THE RELATIONSHIP BETWEEN EDUCATION AND OBESITY AMONG BLACK WOMEN IN THE NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY CYCLES 1999-2010

A Dissertation

by

GWENETTA DENISE CURRY

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Chair of Committee,	William Alex McIntosh
Committee Members,	Verna M. Keith
	Ellisa Lisako McKyer
	Sarah Gatson
Head of Department,	Jane Sell

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ABSTRACT

Although the obesity epidemic in America has begun to level off in recent years, Black women's rates have continued to increase. The latest Center for Diseases Prevention and Control (CDC) numbers show that 56.6% of Black women are considered to be obese compared to 44.4% Hispanic and 32.8% of white women. These numbers simply highlight the need for a deeper understanding of what factors increase the risk of obesity for Black women. This dissertation begins by exploring the current literature on factors that influence obesity rates and linking educational attainment to health outcomes.

The 1999-2010 years of the National Health and Nutrition Examination Survey were combined for these analyzes. I examine the prevalence of obesity among Black women from 1999-2010 by education and age groups. The results show that Black women with some education and associate degree and age group 20-39 had the highest rates of obesity. Next, I ran multiple, logistic, and multinomial regressions to determine which factors are associated the obesity in Black women. The results indicate that C-reactive protein levels $\geq$0.3 mg/dl had a positive association with obesity. C-reactive protein was used to measure exposure to stress triggering an inflammation response.

The results also indicate that Black women have increased odds of being obese if they worked more than 46 hours a week. Fruits and vegetable intake was not associated with body mass index of Black women. Lastly, physical activity was only positively associated with body mass index of Black women with Some College and Associate degrees. These data indicate there is a real need to focus on Black women's health and the impact their environment has on their health behaviors and health outcomes.

DEDICATION

I would like to dedicate this dissertation to my husband Dr. Tommy Curry, through his constant support and encouragement I was able to complete this task. In the ten years, we have been together; you have continued to push me to be more than I ever thought I was capable of being. I am grateful for your dedication to our family and making sure things run smoothly. Love always.

I would also like to dedicate this to my girls Kiàyla and Naeylh as the two of you have pushed me to do everything to the best of my abilities. When the task at hand seems impossible, continue to press on, as our ancestors have fought to give us opportunities they could only dream of.

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NOMENCLATURE

BMI	Body Mass Index
CRP	C-reactive Protein
WC	Waist Circumference

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CHAPTER I

INTRODUCTION

According to the Center for Disease Prevention and Control more than one-third of Americans adults (39% or 78.6 million) are considered obese (CDC 2014). As the seventh leading cause of death in America, scientists are giving special attention to the causes and consequences of obesity. People who maintain a healthy weight status are less likely to develop chronic diseases such as heart disease, some cancers, osteoporosis, and type-2 diabetes, or die at an early age (Healthy People 2020 2015). Women with a healthy weight are reported to experience fewer complications during pregnancy (Guelinckx et al. 2008). Healthy People 2020 has set a target to reduce the number of adults who are considered obese to 30% by the year 2020. Although the overall obesity rate in America has remained stable since 2003, the rates among men, Black women, and Mexican American women have continued to climb. Because of their lower socioeconomic status, much of the current research suggests that minority populations are particularly vulnerable to the growing obesity epidemic. Their relative economic disadvantage compared to whites not only impacts (Healthy People 2020 2016) their social mobility, employment, and makes optimal stress levels harder to attain; it also makes healthy food less available (Williams and Mohammed 2013).

Previous studies have shown a direct link between income level and increased the risk of obesity. Income affects the number of resources available to buy healthy foods and to participate in leisure-time physical activities (Wardle et al. 2002). When

undertaking an analysis of obesity in the United States, the economic conditions of Blacks cannot be overlooked. When compared to whites, Blacks have higher rates of unemployment and mortality at every level of education. According to the U.S. Bureau of Labor Statistics, the unemployment rate for Blacks in 2014 was 10.4 percent, compared to the rates for whites, Hispanics, and Asians being 4.7, 6.6 and 4.0 percent, respectively (Bureau of Labor Statistics 2014). The unemployment rate of educated Blacks in 2014 was no less disheartening among those who are black and had attended some college, 23.7 were unemployed; among those with bachelor degrees, 15.4 percent were unemployed; and among those with advanced degrees, 4.5 percent were unemployed. Labor statistics for 2014 convincingly show that even after gaining a degree, Blacks remain unemployed at higher rates than their white counterparts. Despite a higher number of Blacks gaining university degrees, the U.S. Census Bureau reports the national poverty rate for Blacks was 25.8 percent compared to 11.6 percent for whites. These numbers demonstrate that social mobility through education is extremely difficult for Blacks in America.

Since Blacks were brought to the shores of America, they have had inequitable access to social, educational, and material resources. These disadvantages have had both direct (access to healthy diets and medical care) and indirect effects on health status through their influence on stress, psychosocial resources and positive and negative emotions (Feagin 2014). Even Black women's subjective experience of racism—the stigmas others have of them—can pose serious health threats and appear to be related to obesity and weight gain. In spite of these well-established facts, medical sociologists

continue to focus on race as only a demographic measure without considering the multiple effects impact that racial inequality has on the overall health outcomes of Blacks.

Various authors have established that socioeconomic status strongly correlates with health outcomes. Those who are less educated earn less income or hold less prestigious occupations are at greater risk for a wide variety of diseases and premature death (Adler and Rehkopf 2008). While this is the scholarly consensus regarding white populations, the same has not been found among minorities. Recently Holmes and Zajacova (2014) investigated whether non-Hispanic whites and racial/ethnic minorities indeed experience comparable health benefits with greater educational attainment. Their results showed that educational attainment affected the health of whites more than minorities, even with the inclusion of a wide range of potential socio-demographic, behavioral and economic controls (2014). Similarly, Olshansky et al. (2012) hypothesized that education could explain the difference between Black and white life expectancy; however, they found that Black women did not benefit from higher levels of education as their white and Hispanic counterparts do. While increasing education has been popularly offered as a panacea for many of the problems plaguing the Black community, these findings show that much more research is needed before education can truly be suggested as a real remedy.

Purpose

In this dissertation, I will describe the trends in obesity among Black women from 1999-2010 by education and age. I intend to gain a better understanding of the factors contributing to Black women's risk of obesity including the impact of stress and education.

Problem Statement

Current research shows that Black women are disproportionately affected by the obesity epidemic in America (Control 2014), but there is little research available explaining differences within this subpopulation. Earlier studies have shown there are differences in how BMI tracks from childhood to adulthood between Blacks and whites. Freedman et al. (2009) research has demonstrated that BMI increases with age and that these increases are greater among Black girls than among white girls. Differences in weight perception between white and Black women have also been suggested as a possible explanation as to why Black women suffer from a disproportionate level of obesity compared with white women (Ogden 2009). Boggs et al. (2011) found that the risk of death, from any cause, among Black women was greater among those whose body mass index (BMI) was 25.0 or higher, a pattern similar to that of whites. The larger waist circumference was associated with an increased risk of death from any cause among women who never smoked (Bogg et al. 2011). Interestingly, waist circumference has been positively associated with the risk of death independently of BMI among whites, but these associations were much weaker among Blacks (Koster et al. 2008) or

nonexistent (Stevens et al. 1992; Reis et al. 2009). Previous studies indicate that obese Black women do not perceive themselves as overweight or obese and underestimate their weight status more than white women (Hendley et al. 2011). These debates emphasize the need for further empirical studies of Black women's health to unravel the undergirding causes of obesity among this population.

With over half the Black women in America being considered overweight or obese (Ogden 2009; Flegal, et al. 2010), scholars must consider the possibility that some psycho-social factors are impacting Black women differently than other populations. Among men, there was little difference in the prevalence of obesity by race/ethnicity (CDC Morbidity and Mortality Weekly 2013). Among women, however, the overall 1999-2010 prevalence among non-Hispanic Blacks (51%) was 10% higher than that among Mexican-Americans, and 20 percentage points higher than that among non-Hispanic whites (May et al. 2013). According to the *Journal of Blacks in Higher Education*, "Black women with a bachelor's degree had a median income of $33, 877, which was 111 percent of the $30, 413 median income figures for non-Hispanic white women who held a college degree" (2007). Although these figures show Black women with bachelor degrees making slightly more money than white women with the same education, it does not tell the complete story. Compared with white women, Black women possessed less access to education, high paying occupations and were less able to maximize those resources given the societal structure (U.S. Department of Labor 2008). Fewer resources and larger amounts of debt contribute to the difficulty Black women have with upward mobility. The lack of social mobility among Black women

increases their proximity to poverty and decreases their access to healthy foods, and safe places to exercise. In combination, these conditions make Black women more vulnerable to negative health outcomes.

While obesity increased in all race-sex groups from 1971 to 2000, for white women there was a clear inverse association between obesity and educational attainment over time. White men in the low socioeconomic status groups experienced a decrease in obesity from 1999 to 2002 (Zhang and Wang 2004). Among Black women, a curvilinear association between obesity and education was found, as the medium SES group had the highest prevalence of obesity by 1999 (Zhang and Wang 2004). Black women at every educational level were disproportionately affected by the obesity epidemic compared to their white counterparts (Jackson et al. 2013). Black women with greater than high school education had BMIs higher than white women with less than high school education (Jackson et al. 2013), a finding again demonstrating that the advantages of education are not as great for Black women. In fact, given the available evidence, higher education might worsen Black women's health outcomes due to extra stress related to occupation, debt, and family needs.

While medical sociologists have established that education increases the health of populations (Adler et al. 2003), analyses as to how this gradient operates among Black populations have been greatly under-researched. Previous research has attributed the high rates of obesity among Black women to their socioeconomic status (Zhang and Wang 2004; Hayward, Crimmins, and Miles 2000; Williams and Collins 1995), but it is clear that class alone cannot explain the relationship between Black women and obesity.

Marriage is thought to have protective influences on health outcomes (Lillard and Waite 1995), but some studies show an increase in body mass index for men and women after marriage (Kahn and Williamson 1991). Due to the shortage of men, the delay of marriage, low marriage rates, and the overall rise in cohabitation across the population, Black women have come to head over 60% of Black households (Kenney 2013). Some studies have attributed the lower marriage rates to increased rates of cohabitation being more prevalent among Blacks than whites (Brown, Van Hook and Glick 2008; Thornton et al. 2007; Bureau 2011). Blacks report higher levels of marital strain, which in turn reduces the benefits of marriage for health and longevity in Black populations (Umberson et al. 2005). Unlike white women, Black women are less likely to increase their financial capital from relationship unions (Edin and Kefalas 2005). When controlling for role characteristics (parenthood, employee, marital status), Black women were more distressed and in worse physical health than other race/gender groups (Rushing and Schwabe 1995). As suggested throughout this dissertation, Rushing and Schwabe's research demonstrates that Black women experience greater amounts of stress than their white counterparts and that this amount of stress can exacerbate the Black-white health disparity.

These studies assume that increasing education means that the educated increase their healthy life habits that include more exercise and healthier food choices. Although Black women with college degrees have lower BMI than Black women with less than high school education, both groups are still more likely to be obese than their white counterparts (Jackson et al. 2013). This raises some doubts concerning the effect

education has on Black women's rate of obesity because stress and dietary choices have been shown to contribute to their risk of obesity, which remains unaffected by education alone.

Stress is a major contributor to high blood pressure and obesity (Keaney et al. 2003; Bjorntorp 2008). Stress can come in at least two forms: occupational stress and environmental stress. It has been shown that extended exposure to any of these varieties of stress generates a negative biological response (Adler et al. (2008). Some authors have argued that Blacks have an elevated risk for hypertension due to their prolonged high-effort coping with social and economic stressors (Subramanyam et al. 2013). Historically, Black women have had to work long hours in stressful conditions to help support their families (Glenn 1985; Mays et al. 1996). The research is clear that the more hours spent at work outside the home, the fewer hours are spent preparing meals at home (Jabs and Devine 2006; Bowman and Vinyard 2004). Having to work long hours both increases the likelihood of families eating a lot of highly processed convenience food and fast food and decreases the time for physical activity (Smith 2009). The over-consumption of convenience foods, which contain more calories than homemade meals, may contribute to weight gain (Bowman et al. 2004; Bowman and Vinyard 2004).

