. The effects of high- and low-work-stress were examined separately to evaluate differences in food intake in restrained and non-restrained eaters. Among restrained eaters, a greater stress difference between high- and low-work-stress session was associated with a greater energy difference ($r = 0.32$, $p < 0.05$), whereas, among non-restrained eaters, there was no association ($r = -0.01$). There were no differences in associations in stress and macronutrient intakes. The results of the two studies indicate that individuals who experience work-related stress have a higher energy intake and are vulnerable to adverse effects of stress on eating behaviors. However, the limited amount of research on work-related stress as an environmental factor has not identified a conceptual framework to predict the direct effect of work-related stress on eating behaviors. Research on self-reported stress and dietary intake has produced inconsistent results in its relationship to obesity (Sammel et al., 2003; Wardle et al., 2000). Although research exists on eating in response to stress, the evidence remains unclear as to how stress influence changes in eating behavior or experience weight gain (Greeno & Wing, 1994).
There are a limited number of epidemiological studies examining stress as a risk factor for obesity. Sammel et al. (2003) examined stress and weight gain among women in their late reproductive years (ages 35-47). Three hundred and thirty-six African American and Caucasian American women in a cohort study were followed over a 4-year period. The Perceived Stress Scale was used to assess the degree to which situations were stressful to the participants other instruments were used to assess depression, anxiety and BMI. All of the psychological measures were associated with weight gain in each BMI category and were also significantly correlated to each other. However, when separate multivariate models were conducted to examine each psychological measure, no significant differences was found in women who gained more than ten pounds regardless of the stress measure than other women who did not gain weight.

Rohrer and Rohland (2004) evaluated the importance of personal stressors in determining obesity. The sample (n = 274) was drawn from a low-income female population of women using a family planning clinic for primary care. Exercise, social support, mental health and other personal characteristics were measured and controlled to determine the independent effect of different sources of stress on obesity. Chi-square tests were used to test for the relationship between each independent variable and obesity (the dependent variable). Nearly half of the respondents (47.8 percent) were classified as being obese. Obesity differed significantly by the number of persons in the household ($p = .0047$), level of education ($p = .0060$), income level ($p = .0328$), and marital status ($p = .0183$). Over 60 percent of those lacking high school education were
obese, whereas only 40 percent of those who had more than a high school education were obese. Over 58 percent of married respondents were obese, compared to 42.5 percent of unmarried persons. Individuals who lived alone were much more likely to be obese than persons who lived with four or more people (32.5 percent and 64.8 percent, respectively). Consistent with findings in the Sammel et al. study, there was no significant relationship between self-reported stress and obesity after adjusting for other variables. However, stress may have indirect effect on obesity, an issue not investigated in these studies. Furthermore, the relationships between self-reported perceived stress with objective (psychological and physiological) measures of stress in these studies are unknown (Sammel et al., 2003; Rohrer & Rohland, 2004).

Social stressors such as low SES may affect obesity through social, psychological and physiological reactions to stress. Stressful living environment and social anxiety may impair the need to eat healthfully and influence obesity (Wardle et al., 2000). Cortisol, a hormone that increases with stress, is documented to play a role in energy regulation and obesity by increasing available energy through gluconeogenesis and lipolysis. During stressful events, cortisol release increase appetite, energy expenditure and food consumption. Epel, Lapdius, McEwen, and Brownell (2001) sought to identify whether both biological and psychological responses of stress reactivity, distinguish between stress overeaters from non-overeaters. The researchers hypothesized that high cortisol levels lead to eating in response to stress and mechanisms affecting hunger. Fifty-nine healthy pre-menopausal women, aged 30-45 years, were
exposed to three laboratory-induced stress session and a fourth control session on different days. Snacks were provided to each participant for their voluntary consumption during the stress sessions. Salivary cortisol, mood, and stress assessments were conducted pre- and post- laboratory stress sessions. Stress-induced cortisol reactivity was related to greater caloric intake after exposure to a laboratory stressor. Women who were high cortisol reactors to stress ate more food than low reactors while recovering from stress. Cortisol was significantly higher on the stress day ($M = 28.6$, $SE = 1.7$) than the control day [$M = 22.6$, $SE = 1.5$, $t(54) = 3.1$, $P<0.01$]. On stress days, individuals who were assessed to be high reactors to stress, consumed more calories (calories $M = 216.3$, $SE = 29$) than low reactors to stress (calories $M = 137.3$, $SE = 31.8$). There were no relationships between cortisol reactivity with eating behavior on the additional two laboratory stress sessions. The current study suggests that stress reactivity may increase consumption of food after exposure to an acute stressor. However, eating in response to laboratory-induced stress may not generalize to eating responses to familiar, real-life stressors (Epel et al., 2001; Daniel, Moore, Decker, Belton, DeVellis, Doolen, & Campbell, 2006).

Observations of eating behaviors as coping strategies to deal with stress has been captured in clinical and laboratory settings. However, strategies to cope in stressful situations have been taken into account in only a few studies (Ganley, 1989). Eating, alcohol consumption, and smoking can be used as strategies to avoid stressful situations or obtaining relief from the unpleasantness associated with such situations (Ganley, 1989; Macht & Simons, 2000; Greeno & Wing,
Laitinen & associates (2002) first, studied the association of stress-related eating and drinking as a means to alleviate negative emotions with obesity and food consumption in a population-based study of adults. Second, the researchers examined the predictors of stress-related eating and drinking at 31 years of age. Predictive risk factors for adult obesity, longitudinal SES, and perceived social support were also evaluated. The study consisted of 5,150 men and women in a cohort study in Northern Finland. Subjects were participants and their parents who participated in postal and clinical assessments since birth and completed other examinations including the Ways of Coping Checklist at age 31. Parents’ data consisted of mother’s weight, height, and social class were collected by trained nurses at birth. Follow-up of the cohort took place at the age of 1 year, 14 years, and 31 years as postal and clinical examinations. BMI at 31 years of age was highest among stress-driven eaters and drinkers, especially among women. The proportion of obese women among stress-driven eaters was twice that of those not stress-driven. Stress-driven eating was significantly associated with obesity among women (OR 3.24, 95% CI 2.19-4.79, $P$ value<0.001; by binary logistic regression analysis controlled for BMI at 14 years), but not among men (OR 1.16, 95% CI 0.62-2.18, $P$ value 0.6365). Stress driven male drinkers consumed more alcohol than women or men who were non-stress driven eaters and drinkers. Binary logistic regression analysis showed that the best predictors for men being or becoming stress-driven eaters and drinking were being single or divorced, a work history of consistent unemployment, an academic degree, and a low vocational education.
Among women, the best predictor was a lack of emotional support. None of the variables measuring the high-risk groups for adult obesity predicted stress-related obesity.

Rasheed (1998) conducted a case control study to examine differences in eating and exercise behavior among 74 obese and 70 non-obese healthy, non-pregnant women (15-55 years) attending a primary clinic in Saudi Arabia. Participants consented to have medical records evaluated by the researcher to collect data from medical case records and controls and participants completed the Eating and Exercise Behaviour Questionnaire (EEBQ) and additional questions about participants’ perceptions of ideal body size. To determine weight status, heights and weights were measured by the researcher according to NHANES reference data. The obese were significantly more likely to eat under distress, anger, secrecy, and indulge in binge eating ($P < 0.05$) than other weight status groups. The obese were also more likely to snack frequently and drink regular sodas compared to other groups ($P < 0.05$). More than 75 percent of the study population were not exercising at all, a common characteristic of middle class Saudi women. Women who overestimated (28.6 percent) or underestimated (28.9 percent) their actual body weight with increasing education significantly related to overestimation of weight and vice versa ($P < 0.05$). A change in perception of ideal body image from the overweight female to the slimmer figures was observed with advancing education status.

