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Predictors of Blood Pressure and Lipids Levels Among African Americans

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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2018

Abstract

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by

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Diploma, The Chartered Institute of Marketing, UK, 1998

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

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Abstract

African Americans disproportionately develop cardiovascular disease risk factors including high blood pressure and high cholesterol levels in comparison to European Americans. The purpose of this study was to examine the associations of diet quality and physical activity with blood pressure levels and cholesterol levels among African Americans. The social ecological model was the theoretical foundation for the study. Research questions were designed to examine the extent to which diet quality and physical activity predict blood pressure levels and cholesterol levels. The research design was quantitative cross-sectional secondary analysis of 959 participants. After controlling for demographic factors, body mass index, and energy intake, there was a potential nonlinear association between the dietary approaches to stop hypertension (DASH) diet and blood pressure levels. Multivariable-adjusted logistic regression analysis showed that a fourth-quintile DASH score significantly predicted blood pressure (OR: 0.57; 95% CI [0.35, 0.93]). There was no association between the DASH diet and cholesterol levels. Physical activity was not significantly associated with blood pressure levels or cholesterol levels. Researchers can use these findings to replicate large prospective studies. In addition, findings may be used to promote positive social change by healthcare professionals including dieticians and clinicains, as well as health promotion advocates and other institutions or individuals with public health interest.

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Dedication

“I can do all things through Christ, who strengthens me” (Philippians 4:13). I am very grateful to almighty God for his mercy, protection, and grace upon my life, and to whom I dedicate this doctoral study. I also dedicate this study to the memory of my late parents, Emmanuel and Beatrice Lanor, who brought me up with discipline and encouraged me to pursue education to the highest level. You endured every obstacle just to push us on to be the best that we could. Your outstanding parenting provided a solid platform for me to make it this far. Wherever you may be, I am sure that you are satisfied with us. I dedicate this study to my wife, Grace, and my children, Nathaniel, Nichole, and Ninnette, who sacrified so much to allow me complete this study. I remember the isolation you had to endure through the many nights, weekends, and holidays while I was striving to put this piece together. I am very grateful for your sacrifice. To my siblings, Ernest, Edith, Edmund, and Wilhemina, I share this achievement with you all, and I am very grateful to have you as a family.

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Section 1: Foundation of the Study and Literature Review

Introduction

According to the American Heart Association, in the United States approximately half of African Americans have some form of cardiovascular disease (CVD; American Heart Association, 2015). According to Kramer, Valderrame, and Casper (2015), CVD accounts for one-fourth of the disparity rates in potential life-years that are lost between African Americans and European Americans. African Americans disproportionately develop CVD risk factors including high blood pressure (HBP) levels and high cholesterol (HC) levels when compared to European Americans (Saab et al., 2015). The estimated population of African Americans is 45.6 million or 14% of the U.S. population (U.S. Census Bureau, 2016). The prevalence of HBP levels is higher among African Americans (41.2%) when compared to European Americans (28.8%) and non-Hispanic Asians (24.9%) (Centers for Disease Control and Orevention [CDC], 2015a). In addition, more African Americans (32%) develop high total cholesterol levels when compared to European Americans (30%). Therefore, there is a need to explore what influences the development of HBP and high total cholesterol levels among the growing African American population in line with what Saab et al. (2015) suggested. Systolic and diastolic values measure blood pressure (BP) levels; normal BP has systolic and diastolic values of less than 120 mm Hg and less than 80 mm Hg respectively (American Heart Association, 2017). HBP levels has systolic and diastolic values between 140 -159 mm Hg and 90-99 mm Hg respectively. Normal or desirable total cholesterol level is measured at less than 200 mg/dL, while figures above 240 mmg/dL indicate HC levels

(CDC, 2015b).

According to Saab et al. (2015), many factors may contribute to the disproportionate prevalence of HBP and HC levels among the African American population. Diet (Saab et al., 2015) and physical activity (Bell, Lutsey, William, & Folson, 2013) are essential factors that have been found to contribute to CVD risk among African Americans. Other factors that may contribute to the disproportionate rate of HBP levels and high total cholesterol levels among African Americans include lower levels of education, higher poverty rates, lower insurance coverage, as well as less access to health care (Saab et al., 2015). African Americans also consume foods that are relatively higher in sodium and sugar and lower in potassium, which may contribute to the risk of HBP (World Health Organization, 2003). Chan et al. (2015) also noted that African Americans consume lower quantities of fruits and vegetables when compared to European Americans. In addition, African Americans are less likely to engage in physical activities when compared to European Americans (Bell et al., 2013; Yi, Trinh-Shevrin, Yen, & Kwon, 2016). Bell et al. (2013) indicated that lack of physical activity may contribute to developing CVD risk factors including HBP levels and HC levels.

It is possible that African Americans develop HBP levels and high HC levels partly due to dietary factors and physical inactivity (Baker, Barnidge, Schootman, Sawicki, & Motton-Kershaw, 2016; Di Noia, Furst, Park, & Byrd-Bredbenner 2013; Webb, Khubchandani, Hannah, Doldren, & Stanford, 2016). However, recent studies have been inconclusive on the extent to which dietary patterns predict HBP levels and HC levels (Baker et al., 2016; Chan, Stamler, & Elliott, 2015; Livingstone &

McNaughton, 2016; Liu et al., 2013). The purpose of this study was to examine the extent to which diet quality and physical activity predict BP levels and HC levels among African Americans after controlling for demographic factors, BMI, and energy intake.

The current study is organized as follows: Section 1 consists of the foundation of the study and literature review. There are several subsections including the problem statement, the purpose of the study, research questions and hypotheses, theoretical framework of the study, nature of the study, literature review, assumptions, scope and delimitations, significance, summary, and conclusion. Section 2 consists of research design and data collection, including several subsections such as the research design, and rationale, methodology, threats to validity and summary. Section 3 consists of secondary data set collection, results, and summary. Section 4 is made up of interpretation and discussion of the results, limitations, recommendations as well as implications for professional practice, and implications for social change.

Problem Statement

Several studies have shown that the leading cause of death among African Americans in the United States is CVD. HBP levels and HC levels are some of the major risk factors for developing CVD (Baker et al., 2016; CDC, 2017a; Fraser et al., 2015; Hajar, 2016; & Lee et al., 2013). For example, Di Noia et al. (2013) noted that African Americans disproportionately develop HBP and HC levels due dietary factors. According to the American Heart Association (2016), 48,098 African-American men and 48,138 African-American women died as a result of CVD in 2013. When compared to European Americans (33.9% of men and 31.3% of women), African Americans (43% of men and

45.7 % of women), developed HBP in 2013 (CDC, 2016a). Each year, more than 1.5 million Americans suffer heart attacks and stroke because of HBP. Within this total number, close to 44% of African American men and 48% of African American women of are affected (CDC, 2014a). Dietary quality and physical activity are some of the factors that may influence the management of CVD risk factors (Diaz et al., 2016; Liu et al., 2016; Stradling, Hamid, Taheri, & Neil Thomas, 2014). Chan et al. (2015) reported that there is a higher incidence of HBP levels with suboptimal dietary intake among African Americans than among European Americans. However, the influence of specific dietary patterns that influence the development of CVD risk factors is inconsistent (Chan et al., 2015; Liu et al., 2016), and there is contradictory evidence on the different dietary recommendations for the management and prevention of HBP (Livingstone & McNaughton, 2016).

Although Faeirheller et al. (2014) noted the positive association between aerobic exercise and CVD health among African-American adults, there is limited information on how exercise training contributes to CVD health. Mann, Beedie, and Jimenez (2014) also found that regular exercise may reduce cholesterol levels. However, the frequency, intensity, and duration of training required for optimal cholesterol levels have not been determined. Diaz et al. (2017) reported that the empirical evidence to support the effects of physical activity on incident hypertension is limited among African Americans. Therefore, this study addresses the literature gap through the examinination of the extent to which diet quality and physical activity predict HBP levels and cholesterol levels.

Multivariable logistic regression method was used for analysis with demographic factors, BMI, and energy intake as covariates.

Purpose of the Study

The purpose of this study was to examine how dietary quality measured by Mellen's DASH dietary index, and physical activity predict BP levels and total cholesterol levels, with potential covariates among African Americans.

Research Questions and Hypotheses

The research questions for this study were designed to examined the extent to which the DASH diet and physical activity, as independent variables predict BP levels and total cholesterol levels, as dependent variables among African Americans.

Research Question 1: To what extent does the DASH dietary pattern predict BP levels and total cholesterol levels among African Americans after controlling for demographic factors, BMI, and energy intake?

H_0: The DASH dietary pattern does not predict BP levels and total cholesterol levels among African Americans.

H_1: The DASH dietary pattern predicts BP levels and total cholesterol levels among African Americans.

Research Question 2: To what extent does physical activity predict BP levels and total cholesterol levels among African Americans after controlling for demographic factors, BMI, and energy intake?

H_0: Physical activity does not predict BP levels and total cholesterol levels among African Americans.

H_1: Physical activity predicts BP levels and total cholesterol levels among African Americans.

Theoretical Foundation for the Study

The social-ecological model theory, developed by Uria Bronfenbrenner, was the theoretical foundation for the study. Bronfenbrenner (1979) identified five environmental systems within which an individual interacts. The model has five hierarchical levels: individual, interpersonal, community, organizational, and policy/enabling environment (Bronfenbrenner, 1979; CDC, 2014b). The model helps explain the multiple levels of social system's interactions between individuals and the various settings. The model also helps explain how different selections, messages, and available resources may influence decisions on diet quality and physical activity. For example, the Dietary Guidelines for America and the Physical Activity Guidelines for Americans, help explain how public policies can create an enabling environment to influence dietary and physical activity choices. In addition, decisions on healthy food and physical activity engagement are influenced by sector systems (e.g., government, education, healthcare, and transportation), organizations (e.g., public health, community, and advocacy), and businesses (e.g., planning and development, agriculture, food and beverage, retail, marketing, and media). The sociocultural norms and values, that govern individuals' thoughts, beliefs, and behaviors, may equally influence choice. Individual characteristics such as age, sex socioeconomic status, race, and personal preferences also influence food choice and physical activity engagement. Evidence indicates that the implementation of changes across the different layers of the social-ecological model affects food choices and physical activity engagements (Office of Disease Prevention and Health Promotion [ODPHP], 2015). In addition, health outcomes including BP levels and total cholesterol levels are dependent on dietary and physical activity behavior, which in turn depend on the interactions of all the environmental factors in the social-ecological model.

The social-ecological model is identical to the ecosocial theory, first proposed by Nancy Krieger. The ecosocial theory is used to identify who and what are responsible for the health trends of a population, as well as present and past disease and well-being, and the changing social imbalances in welfare (Krieger, 2001). Similar to the social-ecological model, the core constructs of the ecosocial theory include the ecological and societal context, the material and social worlds that surround the individual. The social-ecological model, on the other hand, shows how various environmental factors influence individual decision-making, such as dietary intake and physical activity engagement, and is, therefore, making it more suitable than the ecosocial theory to guide the study.