Minority neighborhoods, overly saturated with convenient stores, limit the access these racial and ethnic groups have to fresh fruit and vegetables or healthier food options more generally. These are the communities Black people generally, but Black women specifically, grow up in and form eating habits around. Although Black women are becoming more educated, this does not mean that their knowledge about food has

changed. There is a cultural component to eating habits that must be addressed. Certain habits are carried from childhood into adulthood and these habits directly affect health outcomes (Mikkila et al. 2004). Bad eating habits are not unique to Black women; other studies have found increasing knowledge of calories and sugar content did not decrease consumption of unhealthy foods. Acheampong and Haldeman's (2013) research on nutrition knowledge, attitudes, and beliefs in low-income Hispanic and Black women caretakers found that the cost of healthy foods was the major obstacle to obtaining a healthy diet. Also, Park et al. (2014) examined the relationship between health-related knowledge and sugar-sweetened beverage (SSB) intake among US adults and found having knowledge of the energy content of soda was not associated with sugar-sweetened beverage intake. This same study showed the knowledge about adverse effects of sugar-sweetened beverage did not deter the consumption of these beverages among adults. These studies demonstrate that nutritional knowledge alone does not increase the consumption of healthy foods and that income plays a major role in food consumption.

Previous studies indicate if a person is overweight or obese as a child, they more likely to be obese as an adult (Serdula et al. 1993; Guo and Chumlea 1999; Freedman et al. 2005). More recently, First Lady Michelle Obama launched the "Let's Move!" campaign on February 9, 2010, to increase healthy eating and physical activity to help combat childhood obesity. To make significant lifestyles changes, you have to both educate the population on how to eat and make the healthy food accessible and affordable. Some studies have argued that food stamps are linked to increases in obesity

rate due to either increase in purchasing power or people using their extra money that would have allocated for groceries to by fast food (Smith 2009; Gibson 2003). However, The U.S. Department of Agriculture Economic Research Report Summary, states that the "use of food stamp benefits does not increase either Body Mass Index (BMI) or the likelihood of being overweight or obese" (Economic Research Service 2008). Historically, food stamp program participation has been associated with the reducing the food insecurity of participants, but individuals who participated in the food stamp program are still more likely to be food insecure than non-participants (Borjas 2002; Nord 2001).

Significance of the Study

Having a better understanding of what impacts Black women's obesity rates will allow for better policies to make more productive interventions in health and nutrition education in community outreach programs. Black women have the greatest risk of obesity and obesity-related diseases, such as hypertension, type-2 diabetes, coronary heart disease, cancer, arthritis, and high cholesterol than their white female counterparts (Krish et al. 2007; Boggs et al. 2011; Must et al. 1999). These health problems have a negative impact on life expectancy and quality of life among Black women. What is most perplexing about the obesity epidemic is that it is not only isolated to low-income Black women. Unlike other populations, education and income do not protect Black women from the risk of being obese.

Previous research has assumed that Black people in general benefit from higher rates of education similar to their white counterparts. Such claims assume that education gives Black Americans access to healthier food and that they operationalize their education to make better food choices given their increase in economic resources, neither of which addresses the ramifications of environmental and occupational stress.

CHAPTER II

LITERATURE REVIEW

The research on obesity has been widespread, investigating genetic predisposition to socioeconomic status. Previous studies have found that the environment plays an enormous role in overall health outcomes, including but not limited to obesity. This literature review will focus on factors associated with obesity. My review begins with a discussion of the biological responses to stress and how prolonged exposure to stress can lead to obesity. Secondly, I describe the link between educational attainment and obesity and, thirdly, I review the literature linking increased healthy behaviors to decrease obesity outcomes. I then discuss the cultural aspects of body image and weight perceptions among Black women and their relationship to obesity. My fifth section looks at the connection between Black women working long hours and obesity outcomes, followed by a discussion of the consequences the lack of adequate resources have for body weight. I end with a discussion of the impact food security and dietary choices have on these same measures.

Biological Response

The literature suggests that prolonged exposure to stress has a negative impact on overall health outcomes among every population (Mitchell et al. 2015). While there are many contributing factors to the condition of Black women, studies no longer deny the impact that one's environment has on health outcomes. Black women's biological

response to stress plays a major role in obesity rates and obesity-related illnesses of this group. Elevated concentrations of c-reactive protein have been seen in adults with exposure to stress associated with socioeconomic disadvantages (Zhang et al. 2008; Pollitt et al. 2007; Taylor et al. 2006), and there is a confirmed link between CRP and obesity (Brooks et al. 2010; Hamer and Stamatakis 2008; Part et al. 2005). Recent studies have shown that biological responses to stress cause an increase in cortisol secretion. This results in increased fat storage, most notably in the abdominal region, which is more pronounced in Blacks than whites (Hunte and Williams 2009). Geronimus' study demonstrated that low-income black women experience accelerated biological aging in response to repeated or prolonged adaptation to subjective and objective stressors (Geronimus et al. 2010). Her results have shown that Black women at the age of 49 to 55 are 7.5 years biologically older than their white female counterparts. Geronimus and others found that perceived stress and poverty accounted for 27% of the "biological age" difference between Black and white women (Geronimus et al. 2010). Geronimus' work highlights the effects of environmental stress on Black women's homeostasis and how these imbalances are particularly worrisome since they cause Black women's health to deteriorate quicker than white women's health.

A recent study by Tomiyana et al. looked at the link between acute, chronic stress and obesity in Black and white females aged 10-19. Their results show that higher levels of stress after ten years predicted significantly greater increases in BMI over time compared to lower levels of stress. This relationship was significantly stronger for Black girls compared to white girls. They concluded that stress is a modifiable risk factor that

may reduce racial disparities in BMI at early ages (Tomiyana et al. 2013). This study indicates that stress greatly influences Black women's obesity rates and if addressed at a young age could lessen the gap in BMI between white and Black women later in life.

Previous studies have shown that prolonged exposure to stress has a negative effect on overall health outcomes and morbidity. For example, Wisnivesky et al. have investigated the relationship between perceived stress and morbidity among adult inner-city asthmatics. Their results show that higher perceived stress is strongly associated with increased asthma morbidity across a one-year follow-up (Wisenivesky et al. 2010). Similarly, Mullings and Wali have shown that Black women experience substantial stressors related to SES, including perceptions of neighborhood safety, erratic work schedules, lower quality housing, and job strain (Mullings and Wali 2001). All of the stressors above have a negative impact on Black women's health status, morbidity, and mortality. Education does not seem to reduce the stress Black women experience as a result of marginalization.

Education and Obesity

Previous studies show increasing education leads to better health as well as better health behaviors, but most studies have not considered the complexities of the African American population. Kimbro et al. (2008) used National Health Interview Survey from 2000-2006 to investigate the relationship between education and a broad range of health measures by race/ethnicity and nativity. They found that education is a more powerful determinant of health behaviors and outcomes for some groups than it is for others.

Dupre et al. (2008) research found that based on 20 years, of longitudinal data suggested that education is related to both the individual and accumulated number of health risk. These, in turn, were related to increasing educational differences in rates of disease incidence and survival. Dupre et al. note "for hypertension, behavioral risks fully account for education's negative effect on disease onset whereas educational differences in survival are best explained by the accumulation of social and economic risk" (Dupre 2008). Previous studies have shown that waist circumference is considered to be a strong predictor of health risk than BMI alone. Boing and Subramanian's (2015) research indicated there is a positive association between area-level education and waist circumference (WC). In their study, for women, waist circumference was 4.67 cm higher, and BMI was 1.12 kg/m2 higher in residents who lived in low education neighborhoods. More research shows that WC, also known as "central obesity," is a better predictor of chronic diseases, particularly type 2 diabetes, hypertension, and dyslipidemias, than overall adiposity measured using BMI (Wang et al. 2005; Zhu et al. 2005).

Among African American women, education was not found to have a significant effect on being overweight and obese. While whites with higher levels of education significantly decreased their chances of being categorized as overweight or obese (Yun et al. 2006; Mensah et al. 2005), Blacks with higher levels of education did not have either lower rates of being obesity or less risk of being overweight. (Gordon-Larsen, Adair, and Popkin 2003). Across all gender, racial, and socioeconomic groups, body weight was found to increase one's risk of diabetes, hypertension, and high serum

cholesterol. Among obese individuals, the prevalence of hypertension was higher in black subjects. Prevalence of diabetes, hypertension, and heart disease was higher in individuals with lower education compared to their counterparts (Paeratakul et al. 2002). Mensah and other's (2005) research shows that the prevalence of hypertension was high among blacks regardless of sex or educational status. Also, for Black women, education did not reduce their prevalence of having high levels of C-reactive protein, with 50.1% <High School and 50.3% ≥High School education having levels >0.3mg/L (Mensah et al. 2005). These studies reiterate the lack of impact gaining educations has on improving Black women's health outcomes.

Health Behavior

Dressler (2005) defines the Health Behavior model as "a model for the explanation of health disparities that emphasize differences between racial and ethnic groups in the distribution of individual behaviors related to health, such as diet, exercise and tobacco use" (p. 232). Researchers have found unhealthy behaviors to relate directly to overall poor health status. Previous studies show Black Americans are more likely to have poor diets and limited physical activity due to the lack of access to healthy affordable food options, healthcare access, and unsafe neighborhoods(Corral et al. 2011; Grzywacz and Marks 2001; Wickrama, Conger, and Elder 1999).

Diet and Eating Habits

Consumption of high-calorie food has long been associated with increased BMI and negative health outcomes. Noia J. et al. in 2008 conducted a qualitative study of 399 African American adolescents, ranging from age 10-15, to investigate the use of eating behaviors to predict low-fat intake (Noia, Contento, & Schinke, 2008). A Food Habits Questionnaire was used to measure fat-related dietary behaviors, and the Block Fat Screener was used to measure fat intake. Seven behaviors significantly associated with low-fat intake: had chicken that was baked or broiled instead of fried; ordered pasta or pizza served without meat sauce or meat toppings; had a vegetarian dinner; used low-calorie instead of regular salad dressing; ate at least two vegetables (not green salad) at dinner; ate bread, rolls, or muffins without butter or margarine; and avoided foods that were fried in oil, shortening, or lard. The results showed that dietary interventions to reduce fat intake among Black adolescents may promote the adoption of these behaviors. Previous research has demonstrated that reducing consumption of fried foods also reduces cholesterol levels, which have a reduced the risk of heart disease (Dietz et al. 2012). According to the American Heart Association, consuming large amounts of fried foods can lead to obesity and increases the risk of having heart disease (AHA 2014).

A study by Fisher et al. (2007) found that large portions of fried foods may contribute to obesogenic dietary environments by promoting excessive daily intakes among 59 Hispanic and African American children. The effects of larger portions on daily energy intake were tested in 5-year-old children and their mothers from low-income families. Portion sizes of three entrées (lunch, dinner, and breakfast) and an

afternoon snack served during a 24-hour period were the reference size in one condition and doubled in the other condition. Weighed food intake, anthropometric measures, and self-reported data were collected. The results show that children and mothers' intake of the portion-manipulation were not correlated. Total energy intakes in the large portion condition were 12% and 6% higher in children and mothers respectively than the recommended amount of energy intake.

While some people turn to exercise as a means to deal with stress, there are others who turn to food as a form of comfort. Research shows that stress affects eating in a bidirectional way, with some people decreasing and some increasing their food intake to cope with higher levels of stress (Adam and Epel 2007; Macht 2008; Hayman, McIntyre, and Abbey 2015). Sims et al. found there was an association between perceived stresses, emotional eating, and increased consumption of sweet snack foods and that this association was particularly strong amongst overweight and obese African Americans (Sims et al. 2008). Individuals who eat in response to stress prefer high-calorie foods; therefore, prolonged exposure to stress can lead to stress-induced eating resulting in an increase in BMI (Kandiah et al. 2006; Kim et al. 2009). Exposure to chronic life stress seems to be associated with a greater preference for energy and nutrient-dense foods, namely those that are high in sugar and fat (Torres and Nowson 2007; Gibson 2006; Laitinen, Ek, and Sovio 2002). Evidence suggests that glucocorticoids blunt the efficiency of the inhibiting branch of food intake control, which stimulates the food intake branch, leading to increased energy intake and as a result, to obesity (Tattarini, Larson, and Svitker 1996).

Some studies have shown a relationship between consumption of calorie-dense foods with mental health issues. Evidence provided by Keys and others suggests that the paradoxical observation of decreased risk of depression but elevated rates of physical illness among Blacks in the U.S. compared with Whites may have been accounted for by the use of coping behaviors (e.g., alcohol and nicotine consumption, overeating) among Blacks exposed to high stress levels (Keyes, Barnes, and Bates 2011). Their study suggested that coping behaviors mitigate the deleterious effects of stressful exposures on mental health while increasing the risk of physical ailments. Keys and others argued that racial patterning in mental and physical health outcomes could, therefore, be explained by this mechanism if a) these behaviors were more prevalent among Blacks than Whites and, b) the effect of these behavioral responses to stress differed by race. The results showed that a) Blacks were less likely to engage in alcohol or nicotine consumption at low, moderate, and high levels of stress compared to Whites, and b) there was a significant three-way interaction between race, stress, and coping behavior for BMI only. Contrary to their hypothesis, the results showed that elevated BMI was protective against depression in Blacks at low, but not high, levels of stress. Blacks were less likely to engage in alcohol and nicotine consumption but have higher BMI than Whites at all levels of stress. These studies suggest that elevated BMI among Blacks can be beneficial in low-stress situations, but extended exposure leads to increases in physical illness.