Most studies on stress and eating behaviors and obesity were associated with dieting and eating disorders (Polivy & Herman, 1998; Rasheed, 1998;
Wardle, et al., 2000; Weinstein, Shide, & Rolls, 1997) or were clinically- or laboratory-based (Epel et al., 2001). Many of these studies may not provide evidence to support the role of stress to predict obesity in a general population (Epel et al., 2001; Ganley, 1989). Research exists focusing on eating as a way of coping in stressful situations among normal, non-dieting populations (Laitinen et al., 2002; Rasheed, 1998) and men (Laitinen et al., 2002; Weinstein et al., 1997) and low SES (Daniel, Moore, Decker, Belton, DeVellis, Doolen, & Campbell, 2006). Many inconsistent findings exist between perceived stress levels (Laitinen et al., 2002; McLean & Barr, 2003; Rohrer & Rohland, 2004; Sammel et al., 2003; Weinstein et al., 1997) and physiological stress assessed by cortisol (Epel et al., 2001). A review of the literature describes many factors that affect individuals’ perceptions of stressful situations. Food preferences for energy dense foods may be a major factor in the increase of body weight over time (Blundell & Gillett, 2001; Drewnowski & Specter, 2004). Modifications to hunger and satiety signals, over time, affect the pattern of food consumption in overweight or obese individuals, increasing the frequency and/or size of eating occasions and risk for developing eating disorders (Blundell & Gillett, 2001). Other factors, such as employment (Daniel et al., 2006; McCann et al., 1990), and culture (Rasheed, 1998) also predict food-related coping strategies along with the frequency and the stressful conditions experienced. Studies show differences in stress-induced eating among the obese. Obese individuals were most likely to eat to cope with stressful situations consumed high energy-dense foods and drinks.
Emotional Eating and Obesity

Emotional eating is defined as a disordered eating behavior in which an individual eats in response to negative emotions and is risk factor for weight gain, obesity, and bulimic attitudes (Arnow et al., 1995; Waller & Osman, 1998). Emotional and stress responses to life events have been associated with abnormal eating behaviors as a strategy of coping with stress and have been found to affect food consumption and body weight (Greeno & Wing, 1994; Macht & Simons, 2000). Early research into disordered eating behaviors proposed that emotions trigger overeating which serve as a coping strategy or reward. The emotion-driven desire to overeat is cited as a precipitant of disordered eating (Bruch, 1973; Herman & Polivy, 1975). When faced with a negative affect such as anger, depression or anxiety, individuals may overeat to reduce awareness of negative, intolerable cognitions and emotions. Sufficient evidence supports negative affective states drive eating disorders such as bulimia and binge eating behaviors and may affect weight status over time. However, most studies on emotional eating were conducted in clinical settings, were experimental studies, or involved patients diagnosed with eating disorders (Arnow et al., 1995).

Emotional eating has been associated with alexithymia, a cognitive deficit that includes an inability to identify and express emotions. Individuals with alexithymia may overeat to avoid coping with conflicts or expressing emotions to deal with stress. Pinaquy, Chabrol, Simon, Louvet, and Barbe (2003) examined emotional eating, binge eating disorder and alexithymia in overweight and obese women (n = 169) willing to participate in a weight loss program. Measures
included the Dutch Eating Behavior Questionnaire, BMI, depression, and alexithymia scores. Fifty-two percent of the participants in the study had high alexithymia scores. Regression analyses of alexithymia, eating behavior and mood with emotional eating scores were performed to indicate associations with binge eating disorders. Emotional eating and perceived stress were the only predictors of binge eating disorder in these overweight and obese women. Alexithymia and emotional eating were significantly lower in the non-binge eating disorder group compared to the binge eating disorder group. High alexithymia scores among these overweight and obese women suggested a tendency for these women to overeat rather than verbalize or express their feelings.

To date, few studies examine emotional eating in women with non-clinically-diagnosed eating behaviors. Waller and Osman (1998) investigated whether women with normal eating behaviors experienced emotionally driven eating behaviors and if emotional eating was related to unhealthy eating. Fifty-one women with no history of disordered eating completed the Eating Disorders Inventory (EDI) to measure eating disturbances such as drive for thinness, body dissatisfaction, and bulimia. Additional scales examined psychological characteristics such as ineffectiveness, distrust, maturity fears, and asceticism, impulse regulation and social insecurity. Emotional Eating Scale (EES) was used to measure to what extent excessive eating would occur when experiencing 25 negative emotions. The emotions form three subscales, reflecting eating in response to anger (Anger/Frustration) anxiety (Anxiety), and depressed mood (Depression). Correlations were used test associations between EES scores and
eating characteristics. Anger/Frustration and Depression subscales were linked to BMI ($r = .29$, $p < .05$ in each case). Multiple regression analyses were used to determine whether these patterns of were a product of emotional eating. For each dependent variable (EDI Scale), the three subscales of EES were entered simultaneously as predictors. All three of the EES subscales were reliable predictors of EDI Bulimia ($F = 0.72$, $p = .004$, adjusted $R^2 = .220$), Ineffectiveness ($F = 3.96$, $p = .015$, adjusted $R^2 = .165$), and Interpersonal Distrust ($F = 4.20$, $p = .011$, adjusted $R^2 = .172$). However, for each case, there was no reliable effect of any EES subscale, suggesting that the relationship between emotional eating and these eating characteristics was a relatively general one. Women in this study reported substantially lower EES scores as compared to obese and binge eaters in previous studies examining emotional eating. Waller and Osman suggest that high levels of emotional eating were associated with less healthy eating practices. Findings in this study also suggest that EES may have a role in identifying eating problems in the broader population.

It is theoretically plausible that emotional eating may occur in food insecure individuals in households where food insecurity is experienced. Individuals in food insecure households may be at increased vulnerability to negative affects such as feelings of anxiety, loss of control, family dysfunction, and psychological impairment, all of which have been described by food insecure individuals and accompany a preoccupation with allocating food or resources or engaging in activities such as borrowing money, selling possessions or stealing (Tarasuk & Maclean, 1990). Radimer et al. (1990) noted that at the individual
level of the psychological dimension of food insecurity, individuals reported anxiety, feelings of deprivation, and lack of choice. Researchers studying the impact of food insecurity have reported adjustments in coping and management strategies that affect the quality and consumption of foods and occur in response to anxiety and concern about household food supplies at the first level of food insecurity (Kendall, Olson, & Frongillo, 1996). Studies have shown that individuals from households that experience anxiety about running out of food, or do not have adequate resources to access enough food to meet needs were more likely to be overweight or obese (Frongillo, 2003; Townsend et al., 2001).

This review of literature suggests that the increasing rates of food insecurity and overweight/obesity in the U.S. are associated with many psychosocial, physiological and environmental factors. However, most research on disordered eating has been assessed in relation to individual differences in weight or dietary restraint in clinical and laboratory settings. A limited amount of research exists that identify self-reported emotional and stress-induced eating behaviors in non-disordered eating populations (Wardle et al., 2000). Although no single factor is the primary cause of food insecurity or obesity, it is recognized that a combination of factors may contribute to the food insecurity and obesity paradox (Jones, 2005).

To date, there are no studies examining the relationships between food insecurity, stress, emotional eating and obesity. Most studies on stress and emotional eating are related to voluntary dietary restraint methods to lose weight and eating disorders (Ganley, 1989; Greeno & Wing, 1994; Herman & Polivy,
1975; Macht & Simons, 2000). Studies with populations in low SES have provided evidence that an inverse relationship exist between BMI and SES (Sobal & Stunkard, 1989) and predicting eating to cope with stress among low SES populations (Daniel et al., 2006). Obesity has been found to affect individuals with limited resources, racial/ethnic minorities and the poor (US DHHS, 2001). More research is needed to examine conceptual frameworks that include psychosocial factors, such as perceived stress and emotional eating, to explain the food insecurity and obesity phenomenon and develop effective and sensitive policy resolutions and interventions.
CHAPTER III

