1-1-2013

Examining the Influence of Nutritional Behaviors, Knowledge and Attitudes on Body Mass Index of Adults in North Mississippi

Gloria Therese Broughan

Examining the influence of nutritional behaviors, knowledge and attitudes on body mass index of adults in north Mississippi

By

Gloria Therese Broughan

A Thesis
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Master of Science
in Nutrition
in the Department of Food Science, Nutrition, and Health Promotion

Mississippi State, Mississippi

December 2013

Examining the influence of nutritional behaviors, knowledge and attitudes on body mass index of adults in north Mississippi

By

Gloria Therese Broughan

Approved:

_____

Diane K. Tidwell
(Major Professor)

_____

Chiquita A. Briley
(Committee Member)

_____

Ginger W. Cross
(Committee Member)

_____

Z. Zee Haque
(Graduate Coordinator)

_____

George M. Hopper
Dean
College of Agriculture and Life Sciences

Name: Gloria Therese Broughan

Date of Degree: December 14, 2013

Institution: Mississippi State University

Major Field: Nutrition

Major Professor: Diane K. Tidwell

Title of Study: Examining the influence of nutritional behaviors, knowledge and attitudes on body mass index of adults in north Mississippi

Pages in Study: 73

Candidate for Degree of Master of Science

Individuals with weight statuses approaching obesity may be at risk for chronic health problems. Diet, weight, health behaviors, level of knowledge, and attitudes or perceptions have been identified as key factors influencing body weight. The purpose of this study was to determine which factors were related to BMI in adults in north Mississippi and to determine if there were relationships between those factors. A telephone survey was conducted with 500 participants (mean age 46.3 ± 18.5). The average BMI was 27.5 ± 6.2 kg/m^2. Knowledge and attitude/perception-based data were associated with a higher BMI in the population more than dietary behaviors. Significant correlations ($p < .05$) existed between fried food consumption and knowledge of overweight and obesity consequences, dietary attitudes and fruit and vegetable intake and fried food intake, self-reported risk for type 2 diabetes and cardiovascular disease and perception of health.

Keywords: obesity, fruit and vegetable intake, dietary behaviors

ACKNOWLEDGEMENTS

I would like to thank my committee members – Dr. Diane Tidwell, Dr. Chiquita Briley, and Dr. Ginger Cross – for the guidance and dedication they have extended to me during the process of this thesis; however, I am not sure I can truly express in words my gratitude for their support. Dr. Tidwell was there every time I needed her help during this process; no question was too big or too small. Without Dr. Briley's inspiration and encouragement, this thesis would not have been possible. I am truly grateful for the opportunity to have worked with her on many aspects of this research. Dr. Cross provided a phenomenal amount of support and mentorship during this process. Her patience and dedication in helping me with this research has helped me grow both professionally and personally.

Attending Mississippi State University has provided me more opportunities than I ever thought possible and I would not have had my experience as a graduate student any other way. Never have I encountered such a dedicated group of educators, professionals, and peers; to work with everyone was truly a gift. Lastly, I am extremely lucky and grateful to have my wonderful husband, Mark, who has always supported me in achieving my goals. The love and encouragement he has given and the many sacrifices he has made to help me pursue my Master's degree have been the greatest contribution I could ask for.

Research reported in this thesis was supported by the Office Of The Director, National Institutes Of Health of the National Institutes of Health under Award Number R25OD011162. The content is solely the responsibility of the author and does not necessarily represent the official views of the National Institutes of Health.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Overweight and obesity have become prominent public health concerns as the prevalence of these has increased significantly since the 1990s. Surveys conducted by the Centers for Disease Control and Prevention (CDC) in 2009 and 2010 revealed that nearly 69 percent of American adults were overweight or obese (CDC, 2013a). Almost one third of children and adolescents were obese in 2009 and 2010 (U.S. Department of Health and Human Services [USDHHS], 2012a).

Based on the CDC's Behavioral Risk Factor Surveillance System (BRFSS), in 2012 the lowest prevalence of obesity in the United States was in Colorado (20.5%) and the highest was in Mississippi (34.6%). In 2011, not only did Mississippi have the greatest prevalence of overweight and obesity (68.9%), but also, Mississippi had the highest prevalence of diabetes (12.3%) and physical inactivity (36%) as well as the second highest prevalence of hypertension (39.2%). In 2012, Mississippi residents made slight improvements to their health statuses in these areas; however, the prevalence of overweight, obesity, diabetes, physical inactivity and hypertension still remained among the highest compared to other states (Trust for America's Health, 2012).

Body mass index (BMI) measurements, determined by weight (kg) per height (m^2) are used as a screening tool to identify health risks associated with weight problems. A BMI of 25-29.9 is considered overweight and a BMI of 30 or greater is obese (CDC,

2012a). Overweight and obesity are linked to a number of causes including excess energy intake, inadequate physical activity, genetics, social and environmental factors, and eating habits learned as early as infancy and childhood (CDC, 2012b; Esposito et al., 2009). The level of nutritional knowledge may affect weight status and weight maintenance in some populations (Park et al., 2013; Wardle et al., 2000). Additionally, perceptions of health and weight status may also predict discrepancies between clinical BMI categories and perceived categories as well as other health risks linked to an increased weight status (Brener et al., 2004; Chang & Christakis, 2003).

Numerous health problems can result in people with an elevated weight status, and as weight increases towards obesity the risks for these health problems also increase. Cardiovascular problems including hypertension, dyslipidemia, hypercholesterolemia, coronary heart disease, and risk for heart attacks are particularly significant in overweight and obese individuals (National Institutes of Health & National Heart, Lung, and Blood Institute [NIH/NHLBI], 1998; USDHHS, 2012b). Type 2 diabetes, certain types of cancer, poor lung function, depression, osteoarthritis, liver and gallbladder disease, incontinence, stroke, premature death, and an overall reduced quality of life are other health-related consequences of overweight and obesity (CDC, 2012b; French et al., 1995; NIH, 2012, 2013; Reeves et al., 2008; Schnieder et al., 2012; USDHHS, 2011, 2012b, Zammit et al., 2010).

Most health researchers suggest following a healthy lifestyle by being mindful of energy balance, selecting nutrient-dense low-calorie foods, consuming appropriate portion sizes, being physically active, and maintaining a healthy body weight. Overweight and obesity can be prevented (USDHHS, 2012c). National educational

campaigns including We Can! and Let's Move! use strategies that help children and families learn and practice healthy lifestyles in an effort to reduce childhood obesity and assist parents and adults in becoming role models of these lifestyle changes (Let's Move, n.d.; USDHHS, 2012d). The CDC provides recommendations for actions that can be taken at the state, community, and individual levels that would positively impact weight-related problems (CDC, 2010). Several medications and weight-loss surgeries have been identified to help with weight loss and management for some populations (USDHHS, 2012c). Adherence to certain dietary patterns can also help with weight control and improve health status. The USDA MyPlate, the 2010 Dietary Guidelines for Americans, The DASH plan, the Mediterranean Diet, and dietary recommendations given by the American Heart Association (AHA) present eating plans that are rich in plant-based foods and recommend appropriate amounts of foods from each food group (AHA, 2013a,b; Dash Diet, 2013; Sofi et al., 2008; United States Department of Agriculture [USDA] & USDHHS, 2010; USDA, 2013).

Beginning in the 1980s, the CDC has used several telephone surveys to collect health-related data of the American population at local, state, and national levels. These include the BRFSS, the National Health Interview Survey (NHIS), the National Immunization Survey (NIS), and the State and Local Area Integrated Telephone Survey (SLAITS) (CDC, 2012c,d; CDC, 2013b,c). This thesis used a telephone survey to examine nutrition-related behaviors, health-related knowledge, and attitudes and perceptions towards selected health topics that impact BMI in a representative sample of the population living in 20 counties in north Mississippi. The telephone survey was part of the needs assessment for a larger project, "Partnerships to Promote Healthy Lifestyles

for Children and Communities" sponsored by the National Institutes of Health. The goal of the larger project was to educate pre-kindergarten and kindergarten students, their parents, teachers, and community members in 20 north Mississippi counties about topics related to obesity.The project is a collaborative effort involving the following organizations at Mississippi State University: the Social Science Research Center (SSRC); the Food Science, Nutrition, and Health Promotion Department; and the School of Human Sciences.

The purpose of this thesis was to examine nutrition-related behaviors, health-related knowledge, and attitudes and perceptions towards selected health topics that impact BMI in a representative sample of the population living in 20 counties in north Mississippi. It was implemented by administering a telephone survey to adults, aged 18 years and older. The objectives of this thesis were to (1) determine which factors (behaviors, knowledge, or attitudes/perceptions) were associated with increased BMI in the participants, and (2) determine if behaviors, knowledge, or attitudes/perceptions were related to each other. The information gathered may assist in creating health programs and educational strategies for individuals and communities that can be used to reduce the prevalence of obesity.

CHAPTER II

REVIEW OF LITERATURE

Prevalence of Overweight and Obesity

Since the 1990s, the prevalence of overweight and obesity has increased markedly and has become a major public health concern. Data from the National Health and Nutrition Examination Survey (NHANES) and the BRFSS conducted by the CDC reveal that nearly 69 percent of adults in America were overweight or obese (BMI of 25 kg/m^2 or higher) in 2009 and 2010 (CDC, 2013a). Of those, nearly 36 percent were obese (BMI of 30 or higher). More men than women, 74% and 64%, respectively, were overweight or obese during this survey period. Both men and women (36% of each) were equally affected by obesity. People of different racial and ethnic groups were also affected in various ways by overweight and obesity. Nearly two-thirds of white people (66.7%), 76.7% of black people, and 78.8% of Hispanics were considered overweight or obese. Of those, 34.3% of white people, 49.5% of black people, and 39.1% of Hispanics were obese (CDC, 2013a; Flegal et al., 2012; USDHHS, 2012a).

Among children and adolescents, 26.7% of those aged 2-5 years, 32.6% of those aged 6-11 years, and 33.6% of those aged 12-19 were overweight or obese in 2009 and 2010 (USDHHS, 2012a). The prevalence of obesity among these age groups also increased as age increased. Overall, among male and female children and adolescents

aged 2-19 years, 31.8% were considered to be overweight or obese; about half of those youth (16.9%) were considered to be obese (USDHHS, 2012a).

The BRFSS survey provides estimates of obesity prevalence for adults in each state. In 2011, the BRFSS methodology was changed to account for the rapid rise in households that only had cellular telephones. In this year, data from self-reported weight and height revealed that 35.7% of adults were overweight and 27.8% were obese in the United States; however, these data cannot be compared to those from previous years due to the changes in methodology (CDC, 2013a).

The 2012 BRFSS report indicated discrepancies in weight status by state and region. The lowest obesity prevalence was in Colorado (20.5%) and the highest in Mississippi (34.6%). States in the southern region had the highest obesity rates, followed by those in the midwest, the northeast, and the west (CDC, 2013a).

In Mississippi in 2011, 68.9% of adults were considered overweight or obese and 34.9% were considered obese, making it the state with the highest prevalence of overweight and obesity overall. At this time, Mississippi also had the highest overall prevalence of diabetes (12.3%) and physical inactivity (36%), and the second highest prevalence of hypertension (39.2%), led only by Alabama (40%) (Trust for America's Health, 2012).

Also in 2011, approximately 16% of high school students in Mississippi were considered obese, making it the state with the second highest rate of obese high school students. Alabama, Kentucky, and Oklahoma tied for the highest occurrence of obesity among this age group at 17% in 2011 (CDC, 2013d). Based on the 2011 National Survey of Children's Health, 39.7% of Mississippi children aged 10-17 were overweight or

obese; of that age group, 21.9% were obese. Again, Mississippi was the state to have the second highest overall prevalence of overweight and obese 10-17 year old children; only Louisiana had a higher incidence (39.8%) of overweight or obese 10-17 year old children (The Child and Adolescent Health Measurement Initiative, 2012). Among low-income children aged 2-5 years in Mississippi, 13.7% were obese in 2010 (Trust for America's Health, 2012).

By 2012, although it only had a slight decrease, Mississippi was ranked as the state with the second highest overweight and obesity prevalence (69%) as well as obesity prevalence among adults (34.6%), only slightly following the prevalence of these weight statuses in Louisiana (69.6% and 34.7%, respectively). Percentages of adults with diabetes, low physical activity levels, and hypertension also had slight improvements, although none of these changes were statistically significant. In Mississippi, diabetes prevalence reached 12.5% (following West Virginia's 13%), physical inactivity decreased to 30.8% (following West Virginia's 31% and Arkansas' 31.5%), and hypertension decreased to 39.2% (following Arkansas' 40%) (Trust for America's Health, 2013).

Defining Overweight and Obesity

The CDC defines overweight and obesity for adults as "ranges for weight that are greater than what is generally considered healthy for a given height" (CDC, 2012a). These ranges of BMIs are determined by a calculation of using either of the following formulas:

$$\frac{Body\ weight\ in\ kilograms}{(height\ in\ meters)^2} \quad \text{or} \quad \frac{Body\ weight\ in\ pounds}{(height\ in\ inches)^2 \times 703} \qquad (1)$$

Established weight status categories and associated BMI ranges for adults according to the NIH/NHLBI (1998) are summarized in Table 1.

Table 1 BMI Ranges and Associated Weight Categories

BMI (kg/m^2)	Weight Status Category
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and above	Obese

Body mass index measurements are used as a screening tool to identify health risks associated with weight problems. Because a BMI measurement requires only height and weight, it is an easy and inexpensive tool for health care providers and the general public to use. Although BMI generally correlates positively with amounts of body fat, it does not measure body fat directly; therefore, it is not used as the only diagnostic tool. To determine if excess weight poses a health risk for someone with a higher than normal BMI, a healthcare provider would need to further assess body fatness through methods such as skinfold thickness measurements, underwater weighing, bioelectrical impedance, dual-energy x-ray absorptiometry, and other measures (CDC, 2012a).

For children and youth aged 2-19 years, the CDC uses the term "overweight" for those with "a body mass index [BMI] at or above the 85th percentile but less than the 95th percentile for age and sex" and "obese" for those with "a BMI at or above the 95th percentile for age and sex" (Reed et al., 2011). Growth charts developed by the CDC identify BMI-for-age and sex percentile (CDC, 2012e). Like BMI measurements for adults, BMI does not measure body fat on children directly but it can reasonably indicate body fatness for most children and teenagers (CDC, 2012e).