Nature of the Study

The research design for this study was quantitative using secondary cross-sectional data. Cross-sectional data were abstracted from the 2013-2014 National Health and Nutrition Examination Survey (NHANES) and analyzed to examine the extent to which diet quality and physical activity predict BP levels and total cholesterol levels. The independent variables for the study were diet quality and physical activity, and the dependent variables were BP levels and total cholesterol levels. Data on dietary factors, physical activity, BP levels, cholesterol levels, and demographic factors were obtained from NHANES. The multivariable-adjusted logistic regression analysis was used for data analysis to determine the odds of being hypertensive or having HC with physical activity and diet quality as the predictors of interest.

Literature Search Strategy

I examined the extent to which diet quality and physical activity significantly predicted BP levels and cholesterol levels as among African Americans. The literature for the study was sought through EBSCOhost; Walden Library database; ProQuest, PubMed; National Heart, Lung, and Blood Institute; Google search engines; the Centers for Disease Control and Prevention; and peer-reviewed articles. The following keywords were used to search the database: *African Americans, CVD and risk factors, DASH dietary pattern, physical activity, total cholesterol, cardiovascular risk factors, BP*, and *socio-ecological model*. The literature search helped identify articles within 5 years (2013-2017) of publication to identify the knowledge gaps. After screening for duplicates, relevant articles were reviewed for the study. All other available resources, including librarians, committee members, and the committee chair were also utilized for detailed instruction and guidance.

Literature Review Related to Diet, Physical Activity, Lipids, and Blood Pressure

This section provides a comprehensive literature review of relevant articles that justify the study. In this section, I discuss literature on CVD risk factor disparities, dietary patterns and CVD risk factors, physical activity and CVD risk factors, and socioeconomic influence on CVD risk factors. This section ends with a summary of the current state of knowledge in this area and the gaps informing further research.

Blood Pressure Levels and Cholesterol Levels Disparities

It is essential that researchers have evidence-based studies to assess CVD risk factor disparites among various populations as the foundation for further studies. Several studies have shown that there is a higher prevalence of CVD risk factors including BP levels and cholesterol levels among African Americans when compared to European Americans (Baker et al., 2016; Frazer et al., 2015; Lee at al., 2013; Ortega, Sedki, and Nayer, 2013). According to the CDC (2015a), 41.2% of African Americans have HBP levels when compared to 28.8% of European Americans and 24.9% of non-Hispanic Asians. In addition, 32% of African Americans develop high cholesterol levels compared to 30% of European Americans. Graham (2015) noted that the high prevalence of HBP levels among African Americans worldwide might be related to the corresponding high morbidity rates associated with CVD. HBP levels and HC levels are characterized by identical disparities in individual behaviors and lifestyles such as physical inactivity and poor eating habits. Behavioral modification or adjustment, including healthy eating and physical activity engagement could reduce the burden of HBP and HC among African Americans.

Dietary Patterns with Blood Pressure Levels and Cholesterol Levels

Dietary pattern constitutes the whole combination of foods and nutrients that are habitually consumed. The consumption of a suboptimal diet may lead to the development of HBP levels and HC levels (Mozaffarian, 2016). Some of the well-known dietary patterns that are designed to prevent the developments of chronic including conditions such as HBP levels and HC levels are the Mediterranean diet, the DASH diet, and the Healthy Eating Index (HEI; Mozaffarian, 2016).

The American Heart Association and 2015 Dietary Guidelines for Americans have endorsed the DASH plan (Dietary Guidelines for America, 2015). DASH is an eating plan that designed to help prevent the development of HBP within 14 days. The DASH plan emphasizes the intake of foods with high components of fruits and vegetables, whole grains, fish, poultry, beans, fat-free or low-fat milk and milk products, seeds, and nuts. In addition, it emphasizes the minimal inclusion of sodium, added sugars, fats, and red meat (Kwan et al., 2013). Kwan et al. concluded that compliance with DASH plan can reduce HBP levels and HC levels.

DASH recommend the following recommended eating plan: ≥ 4.5 cups of fruits and vegetables per day, ≥ 2.3 of 5-oz. servings of fish per week, ≥ 3 1- oz. ≥ 3 oz. equivalent servings of fiber per day, < 1500 mg of sodium a day and < 450 calories of (36 oz.) of sugar-sweetened beverages per week. The Mediterranean diet consists of foods rich in fruits and vegetables, whole grains, moderate fish intake, seafood, dairy, olive oil, and wine intake (Lanier, Bury, & Richardson, 2016). The HEI is used primarily to measure diet quality and compliance with the Dietary Guidelines for Americans (USDA, 2011). The HEI is based on the American diet and consists of the intakes of total fruit, whole fruit, total vegetables, greens and beans, whole and refined grains, total protein foods, seafood and plant-based protein foods, sodium, and solid fat calories, added sugar, and alcohol beyond moderation (USDA, 2011). When adopted, the DASH Diet, HEI, and Mediterranean Diet can lower the risk of HBP (U.S. National Library of Medicine, 2017).

Dietary guidelines may be helpful in addressing the differences in diet between races that are affecting their health. For example, Chan et al. (2015) analyzed data from NHANES, the Reasons for Geographic and Racial Differences in Stroke (REGARDS), and the Continuing Survey of Food Intakes by Individuals (CSFII) to compare differences in food quality between African Americans and European Americans. According to the 2009-2010 NHANES data African Americans consumed lower amounts of fruits, vegetables, whole grains than European Americans (0.8, 1.2, and 1.3 servings/day for African Americans, vs. 1.1, 1.6, and 2.1 servings/day for European Americans respectively; Chan et al., 2015). In addition, the consumption of sweetened beverages was high among African Americans when compared to European Americans (11.2 servings/day for African Americans vs. 8.3 servings/day for European Americans); the average intake of dietary cholesterol among African Americans was higher (311 mg/day for African Americans vs. 263 mg/day for European Americans); and there were lower amounts of dietary fiber intake compared to European Americans (13.6 g/day for Black men vs. 16.3 g/day for White men). Chan et al. also reported that larger amounts of energy intake from sugars when compared to European Americans (14.5 % for African Americans vs. 12.8 % for European Americans). In addition, higher percentages of European Americans met the Dietary Guidelines for Americans when compared to African Americans for whole grains (≥ 3 servings/day); fruits (≥ 2 cups/day);, vegetables (2 cups/day);, nuts, legumes and seeds (≥ 4 servings/week);, and sugar-sweetened beverages (≤ 36 oz./week). The findings showed that lower percentages of African

Americans met the Dietary Guidelines for Americans, which corresponds to the high rates of HBP levels among African Americans (Chan et al., 2015).

Looking at the effects of adopting dietary guidelines that may improve African American diets, Chiu et al. (2016) conducted a three-period randomized crossover trial among individuals with a controlled diet, a DASH diet, and a higher fat, lower-carbohydrate modification of the DASH diet (HF-DASH diet). The study included healthy men and women over 20 years old with an average systolic BP < 160 mm Hg and diastolic BP between 80 and 95 mm Hg. The objective of the study was to test the relationship between full-fat or low-fat dairy foods in the DASH diet, and BP and total cholesterol, with equal increases in fat and low sugar intake. The authors found that both the DASH and HF-DASH diets reduced BP levels identically relative to control diet, while the DASH diet significantly lowered cholesterol levels (Chiu et al., 2016).

Other studies have also shown how diet quality can affect BP and HPB levels. Livingstone and McNaughton (2016) conducted a study to examine the association between diet quality and HBP levels in a 2011-2013 cross-sectional Australian Health Survey. Participants in the study included 4,908 adults aged (45.2 ± 0.24 years). Livingstone and McNaughton used two 24-hour dietary recalls to generate the dietary guideline index (DGI) as well as recommended food scores (RFS). Findings from the study showed that women had higher mean DGI and RFS when compared to men ($p < 0.001$). In addition, men in the highest tertile of DGI and RFS had lower chances of having HBP levels (DGI: 0.56, 0.37, 0.85, P-trend = 0.006; RFS: 0.62, 0.41, 0.94, P-trend = 0.021). Therefore, there was an association between high diet quality score as estimated by the DGI and low risk of HBP levels (Livingstone & McNaughton, 2016).

In addition to adopting specific dietary guidelines, adopting a different diet like a vegetarian diet may also help improve health. Wang et al. (2015) conducted a quantitative study to examine the influence of vegetarian diet on lipids. Although a large number of people have embraced a vegetarian diet in recent times, its influence on blood concentrations in the blood is still not clear (Wang et al., 2015). Wang et al. conducted a meta-analysis to examine the association between vegetarian diet and total cholesterol levels. They undertook subgroup and univariate meta-regression analysis that included 11 trials to investigate the differences in origin, and found that lower total cholesterol levels were associated with the consumption of a vegetarian diet (Wang et al., 2015).

Diet quality and making improvements to diet can also impact CVD risk. Liu et al. (2013) conducted a cross-sectional study to examine the association between diet quality and CVD risk factors. The authors identified three dietary patterns: the "Southern," the "fast food", and the "prudent. The authors adjusted for demographic variables, smoking, alcohol intake and physical activity for the study. The authors found that increases in "Southern" pattern scores were associated with increases in BP levels. However, the "prudent" pattern, which consisted of diet rich in fruits, vegetables, low-fat dietary products, legumes, nuts, fish, and whole grains, and low in red meat, processed or refined foods, and sweets, had a protective association with HBP levels (Liu et al., 2013). Thus, it is important to understand the association between diet quality and the development of CVD risk factors among African Americans (Liu et al., 2013).

Going back to the potential benefits of a vegetarian diet, Frazer et al. (2015) conducted a study to compare the differences in CVD risk factors between vegetarian and nonvegetarian African Americans in a cross-sectional study. Participants included 592 African American men and women who took part in an Adventist Health Study (Frazer et al., 2016). Blood and physiological data were obtained prior to the study. Among the participants, 25% were either vegan or lacto-ovo-vegetarians (labeled vegetarian/vegans), 13% were pesco-vegetarian, and 62% were nonvegetarian. The odds of the vegetarians/vegans having HBP levels and high total cholesterol levels were lower (0.56, 95% CI and 0.42, 95% CI) respectively than those of the non-vegetarians. Consequently, a vegetarian diet, like specific dietary guidelines, can help address issues with diet quality that are affecting African Americans' health.

Dietary guidelines can also be used to examine the CVD risk by creating diet quality scores. For example, Sotos-Prieto et al. (2015) used the Alternative Healthy Eating Index, DASH, and the Alternative Mediterranean Diet to generate diet quality scores and examine the changes in diet quality scores and its influence on CVD risk over time. Short-term as the period within 4 years and long-term as the periods beyond 4 years for the study, and individuals with stable diet over the 4-year period were noted (Sotos-Prieto et al., 2015). Sotos-Prieto et al. analyzed the association between variations in the three diet quality scores (Alternative Healthy Eating Index, Alternative Mediterranean Diet, and DASH) and the corresponding CVD risk among 29,343 men in the Health Professionals Follow-up Study and 51,1195 women in the Nurses' Health Study. The authors found significant improvements in diet quality scores over the 4-year period.