METHODOLOGY

Research Study Design

A cross-sectional, correlational design was used to examine the relationship between food insecurity and obesity and the role of perceived stress and emotional eating as moderators of the food insecurity and obesity relationship. Survey instruments were used to collect self-reported data on socio-demographic and study variables, and anthropometric measures were collected to determine Body Mass Index (BMI). Parents or guardians who attended registration orientation for children enrolled in Head Start at two regional agencies in South Central Mississippi were recruited for the research project. A description of the research project was presented at the end of the parent orientation session by Head Start personnel. Participants were asked for voluntary consent to respond to written surveys and undergo anthropometric measurements, consisting of height and weight to determine weight status. Written consent to participate was obtained and questions about the research process were answered by either the investigator or trained research assistants. Participants were asked to complete a self-administered survey to collect socioeconomic and demographic data as well as to assess household food security status, perceived stress and emotional eating. The protocol for the research study was approved by the Human Subjects Protection Review Committee at The University of Southern Mississippi prior to data collection (Appendix B).
Research Assistants' Training. Research assistants were senior undergraduate students and graduate students recruited through faculty members in the Department of Nutrition and Food Systems at The University of Southern Mississippi. Research assistants were required to attend a training session to establish and maintain standardized data collection procedures and quality control during data collection. The training session included a review of the study, data collection protocol, equipment instructions, and quality control procedures. Research assistants were trained to use the Tanita Body Fat Analyzer Scale (Tanita Corporation of America, model TBF-310, Arlington Heights, IL) and SECA portable stadiometer (Seca Ltd., model 214, Birmingham, England) to collect measured weights and heights. The training session and training manuals were designed to reduce errors and limit variability that may occur among observers in obtaining and interpreting anthropometric measurements. Training manuals were provided and available for use by research assistants at all data collection sites. The researcher was present at each data collection site to answer questions and resolve any issues related to data collection procedures.

Participants. Numerous studies suggest many similarities between food insecurity and obesity with the highest reported prevalence in women (Frongillo et al., 1997; Olson, 1999), with low socioeconomic status (Chang & Lauderdale, 2005; Rose, 1999), among ethnic minorities (Adams et al., 2003; Frongillo et al., 1997). Head Start programs were chosen as the research site for participant recruitment because this program specifically serves low-income families of
preschool-aged children. The two Head Start agencies chosen for this research project serve predominantly African American populations. Therefore, these Head Start centers had great potential for investigating relationships among food insecurity, stress, emotional eating and obesity.

**Sample Size and Power Calculation.** A minimum sample size of 150 to 200 food insecure respondents was needed to achieve a 75-80 percent power to detect small to moderate relationships between the independent variables (food insecurity, stress, emotional eating), the dependent variable (overweight/obesity), and the moderator effects, with a probability level of $p \leq .05$. A recent study of food insecurity among a representative sample of the population in the Lower Mississippi Delta of Mississippi (LMD) reported food insecurity rates of 33 percent (The Lower Mississippi Delta Nutrition Intervention Research Initiative, 2004). Study participants had a child participating in the Head Start Program or were parents or guardians and received food stamps, and/or were a guardian of a child or children approved to receive free meals under the National School Lunch Program. Only low-income households are eligible for Head Start program participation. Therefore, the sample was predominantly low-income. In addition, Five County Child Development Head Start centers are located in four counties with unemployment rates ranging from 6-10 percent, well above the national average of 4.6 percent (Bureau of Labor Statistics, 2005). Therefore, the researcher anticipated the rate of food insecurity among the current study population to be similar to that of the LMD. A final sample size of 650–700 was estimated to provide a food insecure sample of 150–200.
Adults \((n = 690)\), 18 years of age or older, were recruited to participate in the study. Mothers or female guardians attending Head Start orientation at Pinebelt Association Community Enhancement (PACE) Head Start centers in Hattiesburg, Mississippi, and Five County Child Development Program Head Start centers in Covington, Jefferson Davis, Simpson, and Lawrence counties, Mississippi, were recruited. To increase participation and reach households who were most likely to experience food insecurity, mothers or female guardians with children who received free lunch under the National School Lunch Program in primary and secondary schools and/or those who received food stamps in households with children were also recruited by word-of-mouth by study participants in the community. Letters of support were obtained from the Directors of the Head Start Centers to conduct this study at the registration sites (Appendix C). Informed written consent was obtained from participants prior to data collection (See Appendix D). Participants who completed survey instruments and anthropometric measurements received $10 Wal-Mart gift cards for their participation in the study.

Survey & Anthropometric Measurement Instruments

The survey instrument consisted of three published instruments with documented reliability and validity. These instruments included a modified version of the Six-Item Food Security Scale [FSS-6] developed by USDA (Nord, Andrews, & Bickel, 1999; Dunifon, Bartfelf, & Nord, 2004), the Perceived Stress Scale-10 item [PSS-10] developed by Cohen et al., (1983) and the Emotional Eating Scale [EES] developed by Arnow et al. (1995). In addition, self-reported
heights and weights, perceived weight status, age, educational level, income, race, number of members living in the household, marital status and participation in food assistance programs were included as demographic characteristics at the end of the survey (Appendix E).

A pilot study was conducted for cognitive testing and content validation of the compiled survey instrument with 10 mothers or female guardians with children participating in the NSLP. Participants in the pilot study were asked to evaluate the clarity of directions and evaluate survey questions to identify vague and unclear words. Participants were also asked to complete anthropometric measures to estimate the length of time required to complete the entire data collection process for each participant and evaluate instructions and scripts for research assistants' training manual. Comments and opinions regarding the time required to complete the research process were also solicited and modified to ensure that each step in the research process were consistent and reduce data collection errors. Based on suggestions from pilot study participants modifications to the order of the survey instruments and anthropometric data collection procedures were made. The research process for participants in the pilot study was approximately 20 minutes to complete survey and anthropometric measurements.

Food Security Scale – 7. Food insecurity was assessed based on the six-item food security scale (Nord et al., 1999; Dunifon et al., 2004) and one additional question from the 18-item Household Food Security Survey Module (Bickel et al., 2000) to create a seven-item scale (Nord, 2006, personal communication). The
six-item food security scale is a short version that provides a comparable substitute to the standard 18-item food security survey module. The six-item scale has been utilized as a self-administered instrument to assess mild to moderate food security status of households with school-aged children in a community (Dunifon et al., 2004). One additional item from the 18-item survey module was added to the six-item module to measure a range of conditions and behaviors experienced when quality or amount of available food is constrained as a result of lack of money or other resources. The additional question assessed worry or uncertainty about having enough food (Bickel et al., 2000). The seven-item scale was given to study participants as a self-administered survey to assess food security, food insecurity and food insecurity with hunger among adults. Although the FSS-7 did not capture the most severe level of food insecurity (food insecurity with hunger among children), the FSS-7 provide a reliable indicator of moderate risk within the household (Bickel et al., 2000). The internal consistency was Cronbach’s $\alpha = 0.85$ for the U.S. food security measures (Hamilton, Cook, Thompson, Buron, Frongillo, Olson, et al., 1997).

Perceived Stress Scale -10. The PSS-10 has been used to evaluate stress over three months (Cohen et al., 1983) and measures the extent to which situations in an individual’s life are appraised as stressful events. The PSS-10 has been used to assess stress over a period of time of one month to one year. However, predictive validity begins to fall with periods longer than 12 weeks (Cohen, 1983). The PSS-10 has been widely used in research on stress and health and has been shown to be a better predictor of psychological symptoms,
physical symptoms, and health service utilization than life-event scales (Wardle et al., 2000). In this study, the PSS asks individuals questions such as “In the last four months, since April 2006, how often have you felt nervous and stressed?” with responses rated on a five-point scale, with responses of never, almost never, sometimes, fairly often, and very often. Total scores could range from 0 to 40, with higher scores indicating greater perceived stress. The PSS-10 has been shown to provide a slight gain in psychometric quality over the original 14-item scale and has been recommended by the scale’s authors (Cohen et al., 1983). Internal consistency for the PSS-10 has been reported as very good with a Cronbach’s $\alpha = 0.78$. The internal consistency for the PSS-10 for this study was reported as Cronbach’s $\alpha = .782$. The PSS-10 was designed for use in community samples with at least a junior high school education (Cohen et al., 1983) and was therefore deemed appropriate for the population of this study.