Health Consequences of Overweight and Obesity

Research reveals that as adult body weight increases towards overweight and obese statuses, the risks for several health conditions and preventable death also increase (NIH/NHLBI, 1998; USDHHS, 2012b). Cardiovascular abnormalities and type 2 diabetes are particularly significant health problems that have resulted in higher morbidity in overweight and obese individuals. Cardiovascular abnormalities may be characterized by the following conditions: (1) Hypertension, or elevated blood pressure (the difference in blood pressures seen in adults with a BMI of 30 or greater compared to their non-hypertensive counterparts translates to an increased risk for cardiovascular disease by approximately 12 percent and an increased risk for stroke by 24 percent for obese individuals), (2) Dyslipidemia characterized by high total blood cholesterol, high triglycerides, low high-density lipoprotein cholesterol, or elevated low-density lipoprotein cholesterol, or (3) Coronary heart disease (CHD). Overweight, obesity, and excess abdominal fat are associated with the cardiovascular risk factors of hypertension and dyslipidemia described above as well as increased morbidity and mortality from CHD. Furthermore, "the risks of nonfatal myocardial infarction and CHD death increase with increasing levels of BMI" (NIH/NHLBI, 1998).

Type 2 diabetes occurs when the body does not respond correctly to insulin. Although it can develop in people of normal weight, most people with the disease are overweight when they are diagnosed (NIH, 2013). The NIH/NHLBI (1998) reported that "27 percent of new cases of diabetes was attributable to weight gain in adulthood of 5 kg (11 lb) or more" and abdominal obesity is a major risk factor for type 2 diabetes. Additionally, obesity is associated with increased risk for several cancer types including

breast, colon, endometrial, esophageal, gallbladder, kidney, pancreatic, and thyroid. In 2007, it was estimated that as many as 40 percent of some cancers were attributed to obesity, especially endometrial cancer and esophageal adenocarcinoma (NIH, 2012).

Abdominal obesity is associated with poor lung function and other adverse effects upon the respiratory system. Those who are overweight or obese are more likely to suffer from impaired lung symptoms than those with a normal BMI. Asthma, chronic obstructive pulmonary disorder, sleep apnea, and obesity hypoventilation syndrome are examples of respiratory disorders that are more common and difficult to treat in obese individuals. Muscles involved in respiratory functions have been shown to be weaker in cases of obesity, in addition to a reduced overall fat-free body mass, this "may contribute to the additional oxygen demand required for ventilation and may heighten sensation of breathlessness in obese patients." In these patients, weight loss can alleviate these problems by restoring muscle function in the respiratory system (Zammit et al., 2010).

A relationship has also been reported between obesity and mental health disorders including low self-esteem and depression in adults, adolescents, and young children (French et al., 1995; Reeves et al., 2008; Schneider et al., 2012). Although depression can exist in individuals with a normal BMI, Schneider et al. (2012) noted that "negative moods can both prompt and result from binge eating episodes," thus creating a linkage between the two maladies. By review of cross-sectional studies, French et al. (1995) discovered that self-esteem in overweight children was lower than that of normal weight children; furthermore, self-esteem was positively associated with ratings of a "good physique" and inversely related to BMI in some populations. Because "obesity in childhood is highly predictive of adult obesity" and "depression is highly comorbid with

obesity," efforts to address both issues simultaneously should be sought in interventions (Schneider et al., 2012).

The CDC, NIH, and the Surgeon General have identified other health-related consequences of overweight and obesity. As BMI increases towards these ranges so does the risk for osteoarthritis, gynecological problems in women, liver and gallbladder disease, gallstones, incontinence, stroke, premature death, and an overall reduced quality of life (CDC, 2012b; USDHHS, 2011; USDHHS, 2012b).

Causes of Overweight and Obesity

Overweight and obesity are linked to a variety of causes including increased energy intake, inadequate energy expenditure, genetics, social and environmental factors such as the cost of foods and access to places to exercise, and health habits and feeding practices during infancy and early childhood (CDC, 2012b). Nutritional knowledge may be another factor affecting weight status and weight maintenance in many populations and some interventions that have sought to reduce overweight and obesity through increasing nutritional knowledge have shown moderate success (Brownell & Kaye, 1982; Brug et al., 2003; Contento et al., 2002). Attitudes towards weight status and nutrition principles may also predict discrepancies between clinical BMI categories and perceived BMI categories; however, studies on this relationship yield inconsistent outcomes (Hollis et al., 1986; James, 2004). Because of the variable, and sometimes interrelated nature of these factors, overweight and obesity have become complex health topics. Specific causes of overweight and obesity examined in the current research include dietary habits or behaviors, knowledge related to nutrition topics, and attitudes and perceptions about nutrition-related health topics.

Dietary behaviors

A simple energy imbalance – eating too many calories and not expending the excess energy through body functions and activities – can cause increases in body weight (CDC, 2012a; Ebbeling et al., 2002). Over a long period of time, factors that raise caloric intake or lower energy expenditure, even by a small amount, will cause obesity (Ebbeling et al., 2002). Reasons for over-consumption of calories vary greatly between individuals, communities, and cultures. Habits may be attributed to practices learned early in life, routines practiced daily in places such as work and schools, the amount and variety of foods available, influences from media marketing, and biological and genetic influences (Esposito et al., 2009; Estabrooks et al., 2008; Nevins & Hoffman, 2012).

Over-consumption of sugar-sweetened foods and beverages has been directly linked to obesity (Ludwig et al., 2001; Nevins & Hoffman, 2012). Although some sugars exist naturally in a variety of foods, it is added to many others, especially beverages such as soft drinks, energy drinks, and sports drinks (Harvard School of Public Health, 2012; Nevins & Hoffman, 2012). During the past several decades, standard soft-drink bottles have increased in size by three or more times their volume; consumption of these beverages has increased as well, providing consumers with a higher caloric intake. It is estimated that half of Americans consume sugar-sweetened beverages on any given day and for 25 percent of these people, that accounts for about 200 calories; five percent of the population consumes an estimated 567 calories daily from sugar-sweetened beverages alone (Harvard School of Public Health, 2012). Because ingestion of these beverages does not result in feelings of satiety, consumers often fail to compensate for energy at

subsequent meals following intake of calories from beverages, which may cause weight gain (Hu & Malik, 2010).

Other specific dietary patterns, such as under-consumption of fruits, vegetables, and whole grains, are likely determinants of overweight and obesity and have been linked to several of the major chronic diseases associated with obesity (Bazzano et al., 2002; He et al., 2006; Harvard School of Public Health, 2013; Liu et al., 1999; May et al., 2007). Furthermore, studies have shown that diets rich in fruits, vegetables, and whole grains can lower the risk for cardiovascular and other obesity-related chronic diseases thus providing the consumer some protection from developing these chronic diseases; whole grain and foods high in fiber content also provide a feeling of satiety which may assist in reducing overall dietary intake (Bazzanno et al., 2002; Harvard School of Public Health, 2013; Liu et al., 1999).

Research shows that consumption of fast food and foods containing trans fats, which are not always mutually exclusive, positively correlate with an increased BMI and an elevated risk for coronary heart disease, both of which are associated with obesity (Fraser et al., 2011; Oh et al., 2005, Roach et al., 2004). Trans fats can be found in a wide variety of manufactured foods including margarines, cooking oils, cookies, pastries, and salad dressings and they can exist naturally in some animal products including meat from cattle, sheep, and goats. When humans consume these items, the trans fats from the food products can become incorporated into cell membranes and lead to atherosclerosis (Chen et al., 2011).

Additionally, frequent fast food consumption has been shown to be negatively correlated with fruit and vegetable intake (Fraser et al., 2011). Because fast food "is

typically quick, convenient, cheap and uniform in its production" but also "high in saturated fats, energy dense and has low micronutrient content," consumers of these foods have higher overall energy and fat intakes and weight gain (Fraser et al., 2011). Because trans fats closely resemble saturated fats, the body has nearly equal difficulty in digesting them (Roach et al., 2004). Packaged and processed foods, including many fast food items, contain trans fats leading many Americans to consume as much as 13.3 grams of it per day (Roach et al., 2004). Based on the 2010 Dietary Guidelines for Americans, there is no recommendation for trans fat consumption; however, it is recommended that saturated fat consumption remain at less than ten percent of total calories (USDA & USDHHS, 2010).

Knowledge of nutrition principles

Knowledge of nutrition principles may also correlate with BMI and health-related behaviors. Wardle et al. (2000) reported that individuals with higher levels of nutritional knowledge were 25 times more likely to meet recommendations for fruit, vegetable, and fat intakes than those with low nutritional knowledge. Knowledge was assessed using a written survey addressing four main areas: (1) experts' recommendations regarding healthy eating, (2) nutrient content of 69 different food items, (3) daily food choices, and (4) links between diet and diseases. The results of the study suggested that dietary quality could be improved by increasing nutritional knowledge through health education (Wardle et al., 2000).

Increasing awareness that foundations for weight and health status are established during infancy and early childhood could be another potential topic for heath education. Esposito et al. (2009) established that risk for obesity and metabolic disorders begins

during gestation, and taste acquisition and food preferences are developed at birth; "The foods that women eat when they are pregnant and nursing are precisely the ones that their infants should prefer because the mothers' eating them teaches the child that these foods are available, safe, and nutritious" (Esposito et al., 2009). Although a high preference for sweet, high-energy foods and an innate aversion towards bitter-tasting ones is apparent in newborns and persists until adolescence, "with repeated exposure, infants can come to like certain foods that are bitter, particularly some vegetables" (Esposito et al., 2009). These discoveries imply that mothers and families can positively impact the health of their developing children by exposing them to nutritious foods early and often.

The Bogalusa Heart Study, a longitudinal study beginning in 1972 designed to identify "predisposing characteristics, risk factors, and lifestyle behaviors related to future [coronary artery disease]" examined all aspects of childhood health (Berenson, 2001). Only about five years into the study, when autopsies revealed plaque in the arteries and blood vessels of children with high blood pressure, it was determined that chronic cardiovascular diseases begin during childhood (Berenson, 2001; Nevins & Hoffman, 2012).

Overweight and obese children are at risk for the same chronic health issues as overweight and obese adults, even if the increased weight status does not persist into adulthood (Biro & Wien, 2010). According to the Surgeon General's 2001 Call to Action, adolescents who are overweight have a 70 percent chance of becoming overweight or obese adults. This increases to 80 percent if one or both parents are overweight or obese (USDHHS, n.d.).

Although some research supports that genes might influence weight status, the majority of studies have examined the effect of external influences that lead to overweight and obesity and how these external factors might also be used in reducing body weight (Biro & Wein, 2010; CDC, 2012b; Davison & Birch, 2001). Family involvement, particularly by parents, in recognition of excess weight and its associated health risks in children could effectively help treat childhood obesity and prevent it from occurring in the future (Park et al., 2013).

Attitudes and perceptions towards health topics

Because weight status during early childhood may indicate future health status, it is important that parental attitudes and perceptions of child body weight are correct. It is commonly observed that parents of overweight children perceive their children as being either at an appropriate weight or underweight (Garrett-Wright, 2011). Garrett-Wright (2011) compared parents' responses to a question about their perception of their child's weight to the child's actual weight status based on CDC standards. Consistent with the literature, over a quarter of the parents in the study misperceived their child's weight by underestimating it; only 5% of children in the study were actually in the "underweight" category. While 4.2% of parents estimated that their child might be overweight, 17.5% were actually in this category (Garrett-Wright, 2011).

Park et al. (2013) concluded that if parents are unable to recognize that their children are overweight or obese, they might also be less aware that these weight statuses pose a health risk. "Risk perception has been shown to be consistently associated with readiness to change health behaviors, and inaccurate parental perceptions of childhood weight status and health risk may compromise the success of interventions" (Park et al.,

2013). In this study, the majority of parents did not recognize their child as being overweight, and nearly 80% of parents did not perceive their child's weight as a health risk. Among the parents that correctly identified their child as overweight, 41% did not consider this weight status to be a health threat (Park et al., 2013). In a similar study by Young-Hyman et al. (2000), results were consistent in that less than half of parents perceived their child's overweight status as a potential health problem. Bridging the gap between parental perception of their child's weight status and the associated health problems may be necessary for achieving a healthy body weight and increasing health status in many populations (Park et al., 2013).

As children come into adolescence, misperceptions of body weight may lead individuals in this age group to also misperceive their health status. Likewise, this may affect their likelihood to engage in nutritional practices and amounts of physical activity sufficient to control weight (Brener et al., 2004). Brener et al. (2004) reported that although nearly half of high school students in a diverse sample were overweight according to BMI calculations, less than one-fourth perceived themselves as overweight. The prevalence of overweight and obesity among all age groups has increased over the past several decades and comparing oneself to one's peers may not result in an accurate perception of overweight status. Educating high school students on clinical definitions of the various weight categories may be an effective strategy for establishing accurate weight perceptions among adolescents (Brener et al., 2004).

Data from the Third National Health and Nutrition Examination Survey revealed that in a large, representative sample of Americans, many men (29.8%) and women (27.5%) did not accurately identify their own weight classification when asked, "Do you

consider yourself now to be overweight, underweight, or about the right weight?" (Chang & Christakis, 2003). Gender differences were noted, and 38.8% of clinically normal weight women classified themselves as overweight. Conversely, 32.8% of clinically overweight men considered themselves to be "about the right weight." Pervious work suggests that "there is a strong association between self-perceived weight status and weight control behavior," regardless of actual weight status; furthermore, these studies have shown that large numbers of normal weight individuals are trying to lose weight while an equally large number of overweight individuals are not (Chang & Christakis, 2003; Horm & Anderson, 1993). Social and cultural factors are likely to influence weight perception, weight loss intentions, and body size appropriateness among adults. Ecological factors including family environment, school environment, the community, and other social settings can place individuals, especially young children, at risk for developing weight problems (Davison & Birch, 2001). For these reasons, is it important for public health initiatives to address these influences in an effort to bridge the gap between medical and social definitions of appropriate body weight.

Prevention/Treatment Strategies

The CDC provides recommendations for actions that can be taken to positively impact the problem of obesity at Federal, state, community, and individual levels. At the U.S. Government level, national programs can be initiated and promoted to support the effort to fight obesity. Such programs might establish policies that can be used in schools and communities that allow children and adults to have access to affordable, healthy foods, and increase time spent being physically active (CDC, 2010).

National educational campaigns such as We Can! (Ways to Enhance Children's Activity & Nutrition), which is a campaign of the NHLBI, aim to raise awareness and disseminate key health messages to the public (USDHHS, 2012d). We Can! is an evidence-based program that develops and disseminates educational materials to parents and caregivers, forms partnerships with communities, sends messages to the public via media outlets, and assesses its impact to improve upon programming in the future. Using these strategies, We Can! seeks to help children aged 8 to 13 years old maintain a healthy weight. In 2010 the Federal Government began funding Let's Move!, which is a national campaign that seeks to solve the problem of childhood obesity in America. As a part of the initiative, President Barack Obama established the Task Force on Childhood Obesity to plan strategies, actions, and recommendations that can effectively reduce the rate of childhood obesity to five percent by 2030. This Task Force determined five focus areas for the initiative: (1) create healthy nutrition and physical activity environments for young children, (2) empower parents and caregivers to promote healthy lifestyles for children, (3) provide healthy food options in schools, (4) improve access to healthy, affordable foods, and (5) increase physical activity among children (Let's Move!, n.d).