There was a 7% - 8% decrease in CVD risk (pooled hazard ratio, 0.92 [95% CI: 0.87-0.99] for Alternative Healthy Eating Index; 0.93 [95% CI: 0.85-1.02] for Alternative Mediterranean Diet; and 0.93 [95% CI: 0.87-0.99] for DASH; all P-trends < 0.05). Diet scores were increased from baseline to the initial 4-year follow up. There was also an associated decreased CVD risk over the following 20 years (7% [95% CI: 1% to 12%] for Alternative Healthy Eating Index and 9% [95% CI: 3% to 14%] for Alternative Mediterranean Diet). The findings from this study show an association between decreases in diet quality scores with increased CVD risk in addition to diet quality score improvements showing positive associations with HBP levels both in the short and the long terms (Sotos-Prieto et al., 2015).

Another study showing the association between diet quality and CVD was conducted by Najafi and Sheikhvatan (2013), who examined the association between diet and CVD risk factors in men and women with heart disease. Participants included 461 patients (355 men and 106 women) between the ages of 35 and 80. The authors calculated diet scores in all dietary groups and reported the total score as the Mediterranean Diet Quality Index (MedDQI). The authors found higher BP levels among women ($p < 0.001$) than among men. Although the consumption of fruits, vegetables, and cereals in both genders was at the recommended quantity, the consumption of fish and olive oil was low, and women consumed food that contained more fat (Najafi & Sheikhvatan, 2013). There was also a difference in the MedDQI scores for both genders with hypertension. The authors concluded that, diet was associated ($p = 0.018$) with modifiable classical risk factors for CVD which were more prevalent in women than in men (Najafi & Sheikhvatan, 2013).

In addition to diet quality affecting CVD risk, other studies have shown an association between diet quality and BP levels as well as CVD risk. Nicklas, O'Neill, and Fulgoni (2012) examined the influence of diet quality on CVD risk factors including BP levels and cholesterol levels. Participants included 18,988 adults (51% men, 21% African Americans, 50% White, 25% Hispanic Americans and 4% other) over 19 years old. The authors used 2001-2008 data from NHANES and compared the quality of diet based on the 2005 HEI scores and cardiovascular risk factors factors in adults and a 24-hour dietary recall to calculate diet quality scores. The authors found that increased trends in HEI were related to decreased trends in total cholesterol levels and BP levels. The consumption a of high-quality diet decreased BP levels to 26% and lowered cholesterol to 21%. Data from the study suggested that increases in diet quality was directly associated with decreases in HBP levels and cholesterol levels (Nicklas et al., 2012).

Several studies have shown the importance of understanding the association between diet quality and the development of HBP and HC levels among African Americans. The review of the literature showed that adherence to the consumption of a high-quality diet could improve BP levels and cholesterol levels (Chan et al., 2015; Chiu et al., 2016; Najafi & Sheikhvatan, 2013; Sotos-Prieto et al., 2015). The 2015 Dietary Guidelines for America recommends that a high-quality diet be rich in fruits, vegetables, legumes, nuts, fish, and whole grains, with low quantities of red meat, sodium, sweets, sugary beverages, and processed foods (Dietary Guidelines for America, 2015; Liu et al., 2013; Sotos-Prieto et al., 2015). The food components and recommendations of DASH, which measures diet quality, are not any different from the Dietary Guidelines for America recommendations. There are positive results concerning the influence of diet quality on BP levels and cholesterol levels. What is not known is the extent to which the DASH effectively influences BP levels and cholesterol levels with considerations to demographic factors, BMI, and energy intake.

Physical Activity with Blood Pressure Levels and Cholesterol Levels

Regular physical activity promotes overall well-being and may contribute to the reduction of CVD risks factors including HBP levels and high total cholesterol levels. The Physical Activity Guidelines for Americans provides an essential resource on the minimum physical activity requirements for optimal health, recommending that healthy adults engage in 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic activity each week. Lanier et al. (2016) noted that moderate-intensity physical activity can reduce CVD risk factors by 15%-39% CVD.

Regular physical exercise can help reduce cholesterol levels. Mann et al. (2014) conducted a study on the association between different kinds of exercise and lipid profile by reviewing published articles. The authors examined the modes of exercise and their relationships with cholesterol levels. Physical activity and exercise were used interchangeably for analysis. Physical activity may be occupational, leisure, or daily activities. The authors referred to exercise as a routine physical activity that is performed for a reason and may include aerobics, resistance training or the combination of both. After reviewing articles on modes, intensities, and frequencies of physical activit and its effect on cholesterol reduction, Mann et al. (2014) confirmed that regular physical activity might reduce cholesterol levels, but the beneficial impact may be related to the differences in volumes and intensities as well as different lipid types. Though regular physical activity and exercise can reduce total cholesterol levels, the amount of exercise that is needed to safeguard an individual from having high total cholesterol levels and other CVD risk factors is not clear.

Physical activity can also help improve BP levels. Bell, McIntyre, and Hadley (2014) conducted a study on the influence of long-term physical exercise on BP levels among African-American adults. Participants included 20 African Americans (six males and 14 females) below the age of 65. The authors required participants' baseline BP not to exceed 140/90 mm Hg and being above 18 years old (Bell et al., 2014). Bell et al. took participants BP readings to begin with the study and also repeated at the end of the sixth and the 12th week. The participants then engaged in various types of physical activities for 20-60 minutes for 3 to 5 days each week for 12 weeks. At the end of the intervention, the authors noticed a small decrease in BP levels from baseline to the sixth week. In addition, BP levels decreased significantly at the end of the 12th week relative to baseline (Bell et al., 2014). These results suggest that long-term physical exercise can reduce BP levels significantly.

Physical activity may not reduce BP levels. Diaz et al. (2017) conducted a study on the association between physical activity and incident hypertension among African Americans in the Jackson Heart Study. The study included 1311 African American adults and at least 21 years old. The researchers measured physical activity at baseline using the

Jackson Heart Study Physical Activity Survey and classified it into four domains: active living habits, work, home life, and sports/exercise activities. The researchers quantified the number of minutes per week spent on moderate or vigorous physical activity and the three most performed sports/exercises. After 8 years of follow-up, 650 (49.6%) cases of incident hypertension were reported. Participants with intermediate and ideal versus poor levels of moderate-to-vigorous physical activity were compared. The authors did not find any significant association between overall physical activity, or work, active living, and household-related physical activity. The authors concluded that evidence to support the protective effects of physical activity in hypertension prevention is limited among African Americans.

Other studies have reported that physical activity may not improve BP levels. Feairheller et al. (2014) conducted a study on how aerobic exercise could improve vascular health and BP levels among African Americans. The authors used a single group pre-post intervention for the study. Participants included 21 females and five male African American adults aged between 40 to 75 years, who were taken through flow-mediated dilation (FMD) testing before and after exercise training. The study included sedentary individuals (less than two days of aerobic exercise in a week) who were non-diabetic and nonsmoking, had office BP < 160/10 mm Hg, and took CVD medications, as well as those without any history of CVD. The researchers conducted baseline testing, after which laboratory technicians oversaw a 6-month aerobic exercise training intervention. The office and ambulatory BP levels measured at baseline were 123.3 ±13.7

mm Hg systolic BP and 79.1 ± 7.6 mm Hg diastolic BP. The authors did not find any improvements in BP levels after participation in aerobic exercise training.

Other studies have shown the association between physical activity and cholesterol levels is inconclusive. Thomson, Goodman, & Tussing-Humphreys (2015) conducted a study on the influence of physical activity on the cardiovascular health of the Southern African American dominated population. The authors conducted a 6-month intervention focused on physical activity sessions to improve physical activity among five selected churches. The initial intervention was a supervised 60-minute physical activity. The physical activity lessons consisted of equally allocated time for aerobic exercises which included Zumba and flexibility and strengthening activities. A qualified health specialist co-mediated the instructional physical activity session and instructed the managed physical activity classes. The authors used the Rapid Assessment of Physical Activity survey toolkit and generated physical activity scores. The authors observed significant changes in physical activity in the intervention group when compared to the control group. The authors also noted significant reductions in mean cholesterol levels and BP levels in the intervention group but did not observe any significant difference in the control group. Given the results, physical activity interventions have inconstitent effects on lipid profiles among African American adults.

Physical activity may not help reduce cholesterol levels. Brown, Becker, and Antwi (2016) conducted a population-based cross-sectional study to investigate the association between physical activity and lipid biomarkers. The biomarkers identified for the study included cholesterol levels. According to the authors, physical activity could decrease the risk of CVD. However, the biological mechanisms that explain the association between physical activity and the risk of CVD are not well understood. The authors classified physical activity into different measures, including moderate and mild self-reported activity and 30 minutes of walking for more than 1 week. The authors used data from the Understanding Society Survey for the study. The authors found a significant association between moderate and mild self-reported physical activity and total cholesterol levels among both men and women. The relationship between 30 minutes' walk and total cholesterol level was insignificant, while there was no association between mild physical activity and total cholesterol levels.

Intense physical activity may not reduce cholesterol levels. Crichton and Alkerwi (2015) conducted a study to investigate the relationships between the intensity of physical activity and time spent on moderate and intense physical activity and total cholesterol levels. Participants for the study included 1331 individuals aged between 18 and 70 years in the Observation of Cardiovascular Risk Factors in a Luxembourg study. The authors collected data through the International Physical Activity Questionnaire. The time spent in engaging moderate and intense physical activity was noted. The authors noted that there was a significant association between increased intense physical activity time and higher levels of cholesterol ($p < 0.05$), after adjusting for dietary factors and socio-demographic factors. Individuals who engaged in medium intense physical activity (0.5-1 hour/day) significantly had higher HDL cholesterol level (mean = 64.5±1.2 mg/dL [1.67 ± 0.03 mmol/L]) when compared to those who engaged in less time (mean = 60.8 ± 0.52

mg/dL [1.57 ± 0.01 mmol/L]). The authors, in their conclusion, noted that there was no significant association between total cholesterol levels and intense physical activity time.

Regular physical activity is known to promote individuals' well-being and minimize their CVD risk factors including BP levels and cholesterol levels. The Physical Activity Guidelines for Americans recommends that adults get a minimum of 150 minutes a week of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity for health benefits (DHHS, 2017a). The literature review for the current study showed that physical activity could reduce the development of CVD risk factors. In addition, the duration and intensity of physical activity could influence CVD related health outcomes. However, the extent to which physical activity is associated with BP levels and total cholesterol levels is not yet known.

Demographic Factors with Blood Pressure Levels and Cholesterol Levels

There are marked differences in the influence of demographic factors of age, gender, education, and income on CVD risk factors (Psalstopoulou et al., 2017). Demographic factors shape individual behaviors due to differences in socioeconomic standing and sociocultural processes that may affect food choices and physical activity engagement. Willig et al. (2015) noted that African American men and women are twice as likely to develop HBP levels (OR = 1.72). Everett and Zajacova (2015) conducted a study to examine gender difference in HBP in a National Longitudinal Study of Adolescent to Adult Heart (Add Health), a nationally representative sample of U.S. adolescents drawn from 80 high schools and 52 middle schools. The participants ranged from 18 and 34 years old. Trained interviewers measured three systolic and diastolic readings. The key predictor for the study was gender. The authors found that 27% of the men who were in their late twenties had HBP levels when compared to 12% of women in the same age group. Findings from self-reported data showed that women are significantly less likely to develop HBP levels when compared to men (OR = 0.37, $p < .001$). The authors also concluded that the differences in observed HBP might be linked to differences in behavioral risk factors such as smoking and physical activity.