Physical Activity

Physical activity plays a major role in maintaining overall health and is especially key to maintaining a healthy weight. Ladabaum et al. (2014), using the National Health and Nutrition Examination Survey data for adults from 1988 to 2010, found BMI and waist circumference trends were associated with physical activity level but not calorie intake (Ladabaum et al. 2014). According to the CDC, more non-Hispanic white adults (22.8%) met the 2008 Physical Activity Guidelines for aerobic (two hours and 30 min of moderate intensity aerobic activity) and muscle-strengthening activity (2 or more days a week work all major muscle groups) than non-Hispanic Black adults (17.3%) and Hispanic adults (14.4%) (CDC 2014).

Bennett and others (2007) conducted a study investigating the association of perceived neighborhood safety with pedometer-determined physical activity and activity self-efficacy. He found that women and men who reported feeling unsafe during the day were associated with significantly lower odds of having high physical activity self-efficacy (Bennett et al. 2007). Previous studies have shown there is a clear link between exercise and reducing stress (Tsatsoulis and Fountoulakis 2006; Austin, Shah, and Muncer 2005; Salmon 2001; Berger and Owen 1988). While the cause of the rising prevalence of obesity, particularly in the black population, is unclear, although there is increasing evidence to suggest that physical inactivity does play a major role (Weinisier, Goran, and Sell 1998). The inequalities that Blacks face daily, as a result of unemployment and under-employment, create a chronic stressful environment. Cross-sectional analyzes indicate that obesity is more prevalent in sedentary persons; however,

the variation in adiposity that can be attributed to physical activity is small (Weinsier et al. 2000).

Although physical activity among Americans is low and extremely low among women, Black women report particularly low levels of leisure time physical activity. According to the Center for Disease Prevention and Control only 34.9 percent of Non-Hispanic Black women, 18 years and older, achieve the recommended physical activity levels, representing the lowest prevalence for any race and sex demographic group (2014). Not only do African American women have the lowest physical activity score, but they also have unique reasons for not engaging in physical activities. According to Resnicow and others, Black women reported reasons for not being physically active: having to redo hair, lack of time due to family and church duties, limited safe places to exercise and cost of gym memberships (Resnicow et al. 2002). Barriers associated with hair-care maintenance and preference for a more full-figured body shape appeared to be specific to Black women. Previous studies have reported that Black women participants did not engage in physical activity because they did not want to "sweat out" their hair style or because they perceived sweat as an irritant to their head/scalp (Joseph et al. 2015; Harley et al. 2009; Hall et al. 2013; Pekmezi et al. 2013). Their results show that 50 percent of Black women modified their hairstyle to accommodate exercise, and nearly 40% avoid exercise at times owing to hair-related issues.

The majority of the literature show two primary reasons for lack of time to engage in physical activity, work schedules (Bopp et al. 2007; Ingram et al. 2011; Pekmezi et al. 2013) and family caretaking responsibilities (James et al. 2012; Hoebeke

2008; Dunn 2008; Pekmezi et al. 2013). Historically speaking women of all racial/ethnic backgrounds have an established ethic of care that places the needs of others ahead of their own (Henderson and Allen 1991; Gilligan 1982). However, these barriers may be more accentuated in the Black community, given the collective societal viewpoint emphasized in Black cultures as opposed to the more autonomous viewpoint in white cultures (Henderson and Allen 1991).

Some of the correlates of physical activity among Black women consist of personal, social environment and physical environmental factors. Ainsworth and others in 2003 conducted a quantitative study in two different counties in South Carolina on physical activity among African American women between the ages of 20 to 50 years old (Ainsworth et al. 2003). In their study, one-third (34.1%) of the women met the current recommendations for moderate or vigorous physical activity, 49.4% of insufficient activity, and 16.5% were inactive. The things that influenced the women meeting the recommended level of physical activity were related to: higher educational attainment, being married or with a partner, being in excellent or very good health, having greater self-efficacy, seeing people exercise in the neighborhood, having more favorable ratings of women who exercise, having lower social role strain and reporting the presence of sidewalks or lighter traffic in the neighborhood.

Cultural attitudes and perceptions can have an effect on body image, food choices and physical activity. Environmental and personal influences determined Black women's perceptions of weight and healthy lifestyle. Chithambo and Huey's (2013) research showed that Black women reported having a lower perceived weight and higher

attractiveness than white women, in spite of having a higher Body Mass Index. Their research echoes the findings of many other scholars. In Black culture, many Black women who are overweight do not see themselves as overweight or obese. As a result, many do not see the need or importance in losing weight. Previous studies have also shown that Black men have a preference for the heavier weight women, which reduces the incentives for Black women to focus on maintaining a healthy weight (Grabe and Hyde 2006; Sabik, Cole, and Ward 2010). These studies highlight some of the reasons there isn't more of a push for Black women to maintain a "healthy" weight status.

In a qualitative research study, James and others (2012) used the Health Belief Model to develop culturally appropriate weight management programs for African American women. They found that the participants made a clear distinction between the terms healthy weight, overweight and obese while using terms such as "thick," "stacked", and "curvy" to describe extra weight. Most of the participants believed that culture and genetics made them more susceptible to the obesity epidemic. The women also mentioned that the Black communities protect them from the media pressure to be thin, stating that "I think that as black women, we have been brought up to think that big is beautiful" (666). But they also point out that "We don't want to be skin and bones like them [white women]. For them, a size 8 means they are fat, but for us, it means that we look good." "They have the luxury of going to the gym. We have to work two jobs" (666). These statements support the claim that not only do Black women have a preference for being overweight, they also see exercise as a luxury they don't have due to their heavy work schedules.

A study by Mama and others investigated the relationship between body image and physical activity among Latina and Black women (Mama et al. 2011). In their study, Black women perceived their body image correctly 56.8% of the time, meaning their measured weight was associated with their perceived weight. The percentage of Black women who accurately perceived themselves as overweight, obese and normal weight were 28.8, 60.8, 28.8 percent, respectively. Interestingly, 67% of the Black women in this study desired to be obese, while only 24% desired to be normal weight. This study highlights the fact that Black women misperceived themselves as smaller even when they are overweight.

Work Hours and Health Outcomes

Black women have historically worked long hours to support the needs of their families due to the disenfranchisement of Black men in the community. "When slavery was abolished limited economic opportunities for Black men, among other factors, led to the paid employment of Black women outside the home" (Roehling, Jarvis, and Swope 2005). Black families are more likely to include multiple generations and members who are not blood relatives, or first of kin. Thus, employed Black women are more likely to have the support of their husband, family, and community in caring for their children than are other groups (845).

Working long hours have been linked to negative health outcomes, such as preterm birth, obesity, and cardiovascular disease (Virtanen et al. 2012; Bannai and Tamakoshi 2014). Nakamura and others in 1998 found that working overtime was

associated with increases in BMI and waist circumference over a three-year period (Nakamura et al. 1998). Working more than 55 hours in the average week is related to approximately 40 percent excess risk of incident coronary heart disease (CHD) (Virtanen et al. 2012). Echoing these results, Bannai and Tamakoshi found working long hours (>40 hrs a week) was associated with depressive state, anxiety, sleep condition and coronary heart disease (Bannai and Tamakoshi 2014). The risk of coronary heart disease is directly associated with being obese or overweight. These studies demonstrate how working long hours can cause an increase in waist circumference and lead to coronary heart disease.

In a recent study, Virtanen and other conducted a systemic review and meta-analysis of published studies and unpublished individual participant data to quantify the association between long working hours and alcohol use. In their study, they found that individuals whose working hours exceed standard recommendation were more likely to increase their alcohol use to levels that pose a health risk (Virtanen, Jokela, et al. 2015). Lieu et al. 2012, examined the association between rotating night shift work and the risk of hypertension in Black and white women in the Nurses' Health Study II and found that Blacks slept fewer hours, had higher BMI values, had lower physical activity scores and higher proportion had a family history of hypertension (Lieu et al. 2012). By contrast, whites had higher alcohol intakes, used more analgesics and smoked more than Blacks.

Work hours may influence obesity because it is linked to a reduction in healthy eating. Hamilton et al. investigated work hours and perceived time barriers to healthful eating among young adults (Escoto et al. 2012). "Women working more than 40 hours

per week were likely to report not having time to think about eating healthfully and eating on the run; those working 20-39 hours per week were more likely to report being too busy to eat healthfully" (5). The results showed that among women working both part-time and >40 hours per week had both time-related barriers and unhealthy dietary intake. Welch and others' (2009) research investigated the perception of time pressure as a possible barrier to healthy eating and physical activity among women. Time pressure as a barrier to healthy eating was reported by 41% of the women and as a barrier to physical activity by 75%. The women who reported time pressure as a barrier to healthy eating were significantly less likely to meet recommended servings of fruit, vegetable, and physical activity and more likely to eat fast food more regularly.

The majority of the current studies of work hours and health outcome do not focus on African American women. African American women have a unique position since they have historically been a major part of the labor force, unlike white women. To gain a better understanding of the influence of work-hours on health outcomes of this population, it is important to understand their historical relation to the labor force.

Resources and Obesity

Research has shown a strong correlation between poverty and obesity in the United States. James Levine (2011) investigated the association between poverty and obesity in 3,139 counties in the US and found people who live in the most poverty-dense counties are those most prone to obesity. The results showed counties with poverty rates greater than 35 percent have obesity rates 145 percent greater than those of wealthy

counties. Among the lower SES population, there is more obesity, smoking, and exposure to stress, in addition to high blood pressure, less leisure-time exercise and poorer diets (Cockerham 2003). The socio-ecologic characteristics of financially disadvantaged women were associated with higher BMI and cardiovascular disease risk (Mobley 2006). Ahern et al. (2011) found a positive relationship in both metro and non-metro counties between high obesity rates and the percentage of African Americans affected.

Previous studies have found that income has a negative effect on BMI, while other studies found insignificant differences between income groups. Gornick et al. (1996) found among Blacks and whites that the highest-income group had the lowest mortality rates, and the lowest income group had the highest mortality rates, except Black women. In Gornick's study, Black women in the lowest income group had a mortality rate of 5.2 but the rate for the highest income group was 5.3. Williams and Jackson's (2005) research showed that mortality from heart disease among low and middle-income Black women is 65 percent and 50 percent higher respectively than for comparable white women. The research linking income to mortality rates are clear, and the relationship between income and obesity rates continue to be inconsistent.

Food Insecurity

Food security is defined as "ready availability of nutritionally adequate and safe foods and an assured ability to acquire acceptable foods in socially acceptable ways (e.g. without resorting to emergency food supplies, scavenging, or other coping strategies)"

(Anderson 1990). Previous research has found a positive relationship between food insecurity and obesity in adults (Olson 1999; Dietz 1995). Pan et. Al. (2012) showed that compared with food secure adults, food insecure adults had significantly higher prevalence of obesity in the following population subgroups: adults ages ≥30 years, women, non-Hispanic whites, non-Hispanic blacks, adults with some college education or a college degree, a household income of <$25,000 or 50,000 to $74,999, and adults with none or two children in their households.

According to federal dietary guidelines, it is recommended individuals consume two cups of fruits and two and a half cups of vegetables per day for a recommended 2,000 calories per day diet. Increasing fruit and vegetable intake has been shown to reduce antioxidant stress, improve lipoprotein profile, lower blood pressure, increasing insulin sensitivity and improving homeostasis regulation (Duyn and Pivonka 2000). The cost associated with higher fruit and vegetable intake has been identified as a major inhibiting factor in fruit and vegetable consumption in urban and rural areas. As a result, the high prices of fruits and vegetables drive consumers who cannot afford these items to cheaper higher fat and sugary products.

Eyler et al. (2004) showed that higher education and income were associated with low-fat eating behaviors, fat calories, and frequency of fat/oils/sweets. Mushi-Burnt and others (2007) research also found no statistically significant differences in fruit and vegetable intake by income status, and perceptions of the cost of fruits and vegetables were found to associate significantly with fruit and vegetable intake among children and parents. In a more recent study, Carlson and Frazao (2014) showed a weak relationship

between income and diet quality; healthy foods were found to be affordable, but the message needs to be communicated to the community. Carlson's article also points out that the way the food price is measured determines the perception of how expensive healthy and less healthy food is. Perceived food insecurity may influence consumers to buy low-cost, energy-dense food.