Actions that promote health and aim to control weight status at the state level include incentivizing the sale of healthy foods in food stores and farmer's markets; implementing and expanding programs that provide local produce to schools; encouraging breastfeeding in hospitals; and implementing policies that promote bicycling and public transportation (CDC, 2010). Within communities, safe neighborhoods and play areas for physical activity can be maintained. Communities can also advocate for many of the actions at the state level, such as implementing policies for physical

education in schools, establishing breastfeeding support programs, and expanding programs that provide local fruits and vegetables in various community establishments (CDC, 2010).

The CDC recommends many lifestyle modifications that individuals can make to combat obesity. These include increasing intake of fruits and vegetables while reducing consumption of foods high in fat and sugar, drinking more water, limiting screen time, promoting policies that bring healthy choices to homes and communities, and becoming more physically active (CDC, 2010). The NIH/NHLBI also provide information on the treatment of overweight and obesity at the individual level (USDHHS, 2012c). Lifestyle changes that involve following a healthy eating plan and learning new healthy habits over time are key factors in achieving long-term weight loss and maintenance. Learning the appropriate caloric needs for safe weight loss, obtaining necessary nutrients by consuming items from each food group, limiting foods that are high in saturated fat, learning appropriate portion sizes for meals and snacks, and being physically active are other healthy lifestyle changes endorsed by the NIH. The NIH/NHLBI outline one strategy for preventing overweight and obesity: following a healthy lifestyle. Because many lifestyle habits are learned during childhood, parents and families are encouraged to follow healthy living patterns together. Suggestions to facilitate this include being mindful of energy balance, consuming appropriate portion sizes especially for meals eaten away from home, being physically active, limiting screen time, and keeping track of weight, BMI, and waist circumference (USDHHS, 2012c).

Similarly, the report, "The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity" outlines several strategies that can be used to address

body weight. These include requiring physical education in schools, providing more healthy food options in schools, and providing recreational facilities for all community members. The Call to Action particularly emphasizes using regular physical activity as a strategy for weight control as well as a method to combat many of the chronic diseases that accompany an overweight or obese weight status. When done on a regular basis, moderate amounts of basic activities such as yard work, walking, taking the stairs, dancing, or participating in team sports can burn enough calories to compensate for energy intake and can reduce body weight. Although many people are at risk for obesity during any point during their lifetime, growing evidence suggests that the risk begins during gestation. Maternal interactions and influences occurring from birth to adolescence that might impact weight status must be considered for obesity prevention or intervention (Esposito et al., 2009). Physical activity, planning for healthy meals and snacks, and healthy role modeling by parents are recommendations from the Surgeon General for decreasing overweight and obesity in children and adolescents (USDHHS, n.d).

Beyond individual lifestyle choices and social/environmental strategies, several medicines have been approved by the Food and Drug Administration (FDA) to assist in weight loss and management. Orlistat (Xenical ®and Alli ®) generally causes people to lose between five and ten pounds over six months. These medicines cause weight loss by reducing the absorption of fat by the body. However, absorption of the fat-soluble vitamins A, D, E, and K is also reduced. These medicines may cause mild side effects, interact with other drugs, and in rare cases, cause liver disease. The medicines Lorcaserin Hydrochloride (Belviq®) and Qsymia™ have also been approved by the FDA for weight

loss in individuals with of BMI of 27 or higher who also have a weight-related condition such as type 2 diabetes or high blood pressure. These medicines are intended to be used in combination with a reduced-calorie diet and regular physical activity. Some prescription medicines, although not approved by the FDA for obesity treatment, are prescribed as weight loss medications because weight loss can be a side effect. These include some anti-depressants, medicines to treat seizures, and medicines to treat diabetes (USDHHS, 2012c).

Several types of weight-loss surgery may be an option for very obese individuals as well as obese people who also have life threatening conditions such as sleep apnea, certain heart diseases, and severe type 2 diabetes. Banded gastroplasty surgery and Roux-en-Y gastric bypass surgery are two operations which limit the amount of food and liquids the body can hold, and limit the amount of calories that can be taken in at one time. Although these surgeries can reduce body weight and improve health, they can also be risky and involve perilous side effects. Major lifestyle changes and medical follow-up are needed after weight loss surgery (USDHHS, 2012c).

Although the strategies to reduce and prevent the prevalence of overweight and obesity are many, one "best" strategy has not been defined. Galani and Schneider (2007) sought to discover if lifestyle interventions targeting weight loss were effective in mid- to long-term prevention and treatment of obesity. The meta-analysis reviewed 13 studies in the prevention of obesity and 17 studies in the treatment of obesity. Findings indicated that lifestyle interventions, which involved dietary counseling and physical activity to achieve and maintain a healthy weight reduction, were effective in significantly reducing body weight and cardiovascular risks for a follow-up of about three years. Little

information is available on the effects of lifestyle interventions over a lifetime; further research is necessary to determine this (Galani & Schneider, 2007).

Weight Management Strategies using Nutrition Guidance

Many nutrition plans and dietary patterns may be recommended to achieve and maintain good health; however, there is no single dietary design that has been established as the best for health or weight control. Over the past several decades, the USDA has developed food guidance systems deemed appropriate for most Americans and presented these to the public via various graphic representations (Britten et al., 2006; Haven et al., 2006; USDA, 2011).

The most recent of these, presented in 2011, is the USDA MyPlate. The MyPlate illustrates the five food groups – fruits, vegetables, grains, protein foods, and dairy – in a place setting for a meal in order to facilitate building a healthy plate during each meal (USDA, 2013). When following the MyPlate eating plan, most people should consume one and a half to two cups of fruits, two and a half to three cups of vegetables, five to eight ounce equivalents of grains, five to six ounce equivalents of protein foods, and three cups of dairy products daily. By current USDA standards, oils are not recognized as a food group; however, they are recommended to be consumed in small amounts because the polyunsaturated and monounsaturated fatty acids they contain are necessary for good health. An illustration of the USDA MyPlate is presented in Figure 1 (USDA, 2013).

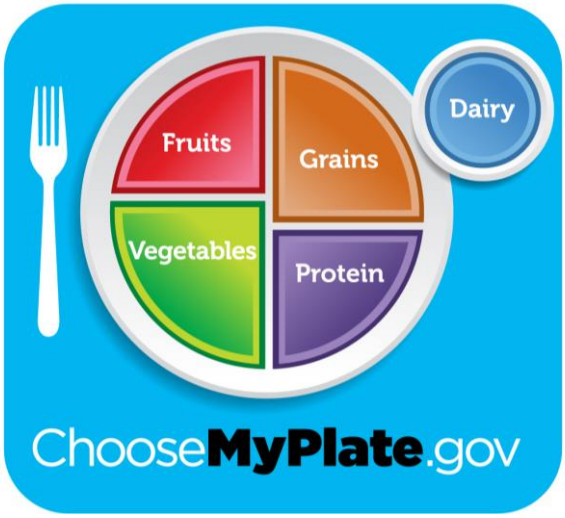

Figure 1 USDA MyPlate Diagram

The Dietary Guidelines for Americans, developed by the USDA and USDHHS, is reviewed, updated, and published every five years. The most recent update of this document was published in 2010 and is based on "scientific evidence that…may help people attain and maintain a healthy weight, reduce the risk of chronic disease, and promote overall health" (USDA & USDHHS, 2010). The information it provides is meant to apply to the American population, ages 2 years and older, to help individuals maximize the nutritional content of their meals and decrease their risk of chronic disease, even in the absence of overweight or obesity. The 2010 Dietary Guidelines for Americans recommends that most people consume one and a half to two cups of fruit, two and a half to three cups of vegetables, six to seven ounce equivalents of grains, five to six ounce equivalents of protein foods, three cups of dairy, and 24-29 grams of oils daily (USDA & USDHHS, 2010).

The DASH, or Dietary Approaches to Stop Hypertension, eating plan was developed to lower blood pressure for those with hypertension. In addition to a specific eating pattern, the DASH plan also limits sodium intake to 1500 milligrams per day. Scientific trials have shown that the DASH plan may effectively lower blood pressure (USDHHS, 2003). Further research has shown that adherence to the DASH plan may yield other health benefits as well, including weight loss and maintenance, and lowered risks of coronary heart disease, stroke, type 2 diabetes, kidney stones, and some cancers (DASH Diet, 2013; DeKoning et al., 2011; Fung et al., 2008; Fung et al., 2011; Taylor et al., 2009). Following the DASH pattern, daily food consumption would include four to six servings of fruits, four to six servings of vegetables, six to twelve servings of grains, one and a half to two and a half servings of lean meats and fish, and two to four servings of dairy. Recommendations for nuts, seeds, and legumes are given on a weekly basis, three to six servings per week for most, and fats and sweets may be included two to four times per day for some, although items in these categories are generally limited (Dash Diet, 2013).

The AHA endorses a diet similar to the DASH plan. Additionally, its guidelines indicate that for most adults, sugar sweetened beverages should be limited to 36 ounces or less per week, processed meats to two servings or less per week, and saturated fat to less than seven percent of total energy intake. Other specific recommendations regarding fish, fiber-rich whole grains, nuts, legumes, and seeds are made, as these foods are associated with reduced incidence of heart disease. (AHA, 2013a,b). Specifically, the AHA suggests four to five servings of fruit, four to five servings of vegetables, six to eight servings of grains, no more than six ounces of lean meats and seafood, two to three

servings of low-fat or fat-free dairy products, and two to three servings of fats and oils per day. Nuts, seeds, and legumes are recommended on a weekly basis and servings of these should fall between three and five servings each week. Sweets and added sugars should not be consumed more than five times per week (AHA, 2013b).

The Mediterranean Diet is an eating plan recognized in the Dietary Guidelines for Americans as a plan that can promote health and reduce the risk of death from chronic diseases and prevent the onset of many chronic diseases (Sofi et al., 2008; USDA & USDHHS, 2010). Research reveals that adherence to the Mediterranean Diet is associated with reduced risk of death and incidents associated with cardiovascular disease (Estruch et al., 2013; Hoevenaar-Blom et al., 2012). The Mediterranean Diet emphasizes many of the same principles as the DASH plan, and although it does not give a specific guideline for sodium intake, it does promote the use of herbs and spices in place of salt to make foods more palatable. The Mediterranean Diet does not outline specific amounts or equivalents to consume from each food group. The diet emphasizes that fruits, vegetables, grains, and other plant-based foods such as legumes and nuts must comprise the majority of food consumed. Fish and poultry should be eaten at least two times per week, and red meats should be limited to only a few times per month. Low-fat dairy products are also recommended to include in moderation. Olive oil should primarily replace butter and margarine in the diet. Overall, the diet is low in saturated fat (less than or equal to 7-8% of energy intake) with total fat ranging from 25-35% of energy intake. The diet plan also states that a moderate amount of red wine can yield health benefits; however, this recommendation may not apply to everyone (Willett et al., 1995).

All of these food patterns, although they contain slight differences, present eating plans that are rich in plant-based foods such as fruits, vegetables, whole grains, and legumes. Meat and animal products are presented as valuable additions in each diet, although the recommended amounts of these are proportionally lower than the amounts of plant-based foods. Studies have shown that increasing intakes of fruits and vegetables is an effective strategy to control weight and diminish the risk of obesity as well as many of the risk factors associated with being obese (Azagba & Sharaf, 2012; Bazzano et al., 2002). Many of the nutrients and compounds in fruits and vegetables including folate and other vitamins, potassium, phytochemicals, fiber, and proteins have been inversely associated with high blood pressure, stroke, and other cardiovascular diseases (Bazzano et al., 2002; He et al., 2006; Steffen, 2006). Obtaining these nutrients from whole foods rather than by consuming single nutrients may further protect individuals from nutrition-related chronic diseases (Steffen, 2006). The Nurse's Health Study, a cohort study initiated in 1984, concluded that increasing dietary whole grain consumption might also protect against coronary heart disease (Liu et al., 1999).

Using Telephone Surveys to Monitor Health Status

The CDC uses several telephone surveys to collect health-related data of the American population at local, state, and national levels. Among these are the BRFSS, the National Health Interview Survey (NHIS), the National Immunization Survey (NIS), and the State and Local Area Integrated Telephone Survey (SLAITS).

First conducted in 1981, BRFSS has since become the largest telephone survey in the world. In 2011, more than 506,000 telephone interviews took place for the survey in the fifty states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, Guam,

American Samoa, and Palau. The survey is regarded as "the nation's premier system of health-related telephone surveys that collect state data about U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services" (CDC, 2013c). BRFSS also collects data on emerging health issues and prevalence rates of certain illnesses. To increase representation and reduce the potential for selection bias, BRFSS data are weighted according to demographic variables including age, sex, race/ethnicity, education attainment, marital status, and telephone ownership. Data collected are used to establish and track health objectives, plan health-realted programs, implement disease prevention and health promotion endeavors, and monitor trends. Many states also use the data to inform health-related legislative efforts (CDC, 2013c).

The purpose of the NHIS, a data collection program of the National Center for Health Statistics (NCHS), which is part of the CDC, is to monitor the health of individuals in the U.S. through the collection and analysis of data on a wide range of health topics. This survey can display health characteristics by demographic and socioeconomic factors. The NHIS questionnaire contains a core questionnaire that consists of basic health and demographic items related to households, families, adults, and children. Supplemental questions are also asked in the NHIS and the results from these questions are used to address new public health concerns. Data collected in the NHIS are used throughout the USDHHS to monitor trends and track progress toward national health objectives. The public health research community also uses NHIS data for epidemiologic and policy analysis associated with health issues and problems,

determining barriers to access and use of health care, and evaluation of Federal health programs (CDC, 2012c).

Unlike BRFSS and NHIS, the target population for the NIS is children aged 19 to 35 months living in the U.S. The NIS has two components: (1) a household telephone survey asking about childhood immunization for the target population and also requesting parental permission to contact children's vaccination providers, and (2) a mailed survey of the vaccination providers who have provided consent for the study. Data from the NIS are used to monitor and estimate vaccination coverage in preschoolers in non-overlapping geographic areas (CDC, 2012d).

The NCHS and CDC developed SLAITS to collect important health care data at state and local levels. Data are available at national and regional levels that are useful for establishing health priorities for the entire country. However, much diversity exists throughout the country within specific groups or populations. SLAITS is used to supplement national data collection strategies by providing in-depth data at the state and local area levels. These are used to answer certain questions, measure strengths and weaknesses of programmatic areas, and inform program and policy needs in the health care system (CDC, 2013b).

CHAPTER III

MATERIALS AND METHODS

Purpose

This thesis used a telephone survey to examine nutrition-related behaviors, health-related knowledge, and attitudes and perceptions towards selected health topics that impact BMI in a representative sample of the population living in 20 counties in north Mississippi. The telephone survey was part of the needs assessment for a larger project, "Partnerships to Promote Healthy Lifestyles for Children and Communities" sponsored by the National Institutes of Health. The goal of the larger project is to promote healthy lifestyles using a variety of strategies including formal (classroom) and informal (field trip) education, as well as media and social marketing activities. To determine the overall objectives for each educational strategy, the project team conducted an initial needs assessment that involved child assessments, parent and teacher focus groups, and a community telephone survey.