Maleki, Haghjoo, and Ghaderi (2016) conducted a cross-sectional study to examine the association of gender and age differentials and healthy behavioral measures among patients with heart disease. The 412 participants included 239 men and 173 women. The authors collected data on demographic characteristics to assess health behaviors through questionnaires. The participants responded to questions on diet quality and physical activity on a 4-point Likert scale (1 = never, 2 = sometimes, 3 = often, and 4 = routinely). Higher scores meant healthier lifestyles, while lower scores meant unhealthier lifestyles. The scores on the lifestyle scale ranged from 5 to 30. The authors did not find any significant difference in BP levels, cholesterol levels, and age between both genders ($p = 0.092$, $p = 0.573$, $p = 0.573$). The lifestyle mean scores for men and women were 19.2 ± 4.2 and 18.8 ± 3.2, respectively. The authors also found that in general, the healthy lifestyle scores between the two genders were not statistically significant ($p = 0.342$). In other subscales, women consumed a higher-quality diet ($p = 0.000$) than men, while men were more physically active ($p = 0.00$) than women. The authors concluded that it was evident that the participants' lifestyles were unhealthy. Mannocci et al. (2015) conducted a study to investigate the prevalence of major CVD risk factors at the initial stage of medical examination in an observational cross-sectional study. Participants for the study included 1073 oil and gas contractors (mean age 41, SD = 9.5) with HBP levels and cholesterol issues. Data were collected from participants' medical records as a follow up on employees' health during the period of employment. The variables that were analyzed include age (< 45, 45-54 and > 54 years old), HBP (if systolic values ≥ 140mm Hg and/or diastolic values were ≥ 90mm Hg) and cholesterol (< 200 mg/dL healthy level; 200-239 mg/ dL borderline; ≥ 240 mg/dL high level). The authors found that workers aged 45 years and over had a significantly higher risk of HBP levels (OR = 2.7, 95% CI = 2.1-3.6) and HC levels (OR = 2.7, 95% CI = 2.0-3.6) when compared to participants under 45 years old.

Wagner, Boing, Subramanian, Höfelmann, and D'Orsi (2016) conducted a cross-sectional study to test the association of neighborhood socioeconomic status with HBP levels among older adults. Participants included 1,705 adults with an average age of 70.7 years from Florianópolis, southern Brazil. The authors categorized participants as having HBP levels when their systolic BP was higher than 140 mm Hg and diastolic BP was higher than 90 mm Hg, or both. The average systolic BP level was 133.5 mm Hg (SD = 20.5 mm Hg) while the average diastolic BP level was 81.9 mm Hg (SD = 12.5 mm Hg). The authors found that systolic BP among the population sample that lived in the census tracts with lower levels of education was 4.46 mm Hg (95% CI 1.00-7.92) higher. The chance of having HBP levels was 1.80 (95% CI, 1.26-2.57) among the same sample. The authors concluded that there was an association between neighborhood socioeconomic status and systolic BP levels, without consideration of individual characteristics.

Najafi and Sheikhvatan (2013) examined the association between diet and CVD risk factors in men and women with heart disease. Participants included 461 patients (355 men and 106 women) between the ages of 35 and 80 years. The authors obtained data on the quantity and components of nutrients to calculate diet scores in all dietary groups. The authors reported total score as the Mediterranean Diet Quality Index (MedDQI). The authors found that the likelihood of having HBP level was higher in women ($p < 0.001$) than in men. The consumption of cereals, fruits, and vegetables in both genders was within the recommended quantity, but the consumption of fish and olive oil was low. The authors also noted that women consumed high-energy food with more fat. There was a difference in the MedDQI scores for both genders with hypertension ($p = 0.018$). The authors concluded that diet was associated with modifiable classical risk factors for CVD, which were more prevalent in women than in men.

Covariates including age, sex, income, and education were treated as confounders. Confounders are variables that are not needed but may influence the association of both the independent variables (diet quality and physical activity) as well as the dependent variables (BP and cholesterol levels). Statistical methods may be used to control confounders because of their flexibility to control the effects of confounders (Pourhoseingholi, Baghestani, & Vahedi, 2012). It is essential to control the stated covariates as confounders because their existence may distort the findings of the study. In addition, it may be difficult to establish the actual relationship between the dependent and independent variables for the study (Pourhoseingholi et al., 2012).

Body Mass Index and Energy Intake with CVD Risk Factor

Dua, Bhuker, Sharma, Dhall, and Kapoor (2014) conducted a cross-sectional study to examine the prevalence of HBP and overweight/obesity among adults. Participants for the study included 117 male and 123 female adults between the ages of 18 and 50 years that resided in the Punjabi community. The researchers conducted physical examinations on participants and measured BP levels, percentage of body fat and body mass index (weight/height^2). After controlling for age, the authors found that BP levels were significantly associated with BMI ($p < 0.001$). The authors concluded that individuals who were overweight/obese were more likely to have high BP than those who had normal BMI.

Mohammed, Idriss, Nora, and Fatiha (2017) conducted a study to examine the association between BMI and total cholesterol levels among married and unmarried Algerians. Participants for the study included 18 unmarried and 18 married women with a mean age of 22.75 years. The participants showed homogeneity in educational and social status as well as in occupation. Participants agreed voluntarily to the study, and blood was drawn after they had fasted. The researchers conducted physical examinations and measured all subjects BMI. The researchers found an association between BMI and total cholesterol levels. However, the association might be explained by the intake of contraceptives which caused a decrease in cholesterol among married women.

Mathew and Chary (2013) conducted a study to examine the association of dietary calorie intake and BMI in individuals with HBP. Participants included 593 women and 553 men 30 years and older who consented to the study. Individuals free of HBP and other diseases and not taking any particular medication were randomly selected to form a control group. The control group was made up of 217 women and 183 men aged between 30 and 80 years. The authors used information from questionnaires to calculate individuals' daily calorie intake. Physical examinations were conducted to take BP values. Blood was drawn under fasting conditions, and total cholesterol and BMI were measured for all participants. The researchers conducted their analysis based on the control and hypertensive groups according to daily calorie intake to assess the effect of calorie intake on BP, cholesterol, and BMI. The researchers found a significant association between high-calorie diet and BP levels, cholesterol levels, and BMI.

Definitions

Blood pressure levels: The pressure of blood that exerts on the arterial wall is known as BP. BP levels are measured by systolic and diastolic values and may be categorized into high (≥ 140/90 mm Hg), normal (≤ 120/80 mm Hg), or low levels (≤ 90/60 mm Hg; CDC, 2016a).

Body Mass Index (BMI): This is a measure of body fat by dividing an individual's weight by the square of his or her height. An individual with a BMI value of <18.5 is considered underweight, 18.5-24.9 is normal weight, 25-29.9 is overweight and >30 is obesity (National Heart, Lung, and Blood Institute, 2017).

Cardiovascular Diseases: The group of disease that involves the heart or the blood vessels (CDC, 2017b).

Dietary Approaches to Stop Hypertension (DASH): DASH is an eating plan that may be adopted to aid BP management. The plan places much emphasis on the consumption of healthy foods and limiting the intake of red meat, sodium (salt), and sweets (including added sugars and sweetened beverages; American Heart Association, 2017).

Dietary Pattern: The quantities, proportions, variety or combinations of different foods and beverages in diets, and how frequently they are consumed as a habit (Office of Disease Prevention and Health Promotion, 2017a).

Healthy Eating Index (HEI): The HEI is used by the USDA to measure diet quality in compliance with the Dietary Guidelines for Americans. In addition, the HEI may be used to examine the relationship between diet and health-related outcomes (U.S. Department of Agriculture, 2011).

Total Cholesterol: This consist of the overall amount of cholesterol in the blood. It is made up of low density-lipoprotein (LDL) and high-density lipoprotein (HDL). Total cholesterol levels of 200 mg/dL are desirable for adults without heart disease, but values over 240 mg/dL are high (CDC, 2015d). HDL is known as the "good" cholesterol because high levels are associated with reduction in CVD risk, including heart disease and stroke. LDL is known as the "bad" cholesterol because high levels of it in the blood lead to the build-up of plaque in the arteries (CDC, 2015d). It is important to know both cholesterol forms to keep the HDL ($\leq$ 40 mg/dL) and the LDL ($\leq$ 100 mg/dL) at optimal levels.

Prudent Diet: A dietary pattern that consists of fruits and vegetables, legumes, whole grains, nuts, fish, and low-fat dairy products (2015 Dietary Guidelined Advisory Committee, 2015).

Physical Activity Guidelines: The Physical Activity Guidelines for Americans provides a set of recommendations for American adults, specifying the minimum amount of physical activity required each day for optimal health. (ODPHP, 2017b).

Southern Diet: The Southern dietary pattern consists of fried foods, added fats, egg dishes, processed meats, organ meats and sugar-sweetened beverages (Shikany et al., 2015).

Assumptions

The following assumptions were taken into consideration to enhance the validity of the study:

The socioecological model (SEM) selected is the best option to examine the extent to which diet quality and physical activity predict BP levels and cholesterol levels. According to the Office of Disease Prevention and Health Promotion (2017b), the model helps professionals to understand how individual behaviors including physical activity and food intake, influence health outcomes, including BP levels and cholesterol levels.

There is a random occurrence of missing data values which was managed by using IBM's Statistical Package for Social Sciences' (SPSS) listwise deletion function (IBM, 2016). Treatment of missing data is a rule for quantitative studies (Dong & Peng, 2013). In addition, failure to consider and treat missing data may result in a potential bias of the estimation of research parameters, decrease the statistical power, and also affect the generalizability of the study results.

The sample selected, African Americans 18 years and older, is a true representation of the population that was considered for the study. The CDC uses survey samples to represent all ages of the population. In addition, findings from various NHANES studies have formed the basis for United States standards for health outcomes including BP and cholesterol levels.

The stated variables of interest, diet quality, and physical activity were important for determining CVD risk factors among African Americans. Several studies have noted that African Americans disproportionately develop HBP and HC due to dietary and physical activity factors (Diaz et al., 2016; Liu et al., 2016; Stradling et al., 2014).

Scope and Delimitations

The was study was based on diet quality and physical activity and how they associate with cholesterol levels and BP levels among African Americans. Data for the study were extracted from the 2013-2014 NHANES database. African American adults residing in the 50 states and Washington, D.C., were considered for study because of the high incidence of CVD risk among the population. The following were the delimitations of the study:

The study was restricted to the use of a cross-sectional quantitative survey. As a result of this method, there were no control groups to be used for study comparison. In addition, the data from the 2013-2018 NHANES dataset were collected at a specific time. Because the data for the study were secondary only, variables available in the dataset were used. The size of the sample delimited the study. The sample size for the study included African Americans who were 18 years and older. Therefore, the study did not include individuals who were below the specified age. In addition, there were limitations on the number and types of questions that were included in the questionnaire. Most questions were dichotomous; therefore, participants were unable to provide unrestricted answers.