Research Hypotheses

Hypothesis 1: There will be a gradient decrease in obesity with the increase of education among Black Women.

Hypothesis 2: C-reactive protein, as an indicator of stress, will be strongly associated with BMI and WC among Black women.

Hypothesis 3: Among black women, C-reactive protein will moderate the relationship between education and obesity.

Conceptual Model

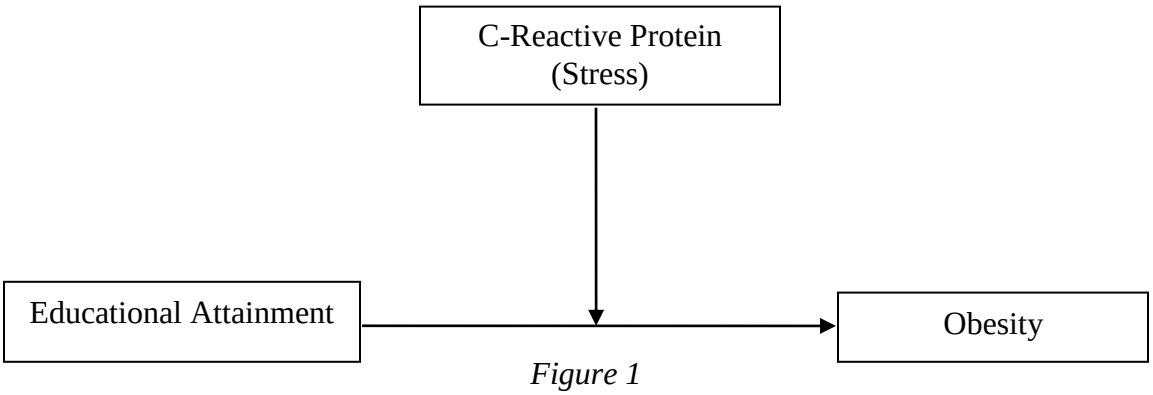

Figure 1

Summary

As stated earlier, increasing education has been seen as a means to improve one's quality of life and health outcomes, but for minority populations, this has not been the case. Educational attainment among Black women is at an all-time high while their obesity rates remain higher than any other population in America. Compared to white women, Black women maintain a higher rate of obesity regardless of education level.

CHAPTER III

METHODS

Dataset Description

I used data from the National Health and Nutrition Examination Survey (NHANES) cycles 1999-2010, to examine whether there is an education gradient in obesity among Black women. NHANES uses a nationally representative sample of adults and children in the United States. Data collection includes in-depth, in-person surveys, physical and physiological examinations and laboratory tests (CDC 2015). Since the National Center for Health began NHANES in the 1960s, there have been several changes. NHANES I, II, and III were completed over various spans of time, from four years in NHANES I to seven years in NHANES III. Since 1999, NHANES has collected data using a consecutive, cross-sectional design in ongoing 2-year cycles ("Continuous NHANES"). The survey samples included approximately 5,000 individuals each year.

I used a subsample of the Continuous NHANES dataset to reflect Black women age 20 and over (N=3,380). Participants without body weight and height were excluded from the study. Pregnant women were also excluded from the sample. After accounting for missing observations, the final analytical sample included a total of 2,760 NHANES participants.

Dependent Measures

Body Mass Index and Obesity

Participants' weight and height were measured in a mobile examination center using standardized techniques and equipment. Body mass index (BMI), was expressed as weight in kilograms divided by the square of height in meters. Adults are commonly classified as overweight (BMI 25.0-29.9kg/m*2), obese (BMI greater than or equal to 30.0kg/m*2) and extreme obesity (BMI greater than or equal or equal to 40kg/m*2) among adults (age 20 years and over). Body Mass Index will be used to measure obesity three different ways: continuous, dichotomous (0=Not Obese, 1= Obese) and categorical (1=underweight, 2= Normal, 3= Overweight, 4= Obese).

Waist

Waist measurements were taken by trained health technicians in the mobile examination center. A trained recorder assisted the health technician. The technician and recorders worked as a team to the position, measure and record the body measurement data accurately (Center for Disease Control 2000).

Independent Measures

Educational Attainment

Education will be used to measure socioeconomic status (SES) and has been suggested by many scholars to be the most stable and robust indicator of SES. Other SES variables, such as income and occupation, vary over time and have a lower response rate than education items. Educational attainment will be measured using the question

"What is the highest grade or level of school completed or the highest degree received?" Education is coded as a categorical variable where 1= Less than High School, 2=High School, 3 Some College or Associate, 4= College Graduate or Greater. The reference group will be the "high school." Education will be treated as an independent variable rather than a moderator when testing the hypotheses.

Serum C-reactive protein

Participants' serum C – reactive protein was taken in the mobile examination center with values ranging from 0.01 to 18.01 mg/dL. C-reactive protein measures inflammation response and participants with levels greater than or equal to 0.3 indicate high risk. Analysis will be measured two ways: continuous and dichotomous (0= <0.3; 1 = $\geq$0.3).

Control Measures

Food Insecurity

Household food security status was based on the NHANES household food security category designation, which was determined using the 18-item U.S. Food Security Survey Module known as the "Core food security module." Only one respondent per household answered the Module, even if there is more than one family living in a household. Screening into the module depended on responses to previous questions, and those households screened out were assumed to have negative responses to all module questions. Households that give uniformly negative responses to the early questions will have a very low likelihood of having experienced any conditions of food

insecurity and can safely be deemed to be food secure (Office of Analysis 2000). The two level of screening is the First-level screen, including optional Q1. "We always have enough to eat and the kinds of food we want" and respond "never true" (or "don't know" or "refuse" to all five of questions Q2 to Q6.[1] Second level screening for households not previously screened out responded: "never true" (or "don't know" or "refuse") to "The children were not eating enough because we just out couldn't afford enough food" were omitted. Food security question referred to circumstances over the 12 months preceding the survey. The NHANES categories are as follows: "fully food secure," "marginally food secure," "food insecure without hunger" and "food insecure with hunger." Participants were considered "fully food secure" if they had no affirmative response in any items from the Food Module. Participants who were considered "marginally food secure" answered affirmatively to 1 or 2 items in the module. The participants considered having "low food security" answered affirmatively to 3-5 items in the module. The participants who were "very low food security" answered 6 to 10 items in the module in the affirmative.

Hours Worked

Hours worked is measured through a series of questions related to the number of hours worked at all their jobs or businesses in the last week. (Continuous numbers)

[1] Question 2: "I worried whether our food would run out before we got money to buy more." Q3 "The food that we bought just didn't last, and we didn't have money to get more." Q4 "We couldn't afford to eat balanced meals" Q5 "we relied on only a few kinds of low-cost food to feed the children because we were running out of money to buy food." Q6 "We couldn't feed the children a balanced meal because we couldn't afford that"

Physical Activity

Physical activity is measured with items concerning daily activity and activity over the last 30 days. If they did not participate in vigorous or moderate activity, their response was coded as 0=No and 1=Yes if they exercised. Responses of "Unable to do activity", "Refused", "Don't Know" coded as missing (.).

Food Measures

Twenty-four-hour dietary recall interviews were conducted where foods and beverages consumed the previous 24 hours ending at midnight were solicited and recorded using the standardized Automated Multiple Pass Method (AMPM) (Moshfegh et al. 2008). "With the exception of a few entry screens, all of the Dietary Recall section of the interview were collected using the AMPM program and all of the post-recall session is collected using the wrapper program. The 24hr dietary recall collects a list of all the foods and beverages consumed within a 24hr period; the time of consumption and the name of the eating occasion; detailed food descriptions and amounts of the reported foods; where it was obtained; and whether it was eaten at home or not. The recall data is coded and linked to the database of foods and their nutrient composition. Calculations of total daily nutrient intakes were derived from these data" (NHANES Dietary recall 2006). Additionally, Food measure guidelines were given to participants for assistance in estimating portion sizes during the interview. Fruit intake will be measured using a dummy variable (0= No fruit, 1=Fruit). Vegetable intake will be measured using a dummy variable (0=No Vegetable 1=Vegetable).

Income

Participants were asked to disclose information regarding their total annual family income. "National Center for Health Statistics used the U.S. Bureau of Census Current Population Survey definition of "family" to household group members into one or more families. The CPS defines a family as "a group of two people or more (one of whom is the householder) related by birth, marriage or adoption and residing together"; all such people (including related subfamily members) are considered to be members of one family" (Center for Disease Control and Prevention 2009).[2] Total family income reported as a range of values in dollars was measured on a 15-point scale (1= <4,999 and 15= >100,000). The income groups were combined to generate three income categories (1=<20,000, 2= 21,000-54,999 and 3=55,000 to >100,000).

Age

Participants were asked "Best age in years of the sample person at the time of HH screening. Individuals 80 and over were top coded at 80 years of age" (Center for Disease Control and Prevention 2009). Age will be broken down into three different groups 1= 20-39, 2= 40-59, 3= 60-80. Age was also measured as a continuous variable.

[2] "The income section of the household interview includes several questions about sources of income including wages, retirement income, disability payments, interest income, and assistance programs, but the amounts of income from each of the income sources were not obtained. The respondent was asked to report total family income for themselves and the other members of their family in dollars (question UNQ200). If the respondent refused to answer INQ200 or did not know the total combined family income, an income screener question was asked (question INQ220) to query if the total family income was < $20,000 or > $20,000. If the respondent answered INQ220, a follow-up question asked the respondent to select an income range (question INQ230) from a list of income ranges listed on a printed hand card; the midpoint of the income range value was used as the total family income value." (Center for Disease Control and Prevention 2009)

Marital Status

Marital status measured as a (0= Not Married and1= Married/Living with a partner). The not married category will include divorced, widowed, separated and never married. Participants who responded "refused" or answered "don't know" were coded as missing. The "Married" category will be the reference group.

Statistical Analysis

Data will be analyzed using Stata version 13.1, College Station, Texas for Windows software programs. All analyses included sample weights that account for the unequal probabilities of selection, oversampling and nonresponse. To account for the complex survey design survey set (SVYSET), primary sampling unit (PSU) and stratified sampling (STRATA) codes were used for unequal probabilities of sample selection in NHANES. Trends in obesity prevalence over the 2-year study cycles examined with year coded as a 6 level interval variable. All estimates of the prevalence of obesity will be age adjusted to the 2000 Standard U.S. Population. The overall 12-year prevalence of obesity examined across categories of the various characteristics (educational attainment, age). Differences between the six surveys will be tested using a basic T-Test to show how obesity rates and waist circumferences have changed over the last decade. Statistical significance determined at a p-value of 0.05.

Descriptive statistics calculated for sociodemographic characteristics, food insecurity and C-reactive protein, waist measurements, body mass index and weighted with the sample weights calculated for the 12-year sample in NHANES. Separate analyses will be carried out at each education level, after which the significance of education interaction effects examined. Logistic regression models for Black women will be used to investigate the association of c-reactive protein and health behaviors with obesity. The estimates reported as odds ratios and 95 percent confidence intervals. Multiple linear regressions will be used to analyze the association between BMI, waist and education. Also, some of these regression models will contain interaction terms to test whether education moderates the effect of c-reactive protein on obesity.

CHAPTER IV

FINDINGS

Descriptive Analysis

Table 1 is a descriptive table that shows the makeup of the participants in the dataset. The mean/percentages and standard deviations for the overall sample of Black Women and by education groups--less than high school, high school, some college & associate, and college. The majority of the Black women in the study had Some College or Associate Degree education 32.4 percent compared to 31.1, 22.6 and 13.9 percent for Less Than High School, High School, and College respectively. The overall average age is 47.1 years old. The average age across education groups is 36.4, 41.2, 45.1, and 44.9 for the Less Than High School, High School, Some College and Associate, and College educated, respectively.

The average overall body mass index was 31.1 kg/m*2 and across education groups the numbers exceed 30.0; 30.2, 31.3, 34.0 and 30.2 kg/m*2 for Less than High School, High School, Some College, and College, respectively. These results demonstrate that for all levels of education, the average BMI is in the obese range. The Some College and Associate Education group had the highest average BMI, which is very different from what other studies have found with white populations. According to the NHANES Survey from 2005 to 2008 white women with less than high school education had the highest rate of obesity (42.1%) compared to 21.8% with a college degree (Ogden et al. 2010).