*Emotional Eating Scale – 25.* The Emotional Eating Scale (EES) is a 25-item scale designed to assess tendency toward overeating in response to negative emotions (Arnow et al., 1995). The EES assesses an individual’s tendency to overeat in response to distinct emotional states, classified into three different affective subscales, anger/frustration, anxiety, and depression, measured with 11, 9, and 5 items, respectively. Responses for items reflecting each emotional state use a five-point Likert scale to rate how strong an urge to eat is experienced when an individual feels a distinct emotion. Response options range from a suppressive or “no desire to eat” to an overwhelming or “strong desire to eat”. The internal consistency for the entire scale has been reported as
a Cronbach's $\alpha = 0.81$ and the reported reliability of each subscale was
anger/frustration with a Cronbach's $\alpha = 0.78$; anxiety, with a Cronbach's $\alpha = 0.78$; and depression with a Cronbach's $\alpha = 0.72$. The internal consistency for each of the three subscales is: Cronbach's $\alpha = .918$ for anger/frustration, Cronbach's $\alpha = .895$ for anxiety, and Cronbach's $\alpha = .810$ for depression. The possible range of raw subscale scores is 0-44 for the anger/frustration subscale, 0-36 for the anxiety subscale, and 0-20 for the depression subscale. Higher scale scores indicate a greater tendency to eat when experiencing negative affect. However, the author suggests that results should be reported by specific subscale to distinguish between relationships with specific negative emotional states. The survey has been used in clinical (Arnow et al., 1995; le Grange, Telch, & Agras, 1997) and nonclinical (Waller & Osman, 1998) populations and with various ethnic groups (Jackson, Cooper, Mintz, & Albino, 2003; le Grange et al., 1997).

*Heights and Weight.* Height and weight measurements were collected by either the researcher or trained research assistants after participants completed the survey instrument. Participants were asked to stand without shoes to measure standing heights and measurements were recorded to the nearest 0.1 centimeter using a Seca Portable Stadiometer (SECA, Ltd, Olney, MD, USA). The Seca stadiometer is a portable stadiometer acceptable for measuring standing heights of adults (Temple, Wrotniak, Paluch, Roemmich, & Epstein, 2006; O'Donovan, Owen, Kearney, Jones et al., 2005). Heights were recorded on an anthropometric form (Appendix F) and initialed by the researcher or research assistant. Participants were then weighed using the Tanita Body Fat
Analyzer TBF-310 (Tanita Scale) (Tanita Corporation of America, Arlington Heights, IL). The Tanita Scale has been used in research to assess weight, calculate BMI, percent body fat, fat mass, Lean Body Mass [LBM] and Total Body Mass [TBM] (Sung, Lau, Yu, Lam, & Nelson, 2001). This model prints a hard copy of these variables. Weight for light clothing was estimated to be one pound for all participants and manually entered into the control panel of the Tanita Scale by a research assistant. Age, gender, and height were also manually entered. Participants were asked to stand without shoes on the Tanita scale for body weight measurements and BMI calculation. BMI computed by the Tanita Scale measure is based on guidelines established by the National Institutes of Health (Tanita Body Composition Analyzer Technical Notes, p. 4). Only measured body weights and BMI calculated from measured heights and weights were printed and attached to the participants’ anthropometric form (See Appendix E).

Procedures

In order to meet the goals of this study, procedures to collect data were as follows:

1. Participants read consent forms (Appendix D) and provided signatures if they agreed to participate in the study. Researchers and research assistants were available to answer any questions associated with the study.

2. Participants were then asked to complete the survey instrument which contained the seven-item food security scale, ten-item perceived stress scale, twenty-five item emotional eating scale as well as
socioeconomic and demographic questions such as self-reported heights and weights and weight status.

3. The researcher or research assistants measured heights and weights of participants, then recorded and initialed measurements on the anthropometrics form. The anthropometric form was stapled along with the weight and BMI printout to each participant’s numbered surveys.

4. Last, participants signed a Confirmation Compensation Form (Appendix F) and were offered a small incentive and a printed copy of their weight and BMI status. The researcher and research assistants were available for any questions that participants had during the study.

The data collection process took approximately 15-20 minutes to complete per participant. Data collection took place over the entire month of August 2006.

Data Analysis

SPSS (Version 13.0, SPSS Inc., Chicago, IL) was used for data analysis. Means, standard deviations, and frequencies were used to describe the sample population with regard to demographics, food insecurity scores, perceived stress, emotional eating and BMI. Dummy variables were used to code food security/food insecurity raw scores rather than use raw scale scores to represent food security status since it was unknown if a relationship between food security and overweight/obesity was linear. Food insecurity was noted for participants who responded positive from one to seven on the food security survey. For the purpose of this study, three dummy variables were used: “food 1” for marginal or mild food insecurity if the raw food security survey scores were 1-2; “food 2” for
low or moderate food insecurity if raw food security survey scores were 3-5; and “food 3” for food insecurity with hunger if raw scores were 6-7. Individuals were food secure if they responded with negative answers to all food insecure items. Only food 1, food 2 and food 3 were used as categorical variables in multiple regression analyses to test whether food insecurity was a significant predictor of overweight or obesity. Participants were classified as food secure if responses were all negative. Mean perceived stress scores were calculated. Scores below the mean were considered to be low stress and scores above the mean were high stress scores. Higher scores reflect higher perceived stress (Cohen, 1983). Mean emotional eating scores were calculated for each subscale, Anger/Frustration, Anxiety, and Depression. The subscale with the highest mean score reflects the negative affects that influence overeating (Arnow et al., 1995).

BMI categories were used in the data analysis to address all research questions. BMIs was calculated by the Tanita Scale from participants’ measured height and weight. Relative body weight status was defined as both continuous and categorical variables to make findings comparable with those of previous studies. For categorical analyses, participants’ BMI values were grouped into four weight status categories based on NIH guidelines: underweight (BMI < 18.5 kg/m²), normal weight (BMI of 18.5 kg/m² to 24.9 kg/m²), overweight (BMI of 25 kg/m² to 29.9 kg/m²) and obese (BMI ≥ 30 kg/m²).

Analytic procedures following methods described by Baron and Kenny (1986) were used to evaluate whether a relationship between food insecurity and overweight/obesity was moderated by emotional eating and/or stress. Moderation
refers to an examination of the statistical interaction between two or more independent variables in predicting a dependent variable. The method has been used by other food insecurity researchers to investigate differential effects of other factors such as food assistance participation on relationships between food insecurity and overweight/obesity or other outcome variables (Jones & Frongillo, 2006; Jones, Jahns, Laraia, & Haughton, 2003). In this study, moderation analysis was performed to clarify the extent to which each of the independent variables predicted the dependent variable and whether there was interaction between the independent variables that also predicted the dependent variable. Statistical significance was set at $\alpha < .05$ level to interpret results.

The first three research questions assessed if food insecurity, perceived stress or emotional eating independently predicted overweight/obesity. Multiple regression was used to evaluate relationships between the dummy codes for food insecurity, perceived stress scores, emotional eating subscale scores and overweight/obesity weight status using BMI scores. The last research question was to determine if stress and emotional eating moderate an association between food insecurity and overweight/obesity. The interaction between stress and emotional eating scores (perceived stress x emotional eating) was entered into the regression equation. Moderation was assumed if perceived stress x emotional eating analysis was significant (Baron & Kenny, 1986).
CHAPTER IV

RESULTS

Numerous published studies attempt to describe the relationship between food insecurity and obesity. Therefore, the purpose of this study was to examine the hypothesized relationships among food insecurity, obesity, stress and emotional eating and determine if stress and emotional eating serve as moderating mechanisms for the food insecurity and obesity phenomenon. Multiple linear regression and moderation analyses were used to examine linear relationships between food insecurity, perceived stress, emotional eating and BMI of mothers and female guardians attending Head Start orientation through two Head Start agencies in South Mississippi.