Significance, Summary, and Conclusion

The possibility of suffering a heart attack is high with increases in BP levels and cholesterol levels (CDC, 2016a). The positive social change implication of this study emerges from the disproportionate burden of CVD risk, including HBP levels and HC levels among African Americans compared to European Americans. Findings from the study can contribute to positive social change by promoting the adoption of healthy behaviors and recommend appropriate behavioral risk factor interventions at the individual, community, and national levels, to reduce the incidence of CVD among African Americans. In the long term, lifestyle modifications will promote the well-being of African-American communities. There are significant differences in the association of different dietary patterns with HBP. In addition, the 2015-2020 Dietary Guidelines for Americans noted that large proportions of African Americans did not meet the Dietary Guidelines for Americans. Perhaps, this finding, among other thing,s may be a contributing factor to the high prevalence of HBP levels and HC levels among African Americans when compared to European-Americans. However, the extent to which dietaryquality is associated with HBP levels and HC levels remains inconclusive.

Physical activities play an essential role in the cardiovascular health of individuals, by reducing HC levels (Silva et al., 2016) and HBP levels (Börjesson, Onerup, Lundqvist, & Dahlöf, 2016). However, the type of physical activity and intensity required for optimal BP and total cholesterol levels also remains inconclusive.

Feairheller et al. (2014) noted that African American adults could have improved BP levels and total cholesterol levels should they engage in aerobic exercise for at least six months. Increase in leisure-time physical activity and healthy eating habits could improve total cholesterol levels and BP to healthier levels among African Americans.

Lifestyle modifications, including physical activity engagement and diet quality improvements, are essential for the reduction of CVD risk factors including cholesterol levels and BP levels among African Americans. Newton, Griffith, Kearney, and Bennett (2014) indicated that diet quality and physical activity influence HBP and high lipid profiles. The 2015 Dietary Guidelines for Americans posited that a healthy diet promotes overall well-being and reduces the risks of chronic disease. Newton et al. (2014) further noted that African Americans consume fewer fruits and vegetables when compared to European Americans. In addition, African American diets contain more fat, red meat, sodium, calories and sugar-sweetened beverages. African Americans adults are also less likely to meet the current physical activity guidelines when compared to European Americans (Newton et al., 2014). Despite available evidence that high diet quality and high levels of physical activity are associated with improved BP levels and total cholesterol levels, research has yet to identify specific dietary patterns and types of physical activity that have a positive influences on CVD risk factors among African Americans.

The next section, Section 2, consists of the research design and the rationale for the study. The methodology, population, sampling procedures and instrumentations and operational constructs are discussed. The data analysis plan, sample size, power calculation, threats to validity, and ethical procedures are also explained.

Section 2: Research Design and Data Collection

Introduction

The purpose of this study was to examine the extent to which diet quality and physical activity predict BP levels and total cholesterol levels among African Americans. This section provides a detailed description of the nature of the study, research design and methodology, population, sampling and sampling procedures, threats to validity, and ethical concerns.

Research Design and Rationale

The research design consisted of a quantitative cross-sectional study. The approach to this study was a retrospective analysis of secondary datasets. Datasets for both dependent and independent variables were extracted from NHANES in multiple files and merged to produce analytic datasets for the study. The rationale for using the cross-sectional approach was determined by using secondary data that are cross-sectional. For example, data on demographic factors including age, gender, education, and income levels were collected at the same time as the data on the dependent variables (BP levels and total cholesterol levels).

Methodology

The methodology section provides information on all the steps that were taken to conduct the study. There are sections on the target population, sampling and sampling procedures, data analysis, instrumentation and operationalization of constructs, threats to validity, and ethical concerns.

Population

The target population for the study consisted of community residents of the United States. targeted for the 2013-2014 NHANES survey. NHANES excluded individuals under supervised care or institutional custody, all active-duty military personnel and families living overseas, and those residing outside of the 50 states and the District of Columbia (CDC, 2016b). NHANES over-sampled minority populations, including non-Hispanic Blacks, Hispanics, Asians, low-income Whites and persons aged 60 and above, for statistical reliability (CDC, 2016b). The sample for the current study comprised participants who were African Americans and 18 years or over.

Sampling and Sampling Procedures

The sampling method NHANES used for data collection was the stratified multistage cluster technique (CDC, 2016b). A nationally representative sample of 5,000 individuals spread across 15 sampled counties in the country was visited and interviewed in their homes for the survey. In addition, the researchers divided the counties into 15 groups based on their characteristics. A county from each large group was then selected to constitute the primary sampling units (PSU) needed for the NHANES survey every year (CDC, 2016b). The researchers also formed smaller groups with large numbers of households within each of the counties and selected between 20 and 24 of the groups. A sample of about 30 households was selected from each group from all identified homes within the small groups. A total of 14,332 individuals from 30 different study locations in 15 counties participated in the survey. A computer algorithm was used to randomly select some, all, or none of the members of the household (CDC, 2016b). Among the NHANES participants recruited, 10,175 completed the interview, whereas 9,813 received a complete examination. The response rates for the interview and examination were 71% and 68.5%, respectively (CDC, n.d). Trained medical personnel were responsible for the administration of laboratory tests.

Instrumentation and Operationalization of Constructs

The 24-hour dietary recall data were examined to assess dietary patterns and physical activity and their influence on BP and total cholesterol levels among African Americans 18 and older. The independent variables used were DASH diet quality, moderate work activity, and moderate recreational physical activity. According to DASH, the following eating plan is recommended: ≥ 4.5 cups of fruits and vegetables per day, ≥ 2.3 of 5 oz. servings of fish per week, three 1 oz. ≥ 3 oz. equivalent servings of fiber per day, < 1500 mg of sodium a day, and < 450 calories (36 oz.) of sugar-sweetened beverages per week.

The dependent variables used for the study were total cholesterol levels and BP levels. BP level was categorized as “high” if participants were ever told they had high pressure or at the time of the interview were taking medications for HBP. Participants with systolic BP ≥ 20 mm Hg or diastolic BP ≥ 90 mm Hg were considered to be in the HBP bracket. Total cholesterol levels were categorized as “high” if values ≥ 200 mg/dL while values ≤ 200 mg/dL were categorized as “low.”

The definition of physical activity levels from the NHANES data was used. The number of minutes per day engaged in physical activity was used to measure moderate recreational activity and moderate work activity. The 2015 Physical Activity Guidelines for Americans recommends that adults engage in at least 150 minutes of moderate-intensity physical activity per week for significant health benefits. Therefore, less than 150 minutes per week was considered as not meeting Physical Activity Guidelines for Americans and categorized as “low.” The description of each study variable and the corresponding options for coding are shown in Table 1. The variables were organized by dependent variables (BP and cholesterol level, derived as binomial distributions), key independent variables (physical activity in low, medium, and high ordinal levels), and DASH dietary index, classified as continuous and in quintiles. Demographic variables included age (continuous) and gender, education, and income (binomial and ordinal). The complexing weighing variables to account for primary sampling unit (PSU) and strata and variance masking were also included.

Table 1

Variables and Their Corresponding Codes

Variables	Survey Questions	Data Code	Variable Type
BP	1. Have you ever been told you have HBP? 2. Are you currently taking medications for BP? 3. Systolic BP 4. Diastolic BP	1=High = affirmative to Q1 or Q2, systolic BP ≥ 120mm Hg, or diastolic BP ≥ 90mm/Hg. 0=Low = negative to Q1 or Q2, systolic BP ≤ 120mm Hg, or diastolic BP ≤ 90mm/Hg.	Binomial Dependent
Cholesterol	Total cholesterol	1=High = total cholesterol ≥200mg/dL 0=Low = total cholesterol ≤200mg/dL	Binomial Dependent
Physical Activity	1. Do you engage in moderate work activity? 2. Do you engage in moderate recreational activity? 3. Minutes moderate work activity 4. Minutes moderate recreational activity	High = affirmative to Q1 or Q2, minutes moderate work activity ≥ 300 minutes/week, or minutes moderate recreational activity ≥ 300 minutes/week. Medium = affirmative to Q1 or Q2 but between 150 – 300 minutes/week Low = negative to Q1 or Q2, minutes moderate work activity ≤ 150 minutes/week, or minutes moderate recreational activity ≤150 minutes/week.	Ordinal Predictor
DASH Dietary Score	Various (see Table 2)	0 – 9 points	Continuous Predictor
DASH Dietary Score	Various (see Table 2)	Quintiles	Ordinal Predictor
Age	Age in years	n/a	Continuous Covariate
Education	Level of education	0 = high school diploma 1 = less than high school 2 = some college or associate degree 3 = college graduate or graduate degree	Ordinal Covariate
Gender	Gender	0 = male 1 = female	Binomial Covariate
Income	Household Income	0 = $75,000 or more 1 = less than $10,000 2 = $10,000-$24,000	Ordinal Covariate

(table continues)

Variables	Survey Questions	Data Code	Variable Type
		3 = $25,000-$34,000 4 = $35,000-$44,000 5 = $45,000-$54,000 6 = $55,000-$64,000 7 = $65,000-$74,000	
Masked Variance Pseudo-PSU	SDMVPSU	n/a	Complexing Sampling Weighting Variable
Masked Variance Pseudo-Stratum	SDMVSTRA	n/a	Complexing Sampling Weighting Variable

The food and nutrient components of the DASH diet index were contained in the NHANES data set. The nine components of the DASH were calculated using the average of NHANES days 1 and 2, 24-hour recall data. The total scores of the nine nutrient components resulted in a total maximum score of 9, as shown below in Table 2. Opertaional variables included physical activity, BP, total cholesterol, and dietary quality. These are described in more detail in the following paragraphs.

Physical activity was assessed by participants' self-reported and actual time spent in physical activity engagement. Participants provided answers by self-reports to whether they engaged in moderate work or moderate recreational activity. The number of minutes of moderate work activity (e.g., brisk walking or carrying light loads) and moderate recreational activity (e.g., walking or bicycling) was used to measure the frequency of physical activity per week. Participants' response to whether they engaged in moderate-work activity or moderate recreational activity was used to categorize those that engaged in physical activity. In addition, if time spent on physical activity was less than 150 minutes per week, participants were categorized as "low," values between 150 and 300 minutes per week were categorized as "medium," and physical activity greater than 300 minutes was categorized as "high."

Participants' self-reports and actual measurement assessed BP levels. Participants' responses to whether they were ever told they had HBP or whether they were currently taking medications for BP were used to categorize those with HBP. Participants that were considered to have HBP levels were those with systolic BP ≥ 120 mm Hg or diastolic BP ≥ 90 mm Hg. Actual blood measurement assessed total cholesterol levels. Participants were considered to have high total cholesterol if they had values ≥ 200mg/dL or considered to have low cholesterol levels if values ≤ 200mg/dL.

The DASH dietary index was used to assess dietary quality. The DASH index was used to determine the consumption of nine targeted nutrients, with protein, fiber, magnesium, calcium, and potassium expected to be higher, and total fat, saturated fat, sodium, and cholesterol expected to be lower. Proportions of calories consumed per 1,000 kcal by each group of nutrients were calculated according to Mellen's DASH index (Mellen, Gao, Vitolins, & Goff, 2008). Participants with nutrition intake equal to or higher than the recommended portions of food groups scored high (between 5 and 10 points); the absence of any food consumption was scored as 0, and intermediate values were given scores in proportion to actual consumption. The target associated with the DASH index is 2,100 kcal. The optimal index as recommended by Mellen's DASH index per 4,184 kJ (1000 kcal) is ≥ 18% for protein, ≥ 14.8 g for fiber, ≤ 27% for total fat, ≤ 71.4g for cholesterol, ≥ 2 38 mg for magnesium, ≥ 590 mg for calcium, ≤ 1143 mg for sodium, and ≥ 2238 mg for potassium (Mellen et al., 2008). The summation of the nutrient components provided the overall DASH score, which ranged from 0 to 9 points.