The results show that overall 50.8 percent of Black women in this study are considered to be obese, and 27.4 percent are overweight. Black women with Some College and Associate degrees had the highest percentage of obese women with 56.5 percent being categorized as obese compared to 46.9, 50.0 and 46.3 percent for Less than High School, High School, and College, respectively. College-educated Black women had the highest percentage of women who were considered "normal" weight, 26.9% compared to 21.8, 23.1 and 21.8 percent for Less than High School, High School, and Some College & Associate, respectively.

The overall waist circumference for Black women was 97.0cm. Across education groups, the average waist circumference was 94.3, 96.9, 102.0 and 95.3cm for Less than High School, High School, Some College & Associate and College, respectively. Similar to what was seen with the average BMI scores, waist circumference was the highest for the Some College and Associate education groups. Forty percent of Black women in this study participated in some moderate or vigorous physical activity in the past thirty days. Black women the Some College & Associate degrees had the highest participation in physical activity with 51.2% participation compared to 28.3%, 40.9% and 47.7% for Less than High School, High School, and College, respectively. C-reactive protein levels decreased as the level of education increased but remained in the high-risk range after obtaining a College Degree (see Figure 4). Black women with less than a High School education had the highest C-reactive protein level 0.70 compared to .66, .57, and 0.53 for the High School, Some College or Associate, and College degree, respectively. The majority of the participants had a high-risk c-reactive protein level 53.7 percent

compared to 46.2 percent. The Black women with a college degree had the lowest percentage with high-risk C-reactive protein levels, 49.3 compared to 56.6, 55.9, and 51.3 for less than high school, high school, and some college or associate, respectively.

The majority of the population worked less than 40 hours a week (65%), and those with less than a High School education had the highest percentage working under 40 hours, 80.9 percent compared to 64.2, 58.4, 47.3 for High School, Some College or Associate, and College educated, respectively. Black women with a College degree had the highest percentage working more than 55 hours (15%) and 40 hours a week (52%). Interestingly, work hours increased as the level of education increased demonstrating that education doesn't protect Black women from working long hours.

The majority of the Black women in our study made between 20,000 to 54,000 dollars in the last year. As expected, Black women with less than a High School education had the highest percentage of women making less than 20,000 dollars in the last year. Also, Black women with college degrees had the highest percentage of women making more than 50,000. The percentage of women making between 20,000 to 54,000 dollars was practically the same for the High School, Some College & Associate, and College education women, 46.7%, 46.2%, and 46.6% respectively.

Overall 36.3 percent of the Black women were either married or cohabitating with a partner. Across education groups, the majority of the women were not married or cohabitating, and the women with Less than High School education had the highest percentage not married, 68.9% compared to 63.8%, 62.6%, and 55.5% for High School, Some College or Associate and College educated respectively. The College educated

women had the highest percentage of Marriage 44.5% compared to 31.1%, 36.2%, and 37.4% for the Less than High School, High School, and Some College and Associate, respectively.

Fruit and Vegetable consumption were rather low across all groups. The lowest fruit consumption was found among the population with Less than High School population, 91.1 percent did not consume any fruit during the 24 hr dietary recall. The High School educated women had the highest percentage of fruit consumption 10.3 percent compared to 8.9%, 6.9% 6.5% for the Less than High School, Some College and Associate and College educated, respectively. Vegetable consumption was much higher than fruit consumption. Overall 21.9% consumed vegetables during the 24-Hour dietary recall. Black women with Some College or Associate degree had the highest consumption of vegetables 24.2% compared to 20.4%, 19.5%, and 23.7% for the Less than High School, High School, and College educated respectively.

The majority of the population was considered to be Fully Food Secure with College-educated Black women having the highest percentage of participants who were Fully Food Secure, 83.5% compared to 63.8%, 64.5% and 69.5% for the Less than High school, High School, and Some College & Associate, respectively. Overall only 7.3% of the total group was considered to be Food Insecure with hunger.

Table 1: Descriptive Statistics

		Education Category			
	Overall	Less Than HS	High School/GED	Some College or Associate	College Graduate
Less than High School	31.1%				
High School/GED	22.6%				
Some College or Associate	32.4%				
College Grade+	13.9%				
BMI (kg/m**2) (ave)	31.1	30.2	31.3	34.0	30.2
Waist Circumference (cm)	97.0	94.3	96.9	102.0	95.3
BMI Category					
Underweight	0.8%	1.2%	0.8%	0.6%	0.7%
Normal Weight	21.0%	21.8%	23.1%	21.8%	26.9%
Overweight	27.4%	30.1%	26.2%	21.2%	26.1%
Obese	50.85	46.9%	50.0%	56.5%	46.3%
CRP (%)					
Low Risk	46.2%	43.4%	44.1%	48.8%	50.7%
High Risk	53.7%	56.6%	55.9%	51.3%	49.3%
Age (ave yrs)	47.1	36.4	41.2	45.1	44.9
Work Hours (ave)	22.8	13.9	22.9	25.5	32.8
Work Hours (%)					
<40hrs	65.4%	80.9%	64.2%	58.4%	47.3%
≥40hrs	34.6%	19.1%	35.8%	41.6%	52.7%
<55hrs	92.5%	97.2%	92.8%	91.4%	84.0%
≥55hrs	7.47%	2.8%	7.2%	8.7%	16.0%

Table 1 Continued

	Overall	Less Than HS	High School/GED	Some College or Associate	College Graduate
Marital Status (%)					
Not Married	63.8%	68.9%	63.8%	62.6%	55.5%
Married/cohabitating	36.3%	31.1%	36.2%	37.4%	44.5%
Income (%)					
<$20,000	39.9%	54.4%	38.6%	35.9%	14.3%
$20,000 to $54,000	42.8%	33.4%	46.7%	46.2%	46.6%
>$55,000	17.3%	12.2%	14.7%	17.9%	39.2%
Physical Activity (%)					
No	58.6%	71.8%	59.2%	48.8%	52.3%
Yes	41.4%	28.2%	40.9%	51.2%	47.7%
Food Security (%)					
Fully Food Secure	68.5%	63.8%	64.5%	69.5%	83.5%
Marginally Food Secure	13.5%	13.9%	15.8%	13.7%	8.3%
Food Insecure w/o Hunger	10.6%	13.1%	11.2%	10.2%	5.1%
Food Insecure w/hunger	7.3%	9.2%	8.5%	6.6%	2.9%
Fruit Intake					
No	91.8%	91.1%	89.7%	93.1%	93.5%
Yes	8.2%	8.9%	10.3%	6.9%	6.5%
Vegetable Intake					
No	78.1%	79.6%	80.5%	75.8%	76.3%
Yes	21.9%	20.4%	19.5%	24.2%	23.7%
Number of Observations	N=2,658	N=826	N=600	N=862	N=370

Table 2 shows obesity by education for Black women ages 20 to 80 years old in NHANES cycles 1999-2010. In Black women with less than a High School education, the obesity rate increased 9.29% from cycle 1999-2000 to 2009-2010. The High school group slightly decreased from 50.81% to 49.85% between the first and last cycle. Some College or Associate education group consistently had the highest percentage of Black women who were obese. College educated group had the lowest rate of obesity across all cycles except the 2009-2010 cycle. The College education group had the highest increase from 1999-2000 to 2009-2010.

The absolute difference in obesity prevalence was the greatest between Black women with some college and associate degree education and the women with a college degree from 1999 to 2008. Interestingly, in 2009-2010 absolute difference between the women with some college and those with a college degree was only -1.93 compared to -10.61 in the previous cycle. The same pattern can be seen in the relative differences between some college and college degree groups. Also, the greatest relative difference and absolute difference was between the women with high school education and some college in a positive direction. This is a possible indication of the Black women with some college, and associate degrees are uniquely vulnerable to being overweight or obese. While educational attainment leads to increased access to resources, some college and associate degree group may still lack upward mobility.

Table 2. Trends in the Disparity of Obesity by Education Among US Black Women age 20 to 80 Years Old: NHANES 1999-2010

	NHANES Cycles					
	1999-2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010
Prevalence (%)						
< High School	46.52	51.18	53.95	46.66	47.56	55.81
High School	50.81	44.05	56.59	47.48	44.22	49.86
Some College or Associate	56.39	49.74	54.65	55.37	49.71	58.84
College	45.25	37.88	44.97	46.24	39.10	56.91
Absolute difference in prevalence						
< High School & High school	4.29	-7.13	2.64	0.82	-3.34	-5.95
High School to Some College	5.58	5.69	-1.94	7.89	5.49	8.98
Some College & College	-11.14	-11.86	-9.68	-9.13	-10.61	-1.93
Relative difference in prevalence						
(< High School & High School)/ <High School (%)	9.22	13.93	4.89	1.76	7.02	10.66
(High School & Some College)/High School (%)	10.98	13.23	3.43	16.62	12.42	18.01
(Some College & College)/ Some College (%)	-19.76	23.84	17.71	1.81	21.34	3.28

Table 3 showed the trends of obesity by age groups in Black women age 20-80 years. Age group 20-39 years had the lowest percentage of Black women considered to be obese for every cycle until the 2009-2010 cycle when the 60 and over group had the lowest overall percentage. The greatest increase was during 1999-2000 when there was a 9.11 percent increase between the Black women age 20-39 to 40-59 group. The age absolute and relative differences reduced from 1999 to 2010 with the greatest reduction occurred in 2010 between 40-59 and the 60 plus. There was a 7.77 percent decrease in absolute difference in obesity prevalence between the 40-59 and the 60 Plus group.

Table 3. Trends in the Disparity of Obesity by Age Among US Black Women Age 20 to 80 Years Old: NHANES 1999-2010

	NHANES Cycles					
	1999-2000	2001-2002	2003-2004	2005-2006	2007-2008	2009-2010
Prevalence (%)						
20-39	46.16	46.15	51.61	47.37	46.74	57.59
40-59	55.27	47.94	56.83	53.32	50.56	62.71
60+	46.70	49.96	53.43	60.96	50.19	54.94
Absolute difference in prevalence						
20-39 to 40-59	9.11	1.79	5.22	5.95	3.82	5.12
40-59 to 60+	8.57	2.02	-3.4	7.64	-0.37	-7.77
Relative difference in prevalence						
(20-39 to 40-59)/ 20-39(%)	19.73	3.87	10.11	12.56	8.17	8.89
(40-59 to 60+)/40-59(%)	15.50	4.21	5.98	14.33	0.73	12.39

Table 4 contains six different models measuring variables association with body mass index of Black women. Model one indicates that relative to Black women with a college degree, women with some college education were more likely to have a higher body mass index. Model 2 shows that c-reactive protein is positively associated with body mass index with a p-value of 0.00. Model 3 includes education and c-reactive protein. The results show when education and c-reactive protein are in the model together the women with Some College and Associate Education remained statistically different from those with College Education. Also, high-risk c-reactive protein maintains its significantly different from low-risk c-reactive protein in a positive direction. In Model 4, the control variables married, age, and cycle intake were all added to the equation along with c-reactive protein (a measure of stress).

Body mass index for Black women with some college or associate education continued to differ significantly from those, having a college degree. The results show that age was significantly associated with Body Mass Index. Also, serum C-reactive protein level $\geq$0.3mg/dl (High Risk) was significantly associated with body mass index with a p-value $\leq$ 0.01. Stated another way, exposure to stress has a significant positive impact on body mass index compared to the reference group of C-reactive protein level <0.3 (Low Risk).

Model 5 included all of the measures for the previous four models with the addition of Food Security, Fruit and Vegetable intake, and Physical activity. Some college or associate degree continued to be significantly related to obesity. Compared to the reference category of Fully Food Secure, being Marginally Food Secure was not associated with body mass index (p-value <0.01). There was a statistical difference between the reference groups and "Food Insecure w/ Hunger" and "Food Insecure w/o hunger." Participants being physically active and eating fruits and vegetables was not statically different from the reference categories. Indicating that these positive health behaviors did not have an association with body mass index. Education and C-reactive protein interactions were not significant.