The community telephone survey was the main focus for this thesis. The main goals of the telephone survey for the larger project were to (1) define the population based on demographics, socioeconomic factors, household characteristics, weight status, health status, and health history, (2) assess individual factors that might increase risk for obesity such as knowledge, attitudes and behaviors regarding nutrition, physical activity, and obesity, (3) assess social and environmental factors that might increase risk for

obesity such as home and community factors, and (4) determine the best methods for the community to receive health-related information. These goals were determined based on evidence of the relationship between societal characteristics, family and parent characteristics, and individual factors that predict overweight and obesity in children (Davison & Birch, 2001). The purpose of the present thesis was to closely examine which factors (behaviors, knowledge, or attitudes and perceptions) were associated with increased BMI in the population (goal number 2 above), and also to determine if those factors were related to each other.

Instrument and Procedure

Project team members who had experience with telephone surveys and expertise in relevant subject areas collaborated to create the community telephone survey. Survey development included replicating, combining, or modifying questions from national or local surveys, or generating new questions when needed that would help define the population, identify individual risk factors for obesity, and identify social and environmental risk factors for obesity. Survey items were reviewed by individuals external to the project team to ensure validity.

A selection of survey questions related to nutritional habits or behaviors, health-related knowledge, and attitudes and perceptions about certain health topics were identified and further analyzed to assess their impact on the BMI of the target population. Some survey items prompted open-ended responses, and others placed responses on Likert-type scales; those scales varied based on the question. In some cases the scale was prompted with the lowest response first and ended with the highest, for example, "1" might indicate "no risk" and "4," "high risk." In other cases, responses were scaled in

reverse, such as when "1" indicated "excellent" and "5" indicated "poor." Because the survey questions came from different sources, original formatting of responses was preserved. Survey questions, the topic area they address (behaviors, knowledge, or attitudes/perceptions), response types used, and question sources are summarized in Table 2. Some questions addressed multiple topics. Selected questions are listed in the order in which they were asked to participants.

Trained interviewers at the Wolfgang Freese Survey Research Laboratory at Mississippi State University's SSRC collected data from respondents between October and November 2012. The survey was conducted across a 20-county region in north Mississippi using a dual-frame random-digit-dialing sampling methodology to contact eligible adults. This sampling method provided a probability-based representative sample of the households in the target counties. Both landline and cellular numbers were included. The telephone survey procedures and instrument were reviewed and approved by Mississippi State University's Institutional Review Board (IRB), MSU IRB #11-100, before this study began. Research reported in this thesis was supported by the Office Of The Director, National Institutes Of Health of the National Institutes of Health Award Number R25OD011162. The content is solely the responsibility of the author and does not necessarily represent the official views of the National Institutes of Health.

Data Analysis

The Statistical Package for Social Sciences version 21 (SPSS, Inc., Chicago, IL) was used for all data analyses with statistical significance determined at $p \leq .05$. A total of 500 telephone surveys were obtained. Data were weighted in order to make the results more representative of the target population. Specifically, data were weighted to reflect

probability of selection by phone type (landline or cellular) as well as the demographic variables of age, sex, education, and race. Percentages, means, and standard deviations (SD) presented in tables and graphs in this thesis reflect weighted results, whereas n values represent un-weighted numbers of participants. Correlation coefficients were calculated to determine the existence and magnitude of any relationships among variables. Continuous variables are reported as means ± SD.

Table 2 Telephone survey questions examined for this thesis, their topic categories, and original sources

Question	Response Format	Topic Category	Question Source
How many servings of fruits and vegetables do you usually eat per day?	Open-ended	Behaviors	McMillen, 2010
These next questions are about the things you ate or drank during the past 30 days. Please think about all drinks, meals, snacks, and food consumed at home and away from home. I will be asking how often you ate or drank each one: for example, once a day, twice a week, three times a month, and so forth. How often did you eat fried foods such as French fries or potato chips?	Open-ended	Behaviors	Phillips et al., 2011 and Southward et al., 2011 (Question 9)
During the past month, not including diet or artificially sweetened drinks, how many times per day, week, or month did you drink beverages that contained added sugar, such as regular sodas, sweetened tea, sports drinks, or sweetened fruit drinks?	Open-ended	Behaviors	BRFSS, 2011 (Module 4, questions 1 & 2) and NHANES, 2009 (Item CBQ.060), adapted
In general, how healthy is your overall diet? Would you say: excellent, very good, good, fair, or poor?	Likert-type scale 1 = excellent 2 = very good 3 = good 4 = fair 5 = poor	Attitudes/ perceptions	NHANES, 2009 (Item DBQ.700)
How many servings of fruits and vegetables do you think a person SHOULD eat per day for good health?	Open-ended	Knowledge	Phillips et al., 2011 and Southward et al., 2011 (Question 15), adapted
How likely do you think it is that overweight children will become overweight adults? Would you say: very likely, somewhat likely, somewhat unlikely, or very unlikely?	Likert-type scale 1 = very likely 2 = somewhat likely 3 = somewhat unlikely 4 = very unlikely	Knowledge	Phillips et al., 2011 and Southward et al., 2011 (Question 29)

Table 2 (continued)

What health problems or other consequence have you heard about that have been associated with being overweight or obese? [Open-ended; problems and consequence categories determined by the project team: Asthma or other respiratory problems, certain types of cancer, diabetes, heart/cardiovascular disease, high blood pressure, low self-esteem/depression]	Open-ended 0 = don't know/not sure 1 = named 1 consequence 2 = named 2 consequences 3 = named 3 consequences 4 = named 4 consequences 5 = named 5 consequences 6 = named 6 consequences 7 = named 7 consequences 8 = named 8 or more consequences	Knowledge	Phillips et al., 2011 and Southward et al., 2011 (Question 27), adapted
Please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the following statement: Obesity can be prevented	Likert-type scale 1 = strongly agree 2 = somewhat agree 3 = somewhat disagree 4 = strongly disagree	Knowledge, Attitudes/ perceptions	Generated by project team
Would you say that in general your health is: Excellent, very good, good, fair, or poor?	Likert-type scale 1 = excellent 2 = very good 3 = good 4 = fair 5 = poor	Attitudes/ perceptions	BRFSS, 2011 (Question 1.1)
What would you say best describes your own weight? Would you say: underweight, normal weight, overweight, or obese?	1 = underweight 2 = normal weight 3 = overweight 4 = obese	Knowledge, Attitudes/ perceptions	Phillips et al., 2011 and Southward et al., 2011 (Question 84)
How worried are you about your weight? Would you say: very much, somewhat, slightly, or not at all?	Likert-type scale 1 = very much 2 = somewhat 3 = slightly 4 = not at all	Attitudes/ perceptions	Phillips et al., 2011 and Southward et al., 2011 (Question 85)
How would you rate your risk for developing type 2 diabetes? Would you say: no risk, low risk, medium risk, or high risk?	Likert-type scale 1 = no risk 2 = low risk 3 = medium risk 4 = high risk	Knowledge	Generated by project team
How would you rate your risk for developing cardiovascular or heart disease? Would you say: no risk, low risk, medium risk, or high risk?	Likert-type scale 1 = no risk 2 = low risk 3 = medium risk 4 = high risk	Knowledge	Generated by project team
About how much do you weigh without shoes?	Open-ended	N/A (Defining the population); BMI	BRFSS, 2011 (Question 8.11)
About how tall are you without shoes?	Open-ended	N/A (Defining the population); BMI	BRFSS, 2011 (Question 8.12)

CHAPTER IV

RESULTS AND DISCUSSION

This study included 500 participants (301 females, 199 males) aged 18-93 years with a mean age of 46.3 ± 18.5 years. Participants who were 65 years and older were the largest age group (19.1%, n = 159). The majority of participants were white (71.3%, n = 370), and either graduated from high school (31.3%, n = 181) or attended college or technical school (30.9%, n = 125). Survey respondents were most commonly employed for wages (43.5%, n = 191) or retired (22.4%, n = 176), and from 2-person households (33.8%, n = 197). Household income ranged from less than $15,000 to over $50,000. Of the respondents who provided information on their height and weight (n = 478), the average BMI was 27.5 ± 6.2 kg/m^2. A summary of the characteristics of survey participants is presented in Table 3.

Behaviors Related to BMI

The nutrition-related behaviors that impact BMI were of particular importance in this thesis; however, consumption of fruits and vegetables, fried foods, or sugared beverages did not positively correlate with BMI in the target population. The nutrition-related behaviors of participants in each weight category are displayed in Table 4. The correlations between BMI and nutrition-related behaviors are presented in Table 5.

There was no significant correlation between BMI and servings of fruits and vegetables consumed daily ($r = .015$, $p = .745$), nor was there a correlation between BMI and fried food consumption ($r = -.037$, $p = .421$, Table 5). There was a significant correlation between BMI and sugared beverage consumption per week in the target population ($r = -.151$, $p = .001$). The fact that this correlation was negative was unexpected; however, related research findings reported those with a high consumption level of sugar-sweetened beverage consumption did not have a lower BMI (Gibson, 2008; Ludwig et al., 2001; Nevins & Hoffman, 2012).

Because of the negative correlation between sugared beverage consumption and BMI, these data were more closely examined via cross-tabulation. Un-weighted cross-tabulations are reported in Table 6. Only six respondents reported a height and weight that classified them into the underweight category. Of these six, three people reported a consumption level of sugar-sweetened beverages of 6 times per week or more. Of the respondents with a normal BMI ($n = 167$), 79 of them reported that they drank sugar-sweetened beverages six or more times weekly. Of the 184 overweight respondents, 82 consumed these beverages six times per week or more, and 54 of the 120 obese respondents also consumed this amount. Because there was a low number of underweight participants but a large proportion of them reported some of the highest intakes of sugar-sweetened beverages, data analyses may have led to results indicating that a high consumption of these beverages correlates with a lower BMI.

A systematic review of the literature regarding the association of sugar-sweetened drinks and body weight discovered many discrepancies; while the relationship was occasionally "strong," others reported it to be "inconclusive," "equivocal," or "near

zero." Weaknesses and inconsistencies in study designs made it difficult to conclude if sugared beverage consumption or other diet and lifestyle habits led to an increased weight status (Gibson, 2008).

Knowledge Related to BMI

Several questions were investigated that intended to measure participants' knowledge of nutrition and weight-related health principles (Table 7). These included the questions, "How many servings of fruits and vegetables do you think a person should eat per day for good health," "How likely do you think it is that overweight children will become overweight adults," and "What problems or other consequences have you heard about that have been associated with being overweight or obese?" Also, participants reported their risk level for developing type 2 diabetes and cardiovascular disease. The survey items, "Please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the statement: Obesity can be prevented," and "What would you say best describes your own weight?" were also considered knowledge-based questions. However, these items evaluated attitudes and perceptions as well. The former was considered to more heavily measure knowledge and the latter to measure attitudes and perceptions. Likewise, the former is addressed in the current section and the latter in the section, "Attitudes and Perceptions related to BMI."

No significant correlations existed between BMI and knowledge of the number of servings of fruits and vegetables that should be consumed daily for good heath. There was a significant correlation between BMI and responses to the question "How likely do you think it is that overweight children will become overweight adults?" ($r = -.098$, $p = .033$, Table 8), and as BMI increased, participants were more likely to agree or strongly

agree with the question. A summary of the correlations between BMI and questions pertaining to knowledge of nutrition and health-related topics can be found in Table 8.

For the open-ended question, "What health problems or other consequences have you heard about that have been associated with being overweight or obese?" responses categorized for interviewers included "asthma or other respiratory problems," "certain types of cancer," "diabetes," "heart/cardiovascular disease," "high blood pressure," "high cholesterol," and "low self-esteem/depression" as these seven particular consequences were deemed of high importance to researchers. The most commonly known consequence that was mentioned by 70.5% (n = 353) of respondents was diabetes, followed by heart/cardiovascular disease (54.3%, n = 272) and high blood pressure (36.1%, n = 181). A small number of respondents (10.2%, n = 51) mentioned some consequence other than one of the seven sought by interviewers. These respondents commonly mentioned bone and joint problems, kidney problems, and digestive disorders. Even fewer individuals (7.5%, n = 38) did not recall any health consequences related to being overweight or obese. A summary of the responses to the open-ended survey item, "What health problems or other consequences have you heard about that have been associated with being overweight or obese?" is in Figure 2.

There was no significant correlation between participants' BMI and knowledge of consequences related to being overweight or obese ($r = -.020$, $p = .664$). On average, respondents recalled less than three consequences related to these weight statuses (2.1 ± 1.3, Table 8). Including those who mentioned a consequence other than the original seven, the greatest number of people (31.7%, n = 158) could name at least two consequences of being overweight or obese (Table 9). Less than one-third of respondents

(27.6%, n = 138) could name one, and 23.3% (n = 116) could name three consequences. A summary of the numbers of respondents who could name up to eight consequences of being overweight or obese is displayed in Table 9.

There was not a significant correlation between BMI and knowledge regarding whether obesity can be prevented ($r = .017$, $p = .708$, Table 8). The correlation between BMI and self-reported risk for developing type 2 diabetes was significant ($r = .313$, $p < .001$). Likewise, the correlation between BMI and self-reported risk for developing cardiovascular disease was significant ($r = .197$, $p < .001$); as BMI increased, so did the likelihood that respondents acknowledged an increased risk for type 2 diabetes and cardiovascular disease. These calculations excluded unknown and missing responses as well as those who indicated they currently had one of these conditions.

In summary, the most commonly recalled consequences of being overweight or obese were type 2 diabetes, cardiovascular disease, and high blood pressure; however, knowledge of health consequences was not significantly correlated with participants' BMI. The only knowledge-based correlations that were significant were those concerning risks for developing type 2 diabetes and cardiovascular disease and BMI; as BMI increased, so did the incidence that respondents reported a higher risk for developing either of these conditions.

Attitudes and Perceptions Related to BMI

Survey items addressing attitudes and perception (Table 10) included "In general, how healthy is your overall diet," "Would you say that in general your health is excellent, very good, good, fair, or poor," "What would you say best describes your own weight,"

and “How worried are you about your weight?” Several correlations between BMI and questions regarding attitudes and perceptions were significant (Table 11).

Analysis of the question, “How healthy is your overall diet?” revealed that as BMI increased, respondents were more likely to indicate that their diet was “poor” ($r = .163$, $p < .001$). The question asking individuals to rate their overall state of health showed that those with a higher calculated BMI were significantly more likely to indicate that their health was closer to the “poor” end of the scale ($r = .298$, $p < .001$, Table 11).