A 9-point index score represented optimal compliance, whereas a score of 0 represented no compliance with the DASH dietary pattern.

There are four established DASH diet indices: Dixon’s, Mellen’s, Fung’s, and Günther’s DASH diet indices (Miller et al., 2013). Miller et al. (2013) noted that all four indices have different index compositions, reflecting differences in scoring algorithms. Although other indices reflect the composition of specific food choices, others are nutrient-based. Mellen’s DASH index is density-based, that comparing intakes to total calories and based on meeting the recommended 1,143mg/1,000 kcal. In addition, Mellen’s and Fung’s are the only two indexes that include sodium components. Günther’s and Dixon’s use absolute cutoffs or intake rankings in quintiles, as in Fung’s index. Dixon’s and Mellen’s indexes directly examine compliance with saturated fat as recommended in the DASH diet, but Fung’s and Günther’s DASH indexes indirectly assess the intake of fat through food components that are rich in saturated fat.

Table 2

The DASH Score for Nutrient Targets

DASH Nutrient	DASH Nutirient Composition	DASH Score Target (1 point)	Intermediate Score Target (0.5 points)
Saturated Fat (% of Kcal/day)	≤ 6%	6% of energy	11% of energy
Total Fat (% of Kcal/day)	≤ 27%	27% of energy	32% energy
Protein (% Kcal/day)	≥ 18%	18% of energy	16.5% energy
Calcium (mg/day)	≥ 1240 mg	590 mg/1000 kcal	402 mg/1000 kcal
Magnesium (mg/day)	≥ 500 mg	238 mg/1000 kcal	158 mg/1000 kcal
Potassium (mg/day)	≥ 4700 mg	2238 mg/1000 kcal	1534 mg/1000 kcal
Fiber (g/day)	> 31g	14.8 g/1000kcal	9.5g/1000 kcal
Cholesterol (mg/day)	≤ 150 mg	71.4 mg/1000 kcal	107.4 mg/1000 kcal
Sodium (mg/day)	≤ 2400 mg	1143 mg/1000 kcal	1286 mg/1000kcal

NHANES data on variables for the study were part of the physical examination as well as interview data files (CDC, 2015e). The initial questionnaires for the survey were administered at home and followed by a standardized health examination in specially equipped mobile examination centers. Family-focused questionnaires were used to collect data on occupation, smoking, demographic factors (e.g., age, gender, and income levels) and food consumption. Sample person data collection questionnaires were used to collect information on health insurance, medical history, and dietary behavior, along with physiological data including BP levels, cholesterol levels, and weight history (CDC, 2016b).

Data Analysis

IBM's SPSS version 25 was used to import NHANES data for management and analysis. First, the dataset was subset to include only African Americans of at least 18 years of age (*n* = 1,254). Next, the data were assessed for outliers. Outliers were determined following Tabachnick and Fidell's (2013) procedure, where standardized (*z*) scores were created and examined for values beyond two standard deviations from the mean of the continuous variables. Outliers were truncated ±3.29 standard deviations from the mean (Tabachnick & Fidell, 2013). Descriptive statistics were reported for the number of outliers and missing observations in the data. Missing data were managed using SPSS's listwise deletion function (IBM, 2016). This is the default program function used by SPSS, in which if a particular case is missing a variable used in the analysis, that case is automatically dropped from the analysis but not deleted from the dataset (IBM, 2016). This listwise function is applied automatically in the use of logistic regressions in SPSS, regardless of any other data cleaning procedures that are followed (IBM, 2016). For covariates, mean imputation was performed for continuous missing data (IBM, 2016).

Descriptive statistics were used to describe the sample characteristics. Frequencies and percentages were reported for categorical data (i.e., gender, education, income, BP, cholesterol and physical activity). Means and standard deviations were reported for continuous data. The research questions are reiterated below, and the specific analytical strategy explained after.

Statistical Power Calculation

Since the data for the current study were secondary, the sample size available for the analysis was known. The magnitude of the power to detect statistical significance from the known sample size was calculated. The power was determined by the size of the sample, alpha level, and effect size. The power analysis software created by Faul, Lang, Erdfelder, and Buchner (2008), *G*Power*, was used for the calculation. To compute a sample size for logistic regression, some pre-existing knowledge or assumptions about the model are required. These include expected odds ratio (i.e., effect size), the proportion of observations in either group of the dependent variable, and the degree of relatedness among predictor variables. An alpha of .05 is the accepted significance level in research (Cohen, 1992). Theoretically, some of the variables in the model were expected to be logically related to each other (i.e., income and education), so the power of the model was adjusted so that a medium-strength relationship among the predictors was assumed (R^2 = .30). A small (OR = 0.75; Chen, Cohen, & Chen, 2010) odds ratio was used for calculation purposes. G*Power uses the following equation for the binary logistic regression:

$$\log(P/(1 - P)) = \beta_0 + \beta_1 x_1 + \cdot \cdot \cdot + \beta_p x_p$$

where X_1 through X_7 = the predictor variable for income, X_8 through X_{10} = dummy-coded variables of education, X_{11} = the predictor variable of interest (DASH or physical activity), P = the probability of the outcome event, β_0 = the intercept, and β_1 = the slope parameter. There were 1,254 participants with the necessary data. Using the previously described parameters in *G*Power*, binary logistic regression with 1,254 participants would achieve a power of 0.90 to detect a small effect size. As the dataset included 1,254 participants who were African American adults 18 years and older, the minimum statistical power for the study was met. The G*Power graph of power as a function of effect size (odds ratio) is shown in Figure 1.

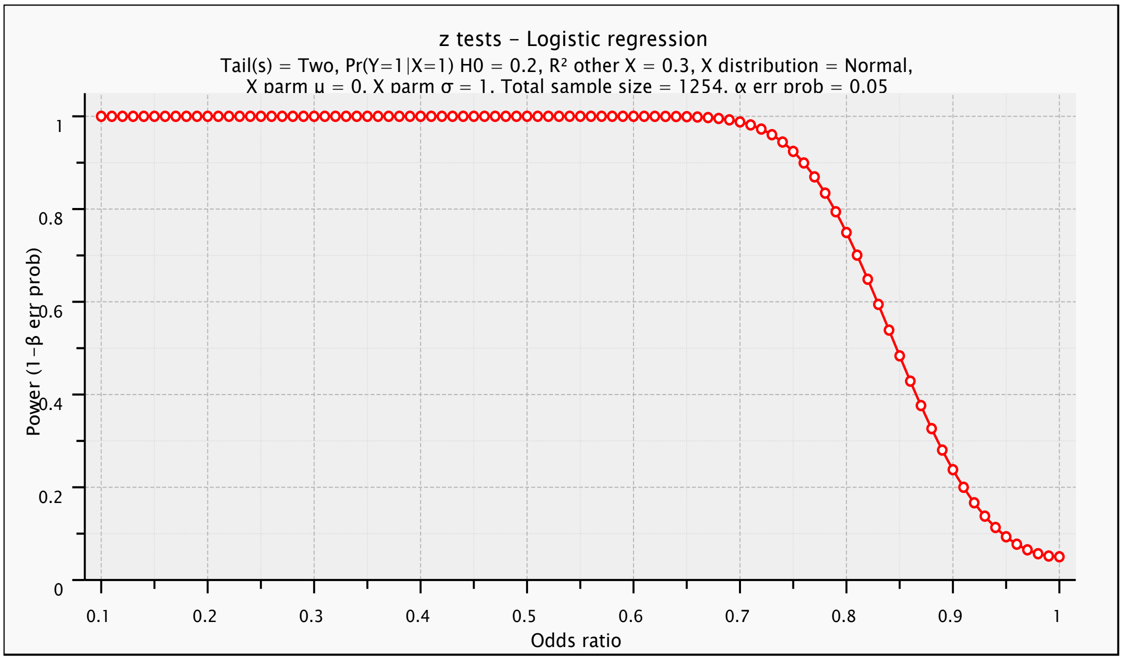

Figure 1. G*Power graph of power as a function of the odds ratio.

To achieve a generally acceptable power level of at least .80 (Cohen,1992), a model with the aforementioned parameters would require a minimum of 1254 participants. However, the parameters used for this calculation were approximations. As such, general expert recommendations should be considered as well. Some experts recommend a minimum of 20 observations per predictor variable (Hosmer, Lemeshow, & Sturdivant, 2013). A more conservative rule of thumb suggested by LeBlanc and Fitzgerald (2000), states that 30 participants should be sought per variable entered into the model. There were 16 predictor variables included in this model, which would necessitate 320 to 480 participants, according to the rules of thumb.

Statistical Plan

To answer research question 1, four multiple logistic regressions were performed. The multiple logistic regression is appropriate when assessing the predictive effect of a set of predictor variables on a binary (1, 0) variable (Field, 2013). The first two logistic regressions had a dependent variable measuring high and low cholesterol levels. The other two logistic regressions had a dependent variable measuring high and low BP levels. The SPSS Complex Samples function was used to run the analyses to account for the complex sampling scheme used for the NHANES data.

In each logistic regression, the demographic covariates of gender, age, income, and education were entered into the model along with the main variable of interest, DASH dietary score. Since income and education are categorical variables with multiple categories, dummy-coding was necessary. In addition, some categories have small cell frequencies, which would cause issues with model fit (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996), necessitating the collapsing of some categories. Collapsing of categories and dummy-coding resulted in seven dummy-coded variables for income (*less than $10,000, $10,000 to $24,000, $25,000 to $34,000, $35,000 to $44,000, $45,000 to $54,000, $55,000 to $64,000,* and *$65,000 to $74,000*) with *$75,000 plus* treated as the reference category. Dummy-coding and categorization resulted in three dummy-coded variables for education (*less than high school diploma, some college or AA degree,* and *college graduate or graduate degree*) with *high school diploma* treated as the reference category.

The omnibus test of model coefficients χ^2 value was assessed to determine the significance of the overall model. The Hosmer and Lemeshow test was unavailable in the SPSS Complex Samples procedure. Therefore, the Nagelkerke R^2 was interpreted as an approximation of the proportion of variance explained (Field, 2013). The overall model was significant, therefore, individual predictors were assessed for significance. If an individual predictor was significant at $p < 0.05$ using the Wald test, the odds ratio (*OR*; also referred to as Exp[β]) for that variable was assessed to determine the predicted probability of belonging to either group of the dependent variable.

The logistic regression is a non-parametric technique, which means that it does not require the same stringent assumptions as parametric techniques, such as linear regression, (e.g., normality, equal variances; Stevens, 2009). However, the analysis does require the absence of outliers in the data and no extreme multicollinearity within the predictors (Tabachnick & Fidell, 2013). Multicollinearity was diagnosed with Variance Inflation Factor (VIF) values. VIF values below 10 indicate that there are no issues with multicollinearity (Stevens, 2009).