Table 4: Linear Regression Body Mass Index of Black Women in the National Health and Nutrition Examination Survey Cycles 1999-2010

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Education	CRP	Education and CRP	Control	Food	Interaction
	b/se	b/se	b/se	b/se	b/se	b/se
Less than High School	0.998		0.402	3.168**	0.341	0.875
	-0.58		-0.55	-1.08	-0.58	-0.6
High School	0.95		0.446	2.843**	0.358	0.419
	-0.57		-0.55	-1.05	-0.59	-0.59
Some College or Associate	1.483**		1.171*	3.124**	1.039	1.257*
	-0.56		-0.54	-1.05	-0.56	-0.56
High-Risk CRP		7.103***	7.100***	14.694***	7.094***	7.591***
		-0.34	-0.34	-0.68	-0.35	-0.74
Married/cohabitating				0.366	-0.06	-0.072
				-0.62	-0.32	-0.32
Age				0.103***	0.012	0.012
				-0.02	-0.01	-0.01
NHANES Cycle				0.674***	0.198	0.201
				-0.2	-0.1	-0.1
Vegetable Intake					-0.24	-0.246
					-0.43	-0.43
Fruit Intake					0.536	0.543
					-0.51	-0.51
Physical Activity					-0.285	-0.275
					-0.31	-0.3
Food Security						
Marginally Food Secure					0.302	0.293
					-0.36	-0.36
Food Insecure w/o Hunger					1.641**	1.648**
					-0.58	-0.58

Table 4 Continued

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Food Insecure with Hunger					1.987**	1.970**
					-0.6	-0.61
Work Hours					0.018*	0.018*
					-0.01	-0.01
Less than High School X CRP						-1.058
						-0.95
High School/ GED X CRP						-0.186
						-0.84
Some College or Associate X CRP						-0.48
						-0.92
constant	30.649***	27.957***	27.342***	82.732***	25.722***	25.500***
	-0.46	-0.18	-0.42	-1.35	-0.72	-0.76
Observation	2,597	2,597	2,597	2,564	2,564	2,564
R2	0.003	0.177	0.18	0.206	0.189	0.19
Degrees of Freedom	90	90	90	89	89	89

Standard Errors in Parenthesis
* p<0.05, ** p<0.01,*** p<0.000

In Table 5 associations with waist circumference were analyzed. As with the previous table, model one only measured the association between educational attainment and waist circumference. The results indicate that there was a statistically significant association between education and waist circumference. All education groups waist circumferences were significantly different from the college educated group. Black women with less than a high school education continued to be significantly different from women with a college degree after adding control variables.

Model 5 indicates that the education relationship found in Model 1 remains significant and shows C-Reactive protein along with marital status, Fruit Intake, Vegetable Intake, Physical Activity, Food Security and Work Hours. Having a High-Risk level C-reactive protein was positively associated with waist circumference compared to the Low-Risk reference(p-value <0.00). As with body mass index, age was significantly related to waist circumference. As with Model 2 C-reactive protein and age continued to be positively associated with waist circumference. The other control variables did not have a significant association with waist circumference. Work hours were not significantly associated with waist circumference in any of the six models. The education and c-reactive protein interactions were not significant.

In all models, compared to Black women with a college degree, those with some college or associate degree education had an positive association with waist circumference. This is a unique finding because in white populations, as education increases the rate of obesity decreases. Black women with a High-Risk C-reactive protein level increased waist circumference 15cm campared to Low-Risk C-reactive protein level (p-value of 0.00). The results show that being Food Insecure with and without hunger increased the odds of being obese (p-value <0.01). Work hours was not signicantly associated with waist circumference in any of the models. The consumption of fruit and vegetable remained non-significant in models 5 and 6. Again, the education and c-reactive protein interaction was not significant.

Table 5: Linear Regression Waist Circumference of Black Women in the National Health and Nutrition Examination Survey Cycles 1999-2010

	Model 1 Education b/se	Model 2 CRP b/se	Model 3 Education & CRP b/se	Model 4 Control b/se	Model 5 Food b/se	Model 6 Interactions b/se
Less than High School	4.504***		3.420**	3.168**	2.517*	3.009*
	-1.09		-1.04	-1.08	-1.09	-1.34
High School	3.737**		2.675*	2.843**	2.256*	2.116
	-1.1		-1.04	-1.05	-1.11	-1.43
Some College or Associate	3.669**		3.055**	3.124**	2.864**	2.698*
	-1.11		-1.04	-1.05	-1.07	-1.33
High-Risk CRP		15.180***	15.085***	14.694***	14.725***	14.810***
		-0.66	-0.67	-0.68	-0.69	-1.37
Married/cohabitating				0.366	0.65	0.631
				-0.62	-0.61	-0.62
Age				0.103***	0.116***	0.116***
				-0.02	-0.02	-0.02
NHANES Cycle				0.674***	0.551**	0.555**
				-0.2	-0.2	-0.2
Vegetable Intake					-0.599	-0.607
					-0.82	-0.82
Fruit Intake					1.253	1.263
					-0.99	-0.99
Physical Activity					-0.648	-0.628
					-0.65	-0.65
Food Security						
Marginally Food Secure					1.772*	1.763*
					-0.88	-0.87
Food Insecure w/o Hunger					4.071***	4.085***

Table 5 Continued	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
					-1.08	-1.08
Food Insecure with Hunger					3.790**	3.746**
					-1.4	-1.42
Work Hours					0.017	0.016
					-0.02	-0.02
Less than High School X CRP						-0.938
						-1.82
High School X CRP						0.237
						-1.89
Some College or Associate X CRP						0.308
						-1.8
constant	96.035***	91.505***	88.959***	82.732***	81.694***	81.665***
	-0.9	-0.45	-0.88	-1.35	-1.75	-1.83
Observation	2,495	2,495	2,495	2,453	2,453	2,453
R2	0.007	0.192	0.196	0.206	0.215	0.215
Degrees of Freedom	90	90	90	89	89	89

Standard Errors in parentheses
*** p<0.00, ** p<0.01, * p<0.05

Table 6 measured the odds of Black women being categorized as obese based on the independent variables. Compared to College Educated Black women, those with Some College or Associate Degree education had an increased odds of being obese. This is a unique finding because in white populations, as education increases the rate of obesity decreases. Having a High-Risk C-reactive protein level increased the odds of being obese five times more than having a Low-Risk C-reactive protein level. After controlling for age, NHANES cycles, and martial status some education and CRP remained significant. In Models 5 and six work hours was not significant, demonstrating the lack of impact work hours on the odds of being obese. The results show that being Food Insecure with and without hunger increased the odds of being obese (p-value <0.01). Again, the education and c-reactive protein interaction were not significant.

Table 6: Logistic Regression of Obesity in Black Women in the National Health and Nutrition Examination Survey Cycles 1999-2010

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Education	CRP	Education & CRP	CONTROL	FOOD	INTERACTION
	or/se	or/se	or/se	or/se	or/se	or/se
Less than High School	1.288		1.154	1.158	1.127	1.319
	-0.18		-0.17	-0.17	-0.17	-0.25
High School/GED	1.306*		1.202	1.225	1.178	1.091
	-0.16		-0.16	-0.16	-0.16	-0.23
Some College or Associate	1.437**		1.415*	1.417*	1.401*	1.504*
	-0.19		-0.2	-0.21	-0.21	-0.29
High-Risk CRP		5.249***	5.266***	5.191***	5.307***	5.884***
		-0.52	-0.53	-0.52	-0.54	-1.27
Married/cohabitating				1.031	1.057	1.05
				-0.1	-0.1	-0.1
Age				1.003	1.006	1.006
				0	0	0
year				1.063*	1.053	1.054
				-0.03	-0.03	-0.03
Veg Intake					0.965	0.961
					-0.11	-0.11
Fruit Intake					1.279	1.285
					-0.18	-0.18
Physical Activity					1.008	1.011
					-0.08	-0.08
Food Security						
Marginally Food Secure					1.007	1.008
					-0.13	-0.12
Food Insecure w/o Hunger					1.665**	1.668**
					-0.26	-0.26
Food Insecure with Hunger					1.800***	1.797**
					-0.31	-0.31

Table 6 Continued

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Work Hours					1.004	1.004
					0	0
Less than High School X CRP						0.743
						-0.2
High School/ GED X CRP						1.146
						-0.33
Some College or Associate X CRP						0.863
						-0.21
constant	0.842	0.464***	0.379***	0.275***	0.206***	0.196***
	-0.09	-0.03	-0.05	-0.05	-0.04	-0.04
Observation	2,597	2,597	2,597	2,564	2,564	2,564
Degrees of Freedom	90	90	90	89	89	89

Standard Errors in Parenthesis

* p<0.05, ** p<0.01,***p<0.001

Table 7 shows the odds Black women fitting a particular BMI category: underweight, normal weight, overweight or obese. The "Normal" category was the base group which all the other groups were compared to. Relative to the women with a college degree, the Some College and Associate category were 1.369 times more at likely to be Overweight (p-value >0.05).

Overweight women are more likely to have a C-reactive protein level in the High-Risk range. Overweight women were 2.131 times as likely to have a c-reactive protein level in the high-risk range than the Normal weight category (p-value<0.001), indicating there was a positive relationship between being "Overweight" and having a C-reactive protein level greater than 0.03mg/dl. Relative to the women with normal weight, Overweight women are more likely to have a C-reactive protein level in the High-Risk range. Relative to being in the Normal weight category, age, fruit intake, physical activity and work hours increased the odds of being overweight. Relative to being Normal weight, women with a High School and Some College education were more likely to be obese than those with College degrees. Obese women were 8.090 times as likely to have a c-reactive protein level in the high-risk range than the Normal weight category (p-value<0.001), indicating there was a positive relationship between being "Obese" and having a C-reactive protein level greater than 0.03mg/dl. Also, age, NHANES Cycle, Fruit Intake, Food Security and Work hours all increased the risk of being categorized as Obese compared to Normal weight.

Table 7: Multinomial Logistic Regression of Body Mass Index Category of Black Women in the National Health and Nutrition Examination Survey Cycle 1999-2010 (Relative Risk Ratio)

	Model 1	Model 2	Model 3
	Body Mass Index Category		
	underweight	overweight	obese
Less Than HS	1.208	1.188	1.247
	(0.895)	(0.262)	(0.230)
High School/GED	1.066	1.315	1.386*
	(0.931)	(0.254)	(0.245)
Some College or Associate	1.328	1.369*	1.699***
	(0.856)	(0.251)	(0.304)
High Risk CRP	0.264**	2.131***	8.090***
	(0.171)	(0.335)	(1.313)
Married/Cohabitating	0.732	1.232	1.184
	(0.291)	(0.160)	(0.153)
Age	0.977**	1.017***	1.015***
	(0.0101)	(0.00413)	(0.00428)
Nhanes Cycle	1.170	1.027	1.076**
	(0.124)	(0.0413)	(0.0324)
Vegetable Intake	1.386	1.178	1.073
	(0.576)	(0.167)	(0.146)
Fruit Intake	1.928	1.601*	1.761**
	(1.237)	(0.413)	(0.409)
Physical Activity	0.438*	0.748**	0.832
	(0.193)	(0.104)	(0.0962)
Food Security			
Marginally Food Secure	0.649	1.078	1.038
	(0.404)	(0.185)	(0.178)
Food Insecure w/o Hunger	1.827	0.887	1.604**
	(1.069)	(0.216)	(0.346)
Food Insecure w Hunger	1.376	0.825	1.658**
	(0.739)	(0.250)	(0.327)
Work Hours	0.973**	1.009**	1.009***
	(0.0102)	(0.00337)	(0.00297)
Constant	0.263	0.316***	0.230***
	(0.267)	(0.118)	(0.0673)
Observations	2,564	2,564	2,564

Standard Error in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In summary, Hypothesis 1 stated there would be a gradient decrease in body mass index and risk of obesity as education increases. Educational attainment has been linked directly to health outcomes among white populations. The current data rejects this hypothesis by demonstrating there is not a gradient decrease in obesity and body mass index with educational attainment. Black women with some college and associate education were more likely to be overweight and had a higher risk of obesity compared to the women with a college degree.

Hypothesis 2 stated that C-reactive protein will be strongly associated with obesity. The results support this hypothesis by demonstrating that C-reactive protein has a strong association with body mass index and increases the odds of being obese when levels are $\geq$0.3mg/dL for Black women. Waist circumference was positively associated with C-reactive protein across education groups in Black women.

Hypothesis 3 states that C-reactive protein would moderate the relationship between education and obesity. This hypothesis was not supported.

CHAPTER V

CONCLUSION

While other populations' obesity rates have remained steady over the years, Black women's rate has increased and continues to outnumber their white female and male counterparts. Educational attainment has long been touted as a solution to decreasing negative health outcomes. This research challenges the current understanding of the relationship between educational attainment and obesity. My research sought to 1) analyze the obesity trends among Black women from 1999-2010 by education and age, 2) gain a better understanding of the psycho-social factors contributing to Black women's risk of obesity across levels of education, and 3) research the impact of stress on Black women's risk of obesity. Below, I synthesize findings from the previous chapter, discuss the implications of this research, discuss the limitations and consider the broader implications of the findings presented in this dissertation.