When asked, “What would you say best describes your own weight?” respondents with a higher BMI were significantly more likely to classify themselves into a higher weight category ($r = .659$, $p < .001$, Table 11). Although participants with a higher BMI generally classified themselves into higher weight categories, it was often observed that participants misclassified themselves into the wrong weight group. This was particularly noted in the overweight participants (n = 184), of which, 102 individuals (59.2%) classified themselves as “normal weight;” less than half in this group (n = 79, 39.4%) correctly identified themselves as overweight. Of the 121 obese participants, 10.6% (n = 12) identified themselves as “normal weight” and 78.7% (n = 95) identified as “overweight.” Only 14 of these individuals (10.7%) correctly identified themselves as obese (Table 10). Although participants were not categorized into sub-groups based on sex, results were similar to those of Chang and Christakis (2003) in the discrepancies seen between self-perceived weight status and clinical standards. Overall, respondents displayed a low ability to correctly classify themselves into the correct category; most perceived their actual weight category to be lower than clinical definitions.

The question "How worried are you about your weight?" revealed that those who had a higher BMI generally indicated they were more worried about their weight ($r = -.278$, $p < .001$, Table 11). Upon closer examination of responses regarding this, nearly 70% of overweight respondents (n = 122) indicated a low level of worry (responses of "not at all" or "slightly worried") while 29.1% (n = 62) were either somewhat or very worried. Among obese respondents, the level of worrying about their weight was higher; about 40% (n = 42) were slightly or not at all worried, while almost 60% (n = 79) were somewhat or very worried. Levels of worry for weight among the different BMI groupings of participants are in Table 10. Horm and Anderson (1993) reported that large numbers of American adults are not trying to manage their weight even though they see themselves overweight or obese.

Overall, it appeared that many attitude and perception-based survey items significantly correlated with BMI. Those with a higher BMI were more likely to state that both their overall diet and their overall health were "poor." As BMI increased, participants were more likely to classify themselves into higher weight categories; however, their ability to classify themselves into correct weight groups based on clinically established categories was low. Underestimation of weight category was common. Participants with higher BMIs were also more likely to be worried about their weight; however only about 30% of overweight and 60% of obese participants reported being somewhat or very worried about their weight.

Relationships among Behaviors, Knowledge, and Attitudes/Perceptions

To examine if the dietary behaviors of participants matched knowledge of nutrition concepts, results of responses to the question, "How many servings of fruits and

vegetables do you usually eat per day" was compared to results of the question, "How many servings of fruits and vegetables do you think a person should eat for good health?" In response to this dietary behavior question, most survey respondents indicated they consumed one (21.7%, n = 109), two (25.8%, n = 129), or three (24.0%, n = 120) servings per day. The majority of participants (83.3%) reported usually consuming one to four servings of fruits and vegetables per day (Figure 3). Only 8.4% (n = 42) reported consuming the recommended amount of five or more servings of fruits and vegetables per day (USDA & USDHHS, 2010). When asked, "How many servings of fruits and vegetables do you think a person should eat for good health?" respondents typically mentioned two (19.7%, n = 98), three (34.9%, n = 175), or four (18.5%, n = 93) servings per day. Only 16.4% of respondents (n = 82) indicated that five or more servings should be eaten per day for good health. A small number of respondents (4.9%, n = 24) reported they did not know or were not sure what amount should be eaten for good health. Overall, very few participants reported either eating or thinking they should eat the recommended amount of five or more servings of fruits and vegetables per day (USDA & USDHHS, 2010); however, participants generally reported eating similar amounts of fruits and vegetables as they thought they should eat daily for good health. Discrepancies in consumption of fruits and vegetables versus knowledge of the number of servings a person should consume daily are demonstrated in Figure 3.

The majority of respondents (59.7%, n = 307) indicated that they ate fried foods up to three times per week; among those, most ate fried foods either one (20.1%, n = 101) or two (18%, n = 90) times per week (Table 12). A small proportion of respondents (9.6%, n = 61) reported they did not eat any fried foods. The majority of respondents

(52.7%, n = 228) stated that they had sugar-sweetened beverages more than six times per week; nearly half of those (26%, n = 130) had sugared beverages seven times per week, and 10.3% (n = 52) had sugared beverages 14 times per week. Over one-fifth of the respondents (21.5%, n = 137) did not have any beverages that contained added sugar (Table 12).

Correlations between dietary behaviors (fruit and vegetable consumption, fried food consumption, and sugar-sweetened beverage consumption) and knowledge of overweight and obesity consequences were also examined to determine if a higher knowledge level could indicate certain dietary behaviors. The correlation between number of servings of fruits and vegetables consumed daily and knowledge of overweight and obesity consequences was not significant ($r = .067$, $p = .139$); however, the correlation between fried food consumption and knowledge of overweight and obesity consequences was significant ($r = -.193$, $p < .001$, Table 13). Those who named more consequences of being overweight or obese reported less frequent fried food consumption. The correlation between sugared beverage consumption and knowledge of overweight and obesity consequences was not significant ($r = -.029$, $p = .521$, Table 13). Of the three dietary behaviors that were examined, it appeared that only fried food consumption was related to increased knowledge of nutrition principles; consumption of fruits, vegetables, and sugared beverages were not.

The correlations between dietary behaviors and risk for developing weight-related chronic diseases (type 2 diabetes and cardiovascular disease) were examined to observe dietary trends among those at higher perceived risk for developing those diseases. When asked, “How would you rate your risk for developing type 2 diabetes?” most respondents

indicated either “no risk” (29.1%, n = 132) or “low risk” (28.4%, n = 153). When asked to rate their risk for developing cardiovascular disease, although the largest number of individuals indicated a “low risk” (31.5%, n = 161), responses were more evenly distributed among the risk levels for cardiovascular disease than type 2 diabetes (Table 14). No significant correlations were observed between the risk for developing type 2 diabetes ($r = .000$, $p = .999$) or heart disease ($r = -.019$, $p = .688$) and fruit and vegetable consumption. Likewise, there was no significant correlation between the reported risk for developing type 2 diabetes ($r = -.009$, $p = .847$) or heart disease ($r = -.062$, $p = .184$) and fried food consumption, and there was no significant correlation between the risk for developing type 2 diabetes ($r = -.044$, $p = .360$) or heart disease ($r = -.063$, $p = .170$) and sugared beverage consumption. Overall, participants that indicated they were at an increased risk for developing either type 2 diabetes or cardiovascular disease did not report any significantly different dietary behaviors than those who indicated they were at a lower risk level for developing those diseases. A summary of the results related to respondents’ perceived risk for developing diabetes or cardiovascular disease is presented in Table 14.

Correlations between dietary behaviors and reported attitudes or perceptions were examined to see if dietary habits were related to attitudes or perceptions about diet and overall health. Some significant correlations were seen between respondents’ reported behaviors and their attitudes or perceptions. Those who reported more frequent fruit and vegetable consumption were less likely to indicate that their overall diet was “poor” ($r = -.254$, $p < .001$, Table 15). Additionally, those who consumed fried foods more often were more likely to indicate that their diet was “poor” ($r = .137$, $p = .002$). The correlation

between sugared beverage consumption and perception of health of overall diet was not significant ($r = -.046$, $p = .305$).

There were no significant correlations between the frequency of consumption of fruits and vegetables and participants' perception of overall health ($r = -.038$, $p = .406$), fried food consumption and perception of overall health ($p = .017$, $r = .709$), and between sugared beverage consumption and overall health ($r = -.079$, $p = .078$). Based on the correlations between behavior and attitudes/perceptions, participants were more likely to associate increased fruit and vegetable consumption and decreased fried food consumption with a better overall diet; however, associations between dietary patterns and overall health were not observed. A summary of the selected correlations between nutrition-related knowledge and questions addressing attitudes or perceptions is displayed in Table 15.

In order to see if health-related knowledge was related to attitudes or perceptions about health, correlations between comparable survey items were conducted and significant correlations were noted. Those who indicated that their risk was higher for developing type 2 diabetes were more likely to perceive that their health was "poor" ($r = .366$, $p < .001$). Likewise, those who indicated that their risk was higher for developing cardiovascular disease were also more likely to say that their health was "poor" ($r = .349$, $p < .001$). Overall, participants who indicated they were at a higher risk for developing weight-related chronic diseases also perceived their overall health to be worse than those at a lower risk.

Because certain dietary behaviors such as high caloric intake, fried food consumption, and sugared beverage consumption are associated with increased BMI

(CDC, 2012b; Ebbeling et al., 2002; Fraser et al., 2011; Ludwig et al., 2001; Nevins & Hoffman, 2012), correlations among dietary behaviors in the target population were conducted to examine if the selected dietary behaviors were practiced in combinations. When comparing fruit and vegetable consumption to consumption of fried foods, no significant correlation was observed ($r = .071$, $p = .119$); comparing fruit and vegetable consumption to intake of sugared beverages, there was a slight non-significant negative correlation (-.056, $p = .216$). There was a significant correlation between fried food consumption and sugared beverage consumption ($r = .227$, $p < .001$). Among the dietary behaviors examined in the survey, the only significant correlation was between fried food and sugared beverage intake; those who reported more frequent consumption of fried foods were also more likely to report more frequent consumption of beverages that contained added sugar.

Similar to examining the inter-correlations among dietary behaviors, correlations between knowledge-based questions were assessed to observe if higher knowledge of specific survey items were associated with one another. There was a significant correlation between the responses to the questions, "How would you rate your risk for developing type 2 diabetes?" and "How would you rate your risk for developing cardiovascular disease?" ($r = .530$, $p < .001$); those who indicated they were at a higher risk for developing one of these diseases were also likely to indicate they were at risk for the other. A significant correlation regarding knowledge of health and weight was observed ($r = .175$, $p < .001$). It would appear that those with a higher level of knowledge of the consequences of overweight and obesity stated that overweight children are less likely to become overweight adults. However, the outliers in these data were considered;

of the 38 individuals who did not know any consequences related to overweight and obesity, 28 of them (73.7%) stated that it was either somewhat or very likely that weight problems would affect children later in life. For those who knew at least one (n = 138) or two (n = 158) consequences of an elevated weight status, 128 (92.8%) and 155 (98.1%), respectively, stated that overweight children were somewhat or very likely to become overweight adults. One hundred percent of survey respondents who knew six, seven, or eight consequences of being overweight or obese also stated that it was very likely that overweight children would become overweight adults. These results were determined by cross-tabulation and are summarized in Table 16.

Regarding general correlations between knowledge-based questions, most respondents who indicated they were at higher risk for developing type 2 diabetes also recognized that they were at higher risk for developing cardiovascular disease. Regardless of knowledge of consequences of being overweight or obese, most survey respondents recognized that overweight children were either somewhat or very likely to become overweight adults.

To assess if certain aspects of attitudes and perceptions were associated with each other, comparable questions of this topic category were correlated. There was a significant correlation between responses to the question, “In general, how healthy is your overall diet?” and perceived health levels given by survey participants. Those who indicated that their diet was poor were also more likely to indicate that their health in general was poor ($r = .436$, $p < .001$). Additionally, respondents who indicated that they were more worried about their weight were also more likely to indicate their health was

poor ($r = -.250$, $p < .001$). Overall, those who rated their health as poor were more likely to rate their diet as poor and to be worried about their weight.

Several items on the telephone survey addressed more than one topic category. For example, the question, "What would you say best describes your own weight?" addresses knowledge of weight classifications and attitudes/perceptions about weight. The item asking respondents to report whether they agree or disagree that obesity can be prevented may indicate which individuals are aware of obesity prevention strategies; however, some respondents may have answered this question based on their perceptions and beliefs about obesity prevention. Those questions that address more than one topic are now discussed.

A significant correlation was observed between responses to the question, "How likely do you think it is that overweight children will become overweight adults?" and agreement to the statement "Obesity can be prevented" ($r = .090$, $p = .048$, Table 17). Those who agreed that obesity could be prevented generally stated that overweight children were more likely to become overweight adults. The correlation between agreement to the statement "Obesity can be prevented" and self-classification into weight categories ($r = -.040$, $p = .379$, Table 17) was not significant. There was a significant correlation between responses for, "What would you say best describes your own weight" and, "How worried are you about your weight?" ($r = -.311$, $p < .001$). Those who classified themselves into a higher BMI category were more likely to be more concerned about their weight. In summary, those who thought that overweight children were likely to become overweight adults generally stated that obesity is preventable. Also, those who

reported themselves to be in a higher weight category usually had a higher level of worry about their weight status.

Limitations

This study had several limitations that are outlined here. First, the physical activity levels of survey participants were not taken into account for this thesis. Research reveals that increased physical activity levels can help with weight loss and weight maintenance (Let's Move!, n.d.; USDHHS, n.d., USDHHS, 2012c). Additionally, a positive association between physical activity levels and quality of life in adults has been reported (Bize et al., 2007). Because this thesis focused on the impact of nutrition-related behaviors, knowledge, and attitudes on adult BMI levels, examination of physical activity data was not included.

Another limitation was the lack of data regarding participants' consumption of whole grains, protein, dairy products, and non-sugared beverage intake. Studies indicate that consumption of whole grains is affiliated with improved health (Liu et al., 1999). Additionally, many nutrition plans emphasize consuming foods from all food groups for weight management and improved health (AHA, 2013b; DASH Diet, 2013; DeKoning et al., 2011; Fung et al., 2008; Fung et al., 2011; Sofia et al., 2008; Taylor et al., 2009; USDA & USDHHS, 2010; USDA, 2013; Willett et al., 1995). Dietary behaviors were investigated with several other topic categories in the telephone survey for the overall project "Partnerships to Promote Healthy Lifestyles for Children and Communities." In order to complete the survey in a timely manner and cover all topic areas of interest, questions related to dietary behaviors were somewhat limited.

Another limitation was the sample size. Although a sample of 500 individuals is large enough to make inferences about the population in the targeted 20-county area, it is not large enough to make inferences about sub-groups of the population such as sex and race groupings. This thesis analyzed sub-groups based on BMI category, but because of the numbers of individuals in each BMI category, results of these sub-groups may not be generalizable to the entire population and should be interpreted with caution.

In addition, this type of research is subject to the Hawthorne effect, or, participants may modify or alter their responses to survey questions because they are aware that they are being examined (i.e., they may respond in a socially desirable or expected manner). Whether participants' responses varied from actual behaviors in the current survey is not known. However, a similar telephone survey methodology is used in national surveys. Furthermore, related studies provide limited data as to the likelihood of a Hawthorne effect in research (O'Sullivan et al., 2004).