Descriptive Statistics

The study population consisted of 690 participants who agreed to complete the survey and anthropometric measurements. Participants were excluded if they were under the age of 18, submitted incomplete surveys or did not complete anthropometric measures, stated they were pregnant or were administrative employees of Head Start \((n = 54)\). Men \((n = 8)\) were also excluded from the analyses since previous studies found a significant association between food insecurity and increased overweight and obesity among women but not among men (Adams et al., 2003; Basiotis & Lino, 2003; Frongillo et al., 1997; Olson, 1999; Townsend et al., 2001). The final study population consisted of 636 female participants. The mean age of participants was 31.46 \((SD = 10.12)\). Age and BMI characteristics are presented in Table 1. As a practical method for
classifying weight status such as overweight and obesity, BMI is used. For this study, participants' self-reported weight status was compared to their computed BMI from measured heights and weights using NIH criteria. According to the National Institutes of Health, a BMI less than 18.5 kg/m² is considered underweight; BMI values of 18.5 kg/m² to 25 kg/m² are considered as normal weight status, whereas a BMI of 25 kg/m² to 29.9 kg/m² is classified as overweight. BMIs of 30 kg/m² or more are classified as obese. Mean body mass index for participants (BMI; kg/m²) was 32.13 (SD = 8.94; range 16.10–63.80), which is considered obese according to the previously discussed classification schema.

Table 1

Participants' Age and BMI (N = 636)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Years</td>
<td>31.46</td>
<td>10.12</td>
<td>18-67</td>
</tr>
<tr>
<td>BMI kg/m²</td>
<td>32.73</td>
<td>13.54</td>
<td>16.10 - 63.80</td>
</tr>
</tbody>
</table>

Other sociodemographic information is presented in Table 2. Almost 84 percent of the participants were African American; 14.8 percent were Caucasian; and 1.5 percent of participants were Hispanic, Native American, Asian or another race/ethnicity. Approximately 53 percent of the participants had either a high school education or less, whereas 47 percent of the participants had technical education beyond high school, or college level education. More than 75 percent of participants earned less than $20,000 per year and most (87.0 percent) lived in a household with at least five members, and a single female adult led 60.5
percent of the households. Many respondents participated in more than one food assistance program resulting in 517 (81.2 percent) respondents who had children participating in Head Start, 252 (39.6 percent) respondents who participated in the food stamp program, and 290 (45.5 percent) respondents had children who were receiving free meals in the National School Lunch Program in local schools.

Of 631 participants reporting their perception of their own weight status, 354 reported themselves to be overweight (See Table 3). Another 51 reported themselves to be obese. However, calculated BMI indicated only 119 women to be in the overweight category while 359 were actually in the obese category. A chi-square test of independence comparing women's perceptions to actual weight classification was significant (χ² (N = 631, df = 9) = 93.22, p < .000) and results are presented Table 4. Among participants, 45.4% of the women who perceived their weight status as normal were overweight and 76.6% of women who perceived their weight status as overweight were obese. Only 13.9 percent of obese participants perceived their weight accurately.
Table 2

**Sociodemographic Characteristics of the Study Sample**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>533</td>
<td>83.7</td>
</tr>
<tr>
<td>Caucasian</td>
<td>94</td>
<td>14.8</td>
</tr>
<tr>
<td>Hispanic, Asian, Native American, &amp; Other ethnic groups</td>
<td>8</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Participants’ education Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ High school graduate</td>
<td>336</td>
<td>53.0</td>
</tr>
<tr>
<td>&gt; High school education</td>
<td>298</td>
<td>47.0</td>
</tr>
<tr>
<td><strong>Number within the household</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 members or less</td>
<td>539</td>
<td>87.0</td>
</tr>
<tr>
<td>6 members or more</td>
<td>101</td>
<td>13.0</td>
</tr>
<tr>
<td><strong>Household Income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income less than $20,000</td>
<td>475</td>
<td>75.3</td>
</tr>
<tr>
<td>Household income more than $20,000</td>
<td>146</td>
<td>23.5</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single, separated, widowed or divorced</td>
<td>416</td>
<td>60.5</td>
</tr>
<tr>
<td>Married or sharing household with a partner</td>
<td>271</td>
<td>39.5</td>
</tr>
<tr>
<td><strong>Participation in food assistance programs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head Start</td>
<td>517</td>
<td>81.2</td>
</tr>
<tr>
<td>Food Stamps</td>
<td>252</td>
<td>39.6</td>
</tr>
<tr>
<td>Child participating in NSLP receiving free meals</td>
<td>290</td>
<td>45.5</td>
</tr>
</tbody>
</table>
Table 3

Perceived Weight Status and Measured Weight Status Percentages

<table>
<thead>
<tr>
<th>Weight Status (kg/m²)</th>
<th>*Perceived Weight Status Count Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>underweight</td>
<td>39 (6.2)</td>
</tr>
<tr>
<td>normal weight</td>
<td>139 (29.6)</td>
</tr>
<tr>
<td>overweight</td>
<td>354 (56.1)</td>
</tr>
<tr>
<td>obese</td>
<td>51 (8.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actual Weight Status</th>
<th>Criteria</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>underweight</td>
<td>BMI &lt; 18.0</td>
<td>14</td>
<td>2.2</td>
</tr>
<tr>
<td>normal weight</td>
<td>BMI = 18.5 – 24.9</td>
<td>139</td>
<td>22.0</td>
</tr>
<tr>
<td>overweight</td>
<td>BMI = 25.0 – 29.9</td>
<td>119</td>
<td>18.9</td>
</tr>
<tr>
<td>obese</td>
<td>BMI = &gt; 30.0</td>
<td>359</td>
<td>56.9</td>
</tr>
</tbody>
</table>

*Only 583 participants reported perceived weight status
Table 4

**Actual Weight Status by Perceived Weight Status**

<table>
<thead>
<tr>
<th>Actual weight status</th>
<th>underweight n (%)</th>
<th>normal n (%)</th>
<th>overweight n (%)</th>
<th>obese n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>14</td>
<td>139</td>
<td>119</td>
<td>359</td>
</tr>
</tbody>
</table>

**Perceived weight status**

<table>
<thead>
<tr>
<th></th>
<th>underweight</th>
<th>normal</th>
<th>overweight</th>
<th>obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>underweight</td>
<td>9 (64.3)</td>
<td>23 (16.5)</td>
<td>1 (0.8)</td>
<td>6 (6.2)</td>
</tr>
<tr>
<td>normal</td>
<td>4 (28.6)</td>
<td>101 (72.7)</td>
<td>54 (45.4)</td>
<td>28 (7.8)</td>
</tr>
<tr>
<td>overweight</td>
<td>1 (7.1)</td>
<td>14 (10.1)</td>
<td>64 (53.8)</td>
<td>275 (76.6)</td>
</tr>
<tr>
<td>obese</td>
<td>0 (0)</td>
<td>1 (0.7)</td>
<td>0 (0)</td>
<td>50 (13.9)</td>
</tr>
</tbody>
</table>

More than one half of the women in the study were food secure. Approximately one-third (32.6 percent) of the participants reported fully food secure households (all items answered negatively) and 31.5 percent reported marginally food secure (1-2 items answered affirmatively). 35.9 percent of the participants were food insecure (3-5 items answered affirmatively) including 26.4 percent who were food insecure without hunger (6-7 items answered affirmatively). The rate of food insecurity with hunger was 9.5 percent. (See Table 5).
Table 5

Food Security Status

<table>
<thead>
<tr>
<th>Food Security Status</th>
<th>*Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food secure</td>
<td>207</td>
<td>32.6</td>
</tr>
<tr>
<td>Marginally food secure</td>
<td>199</td>
<td>31.5</td>
</tr>
<tr>
<td>Food insecurity without hunger</td>
<td>170</td>
<td>26.4</td>
</tr>
<tr>
<td>Food insecurity with hunger</td>
<td>61</td>
<td>9.5</td>
</tr>
</tbody>
</table>

*637 participants reported food security status

For all food security categories, more than 70.0 percent of the women were overweight or obese based on their actual weight status. Of the 635 participants who completed anthropometric measures and the food security survey, more than 50.0 percent were obese for each food security category (See Table 6).