Research Questions and Hypotheses

Research Question 1: To what extent does the DASH dietary pattern predict blood pressure levels and total cholesterol levels among African Americans after controlling for demographic factors, BMI, and energy intake?

H_0: DASH dietary pattern does not predict blood pressure levels and total cholesterol levels among African Americans.

H_1: DASH dietary pattern predicts blood pressure levels and total cholesterol levels among African Americans.

The DASH dietary pattern was represented both continuously and categorically, entered into separate models. The categorical DASH dietary pattern was organized into quintiles to conduct a detailed analysis of dietary patterns, the number of which was determined after DASH scores were calculated. The quintiles were dummy-coded as appropriate for entry into the regression model.

To answer research question 1, two multiple logistic regressions were performed with dependent variables measuring high or low BP and cholesterol levels. The SPSS Complex Samples function was used to run the analyses to account for the complex sampling scheme used for the NHANES data. Dummy-coding, recoding, and entry into the model occurred as described previously.

Along with the demographic covariates, variables representing DASH diet quality were entered into the model. The regression model was used to determine the relationship between the variables of DASH diet quality, BP levels, and total cholesterol levels while controlling for any variability introduced by the covariates.

Research Question 2: To what extent does physical activity predict blood pressure and total cholesterol levels among African Americans after controlling for demographic factors, BMI, and energy intake?

H_0: Physical activity does not predict blood pressure levels and total cholesterol levels among African Americans.

H_1: Physical activity predicts pressure levels total cholesterol levels among African Americans.

To answer Research Question 2, two multiple logistic regressions were performed with a dependent variable measuring BP levels and cholesterol levels (high or low). The SPSS Complex Samples function was used to run the analyses to account for the complex sampling scheme used for the NHANES data. Dummy-coding, recoding, and entry into the model occurred as described previously.

Along with the demographic covariates, variables representing physical activity were entered into the model. The variables were dummy-coded as low and very low, with moderate to high as the reference category. The regression model was used to determine the relationship between the variables of physical activity, BP levels and total cholesterol levels while controlling for any variability introduced by the covariates.

Threats to Validity

The experimental conditions or processes that affect the cause and effect of a study may be described as internal validity (Yu & Ohlund, 2010). Participants' prior knowledge of the processes of and participation in NHANES might have influenced their responses to survey questions and may posed a threat to internal validity. Another issue that may pose a threat to internal validity is confounding.

Confounding factors are additional variables or covariates that were not accounted for but may have a hidden effect on the study results (Yu & Ohlund, 2010). The study accounted for variables including age, gender, education, and income that were of interest and adjusted for the study. However, confounders including poor health status (Norris, 2016), history of CVD (Valerio, Peters, Zwinderman, & Pinto-Sietsma, 2016) or alcoholism (Husain, Ansari, & Ferder, 2014) that were not accounted for may affect the result of the study. Internal validity was minimized because NHANES used the multi-stage probability sampling that involved randomization (CDC, 2015d; Yu & Ohlund, 2010).

Factors that are within the study and capable of reducing the general representation of the study describe threats to the external validity (Yu & Ohlund, 2010). NHANES oversampled specific subgroups including African Americans, whose health status might be of particular interest to increase the precision and reliability of the health data among the subgroups (CDC, 2014c). The selection and oversampling of these subgroups might be affected by bias and response rates, which could also affect statistical analysis and interpretation. Oversampling was undertaken to increase the precision and reliability of the health data among the subgroups (CDC, 2014c).

The response rate bias may pose external threats because the results of the study may not represent the general population. Because NHANES used a multi-stage probability sampling method that also involved randomization external threats were addressed (CDC, 2015d). The limited sample may not be representative of the population (Yu & Ohlund, 2010). However, because a large population sample was used for the study, the threat to the generalizability of the findings was reduced.

Ethical Procedures

Since my study used secondary data collected by the federal government, the 2013-2014 NHANES, there were no human protection issues. The National Center for Health Statistics Research Ethics Review Board approved the original request for new Protocol #2011-17 (CDC, 2017c). In addition, NHANES used the review process, and data collection was protected by public law (45 CFR 46). The National Center for Health Statistics Ethics Review Board approved and documented participant consent prior to the survey.

The data are publicly available but without personal identifying information; therefore, participant privacy, data storage, and encryption were not required. Data for the study were available freely on the Internet; therefore, they did not require any formal permission for their use. However, the source or the owner of the original data was duly acknowledged. The Walden University Institutional Review Board approved the application to conduct secondary analysis for my doctoral study (Walden IRB approval number 01-31-18-0535867) before I proceeded with downloading data and analysis. All my computers that were used for data gathering, analysis, and reporting were protected with passwords, firewalls, and anti-virus software.

Summary

In this section of this study, I provided detailed information on the procedures and processes that were used for data selection and analysis. Data were derived from the 2013-2014 NHANES survey. Specific data fields on diet quality, physical activity, BP levels, and cholesterol levels were selected by IBM SPSS and merged to provide a comprehensive dataset. A cross-sectional quantitative study design was used to examine the extent to which diet quality, and physical activity predict BP levels and cholesterol levels among African Americans 18 years and older. I also explained in detail threats to validity and ethical procedures. In the next chapter, I discuss the study results and findings. I also discuss demographic and descriptive analysis of the population sample, along with multivariate and inferential analysis, and summarize the findings from the analyses.

Section 3. Presentation of Results and Findings

Introduction

The purpose of this study was to examine whether diet quality and physical activity predict BP levels and cholesterol levels among African Americans. In this section, I present the results of the analyses discussed in the previous section using SPSS version 25. I describe the unweighted and weighted characteristics of the sample, followed by the results of the hypothesis testing.

Data Management and Descriptive Analyses

NHANES used a complex, multistage probability design with a large sample size to ensure that the health status of the target population and the sample selected were reliable and precise (CDC, 2015c). The NHANES interview and examination data files were merged by participant identification number and subset to include only observations that met the inclusion criteria of the study. The merged data resulted in a sample population of 1,254 African Americans 18 years of age and older. There were 112 missing cases for education, 11 missing cases for income, and eight for BMI. A total of 131 missing cases were removed for those variables. The weighting variable created for the NHANES dataset was already adjusted for these missing demographic responses (CDC, 2014d). In addition, there were 74 participants with income responses of either “$20,000 and over” or “under $20,000.” These groups were added to group of participants with income of less than $55,000. There were no missing data for the created variables of BP, cholesterol, or physical activity.

There were 162 participants with missing data for the DASH score created from the nutrient intake variables, whom I removed. I then examined outliers on the continuous variables of age and DASH score using Tabachnick and Fidell's (2013) procedure, where standardized values are created and examined for values greater than or less than ±3.29. There were no outliers for age but two outliers for the DASH score. These were truncated to the next DASH score level. A case of HBP levels and HC levels were weighted using the provided NHANES weighting variable as part of the SPSS complex sampling plan file.

The final sample consisted of 959 African Americans 18 years of age and older, slightly more than half of whom were female (54.90%). The data in the sample population were weighted to adjust for potential selection bias. The average age was 48.43 years (*SD* = 16.79). The proportion of the sample with at least some college education or higher was 53.8%. Over half of the sample (69.9%) made income less than $55,000. The full weighted and unweighted frequencies and percentages are shown in Table 3. The means and standard deviations are presented in Table 4. Descriptive statistics for physical activity levels, BMI, total energy intake, and nutrients by DASH quintile are shown in Tables 5 and 6.

Table 3

Unweighted and Weighted Demographic Characteristics of the Study Sample

Characteristic	Unweighted frequencies	Unweighted percentage	Weighted frequencies	Weighted percentage
BP				
Low	343	35.8	8850967.80	40.1
High	616	64.2	13239026.64	59.9
Cholesterol				
Low	671	70.0	15578804.83	70.5
High	288	30.0	6511189.61	29.5
Physical Activity				
Very Low	481	50.2	10682256.85	48.4
Low	337	35.1	7827287.92	35.4
Moderate to High	141	14.7	3580449.67	16.2
Gender				
Female	487	50.8	12125118.42	54.9
Male	472	49.2	9964876.02	45.1
Education level				
No Diploma	202	21.1	4284565.80	19.4
High school graduate/GED	270	28.2	11882898.98	26.8
At Least some college	487	50.8	4284565.80	53.8
Income				
Less Than $55,000	672	70.1	15435144.10	69.9
$55,000 to $74,999	109	11.4	2535166.20	11.5
$75,000 and above	178	18.6	4119684.15	18.6

Table 4

Unweighted Demographic Means and Standard Deviations

Variable	Min.	Max.	*Mean*	*SD*
Unweighted:				
DASH	0.50	7.00	2.89	1.27
Age in years at screening	20.00	80.00	48.43	16.79
Body Mass Index	15.40	77.50	30.63	8.00
Total Energy (kcal/day)	199.00	11361.00	2152.85	1178.29

Table 5

Physical Activity (Unweighted) by DASH Quintile

Variable	DASH Score Quintiles*									
	Q1 (≤1.50)		Q2 (1.50 to 2.00)		Q3 (2.50-3.00)		Q4 (3.50)		Q5 (4.00-7.00)	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Physical Activity										
Very Low	90	48.6	73	51.0	150	48.1	50	47.6	118	55.1
Low	61	33.0	51	35.7	119	38.1	36	34.3	70	32.7
Moderate to High	34	18.4	19	13.3	43	13.8	19	18.1	26	12.1

Note. DASH score quintile cutoffs in parentheses; very low physical activity = 45 minutes or less of moderate intensity work or recreational activity per week; low physical activity = 45-149 minutes of moderate intensity work or recreational activity; moderate to high physical activity = 150+ minutes of moderate intensity work or recreational activity. The lowest score in the sample was 0.50, and the highest score was 7.00. No participant scored >3.5, 3.75, or <4.0.

Table 6

Unweighted Nutrients, Total Energy, and BMI by DASH Quintile

Variable	DASH Score Quintiles*									
	Q1 (≤1.50)		Q2 (2.00)		Q3 (2.50-3.00)		Q4 (3.50)		Q5 (4.00-7.00)	
	M	SE	*M*	SE	*M*	SE	*M*	SE	*M*	SE
Body Mass Index (kg/m^2)	31.91	9.02	30.67	8.67	30.45	7.33	29.67	7.07	30.22	7.90
Total Energy (kcal/d)	2523.51	1288.01	2343.79	1062.27	2184.54	1285.14	2003.14	893.35	1732.07	961.08
Protein (g/d)	83.55	47.20	80.20	43.08	86.01	57.89	80.81	48.53	69.97	45.72
Dietary fiber (g/d)	14.22	10.17	14.67	8.42	13.85	10.29	16.69	11.13	15.80	10.67
Total fat (g/d)	110.04	56.18	100.23	53.56	85.66	56.78	69.96	38.51	52.56	32.75
Total saturated fatty acids (g/d)	35.99	19.35	31.54	17.20	25.68	17.20	21.05	11.69	14.84	9.82
Cholesterol (mg/d)	412.30	280.84	369.76	293.18	337.41	307.17	264.15	231.31	200.27	199.46
Magnesium (mg/d)	255.40	140.70	268.02	137.15	259.70	147.51	292.91	161.19	297.66	163.93
Calcium (mg/d)	809.13	480.86	803.41	535.56	762.77	480.45	764.30	527.30	822.00	627.76
Sodium (mg/d)	3919.88	2113.99	3729.03	1817.10	3537.57	2008.99	3170.26	1725.69	2592.69	1484.39
Potassium (mg/d)	2373.17	1362.24	2354.74	1068.03	2334.96	1332.57	2467.66	1335.04	2510.34	1374.26

**Note.* DASH score quintile cutoffs in parenthesis.

Results

To answer the research questions, I conducted a series of binary logistic regressions with dependent variables of BP levels and total cholesterol levels, respectively. The SPSS Complex Samples procedure was used to perform each analysis. Prior to each analysis, the assumption of absence of multicollinearity was assessed.