Table 3 Characteristics of Participants

Characteristic	Participants, n (weighted %) or mean ± standard deviation (N=500)
Age	46.3 ± 18.5
Age Categories	
18-24	39 (16.2)
25-34	45 (16.2)
35-44	45 (15.7)
45-54	93 (17.1)
55-64	118 (15.6)
65+	159 (19.1)
Missing/Unknown	1 (0.1)
Sex	
Female	301 (47.8)
Male	199 (52.2)
Race	
Asian	1 (0.1)
Black or African American	121 (27)
White	370 (71.3)
More than one race	6 (1.5)
Missing/Unknown	2 (0.2)
Education	
Did not graduate high school	59 (20.6)
Graduated high school	181 (31.3)
Attended college or technical school	125 (30.9)
Graduated from college or technical school	133 (17)
Missing/Unknown	2 (0.2)
Employment Status	
Employed for wages	191 (43.5)
Self-employed	30 (6.5)
Out of work for less than 1 year	5 (1)
Out of work for more than 1 year	9 (3)
Homemaker	21 (4)
Student	17 (6.6)
Retired	176 (22.4)
Unable to work	49 (11.4)
Missing	2 (0.7)
Household Size	
1 person	133 (14.1)
2 people	197 (33.8)
3 people	79 (21.7)
4 people	51 (18.1)
5 people or more	38 (11.5)
Missing	2 (0.8)
Household Income	
Less than $15,000	118 (28.5)
$15,000 - $25,000	63 (12.2)
$25,000 - $35,000	43 (7)
$35,000 - $50,000	55 (11.1)
$50,000 or more	129 (22.4)
Missing	92 (18.8)
Body mass index (BMI) kg/m^2)	27.5 ± 6.2
BMI Categories	
Underweight (BMI < 18.5)	6 (1.5)
Normal Weight (BMI 18.5-24.9)	167 (35.2)
Overweight (BMI 25.0-29.9)	184 (34.1)
Obese (BMI > 30.0)	121 (23.9)
Missing/Unknown	22 (5.3)

Table 4 Nutrition-related behaviors of participants by weight category

Questionnaire Item	Underweight or normal weight participants, n (weighted %) (n=173)	Overweight participants, n (weighted %) (n=184)	Obese participants, n (weighted %) (n=121)	All participants who provided height and weight, n (weighted %) (n = 478)
How many servings of fruits and vegetables do you usually eat per day?				
0	5 (6.7)	7 (5.4)	5 (3.2)	17 (5.3)
1-4 servings	145 (82.7)	148 (81.4)	105 (88.8)	398 (83.3)
5 or more servings	17 (5.2)	26 (12.2)	9 (5.2)	52 (8.4)
Missing/Unknown	6 (5.4)	3 (1)	2 (2.8)	11 (3)
How often did you eat fried foods such as French fries or potato chips?				
0 times per week	19 (9.3)	27 (11.3)	13 (8.6)	59 (9.6)
Up to 3 times per week	114 (59.8)	110 (59.5)	71 (62.5)	295 (59.7)
More than 3 but less than 6	15 (9.8)	24 (12.2)	14 (8.4)	53 (10.6)
6 times or more per week	24 (20.8)	23 (17.1)	21 (19.3)	68 (19.8)
Missing/Unknown	1 (0.3)	0 (0)	2 (1.2)	3 (0.4)
How many times did you drink beverages that contained added sugar, such as regular sodas, sweetened tea, sports drinks, or sweetened fruit drinks?				
0 times per week	51 (21)	50 (22.6)	30 (21.1)	131 (21.5)
Up to 3 times per week	30 (15.9)	41 (20.9)	24 (22)	95 (19.6)
More than 3 but less than 6	10 (4.4)	11 (4.6)	12 (8.5)	33 (5.7)
6 times or more per week	82 (58.7)	82 (51.8)	54 (47.8)	218 (53.1)
Missing/Unknown	0 (0)	0 (0)	1 (0.7)	1 (0.2)

Table 5 Correlations between BMI and nutrition-related behaviors

Questionnaire Item	n	Mean ± Standard Deviation	*r* value *p* value
How many servings of fruits and vegetables do you usually eat per day?	489	2.5 ± 1.6	.015 .745
How often (times per week) did you eat fried foods?	497	3.4 ± 3.7	-.037 .421
How many times (per week) did you drink beverages that contained added sugar?	499	8.7 ± 11.9	-.151** .001

**Correlation is significant at the 0.01 level

Table 6 Cross-tabulation between reported sugar-sweetened beverage consumption and BMI categories

		BMI Categories			
Question	Weekly consumption groupings	Underweight	Normal weight	Overweight	Obese
How many times per week did you drink beverages that contained added sugar?	0	3	48	50	30
	Up to 3 times	0	50	41	24
	More than 3 but less than 6	0	10	11	12
	6 or more	3	79	82	54
Total (n = 477)		6	167	184	120

Table 7 Knowledge of Participants

Questionnaire Item	Underweight or Normal Weight Participants, n (weighted %) (n=173)	Overweight Participants, n (weighted %) (n=184)	Obese Participants, n (weighted %) (n=121)	All participants who provided height and weight, n (weighted %) (n = 478)
How many servings of fruits and vegetables so you think a person SHOULD eat per day for good health?				
0	0 (0)	1 (0)	0 (1.1)	1 (0.1)
1-4	130 (78.1)	135 (81.5)	94 (69.7)	359 (78.7)
5 or more	33 (18.4)	41 (12.3)	23 (27.9)	97 (16.4)
Missing/Unknown	10 (3.6)	7 (6.1)	4 (1.4)	21 (4.8)
How likely do you think it is that overweight children will become overweight adults?				
Somewhat or Very Unlikely	6 (2.4)	7 (4.1)	4 (2)	17 (5.8)
Very or Somewhat Likely	167 (97.6)	176 (95.7)	114 (96.1)	457 (93.2)
Missing/Unknown	0 (0)	1 (0.2)	3 (1.9)	4 (1)
Please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the following statement:				
Obesity can be prevented				
Somewhat or Strongly Disagree	10 (6.5)	5 (3.7%)	8 (4.9)	23 (4.9)
Strongly or Somewhat Agree	160 (91.2)	177 (95.2)	111 (94.1)	448 (93.8%)
Missing/Unknown	3 (2.4)	2 (1)	2 (1)	7 (1.4)
How would you rate your risk for developing type 2 diabetes?				
No Risk	62 (34.8)	53 (32.7)	10 (8.8)	125 (29.1)
Low Risk	62 (29.8)	64 (31.8)	23 (25.5)	149 (28.4)
Medium Risk	26 (18.8)	29 (16.8)	38 (24.1)	93 (19)
High Risk	3 (0.7)	19 (10.1)	22 (20.9)	44 (9.7)
Currently has type 2 diabetes	6 (2.3)	16 (7.7)	22 (14.4)	44 (7)
Missing/Unknown	14 (13.5)	3 (1)	6 (6.4)	23 (6.8)
How would you rate your risk for developing cardiovascular or heart disease?				
No Risk	34 (22)	38 (22.2)	11 (10.5)	83 (20.9)
Low Risk	64 (33)	61 (34.2)	30 (28.1)	155 (31.5)
Medium Risk	39 (23.2)	48 (23.1)	43 (27.6)	130 (24.4)
High Risk	25 (14)	25 (14.9)	27 (29.1)	77 (17.3)
Currently has Cardiovascular Disease	6 (1.5)	8 (3.4)	10 (4.7)	24 (2.8)
Missing/Unknown	5 (6.3)	4 (2.2)	0 (0)	9 (3.1)

Table 8 Correlations between BMI and knowledge-based survey questions

Questionnaire Item	n	Mean ± Standard Deviation	*r* value *p* value
How many servings of fruits and vegetables do you think a person SHOULD eat per day for good health?	478	3.4 ± 1.5	-.036 .449
How likely do you think it is that overweight children will become overweight adults? (1 = very likely, 4 = very unlikely)	496	1.4 ± .67	-.098** .033
Can obesity be prevented? (1 = strongly agree, 4 = strongly disagree)	493	1.5 ± .70	.017 .708
How would you rate your risk for developing type 2 diabetes? (1 = no risk, 4 = high risk)	432	2.1 ± 1.0	.313** < .001
How would you rate your risk for developing cardiovascular or heart disease? (1 = no risk, 4 = high risk)	467	2.4 ±1.0	.197** < .001
What health problems or other consequences have you heard about that have been associated with being overweight or obese? (Range of 0 to 8 responses counted)	500	2.1 ± 1.3	-.020 .664

**Correlation is significant at the 0.01 level

Table 9 Number of consequences of being overweight or obese recalled by respondents

Number of consequences mentioned	n (weighted %)
0	38 (7.5)
1	138 (27.6)
2	158 (31.7)
3	116 (23.3)
4	35 (7)
5	6 (1.2)
6	2 (0.5)
7	6 (1.2)
8 or more	52 (10.2)

Table 10 Attitudes and Perceptions of Participants

Questionnaire Item	Underweight or Normal Weight Participants, n (weighted %) (n=173)		Overweight Participants, n (weighted %) (n=184)	Obese Participants, n (weighted %) (n=121)	All participants who provided height and weight, n (weighted %) (n = 478)
In general, how healthy is your overall diet?					
Poor	3 (1.1)		10 (5.8)	8 (4.6)	21 (3.8)
Fair	26 (20.7)		36 (21.9)	38 (36.7)	100 (25.5)
Good	77 (46.9)		74 (36.9)	57 (46.6)	208 (43.5)
Very Good	51 (24.9)		53 (28.4)	15 (9.8)	119 (21.3)
Excellent	16 (6.5)		11 (7)	3 (2.4)	30 (5.9)
Would you say that in general your health is:					
Poor	13 (5)		12 (6.6)	18 (12)	43 (7.2)
Fair	26 (15.8)		29 (16.1)	43 (34.1)	98 (20.9)
Good	49 (27.1)		61 (31.2)	41 (41.1)	151 (33.7)
Very Good	64 (39.5)		60 (32.1)	17 (11.6)	141 (28.4)
Excellent	21 (12.6)		22 (14)	2 (1.2)	45 (9.9)
What would you say best describes your own weight?	Under-weight (n=6)	Normal Weight (n=167)			
Underweight	2 (11.2)	14 (10.3)	0 (0)	0 (0)	16 (4.3)
Normal Weight	3 (83.3)	141 (82.9)	102 (59.2)	12 (10.6)	258 (55.9)
Overweight	1 (5.6)	11 (5.9)	79 (39.4)	95 (78.7)	186 (36)
Obese	0 (0)	0 (0)	3 (1.5)	14 (10.7)	17 (3.5)
Missing/Unknown	0 (0)	1 (1)	0 (0)	0 (0)	1 (0.3)
How worried are you about your weight?					
Not At All	93 (54.6)		82 (43)	27 (21.8)	202 (41.5)
Slightly	32 (17.6)		40 (26.9)	15 (18.4)	87 (20.5)
Somewhat	30 (17.1)		43 (19.7)	42 (27.9)	115 (21.1)
Very Much	18 (10.7)		19 (10.4)	37 (31.8)	74 (17)

Table 11 Correlations between BMI and attitude/perception survey questions

Questionnaire Item	n	Mean ± Standard Deviation	*r* value *p* value
In general, how healthy is your overall diet? (1 = excellent, 5 = poor)	500	3.0 ± .93	.163** < .001
Would you say that in general your health is excellent, very good, good, fair, or poor? (1 = excellent, 5 = poor)	500	2.9 ± 1.1	.298** < .001
What would you say best describes your own weight? (1 = underweight, 4 = obese)	499	2.4 ± .63	.659** < .001
How worried are you about your weight? (1 = very much, 4 = not at all)	500	2.9 ± 1.1	-.278** < .001

** Correlation is significant at the 0.01 level

Table 12 Summary of fried food and sugared beverage consumption

	How often did you eat fried foods such as French fries or potato chips?	How many times did you drink beverages that contained added sugar?
Times per week consumed	n (weighted %)	n (weighted %)
0	61 (9.6)	137 (21.5)
Up to 3	307 (59.7)	99 (19.6)
More than 3 but less than 6	55 (10.6)	35 (5.7)
More than 6	74 (19.8)	228 (53.1)
Missing/Unknown	3 (0.4)	1 (0.2)

Table 13 Correlations between knowledge level of overweight/obesity consequences and behavior-related questions

Questionnaire Item	n	Mean ± Standard Deviation	*r* value *p* value
How many servings of fruits and vegetables do you usually eat per day?	489	2.5 ± 1.6	.067 .139
How often did you eat fried foods such as French fries or potato chips?	497	3.4 ± 3.7	-.193** < .001
How many times did you drink beverages that contained added sugar, such as regular sodas, sweetened tea, sports drinks, or sweetened fruit drinks?	499	8.7 ± 11.9	-.029 .521

**Correlation is significant at the 0.01 level

Table 14 Respondents' reported risk for developing type 2 diabetes or CVD

Risk level	Self-rated risk for developing type 2 diabetes n (weighted %)	Self-rated risk for developing cardiovascular disease n (weighted %)
No Risk	132 (29.1)	88 (20.9)
Low Risk	153 (28.4)	161 (31.5)
Medium Risk	96 (19)	140 (24.4)
High Risk	51 (9.7)	78 (17.3)
Indicated they currently have this condition	45 (7)	24 (2.8)
Don't know/not sure	23 (6.8)	9 (3.1)

Table 15 Correlations between attitudes/perceptions about "How healthy is your overall diet?" and nutrition-related behaviors

Questionnaire Item	n	Mean ± Standard Deviation	*r* value *p* value
How many servings of fruits and vegetables do you usually eat per day?	489	2.5 ± 1.6	-.254** < .001
How often did you eat fried foods?	497	3.4 ± 3.7	.137** .002
How many times did you drink beverages that contained added sugar?	499	8.7 ± 11.9	-.046 .305

**Correlation is significant at the 0.01 level

Table 16 Cross-tabulation of knowledge-based questions

		Number of consequences mentioned when asked, "What health problems or consequences have you heard about that have been associated with being overweight or obese?"								
Question	Responses	0	1	2	3	4	5	6	7	8
How likely do you think it is that overweight children will become overweight adults?	Very Unlikely	3	1	1	2	2	0	0	0	0
	Somewhat Unlikely	3	2	3	1	1	0	0	0	0
	Somewhat Likely	11	37	47	32	1	3	0	1	0
	Very Likely	21	82	111	84	28	7	3	6	1
Total (n = 494)		38	122	162	119	32	10	3	7	1

Table 17 Correlations between "Obesity can be prevented" and other survey items

Questionnaire Item	n	Mean ± Standard Deviation	*r* value *p* value
How likely do you think it is that overweight children will become overweight adults? (1 = very likely, 4 = very unlikely)	496	1.4 ± .67	.090* .048
What would you say best describes your own weight? (1 = underweight, 4 = obese)	499	2.4 ± .63	-.040 .379