From 1999 to 2010 Black women's average body mass index (BMI) remained equal to or greater than $30mg/k^2$. In the current study, 50.8 percent of Black women were categorized as obese compared to the United States national average of 34.9 percent according to the CDC obesity facts report (CDC 2014). One of the most concerning findings is that the percentage of Black women between the ages of 20-39 had the greatest increase in obesity rate, from 46.2% in 1999 to 57.6% in 2010. If this group's obesity rate continues to grow, the life expectancy rate for Black women could decrease, and those living with comorbidity could increase. While the youngest group

had the largest increase from 1999 to 2010 the middle age (40 – 59) group had the highest percentage of obese women (62%). Whereas prior studies of obesity and health disparities, in general, have investigated disparities between different races and genders, I used a framework that analyzed differences within a particular subpopulation. It is important to focus on differences among Black women to better understand what is impacting their health outcomes.

Drawing on previous findings, I hypothesized that there would be a gradient decrease in obesity with the increase of education among Black Women. In the current study, Black women with some college or associate degree were more likely to be overweight or obese compared to the other education groups. While the causes of this increased risk are unclear, one possible explanation is women with some college education are working multiple jobs which can result in limited time for food preparation and exercise. The Cozier (2014) study found a strong association between experiences of discrimination and obesity rates. While the current study did not measure discrimination and racism, stress was measured using serum C-reactive protein levels. In line with other research, body mass index and being obese was strongly associated with C-reactive protein levels equal to or greater than 0.03 mg/dl. Waist circumference also had a strong positive association with C-reactive protein levels. There are numerous possible sources that could be contributing to Black women's stress levels, but that data was not available for the study. However, the research performed by others demonstrates that Black women experience racism and discrimination. Perceived discrimination based on race and gender has been found to be key factors in chronic stress-related health disparities

among ethnic/racial and other minority groups (Williams and Mohammed 2009; Meyer et al. 2008). Cozier's 2014 research suggest workplace and community-based programs to combat racism and interventions to reduce racism-related stress could be important components of strategies for prevention of obesity. Her findings also suggest that experiences of racism possibly explain why US Black women are disproportionately impacted by the obesity epidemic. Other studies have linked maternal stress as a potential explanation for excess preterm delivery among Black women because of exposure to racism associated stress (Hogue 2005).

I hypothesized that work hours would positively associate with body mass index but not waist circumference. The majority of Black women in this study work in full-time positions but not more than 46 hours a week. The results indicate that working long hours increased their odds of being obese. In the current study, working long hours was not associated with stress, indicating more research is needed to understand better the source of Black woman's stress. The current study did not have access descriptions of the work environment, which could contribute to increased stress levels. Previous research has shown that there is a relationship between psychosocial stressors, such as racism, to health outcomes among Blacks (Brondolo, Gallo, & Myers, 2009). It remains clear that prolonged exposure to stress has an impact on health outcomes and Geronimus' (2010) research supports this claim by showing that Black women aged more rapidly than whites due to stress.

Solovieva and others (2013) investigated the link between psychosocial factors at work and excess weight. Their research observed associations between work long

hours, working overtime and weight gain. In another study Buss (2012) analyzed the associations between obesity, stress and shift work among nurses. In her study, shift work increased the consumption of unhealthy energy dense foods. She found that both the stress from the job and work hours were factors that influenced how and what nurses ate and increased their risk of being overweight or obese. Not only do Black women experience stress from working longer hours they are also faced with racism and inequality in the workplace. Previous studies have found Black women reported perceived racial bias as sources of stress in the workplace (Vines et al. 2006). Cole and Secret (2012) study suggest "that Black women in corporate America experience the subtext type of racial bias more than the management-generated biases, and it is this subtext racial bias that makes the additional, albeit minor, contribution to work-family conflict stress." These studies support the findings of this dissertation by linking work hours and working in a negative work environment increases odds of being obese.

Educational attainment can improve access to healthy foods and increase opportunities for physical activity. In the case of Black women gaining access to these resources has not decreased their risk of being obese. Although increasing physical activity and consuming fruit and vegetables are proven methods for weight loss, these do not operate the same in all populations. In this study, 58 percent of the Black women did not participate in moderate or vigorous physical activity during the week before answering the questionnaire and had low intakes of fruit and vegetables. Previous studies have shown that Black Americans are more likely to have poor diets, less likely to exercise and be more likely to have limited physical activity due lack of access to

healthy affordable food options, healthcare access and unsafe neighborhoods (Corral et al. 2011). In the current study, this was not the case, indicating that are more factors to consider when examining obesity risk or causes among Black women. Also, in this study, 75 percent of the Black women did not consume fruit and vegetables during the time of their 24-hour dietary recall. While we do not have data to determine the availability of fruits and vegetables in their neighborhoods, the results do show that the lack of consumption itself is not associated with obesity. Previous studies have shown when there is a lack of consumption of fruits and vegetables; people are more likely to consume more nutrient-dense foods.

Income has been one measure of socioeconomic status frequently used to determine health disparities. There is a wide range of evidence that demonstrates the influence of socioeconomic status on morbidity and mortality rates. Black Americans are disproportionately affected by diseases, such as hypertension, high cholesterol, asthma and other obesity-related diseases. While there have been some improvements regarding economic and educational gains to decrease the gap between whites and blacks, there is still a significant difference between the two. Health disparities research traditionally stratifies the data several ways but most prominently are by either socioeconomic status or race. Previous studies have pointed out that stratification by SES overlooks the fact that Blacks are overrepresented among the undereducated, unemployed and low-wage jobs (Freeman, 2012). Farmer and Ferraro's research investigated racial disparities in health conditional on socioeconomic status discovering over a 20-year period that Blacks had poorer health than whites, and there were significant interactions between race and

education and race and employment status (Farmer & Ferraro, 2005). Farmer's study shows the interaction effect of race and education demonstrate racial disparity in self-rated health was largest at the higher levels of SES, providing some evidence for the ''diminishing returns'' hypothesis; as education levels increased, black adults did not have the same improvement in self-rated health as white adults (Farmer & Ferraro, 2005). The hypothesis of diminishing returns says that the Black-white health disparities are explained by the ideas that Blacks do not benefit as much as whites from higher SES or higher education due to fewer income benefits of higher education or the stress resulting from greater awareness of social injustices and discrimination at higher levels of socioeconomic status (Non et al. 2012). Everett et al. (2012) research suggest that Black women are better able to translate their educational achievement into health benefits than their male counterparts but not as well as whites (male or female). The current research supports the "diminishing returns" theory because education did not reduce the odds of Black women being overweight or obese.

Implications

The implications of this study are it highlights the need to focus on reducing the obesity rates among Black women and education alone will not solve the problem. This study contradicts most of the previous research linking improvements in SES to increase health outcomes. There are a growing number of studies supporting the theory of "diminishing returns" theory, and this can potentially lead to better methods of analyzing

vulnerable populations. While exercise and increase, healthy habits reduce the risk of mortality, being obese can mute the benefits of those behaviors.

The oppression of Black women is having a damaging impact on their overall health. The results of this study have demonstrated that education does not protect Black women from experiencing high levels of stress. Recent reports have linked increasing obesity rates in Black women to increasing rates of Breast Cancer in Black women. Future studies should investigate what stressors Black women at all levels of education are experiencing. What is missing from this current study are the voices of Black women that could lead to a better understanding of the day to day challenges that are impacting health behaviors in this population. In the field of Medical Sociology, sociologists such as David Williams are bringing much-needed attention to the way the environment can have a negative effect on overall health outcomes. Future research should continue to focus on how racism and discrimination impact food choices, physical activity and their links to obesity.

Assumption and Limitations

There are some limitations using the NHANES dataset due to the survey questions not being made specifically for this study, which limits some of the analyzes of associations with risk of obesity. Also, we do not have access to restricted data that would allow us to look more specifically at the type of food, restaurants and grocery stores available in Black women's neighborhood. Dietary Intake for years 1999-2000 and 2001-2002 only consisted of one day and years 2003 to 2010 included two days of

dietary intake data limiting the amount of food intake data available. More detailed information on physical activity versus sedentary behavior would have shown how much time Black women were spending not being active. Lack of questions regarding experiences of racism and discrimination limited full understanding of the stress that Black women are experiencing which could impact obesity rates.

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APPENDIX A

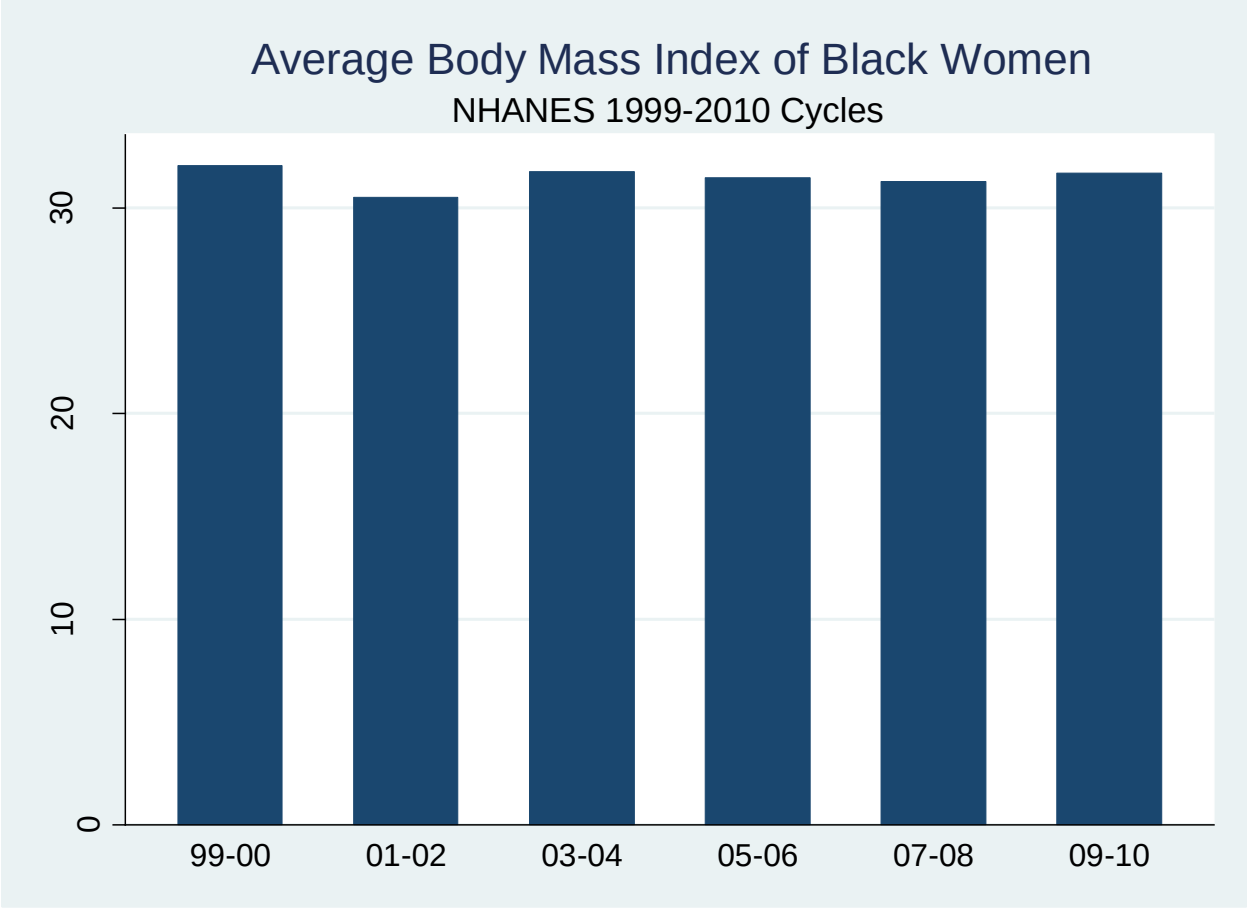

Figure 2. Average Body Mass Index of Black Women in the NHANES 1999-2010 Cycles.