The mean score for perceived stress was 18.97 (6.17), slightly less than the midpoint of the scale, which is 20. Participants’ mean scores on the EES subscales were Anger/frustration = 10.78, SD = 8.65; Anxiety = 9.42, SD = 7.30; Depression = 6.10, SD = 4.71 and are presented in Table 7.
Table 6

Food Security Status vs. Actual Weight Status

<table>
<thead>
<tr>
<th>Food Security Status [FSS]</th>
<th>Actual weight status</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>underweight</td>
<td>normal</td>
<td>overweight</td>
<td>obese</td>
</tr>
<tr>
<td>count</td>
<td>5</td>
<td>56</td>
<td>39</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td>Food Secure</td>
<td>*%</td>
<td>2.4%</td>
<td>27.2%</td>
<td>18.9%</td>
<td>51.5%</td>
</tr>
<tr>
<td>count</td>
<td>2</td>
<td>39</td>
<td>44</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>Marginally Food Secure</td>
<td>%</td>
<td>1.0%</td>
<td>19.7%</td>
<td>22.2%</td>
<td>57.1%</td>
</tr>
<tr>
<td>count</td>
<td>5</td>
<td>31</td>
<td>28</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td>Food Insecure</td>
<td>%</td>
<td>2.9%</td>
<td>18.2%</td>
<td>16.5%</td>
<td>62.4%</td>
</tr>
<tr>
<td>Without Hunger</td>
<td>count</td>
<td>3</td>
<td>13</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>Food Insecure</td>
<td>%</td>
<td>2.4%</td>
<td>21.3%</td>
<td>16.4%</td>
<td>57.4%</td>
</tr>
</tbody>
</table>

*% of subjects in each food security category who fall within each weight status category.
Table 7

Means and Standard Deviations of Perceived Stress, Emotional Eating, and Emotional Eating Subscales

<table>
<thead>
<tr>
<th>Scale</th>
<th>mean</th>
<th>SD</th>
<th>*Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Stress</td>
<td>18.97</td>
<td>6.17</td>
<td>0 - 40</td>
</tr>
<tr>
<td>Emotional Eating</td>
<td>26.78</td>
<td>19.26</td>
<td></td>
</tr>
<tr>
<td>Anger/Frustration</td>
<td>10.78</td>
<td>8.65</td>
<td>0 - 44</td>
</tr>
<tr>
<td>Anxiety</td>
<td>9.50</td>
<td>7.30</td>
<td>0 - 36</td>
</tr>
<tr>
<td>Depression</td>
<td>6.84</td>
<td>4.67</td>
<td>0 - 20</td>
</tr>
</tbody>
</table>

*Score range represents raw scores for each instrument.

Research Question #1. The first research question assessed whether food insecurity predicted BMI.Dummy coded variables for food security categories were entered as independent variables to predict BMI. Food insecurity did not significantly predict BMI [F (3, 631) = .81, p = .487, R² = .004].

Research Question #2. To establish the role of perceived stress in predicting the dependent variable, perceived stress score was used as an independent variable to predict BMI. Among independent variables, perceived stress was the sole predictor of BMI [F (1,634) = 4.14, p = .042, R² = .006]. However, the relationship between perceived stress and BMI was very weak.

Research Question #3. Three EES subscales were entered simultaneously as predictors to determine if emotional eating predicted BMI. None of the three subscales within the Emotional Eating instrument predicted BMI [F(3,631) = .18, p = .908, R² = .001].
Research Question #4. The last research question addressed whether perceived stress and emotional eating moderated the association between food insecurity and BMI.

Multiple regression analyses were used in order to determine whether associations among food security status, perceived stress and emotional eating predicted BMI, in the manner outlined by Baron and Kenny (1986). Food security status, perceived stress and the subscales of ESS were entered in the first regression model. There was no significant prediction of BMI from food security status or the subscales of EES. \( r = .058; r = .030 \) respectively. Only perceived stress was significantly associated with BMI. The interaction of stress and emotional eating was entered into the second model and moderation was assumed if the interaction was significant (Baron & Kenny, 1986). The interaction of perceived stress and emotional eating did not moderate the association between food insecurity and BMI \( [F(3,624) = 2.43, p = .064] \). A revised conceptual model was constructed from the results and is shown in Figure 1.
Hypothesized Model of Relationships among Food Insecurity, Perceived Stress, Emotional Eating and Overweight/Obesity

Food Insecurity

Stress  \( r = 0.81, p < 0.042 \)

Emotional Eating
- Anger/Frustration
- Anxiety
- Depression

Overweight/Obesity (BMI)

Food Insecurity \times Stress \times Emotional Eating

Figure 1.
Chapter V
DISCUSSION

Research over the previous decade has revealed an interesting paradox of obesity and food insecurity coexisting in some population groups (Adams et al., 2003; Hedley et al., 2004; Olson, 1999; Rose, 1999; Townsend et al., 2001). Currently efforts are under way to try to determine factors that could account for these conditions coexisting. One plausible explanation for the food insecurity-obesity paradox may be that food insecurity experiences, perceived as stressors, could prompt individuals to engage in emotional eating behaviors. Food insecurity and obesity share similar psychosocial and behavioral factors that could explain their coexistence. Stress and emotional eating have been investigated as determinants found to affect coping and eating behaviors. According to the literature, overeating becomes an emotionally-driven response for dealing with stress (Greeno & Wing, 1994; McCann et al., 1990; Wardle, 2002) (Arnow et al., 1995; Ganley, 1989; Timmerman & Acton, 2001) and is documented as one of many maladaptive behaviors that may indirectly lead to overweight and obesity (Epel et al., 2001; Wardle et al., 2002).

To examine the food insecurity-obesity paradox, this study investigated hypothesized relationships between food insecurity, perceived stress, emotional eating and overweight and/or obesity. Because the literature suggests that the food insecurity and obesity relationship exists primarily among women, this study assessed these relationships among a sample of low-income women. To assess these relationships among a sample of low income women, a proposed
moderation analysis model was used to examine the following research questions: (1) Does food insecurity predict overweight/obesity? (2) Does perceived stress predict overweight/obesity? (3) Does emotional eating predict overweight/obesity? (4) Do perceived stress and emotional eating moderate an association between food insecurity and overweight/obesity? No significant predictions or modifying effects were found for the conceptual model overall.

Research Questions

In the current study, food insecurity did not significantly predict BMI, in contrast to other studies. Past studies evaluating the food insecurity and obesity phenomenon found the prevalence of obesity was significantly higher in mild and moderate food insecure women than in food secure women (Adams et al., 2003; Frongillo et al., 1997; Olson, 1999; Townsend et al., 2001). Kendall et al. (1996) and Townsend and associates (2001) proposed that individuals who experience food insecurity may be predisposed to obesity similarly as those who experience 'yo-yo' weight cycles of weight loss and regain, making it difficult to maintain a healthy weight. Two unique findings could explain why food insecurity did not predict obesity. First, rate of food insecurity with hunger were high, 9.5%, compared to a national prevalence of 3.9% in 2005 (Nord et al., 2006). In previous studies, no relationships were noted between obesity and food insecurity with hunger (Frongillo et al., 1997; Olson, 1999). Secondly, more than one half of the participants in all food security categories were obese in this study. The high obesity rates among African American women (Ogden et al., 2006), and across food insecurity categories in this study, suggest that obesity in
this population is a multifactorial condition with possible cultural components (Kumanyika, 1994; Kumanyika, Gary, Lancaster et al., 2005).

The second research question assessed whether perceived stress predicted BMI. In this study, perceived stress was the only predictor of BMI. This finding is consistent with those from studies from the psychological literature on perceived stress. Numerous studies have proposed a role of perceived stress and negative mood in overeating, with perceived stress emerging as a predictor of overeating in non-disordered eating samples (Epel et al., 2001; Pinaquy et al., 2003). These studies suggest that women who perceive life events to be stressful may have an increased likelihood of being overweight or obese. According to the perceived stress concept, an individual examines her experiences associated with her loss of control in stressful situations (Cohen & Williamson, 1988), which may result in a number of responses that could lead to weight gain such as overeating, reduced physical activity, depression or substance abuse. Further, a number of studies have shown that people experiencing distress tend to gain weight (Ganley, 1989). Relationships among perceived stress, eating behaviors and BMI in low-income African American populations deserve further exploration.

Analysis of the data related to the third research question found no predictive relationship between emotional eating and BMI. Participants' mean scores on the EES scales (Anger/frustration = 10.78, SD = 8.65; Anxiety = 9.42, SD = 7.30; Depression = 6.10, SD = 4.71) were similar to those reported among non-eating-disordered women (Waller & Osman, 1998) and considerably below.