*Correlation is significant at the 0.05 level

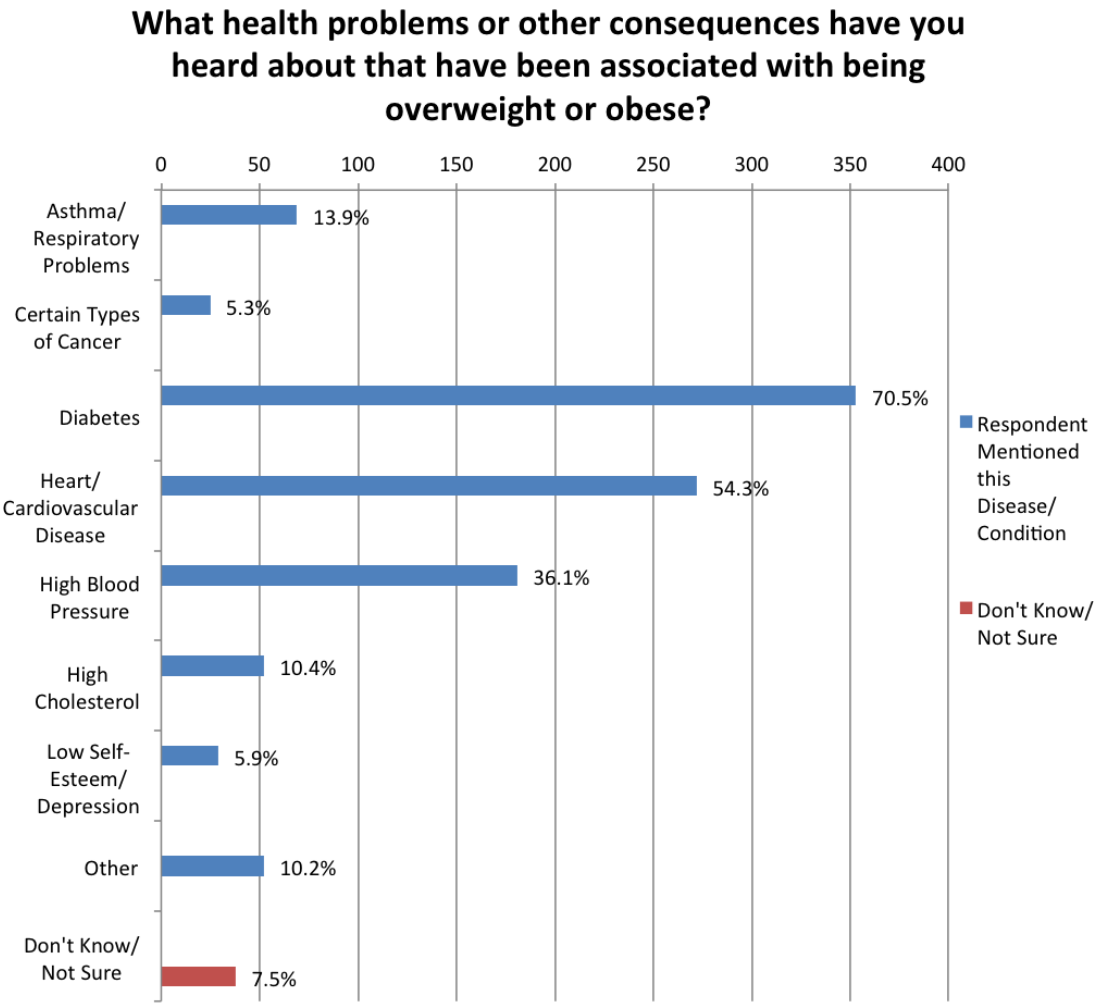

Figure 2 Responses mentioned regarding consequences of being overweight or obese

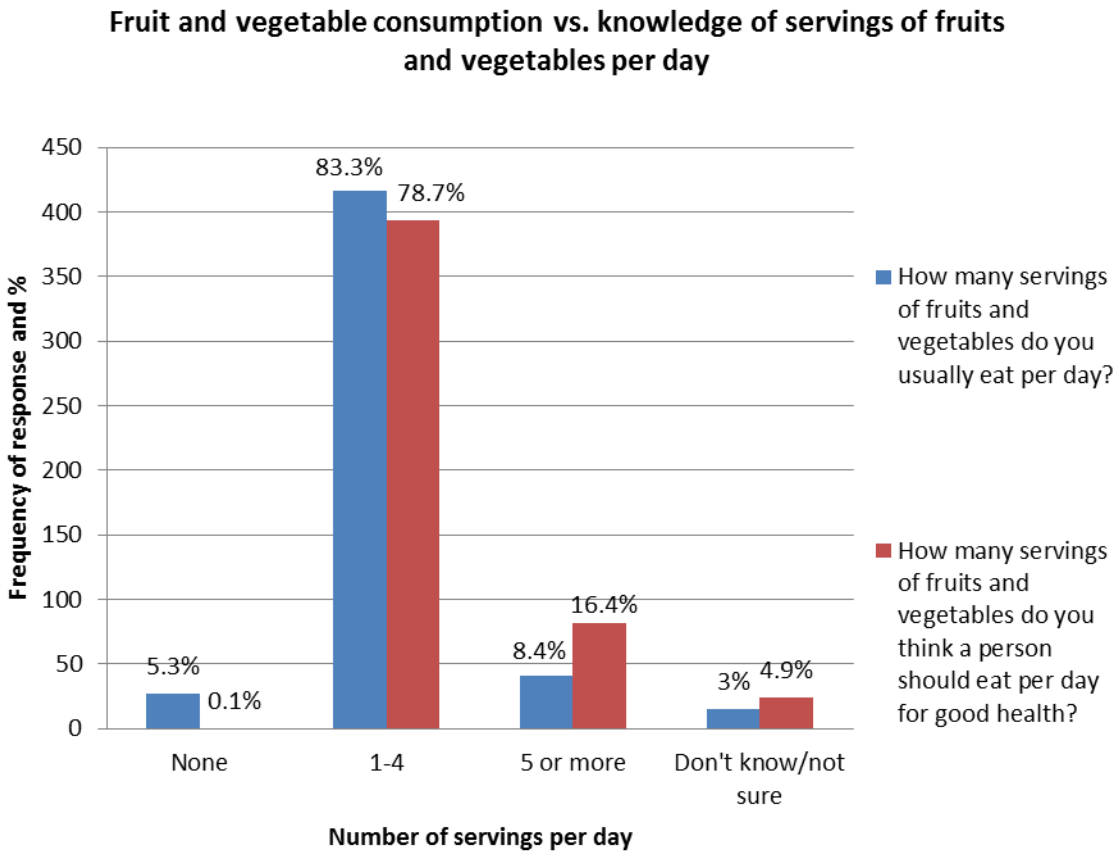

Figure 3 Knowledge of fruit and vegetable consumption versus reported consumption of fruits and vegetables

CHAPTER V

CONCLUSIONS

The prevalence of overweight and obesity in the U.S. has increased tremendously over the past several decades thus ranking among the top public health concerns in the nation (CDC, 2013a). These weight statuses are linked to a variety of causes including dietary behaviors, nutritional knowledge, and attitudes or perceptions towards weight-related health concepts (Brug et al., 2003; Contento et al., 2002; Hollis et al., 1986; James, 2004). Programs and interventions that address the increased BMI of Americans and strategies to reduce BMI in the population through behavior modification and nutrition education exist at the Federal, state, and community levels (CDC, 2010; Let's Move!, n.d.; NIH, 1998; USDA & USDHHS, 2010; USDHHS, 2012c). Information and resources are available for individuals to use in addressing weight issues. Sources including the USDA, USDHHS, CDC, NIH, and NHLBI provide information to the public that individuals can use to improve diet quality, increase knowledge of nutrition information, and create accurate perceptions of health (CDC, 2010; USDHHS, 2012d). Because of the high prevalence of overweight and obesity and their associated health risks, conducting research on weight-related topics is imperative. Disseminating the results of that research is also important so that programs can be delivered to people who are overweight or obese to assist them in effectively managing their weight, especially in Mississippi where overweight and obesity rates are some of the highest in the country.

The objectives of this study were to determine which factors (behaviors, knowledge, or attitudes and perceptions) were associated with increased BMI in adults residing in 20 north Mississippi counties, and also, determine if behaviors, knowledge, or attitudes and perceptions were related to each other for those adults. Correlations in this research do not imply causation. Although many significant correlations were observed, further investigation of these results is necessary to draw conclusions about causal relationships.

It was determined that many of the diet-related practices commonly associated with weight status were not associated with the BMI of adults in the study. Rather, knowledge of health and nutrition as well as attitudes and perceptions about health were more often associated with BMI. Adults with a higher BMI were more likely to know that overweight children are at risk for becoming overweight adults. Also, those with a higher BMI were more likely to acknowledge that they were at risk for developing type 2 diabetes and cardiovascular disease. Individuals with a higher BMI were more likely to respond that their diet and overall health were poor. Although most individuals with a higher BMI generally indicated that their weight classified them into a higher clinical BMI category, many underestimated their weight status. Additionally, those with a higher BMI were more likely to be worried about their weight.

Some correlations were observed between behaviors and knowledge. Although most individuals did not consume recommended amounts of fruits and vegetables, their reported consumption closely matched what they thought they should eat for good health. Participants in this study with a higher level of knowledge of the consequences of obesity reported lower levels of fried food consumption. Since no trends were seen between

consumption of sugared drinks or consumption of fruits and vegetables and knowledge of obesity consequences, it appears that decreasing fried food intake may be the most widely practiced strategy for avoiding the negative health consequences associated with being overweight or obese.

Certain attitudes and perceptions about health were associated with dietary behaviors. Individuals who consumed higher amounts of fruits and vegetables had more positive perceptions about the health of their overall diets. Individuals who consumed higher amounts of fried foods generally had less positive perceptions about the health of their overall diets. Sugared beverage consumption was not associated with attitudes or perceptions addressed by the survey, indicating that the population did not associate the consumption of these beverges with overall health or diet.

Only one connection between knowledge and attitudes/perceptions was observed. Survey participants who indicated they were at risk for type 2 diabetes or cardiovascular disease also perceived their overall health as worse. Knowledge of other health and nutrition principles was not associated with perceptions of overall health or attitudes about the healthfulness of their diet.

Correlations between specific items relating to behaviors, knowledge, and attitudes were analyzed to examine if particular dietary behaviors were practiced together, to examine if knowledge of health topics were related, and to investigate if attitudes and perceptions about nutrition, health, and weight were associated with each other. Among dietary behaviors, those who reported frequent consumption of fried foods were also significantly more likely to report a higher intake of sugared drinks. Although neither sugared drink intake nor fried food intake alone correlated with increased BMI,

the relationship between fried food and sugared beverage intake indicates that individuals who consume these may consume a higher amount of calories overall, thus contributing to a potential for an increased BMI.

Among knowledge-based questions, respondents who stated they were at an increased risk for developing type 2 diabetes were also more likely to state that they were at a higher risk for developing cardiovascular disease. This indicates that overall, the participants understood the connection of each of these diseases to weight status. Furthermore, the vast majority of respondents understood the strong connection between childhood weight status and adult weight status as they indicated that overweight children were somewhat or very likely to become overweight adults.

When comparing attitudes and perceptions to each other, it was clear that much of the population made some connection between diet and overall health; many who indicated that their diet was poor also indicated their overall health was poor. Connections were also made between health and weight status, as many of the participants who indicated that their overall health was poor also stated they were more worried about their weight.

Survey items that addressed more than one topic category, such as both knowledge and perceptions, were analyzed separately. Analysis of these items revealed more information about the target population. The majority of respondents indicated that overweight children were likely to become overweight adults, and they also thought that obesity was preventable. In general, those who included themselves in higher weight categories were also likely to be more worried about their weight. These correlations show that much of the population probably understands how weight issues can persist

during a lifetime. Also, these correlations can be used to validate many of the efforts being proposed and actions being taken at Federal, state, and community levels aimed at reducing overweight and obesity.

The findings in this research can be beneficial for the development of nutrition and health education programs for many populations. The findings reveal the nutritional behaviors, knowledge, and attitudes and perceptions of the population, and also, where there are gaps among these items. For example, participants generally thought that they should consume between one and four servings of fruits and vegetables daily for good health. Likewise, many reported actually eating this amount. Efforts to increase education on recommended servings from each food group may result in the population consuming recommended amounts. Additionally, because few connections were seen between sugared beverage consumption and health or diet, information about that connection can be shared with the population to promote overall health. Also, efforts can be made to increase knowledge about weight and BMI so accurate perceptions about weight status can be made. These findings could help build nutrition and health education components into existing programs that address health and wellness within communities in north Mississippi. Further research and analyses that investigate other aspects of health (i.e., physical activity), more detailed dietary behaviors, and their impact on weight would be beneficial for planning community education and programming efforts.

REFERENCES

American Heart Association. (2013a). Suggested servings from each food group. Retrieved from http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Suggested-Servings-from-Each-Food-Group_UCM_318186_Article.jsp

American Heart Association. (2013b). Healthy diet goals. Retrieved from http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Healthy-Diet-Goals_UCM_310436_SubHomePage.jsp

Azagba, S., & Sharaf, M.F. (2012). Fruit and vegetable consumption and body mass index: a quantile regression approach. *Journal of Primary Care & Community Health*. 3(3): 210-220.

Bazzano, L.A., He, J., Ogden, L.G., Loria, C.M., Vupputuri, S., Myers, L., & Whelton, P.K. (2002). Fruit and vegetable intake and risk of cardiovascular disease in US adults: the first National Health and Nutrition Examination Survey Epidemiologic Follow-up Study. *American Journal of Clinical Nutrition*, 76: 93-99.

Behavioral Risk Factor Surveillance System. (2011). 2011 Behavioral Risk Factor Surveillance System Questionnaire. Retrieved from http://www.cdc.gov/brfss/

Berenson, G.S. (2001). Bogalusa Heart Study: a long-term community study of a rural biracial (black/white) population. *The American Journal of the Medical Sciences,* 322(5): 267-274.

Biro, F.M. & Wien, M. (2010). Childhood obesity and adult morbidities. *American Journal of Clinical Nutrition*, 91: 1499-1505.

Bize. R., Johnson, J.A., & Plotnikoff, R.C. (2007). Physical activity level and health-related quality of life in the general adult population: a systematic review. *Preventive Medicine*, 45(6): 401-415.

Brener, N.D., Eaton, D.K., Lowry, R., & McManus, T. (2004). The association between weight perception and BMI among high school students. *Obesity Research*. 12(11): 1866-1874.

Britten, P., Marcoe, K., Yamini, S., & Davis, C. (2006). Development of food intake patterns for the MyPyramid food guidance system. *Journal of Nutrition Education and Behavior*. 38: 78-92.

Brownell, K.D. & Kaye, F.S. (1982). A school-based behavior modification, nutrition education, and physical activity program for obese children. *American Journal of Clinical Nutrition*, 35: 277-283.

Brug, J., Oenema, A., & Campbell, M. (2003). Past, present, and future of computer-tailored nutrition education. *American Journal of Clinical Nutrition*, 77:1028-1034.