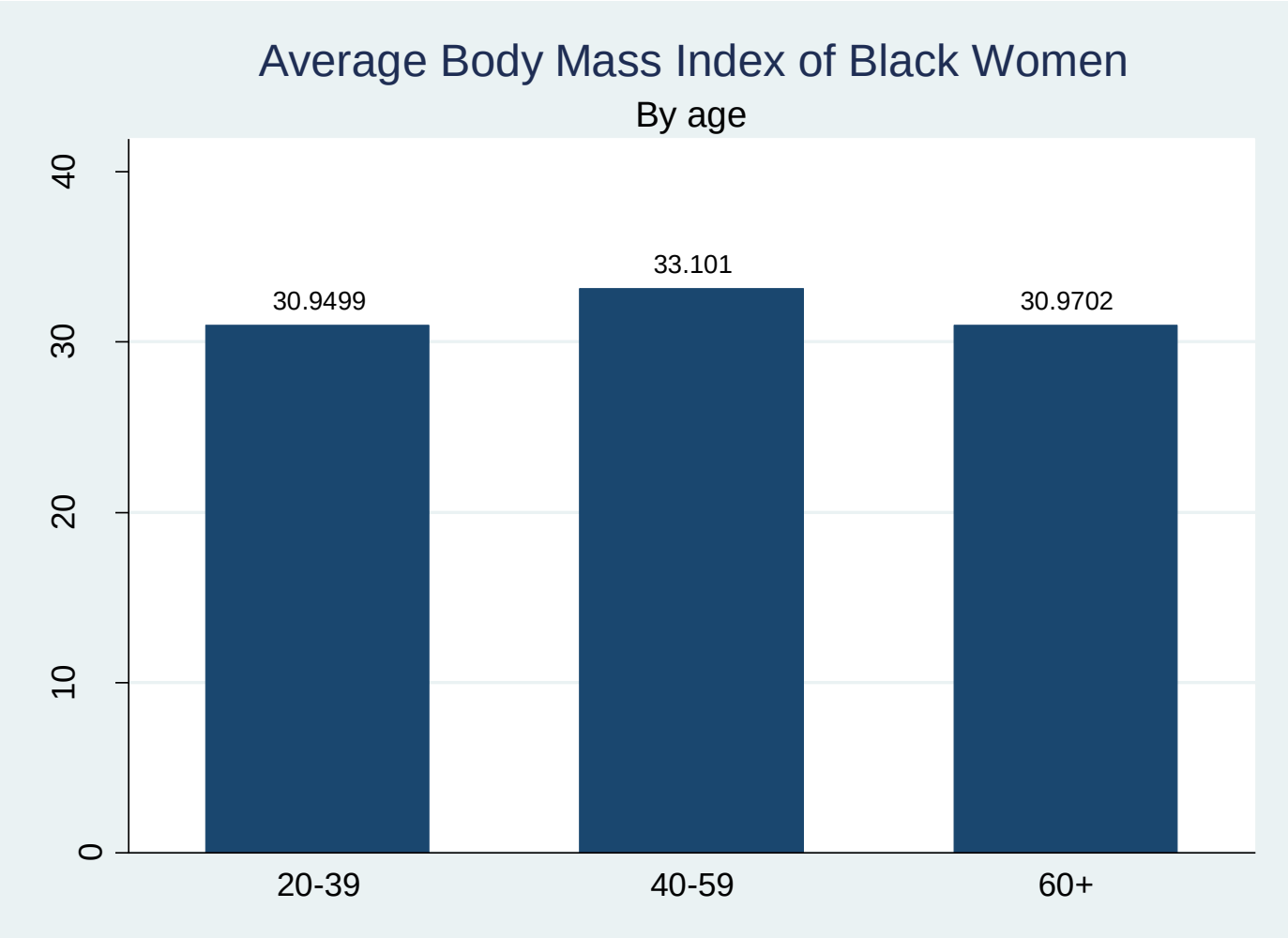

Figure 3. Average Body Mass Index of Black Women by Age group in the NHANES 1999-2010

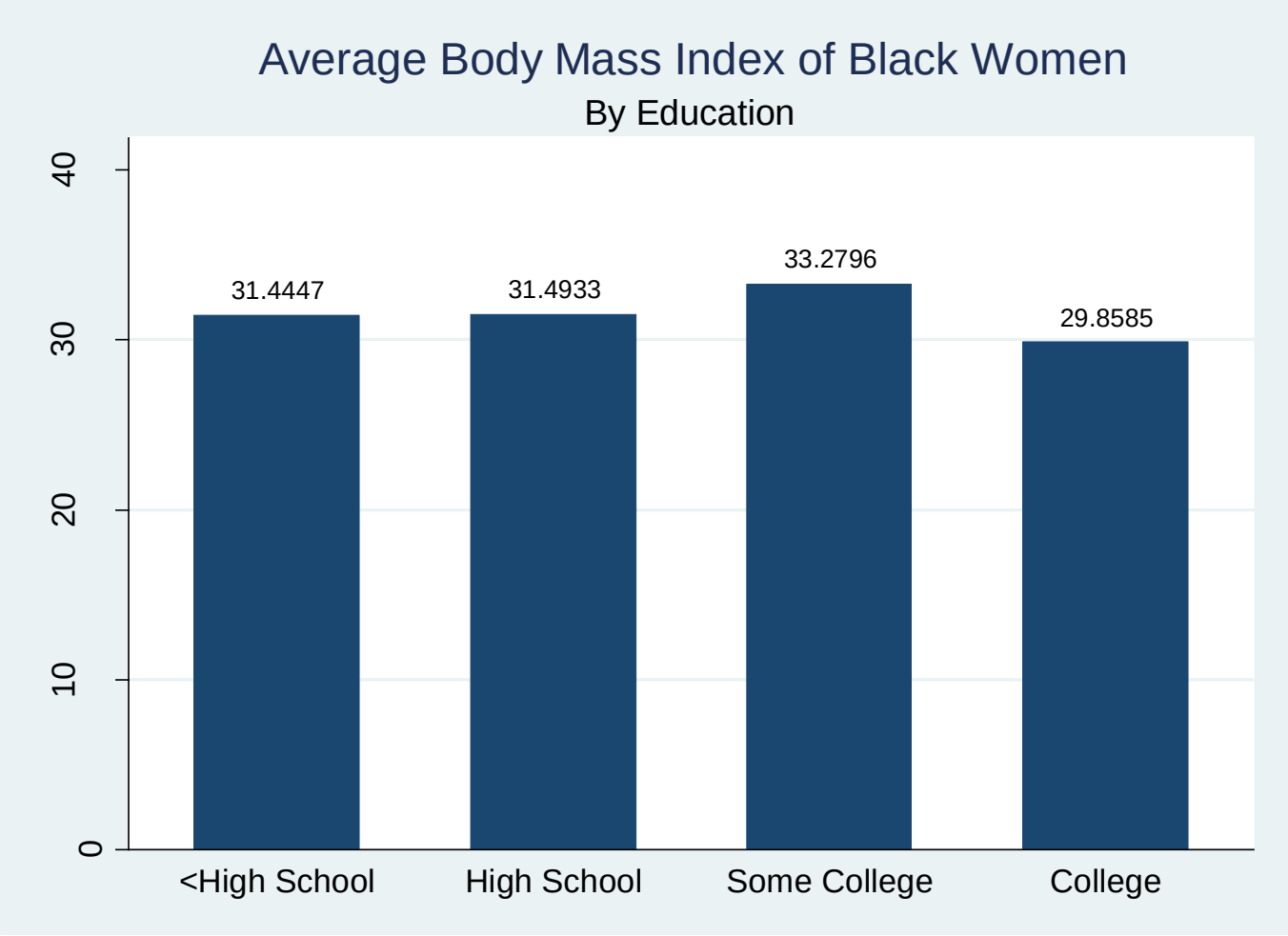

Figure 4: Average Body Mass Index of Black Women by Education Level

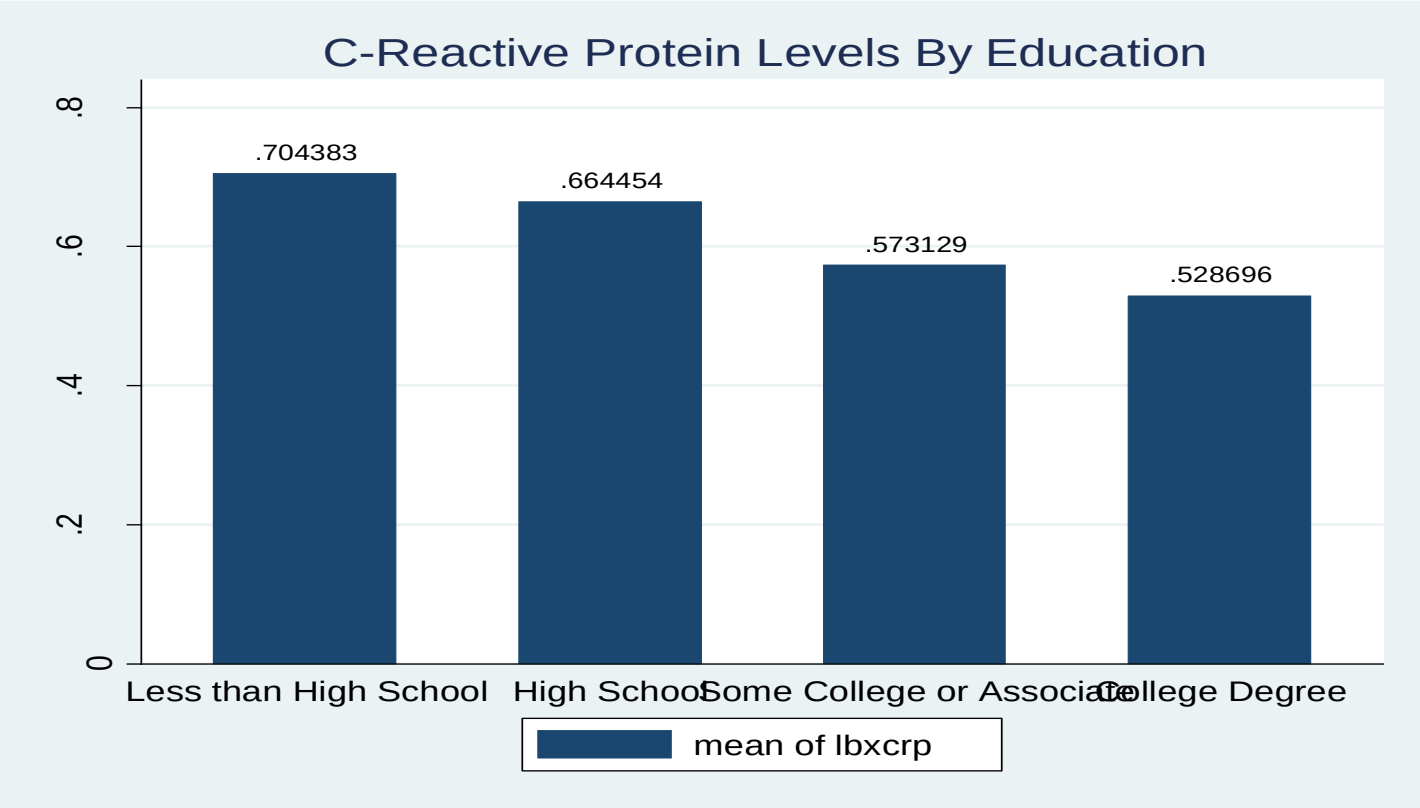

Figure 5: Average C-reactive Protein of Black Women by Education Level

APPENDIX B

VARIABLE CONSTRUCTION

NHANES Variable	Survey Item	Type	Coded	Analytical variable name
dmdeduc2	what is the highest level of school completed or the highest degree received?	Categorical	1=Less than High School, 2= High School, 3=Some College or Associate 4= College Graduate +	Education
ridageyr	Best age in years of the sample person at the time of HH screening	Continuous		Age
lbxcrp	Measured by blood serum	Continuous		C-reactive Protein
		Dichotomous	" 0" CRP level <0.3mg/dL and "1" ≥0.3mg/dL	C-reactive Protein
ocd180 ocq180	Hours worked at all jobs last week	Continuous	if participant did not work it was coded as 0 hours worked	Work Hours
ocd150 ocq150	Type of work done last week	Dichotomous	If participant worked >40 hrs and if participants worked>55hrs	
bmxwaist	Technician measured	Continuous		Waist circumference
dmdmartl	Marital Status	Dichotomous	1= married/cohabitating and 0=single/widowed/divorced	Married
sddsrvyr	Data release number	Ordinal	Survey Year	Year
pad320, paq620	Did you participate in moderate activity in the last 30 days?	Dichotomous	1=yes and 0=no	Physical Activity
Pad200 paq605	Did you participate in vigorous activity in the last 30 days?		1=yes and 0=no	

Appendix B Continued

NHANES Variable	Survey Item	Type	Coded	Analytical variable name
Fsdad	Adult Food Security Category based on a 18 item U.S. Food Security Module (Bickel G, et al 2000)	Categorical	1= Adult full dood security: 0, 2=AD marginal food security: 1-2, 3=Adult low food securit:3-5, 4= Adult very low food security: 6-10	Food Security
Fruit Consumption	Created from frequency numbers by 11 different USDA food groups. Reduced to two groups. Based on 24 hour recall data	Dichotomous	1= Fruit and 0=Not Fruit	Fruit Intake
Vegetable Consumption	Created from frequency numbers by 11 different USDA food groups. Reduced to two groups. Based on 24 hour recall data	Dichotomous	1= Vegetables and 0= Not Vegetables	Vegetable Intake