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those found among binge eaters. These data suggest that emotional eating does not play a role in weight status of food insecure women in this study. Alternatively, the negative emotional constructs measured with this instrument may not be those that are operative in this population. There is little available evidence on the role of emotions in eating in populations without diagnosed eating disorders. Kumanyika (1994) and others (Kumanyika, Gary, Lancaster et al., 2005) identify a broad need for further research on behavioral factors contributing to obesity in high risk ethnic minority populations.

There was no moderation noted between food insecurity, perceived stress, and emotional eating in relationship to BMI. Moderation was not expected since food insecurity and emotional eating did not predict BMI in the first regression analyses. In this study, more than 50 percent of women were obese for all food security categories. The high rates of obesity among all groups in this sample may have masked any potential for predicting obesity. This study did provide some insight regarding obesity perceptions in the study population. More than 70 percent of the women in this study were overweight and obese, but only 54 percent of overweight and only 14% of obese women perceived their weight status accurately. This finding is consistent with that of Mossavar-Rahmani and colleagues (Mossavar-Rahmani, Pelto, Ferris, & Allen, 1996). A possible explanation for this finding is that African American females are less concerned with weight and are more accepting of larger body image than other ethnic groups (Akan & Grilo, 1995; Gluck & Geliebter, 2002).
Limitations

Several limitations of the present study should be acknowledged. Due to the cross-sectional design of the study, causality could not be established. Another limitation of the present study was that the data on food security, stress, and emotional eating were collected using self-reported measures. Self-reported data at the time of data collection may underestimate or overestimate perceived events and result in misclassification of BMI, perceived stress, food insecurity and emotional eating (Rowland, 1990).

Recommendations for Future Research

Further investigation into the food insecurity and obesity paradox using qualitative research approaches to explore coping strategies and ethnic and cultural differences in eating behaviors may provide the foundation for understanding how factors such as food insecurity, stress, emotional eating and others may contribute to obesity. Research is also needed examining racial/ethnic and cultural characteristics of low-socioeconomic women living in the South, where rates of obesity are the highest in the nation. Since obesity develops over many years and involves a multitude of factors (behavioral, genetic, psychosocial, and environmental), future research should include longitudinal components to capture effects of changing environmental factors and psychosocial and behavioral responses that could contribute to overweight/obesity among low-income populations.
APPENDIX A

Hypothesized Model of Relationships among Food Insecurity, Perceived Stress, Emotional Eating and Overweight/Obesity

Food Insecurity → Stress → Emotional Eating → Overweight/Obesity (BMI)

Emotional Eating:
- Anger/Frustration
- Anxiety
- Depression

Food Insecurity X Stress X Emotional Eating
The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: C26073101
PROJECT TITLE: Examining Relationships Among Obesity, Food Insecurity, Stress, and Emotional Eating Among Low-Income African American Women
PROPOSED PROJECT DATES: 08/07/06 to 12/14/07
PROJECT TYPE: Dissertation or Thesis
PRINCIPAL INVESTIGATORS: Kristi L. Lofton
COLLEGE/DIVISION: College of Health
DEPARTMENT: Nutrition and Food Systems
FUNDING AGENCY: Southern Rural Development Center/Delta NIRI
HSPRC COMMITTEE ACTION: Change to a Previously Approved Project
PERIOD OF APPROVAL: 08/28/06 to 08/27/07

Lawrence A. Hosman, Ph.D.
HSPRC Chair
June 21, 2006

The University of Southern Mississippi
Dr. Carol Connell
118 College Drive
P.O. Box 5054
Hattiesburg, MS 39406

Dear Dr. Connell,

PACE Head Start supports your effort to assess food insecurity, stress, emotional eating, obesity, and the nutrition education needs of parents.

Nutrition is an important component of PACE Head Start, and we will be happy to work with you to identify nutrition education needs of our parents and staff, so that the problem of overweight and obesity among young children and their families can be adequately addressed.

If I can be of further assistance, please feel free to contact me at (601) 545-8110.

Sincerely,

[Signature]

Dr. Peggy Answorth
Executive Director
APPENDIX D

Informed Consent

THE UNIVERSITY OF SOUTHERN MISSISSIPPI
Authorization to Participate in Research Project

Dear Participant:

You are invited to participate in a research study to better understand food situations in the household, weight status, stress and eating behaviors. The research will consist of a researcher or research assistant measuring your height and weight and your completion of a survey. The survey contains questions about how you perceive your household food situation, what you think about stress and what feelings give you the urge to eat. It will take approximately 10 to 20 minutes to complete measurements and the survey.

Your measurements and answers to the survey are strictly confidential and will not be shared with anyone. Your participation is voluntary and you may refuse to participate at any time. There are no known risks involved in this study, and the only inconvenience will be the time it takes to conduct measurements and complete the survey. All information collected will be kept locked in filing cabinets in my office, Room 215, Fritzsche-Gibbs Building; on the Hattiesburg campus of The University of Southern Mississippi. Research investigators and assistants will be available for any questions that you may have during the study. Any questions about the research may also be directed to Kristi Lofton at (601) 266-5033 or Carol Connell at (601) 266-6341.

This research project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001 at (601) 266-6620.

Signature of Participant ______________________ Date _____________

Witness Signature ___________________________ Date _____________

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APPENDIX E
Survey Instrument

Examining the Relationships Among Obesity, Food insecurity, Stress and Emotional Eating

Instructions: Please answer each of the following questions by checking or writing the response that applies to you. Remember that all of your answers are important and confidential.

1. Are you a participant in one or more of the following programs (check all that apply)?
   _____ Parent/guardian of a child or children attending Head Start
   _____ Parent/guardian or participant in the food stamp program
   _____ Parent/guardian of a child or children receiving free meals

2. What is your gender?
   _____ Male   _____ Female

3. What is your age?
   _____ years old

4. What is your marital status (check one)?
   _____ Single
   _____ Single but sharing a household with a partner
   _____ Married
   _____ Separated
   _____ Divorced
   _____ Widowed

5. What is your race or ethnicity?
   _____ African-American
   _____ Caucasian
   _____ Hispanic
   _____ Native American
   _____ Asian
   _____ Other
ID:________

6. What is the highest level of education you have completed (check one)?
   _____Less than High School
   _____Some High School
   _____High School Graduate
   _____Some college or Special Training
   _____2-Year College Graduate
   _____4-Year College Graduate
   _____Graduate or professional school

7. Please estimate your height and weight to the best of your ability.
   Height: _____Feet _____Inches
   Weight: _____Pounds

8. How would you describe your current weight status (check one)?
   _____Underweight
   _____Normal weight (appropriate for your height)
   _____Overweight
   _____Obese

9. How many people live with you in your household?
   ______

10. Which of the following describes your family's yearly income (before taxes)?
    _____ $0 - $9,999
    _____ $10,000 - $19,999
    _____ $20,000 - $29,999
    _____ $30,000 - $39,999
    _____ $40,000 - $49,999
    _____ $50,000 - $59,999
    _____ above $60,000

PLEASE CONTINUE TO THE NEXT SURVEY
USDA 6-Month Food Security Scale Questionnaire

Instructions: The next questions are about the food eaten in your household in the last 4 months and whether you were able to afford the food you need. For each of the questions below, circle the response that best describe you or members of your household in the last 6 months since April 2006.