Centers for Disease Control and Prevention. (2010). *What can be done*. Retrieved from www.cdc.gov/vitalsigns/AdultObesity/#Whatcanbedone

Centers for Disease Control and Prevention. (2012a). *Defining overweight and obesity*. Retrieved from http://www.cdc.gov/obesity/adult/defining.html

Centers for Disease Control and Prevention. (2012b). *What causes overweight and obesity?* Retrieved from www.cdc.gov/obesity/adult/causes

Centers for Disease Control and Prevention. (2012c). *National Health Interview Survey*. Retrieved from http://www.cdc.gov/nchs/nhis.htm

Centers for Disease Control and Prevention. (2012d). *National Immunization Survey*. Retrieved from http://www.cdc.gov/nchs/nis/about_nis.htm

Centers for Disease Control and Prevention. (2012e). *Basics about childhood obesity.* Retrieved from http://www.cdc.gov/obesity/childhood/basics.html

Centers for Disease Control and Prevention. (2013a). *Overweight and obesity*. Retrieved from http://www.cdc.gov/obesity/data/adult.html

Centers for Disease Control and Prevention. (2013b). *State and Local Area Integrated Telephone Survey*. Retrieved from http://www.cdc.gov/nchs/slaits.htm

Centers for Disease Control and Prevention. (2013c). *Behavioral Risk Factor Surveillance System*. Retrieved from http://www.cdc.gov/brfss/index.htm

Centers for Disease Control and Prevention (2013d). *Obese youth over time*. Retrieved from http://www.cdc.gov/healthyyouth/obesity/obesity-youth-txt.htm

Chang, V.W. & Christakis, N.A. (2003). Self-perception of weight appropriateness in the United States. *American Journal of Preventive Medicine*. 24(4): 332-338.

Chen, C., Tetri, L.H., Neuschwander-Tetri, B.A., Huang, S.S., & Huang, J.S. (2011). A mechanism by which dietary trans fats cause atherosclerosis. *Journal of Nutritional Biochemistry*, 22: 649-655.

Contento, I.R., Randell, J.S., & Basch, C.E. (2002). Review and analysis of evaluation measures used in nutrition education intervention research. *Journal of Nutrition Education and Behavior*, 34(1): 2-25.

Dash Diet. (2013). The DASH diet eating plan. Retrieved from http://dashdiet.org/what_is_the_dash_diet.asp

Davison, K.K. & Birch, L.L. (2001). Childhood overweight: a contextual model and recommendations for future research. *Obesity Reviews*, 2(3): 159-171.

DeKoning, L., Chiuve, S.E., Fung, T.T., Willett, W.C., Rimm, E.B., & Hu, F.B. (2011) Diet-quality scores and the risk of type 2 diabetes in men. *Diabetes Care*, 34: 1150-1156.

Ebbeling, C.B., Pawlak, D.B., & Ludwig, D.S. (2002). Childhood obesity: public health crisis, common sense cure. *The Lancet*, 360: 473-482.

Esposito, L., Fisher, J.O., Menella, J.A., Hoelscher, D.M., & Huang, T.T. (2009). Developmental perspectives on nutrition and obesity from gestation to adolescence. *Preventing Chronic Disease: Public Health Research, Practice, and Policy*, 6(3): 1-11.

Estabrooks, P.A., Fisher, E.B., & Hayman, L.L. (2008). What is needed to reverse the trends in childhood obesity? A Call to Action. *Annals of Behavioral Medicine*. 36: 209-216.

Estruch, R., Ros, E., Salas-Salvadó, J., Covas, M.I., Corella, D., Arós, F., et al. (2013). Primary prevention of cardiovascular disease with a Mediterranean diet. *The New England Journal of Medicine*, 1-12. doi:10.1056/NEJMoal200303

Flegal, K.M., Carroll, M.D., Kit, B.K., & Ogden, C.L. (2012). Prevalence of obesity and trends in the distribution of body mass index among U.S. adults, 1999-2010. *Journal of the American Medical Association*, 307(5): 491-497.

Fraser, L.K., Edwards, K.L, Cade, J.E., & Clarke, GP. (2011). Fast food, other food choices and body mass index in teenagers in the United Kingdom (ALSPAC): a structural equation modeling approach. *International Journal of Obesity*, 35: 1325-1330.

French, S.A., Story, M., & Perry, C.L. (1995). Self-esteem and obesity in children and adolescents: a literature review. *Obesity Research*, 3 (5), 479-490.

Fung, T.T., Chiuve, S.E., McCullough, M.L., Rexrode, K.M., Logroscino, G., & Hu, F.B. (2008). Adherence to a DASH-style diet and risk of coronary heart disease and stroke in women. *Archives of Internal Medicine*. 168(7): 713-720.

Fung, T.T., Hu, F.B., Hankinson, S.E., Willett, W.C., & Holmes, M.D. (2011). Low-carbohydrate diets, dietary approaches to stop hypertension-style diets and the risk of postmenopausal breast cancer. *American Journal of Epidemiology*, 174(6): 652-660.

Galani, C. & Schneider, H. (2007). Prevention and treatment of obesity with lifestyle interventions: review and meta-analysis. *International Journal of Public Health*, 52: 349-359. doi:10.1007/s00038-007-7015-8

Garrett-Wright, D. (2011). Parental perception of preschool child body weight. *Journal of Pediatric Nursing*, 26: 435-445.

Gibson, S. (2008). Sugar-sweetened soft drinks and obesity: a systematic review of the evidence from observational studies and interventions. *Nutrition Research Reviews*, 21: 134-147. doi:10.1017/S0954422408110976

Harvard School of Public Health. (2012). Fact sheet: sugary drink supersizing and the obesity epidemic. Retrieved from http://www.hsph.harvard.edu/nutritionsource/files/2012/10/sugary-drinks-and-obesity-fact-sheet-june-2012-the-nutrition-source.pdf

Harvard School of Public Health. (2013). Vegetables and fruits: get plenty every day. Retrieved from www.hsph.harvard.edu/nutritionsource/vegetables-full-story/

Haven, J., Burns, A., Britten, P., & Davis, C. (2006). Developing the consumer interface for the MyPyramid food guidance system. *Journal of Nutrition Education and Behavior*, 38: 6S. 124-135.

He, F.J., Nowson, C.A., & MacGregor, G.A. (2006). Fruit and vegetable consumption and stroke: meta-analysis of cohort studies. *The Lancet*, 367: 320-326.

Hoevenaar-Blom, M.P., Nooyens, A.C.J., Kromhout, D., Spijkerman, A.M.W., Beulens, J.W.J, van der Schouw, Y.T., Bueno-de-Mesquita, B., & Verschuren, W.M.M. (2012). Mediterranean style diet and 12-year incidence of cardiovascular diseases: The EPIC-NL cohort study. *PLOS ONE*, 7(9):1-7.

Hollis, J.F., Carmody, T.P., Connor, S.L., Fey, S.G., & Matarazzo, J.D. (1986). The nutrition attitude survey: associations with dietary habits, psychological and physical well-being, and coronary risk factors. *Health Psychology*, 5(4): 359-374.

Horm, J., & Anderson, K. (1993). Who in American is trying to lose weight? *Annals of Internal Medicine*, 119(7 pt 2): 672-676.

Hu, F.B. & Malik, V.S. (2010). Sugar-sweetened beverages and risk of obesity and type 2 diabetes: epidemiologic evidence. *Physiology & Behavior*, 100: 47-54

James, D.C.S. (2004). Factors influencing food choices, dietary intake, and nutrition-related attitudes among African Americans: application of a culturally sensitive model. *Ethnicity & Health*, 9(4), 349-367.

Let's Move! (n.d.). America's move to raise a healthier generation of kids. Retrieved from www.letsmove.gov

Liu, S., Stampfer, M.J., Hu, F.B., Giovannucci, E., Rimm, E, Manson, J.E., Hennekens, C.H., & Willett, W. (1999). Whole-grain consumption and risk of coronary heart disease: results from the Nurses' Health Study. *American Journal of Clinical Nutrition*, 70: 412-419.

Ludwig, D.S., Peterson, K.E., & Gortmaker, S.L. (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *The Lancet*, 357: 505-508.

May, A.L., Donohue, M., Scanlon, K.S., Sherry, B., Dalenius, K., Faulkner, P., & Birch, L.L. (2007). Child-feeding strategies are associated with maternal concern about children becoming overweight, but not children's weight status. *Journal of the American Dietetic Association*, 107(7): 1167-1174.

McLeroy, K.R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, 15(4): 351-377.

McMillen, R. (2010). North Mississippi Medical Center Health Assessment, 2010. *Mississippi State University*.

National Institutes of Health. (2012). *Obesity and cancer risk*. Retrieved form http://www.cancer.gov/concertopics.factsheet/Risk/obesity

National Institutes of Health. (2013). *Type 2 diabetes*. Retrieved from www.nlm.nih.gov/medlineplus/ency/article/000313.htm

National Institutes of Health/National Heart, Lung, and Blood Institute. (1998). Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. (NIH Publication No. 98-4083). National Institutes of Health.

Nevins, S. & Hoffman, J. (Executive producers). (2012). The weight of the nation [documentary]. United States: Home Box Office.

Oh, K., Hu, F.B., Manson, J.E., Stampfer, M.J., & Willett, W.C. (2005). Dietary fat intake and risk of coronary heart disease in women: 20 years of follow-up of the nurses' health study. *American Journal of Epidemiology*, 161(7): 672-679.

O'Sullivan, I., Orbell, S., Rakow, T., & Parker, R. (2004). Prospective research in health service settings: health psychology, science, and the 'Hawthorne' effect. *Journal of Health Psychology*, 9(3): 355-359. doi: 10.1177/1359105304042345.

Park, M.H., Falconer, C.L., Saxena, S., Kessel, A.S., Croker, H., Skow, Á., Viner, R.M., & Kinra, S. (2013). Perceptions of health risk among parents of overweight children: a cross-sectional study within a cohort. *Preventive Medicine*, 57: 55-59

Phillips, M.M., Raczynski, J.M., Walker, J.F. (2011). *Year Six Evaluation: Arkansas Act 1220 of 2003 to Combat Childhood Obesity*. 2010 ed. Little Rock, AR: Act 1220 Evaluation Team: University of Medical Sciences; College of Public Health

Reed, D.B., Patterson, P.J., & Wasserman, N. (2011). Obesity in rural youth: looking beyond nutrition and physical activity. *Journal of Nutrition Education and Behavior*. 43: 5, 401-408.

Reeves, G.M., Postolache, T.T., & Snitker, S. (2008). Childhood obesity and depression: connection between these growing problems in growing children. *International Journal of Child Health and Human Development*, 1 (2): 103-114.

Roach, C., Feller, S.E., Ward, J.A., Shaikh, S.R., Zerouga, M., & Stillwell, W. (2004). Comparison of cis and trans fatty acid containing phosphatidylcholines on membrane properties. *Biochemistry*, 43: 6344-6351.

Schneider, K.L., Baldwin, A.S., Mann, D.M., & Schmitz, N. (2012). Depression, obesity, eating behavior, and physical activity. *Journal of Obesity*, 2012, article ID 517358, 2 pages, 2012. doi: 10.1155/2012/517358

Sofi, F., Cesari, F., Abbate, R., Genisi, G.F., & Casini, A. (2008). Adherence to Mediterranean diet and health status: meta-analysis. *British Medical Journal*, 337: a1344. doi:10.1136/bmj.a1344

Southward, L.H., Baggett, D., Blanchard, T., Buffington, A., Hussein, J., McKee, C., & Parrish,D. (2011). *Parent youth and policymakerperspectives on the Mississippi Healthy Students Act of 2007: year 3 findings*. The Center for Mississippi Health Policy funded by the Robert Wood Johnson Foundation.

Steffen, L.M. (2006). Eat your fruit and vegetables. *The Lancet*. 367: 277-278.

Taylor, E.N., Fung, T.T., & Curhan, G.C. (2009). DASH-style diet associates with reduced risk for kidney stones. *Journal of the American Society of Nephrology*, 20: 2253-2259.

The Child and Adolescent Health Measurement Initiative. (2012). Data Resource Center for Child & Adolescent Health. Retrieved from www.childhealthdata.org/browse/allstates?q=2415

Trust for America's Health, The Robert Wood Johnson Foundation. F as in fat: How obesity threatens America's future. Washington, D.C.: Trust for America's Health; 2012.

U.S. Department of Agriculture. (2011). *A brief history of USDA food guides*. Retrieved from http://www.choosemyplate.gov/food-groups/downloads/MyPlate/ABriefHistoryOfUSDAFoodGuides.pdf

U.S. Department of Agriculture. (2013). *Food groups*. Retrieved from http://myplate.gov/food-groups/

U.S. Department of Agriculture & U.S. Department of Health and Human Services. *Dietary guidelines for Americans, 2010*. 7th Edition, Washington, D.C: U.S. Government Printing Office, December 2010.

U.S. Department of Health and Human Services (n.d.). *The Surgeon General's call to action to prevent and decrease overweight and obesity*. Retrieved from http://www.surgeongeneral.gov/library/calls/obesity/index.html

U.S. Department of Health and Human Services. (2003). *Facts about the DASH eating plan*. Retrieved from http://www.ndhealth.gov/heartstroke/image/cache/Facts_About_The_DASH_Eating_Plan.pdf

U.S. Department of Health and Human Services. (2011). *The Surgeon General's call to action to prevent and decrease overweight and obesity*. Retrieved from www.surgeongeneral.gov/library/calls/obesity/CalltoAction.pdf.pdf

U.S. Department of Health and Human Services. (2012a). *Overweight and obesity statistics*. Weight-control Information Network fact sheet. NIH Publication No. 04-4158. Retrieved from http://win.niddk.nih.gov/publications/PDFs/stat904z.pdf

U.S. Department of Health and Human Services. (2012b). *What are overweight and obesity?* Retrieved from http://www.nhlbi.nih.gov/health/health-topics/topics/obe/

U.S. Department of Health and Human Services. (2012c). *How are overweight and obesity treated?* Retrieved from http://www.nhlbi.nih.gov/health/health-topics/topics/obe/treatment.html

U.S. Department of Health and Human Services. (2012d). *How can overweight and obesity be prevented?* Retrieved from http://www.nhlbi.nih.gov/health/health-topics/topics/obe/prevention.html

U.S. Department of Health and Human Services. (2013). *About We Can!*. Retrieved from http://www.nhlbi.nih.gov/health/public/heart/obesity/wecan/about-wecan/index.htm

Wardle, J., Parmenter, K., & Waller, J. (2000). *Nutrition knowledge and food intake*. *Appetite*, 34: 269-275.

Willett, W.C., Sacks, F., Trichopoulou, A., Drescher, G., Ferro-Luzzi, A., Helsing, E., et al. (1995). Mediterranean diet pyramid: a cultural model for healthy eating. *American Journal of Clinical Nutrition*. 1402-1406.

Young-Hyman, D., Herman, L.J., Scott, D.L., & Schlundt, D.G., (2000). Care giver perception of children's obesity-related health risk: a study of African American families. *Obesity Research*, 8(3): 241-248.

Zammit, C., Liddicoat, H., Moonsie, I., & Makker, H., (2010). Obesity and respiratory diseases. *International Journal of General Medicine*, 3: 335-343.