1. The food that you or other members of your household bought didn't last, and you or other members of your household didn't have money to get more.
   [ 1 ] Often true
   [ 2 ] Sometimes true
   [ 3 ] Never true
   [ 4 ] Don't Know or Refuse to Answer

2. (I/we) couldn't afford to eat balanced meals.
   [ 1 ] Often true
   [ 2 ] Sometimes true
   [ 3 ] Never true
   [ 4 ] Don't Know or Refuse to Answer

3. In the last 4 months, since April 2006, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?
   [ 1 ] Yes
   [ 2 ] No [GO TO QUESTION #5; DO NOT ANSWER #4]
   [ 3 ] Do not Know or Refuse to Answer [GO TO QUESTION #5; DO NOT ANSWER #4]

4. ANSWER ONLY IF #3 = YES How often did this happen?
   [ 1 ] Almost every month
   [ 2 ] Some months but not every month
   [ 3 ] Only 1 or 2 months
   [ 4 ] Don't Know or Refuse to Answer

4. In the last 4 months, since April 2006, did you ever eat less than you felt you should because there wasn’t enough money to buy food?
   [ 1 ] Yes
   [ 2 ] No
   [ 3 ] Don’t Know or Refuse to Answer

PLEASE CONTINUE TO THE NEXT SURVEY
6. In the last 4 months since April 2006, were you ever hungry but didn't eat because you couldn't afford enough food?  
   [ 1 ] Yes  
   [ 2 ] No  
   [ 3 ] Don't Know or Refuse to Answer
Perceived Stress Scale

Instructions: The following questions ask you about your feelings and thoughts during the last 4 months since April 2006. In each case, please circle how often you felt or thought a certain way.

1. In the last 4 months, how often have you been upset because of something that happened unexpectedly?
   [ 0 ] Never
   [ 1 ] Almost Never
   [ 2 ] Sometimes
   [ 3 ] Fairly Often
   [ 4 ] Very Often

2. In the last 4 months, since April, how often have you felt that you were unable to control the important things in your life?
   [ 0 ] Never
   [ 1 ] Almost Never
   [ 2 ] Sometimes
   [ 3 ] Fairly Often
   [ 4 ] Very Often

3. In the last 4 months, since April, how often have you felt nervous and “stressed”?
   [ 0 ] Never
   [ 1 ] Almost Never
   [ 2 ] Sometimes
   [ 3 ] Fairly Often
   [ 4 ] Very Often

4. In the last 4 months, since April, how often have you felt confident about your ability to handle your personal problems?
   [ 0 ] Never
   [ 1 ] Almost Never
   [ 2 ] Sometimes
   [ 3 ] Fairly Often
   [ 4 ] Very Often

PLEASE CONTINUE TO THE NEXT SURVEY
5. In the last 4 months, since April 2006, how often have you felt that things were going your way?

[ 0 ] Never
[ 1 ] Almost Never
[ 2 ] Sometimes
[ 3 ] Fairly Often
[ 4 ] Very Often

6. In the last 4 months, since April 2006, how often have you found that you could not cope with all the things that you had to do?

[ 0 ] Never
[ 1 ] Almost Never
[ 2 ] Sometimes
[ 3 ] Fairly Often
[ 4 ] Very Often

7. In the last 4 months, since April 2006, how often have you been able to control irritations in your life?

[ 0 ] Never
[ 1 ] Almost Never
[ 2 ] Sometimes
[ 3 ] Fairly Often
[ 4 ] Very Often

8. In the last 4 months, since April 2006, how often have you felt that you were on top of things?

[ 0 ] Never
[ 1 ] Almost Never
[ 2 ] Sometimes
[ 3 ] Fairly Often
[ 4 ] Very Often

9. In the last 4 months, since April 2006, how often have you been angered because of things that were outside of your control?

[ 0 ] Never
[ 1 ] Almost Never
[ 2 ] Sometimes
[ 3 ] Fairly Often
[ 4 ] Very Often

PLEASE CONTINUE TO THE NEXT SURVEY
10. In the last 4 months, since April 2006, how often have you felt difficulties were piling up so high that you could not overcome them?

[ 0 ] Never
[ 1 ] Almost Never
[ 2 ] Sometimes
[ 3 ] Fairly Often
[ 4 ] Very Often

PLEASE CONTINUE TO THE NEXT SURVEY
Id: __________

**Emotional Eating Scale**

**Instructions:** Circle how strong you feel an urge to eat for each of the following emotions.

I have an urge to eat when I feel...

<table>
<thead>
<tr>
<th>Emotion</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resentful</td>
<td>No Desire</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
</tr>
<tr>
<td>Discouraged</td>
<td>No Desire</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
</tr>
<tr>
<td>Shaky</td>
<td>No Desire</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
</tr>
<tr>
<td>Worn Out</td>
<td>No Desire</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
</tr>
<tr>
<td>Inadequate</td>
<td>No Desire</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
</tr>
<tr>
<td>Excited</td>
<td>No Desire</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
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</tbody>
</table>

PLEASE CONTINUE TO THE NEXT SURVEY
### I have an urge to eat when I feel...

#### ID: __________

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<tbody>
<tr>
<td>0</td>
<td>No Desire</td>
<td>No Desire</td>
<td>No Desire</td>
<td>No Desire</td>
<td>No Desire</td>
<td>No Desire</td>
<td>No Desire</td>
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<tr>
<td>1</td>
<td>A Small</td>
<td>A Small</td>
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<td>A Small</td>
<td>A Small</td>
<td>A Small</td>
<td>A Small</td>
<td>A Small</td>
</tr>
<tr>
<td>2</td>
<td>A Moderate</td>
<td>A Moderate</td>
<td>A Moderate</td>
<td>A Moderate</td>
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<tr>
<td>3</td>
<td>A Strong</td>
<td>A Strong</td>
<td>A Strong</td>
<td>A Strong</td>
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<td>A Strong</td>
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**PLEASE CONTINUE TO THE NEXT SURVEY**
I have an urge to eat when I feel...

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<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Desire</td>
<td>1</td>
<td>A Small</td>
<td>0</td>
<td>No Desire</td>
<td>1</td>
<td>A Small</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>to Eat</td>
<td></td>
<td>Desire to Eat</td>
<td>2</td>
<td>to Eat</td>
<td></td>
<td>Desire to Eat</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A Moderate</td>
<td>3</td>
<td></td>
<td></td>
<td>A Moderate</td>
<td>3</td>
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<td></td>
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<td></td>
<td></td>
<td>Desire to Eat</td>
<td>An</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A Strong</td>
<td>Urge to Eat</td>
<td></td>
<td></td>
<td>A Strong</td>
<td>Urge to Eat</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>An</td>
<td></td>
<td></td>
<td>A Strong</td>
<td>Urge to Eat</td>
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<td>Urge to Eat</td>
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<td>A Strong</td>
<td>Urge to Eat</td>
</tr>
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<td></td>
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<td></td>
<td>A Strong</td>
<td>Urge to Eat</td>
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<td></td>
<td></td>
<td>A Strong</td>
<td>Urge to Eat</td>
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<tr>
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<td>A Strong</td>
<td>Urge to Eat</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>A Strong</td>
<td>Urge to Eat</td>
</tr>
</tbody>
</table>

PLEASE CONTINUE TO THE NEXT SURVEY
I have an urge to eat when I feel...

23. **Bored**

<table>
<thead>
<tr>
<th></th>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Desire to Eat</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
<td></td>
</tr>
</tbody>
</table>

24. **Helpless**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Desire to Eat</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
<td></td>
</tr>
</tbody>
</table>

25. **Upset**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Desire to Eat</td>
<td>A Small Desire to Eat</td>
<td>A Moderate Desire to Eat</td>
<td>A Strong Urge to Eat</td>
<td>An Overwhelming Urge to Eat</td>
<td></td>
</tr>
</tbody>
</table>

THANK YOU FOR YOUR PARTICIPATION.
APPENDIX F

Data Collector Anthropometric Form

____________________ ID

HEIGHT:_______________

DATA COLLECTOR
INITIAL:_______________

WEIGHT:

DATA COLLECTOR
INITIAL:_______________

*STAPLE A COPY OF THE TANITA PRINTOUT TO THIS FORM.*
REFERENCES


Psychology, 51, 1173-1182.


Institute of Diabetes and Digestive and Kidney Diseases. Retrieved from:


Hamilton, W., Cook, J., Thompson,W., Buron, L., Frongillo, Jr., E., Olson, C.,


Jones, S., Jahns, L., Laraia, B., & Haughton, B. (2003). Lower risk of overweight in school-aged food insecure girls who participate in food...


behavior and body mass index and predictors of this behavior. *Preventive Medicine*, 34, 29-39.


United States Department of Health and Human Services, Administration for...


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