Research Question 1

To what extent does the DASH dietary pattern predict BP levels and total cholesterol levels among African Americans after controlling for demographic factors, BMI, and energy intake?

H_0. The DASH dietary pattern does not predict BP levels and total cholesterol levels among African Americans.

H_1. The DASH dietary pattern predicts BP levels and total cholesterol levels among African Americans.

To answer this research question, two binary logistic regressions with predictor variables of DASH scores were performed and controlled for physical activity, age, income, education, and gender, and dependent variables of BP and cholesterol. I also performed this same version with a categorical DASH score variable in quintiles. In the first step of each regression, only the predictor variable of DASH scores in an unadjusted model was entered. The second step of the regression was the full or adjusted model (i.e., DASH scores and potential confounding variables). The categorical predictor variables were dummy-coded. The dependent variables were coded as 0 = low and 1 = high. Female was the reference category for gender. *No high school diploma* was the reference category for education. Income less than $55,000 was the reference category for income. Moderate to high was the reference category for physical activity. The quintile DASH scores were dummy-coded with the first quintile (≤1.50) as the reference category. The assumption of absence of multicollinearity was met for these models, as all VIF values were below 10.00 (Stevens, 2009; see Table 7 and 8).

Table 7

Variance Inflation Factor Values for DASH Scores and Demographic Covariates

Variable	VIF*
Age	1.12
Gender (reference: female)	1.18
Male	1.72
Education (ref: No High School Diploma)	
High School Diploma	1.72
At Least Some College and Above	2.00
Income (ref: Less than $55,000)	
$55,000 to $74,999	1.08
$75,000 plus	1.18
DASH Score	1.06
Physical Activity (ref: Moderate to High)	
Very Low	2.29
Low	2.26
BMI	1.06
Total Energy	1.19

*Note: Absence of multicollinearity when VIF values < 10 (Stevens, 2009)

Table 8

Variance Inflation Factor Values for DASH Quintiles and Demographic Covariates

Variable	VIF*
Age	1.12
Gender (ref: Female)	
Male	1.17
Education (ref: No High School Diploma)	
High School Diploma	1.73
At Least Some College and Above	2.00
Income (ref: Less than $55,000)	
$55,000 to $74,999	1.08
$75,000 plus	1.19
Physical Activity (ref: Moderate to High)	
Very Low	2.30
Low	2.27
BMI	1.06
Total Energy	1.19
DASH Quintiles (ref: First Quintile [≤ 1.50])	
Second Quintile (2.00)	1.52
Third Quintile (2.50-3.00)	1.85
Fourth Quintile (3.50)	1.45
Fifth Quintile (4.00-7.00)	1.78

*Note: Absence of multicollinearity when VIF values < 10 (Stevens, 2009)

The first step of the first regression model, with a single predictor variable of DASH score and a dependent variable of BP, correctly classified participants 59.9% of the time using the SPSS default predicted versus observed classification table. The overall model for this first step was not significant, $\chi^2(1) = 0.00$, $p = .958$, Nagelkerke $R^2 = 0.00$, indicating that the null hypothesis that DASH scores significantly predict BP level was not rejected. This indicates that DASH score alone does not predict the odds of having HBP. This served as the comparison model, and the covariates were entered in the next step.

The second step of the first regression model (i.e., the full model, with DASH and covariates predicting BP) correctly classified participants 71.41% of the time, indicating that the model fit the data better than the comparison model. The overall model for this step was significant, $\chi^2(22) = 518.36$, $p < .001$, Nagelkerke $R^2 = 0.26$, indicating that the null hypothesis that the combination of predictor variables did not significantly predict levels of BP was rejected. I proceeded to interpret the significance of the individual predictors. The main variable of interest, DASH score, was not significant ($p = .232$). Table 9 presents the full results of the analysis.

Table 9

Binary Logistic Regression with DASH Scores Predicting Blood Pressure Levels

Step	Variable	Wald χ^2	p	OR	95% CI		Blood Pressure	
					Lower	Upper	% High	% Low
1	DASH Score	0.00	.958	1.00	0.90	1.12	-	-
2	DASH Score	1.43	.232	0.94	0.83	1.05	-	-
	Physical Activity (ref: Moderate to High)							
	Very Low	0.59	.444	0.85	0.53	1.35	60.1	39.9
	Low	0.09	.760	0.93	0.57	1.52	60.9	39.1
	Age	105.95	< .001	1.06	1.04	1.07	-	-
	Gender (ref: Female)							
	Male	14.78	< .001	2.38	1.47	3.87	67.2	32.8
	Education (ref: No High School Diploma)							
	High School Diploma	1.61	.204	0.83	0.60	1.14	61.1	38.9
	At Least Some College and Above	3.52	.061	0.72	0.49	1.05	56.2	43.8
	Income (ref: Less than $55,000)							
	$55,000 to $74,999	0.36	.547	1.21	0.62	2.33	63.8	36.2
	$75,000 plus	1.65	.199	0.74	0.45	1.22	54.1	45.9
	Total Energy Intake	1.54	.214	1.00	1.00	1.00	-	-
	BMI	68.31	< .001	1.05	1.04	1.07	-	-

The first step of the categorical version of the first regression model, with dummy-coded DASH quintiles and a dependent variable of BP, correctly classified participants 60.1% of the time using the SPSS default predicted versus observed classification table. The overall model for this first step was significant, $\chi^2(4) = 22.08$, $p < .001$, Nagelkerke $R^2 = 0.11$, indicating that the null hypotheses that the DASH quintile variables combined significantly predict BP levels was rejected. This indicates that when split into quintiles and considered alone, DASH score predicts the odds of having HBP. This served as the comparison model, and the covariates were entered in the next step.

The second step of the first regression model (i.e., the full model, with DASH quintiles and covariates predicting BP) correctly classified participants 70.9% of the time, indicating that the model fit the data better than the comparison model. The overall model for this step was significant, $\chi^2(4) = 22.08$, $p < .001$, Nagelkerke $R^2 =$ 0.,11, indicating that the null hypothesis that the combination of predictor variables did not significantly predict BP level was rejected. I proceeded to interpret the significance of the individual predictors. The fourth DASH quintile (3.50) was significant (OR = 0.57, $p = .013$). The model predicts that those who had a DASH score in the fourth quintile were 63% less likely to have HBP than those in the First Quintile (≤ 1.50). Table 10 presents the full results of this analysis.

Table 10

Binary Logistic Regression with Categorical DASH Scores in Quintiles Predicitng Blood Pressure Levels

Step	Variable	Wald χ^2	*p*	OR	95% CI		Blood Pressure	
					Lower	Upper	% High	% Low
1	Unadjusted DASH Quintiles (ref: First Quintile [≤1.50])							
	Second Quintile (2.00)	0.45	.501	0.89	0.63	1.28	59.3	40.7
	Third Quintile (2.50-3.00)	0.50	.481	0.88	0.61	1.29	59.0	41.0
	Fourth Quintile (3.50)	11.05	.001	0.60	0.43	0.83	49.4	50.6
	Fifth Quintile (4.00-7.00)	0.88	.350	1.15	0.84	1.56	65.1	34.9
2								
	Fully adjusted DASH Quintiles (ref: First Quintile (≤1.50))							
	Second Quintile (2.00)	0.26	.613	0.92	0.64	1.32	59.3	40.7
	Third Quintile (2.50-3.00)	0.62	.430	0.85	0.54	1.33	59.0	41.0
	Fourth Quintile (3.50)	6.11	.013	0.57	0.35	0.93	49.4	50.6
	Fifth Quintile (4.00-7.00)	0.00	.984	1.00	0.71	1.40	65.1	34.9
	Physical Activity (ref: Moderate to High)							
	Very Low	0.75	.386	0.83	0.52	1.32	60.1	39.9
	Low	< .001	.707	0.92	0.57	1.48	60.9	39.1
	Age	93.79	< .001	1.05	1.04	1.07	-	-
	Gender (ref: Female)							
	Male	15.72	<. 001	2.42	1.50	3.89	67.2	32.8
	Education (ref: No High School Diploma)							
	High School Diploma	1.44	.230	0.84	0.61	1.15	61.1	38.9
	At Least Some College and Above	3.49	.062	0.73	0.50	1.05	56.2	43.8
	Income (ref: Less than $55,000)							
	$55,000 to $74,999	0.33	.565	1.19	0.62	2.30	63.8	36.2
	$75,000 plus	1.99	.159	0.72	0.43	1.19	54.1	45.9
	Total Energy Intake	1.40	.237	1.00	1.00	1.00	-	-
	BMI	77.12	< .001	1.05	1.04	1.07	-	-

The first step of the second regression model, with only DASH score predicting the dependent variable of cholesterol, correctly classified participants 70.5% of the time. The overall model for this step was not significant, $\chi^2(1) = 0.33$, $p = .568$, Nagelkerke $R^2 = 0.00$, indicating that the null hypotheses that DASH score significantly predict cholesterol levels was not rejected. This indicates that DASH score alone does not predict the odds of having HC. This served as the comparison model, and the covariates were entered in the next step.

The full model of this regression correctly classified participants 69.9% of the time. The overall model was significant, $\chi^2(11) = 163.65$, $p < .001$, Nagelkerke $R^2 = 0.06$, indicating that the null hypotheses that the combination of predictor variables did not significantly predict cholesterol levels was rejected. The DASH score was not a significant predictor ($p = .384$). Table 11 presents the full results of this analysis.

Table 11

Binary Logistic Regression with DASH Scores Predicting Cholesterol Levels

Step	Variable	Wald χ^2	*p*	OR	95% CI		Cholesterol	
					Lower	Upper	% High	% Low
1	DASH Score	0.33	.568	1.04	0.90	1.20	-	-
2	DASH Score	0.76	.384	1.05	0.93	1.20	-	-
	Physical Activity (ref: Moderate to High)							
	Very Low	0.01	.906	1.03	0.65	1.63	29.5	70.5
	Low	0.00	.948	1.02	0.61	1.70	30.6	69.4
	Age	33.75	< .001	1.02	1.01	1.03	-	-
	Gender (ref: Female)							
	Male	1.28	.258	0.87	0.66	1.13	27.9	72.1
	Education (ref: No High School Diploma)							
	High School Diploma	2.77	.096	1.52	0.89	2.60	31.5	68.5
	At Least Some College and Above	0.82	.367	1.27	0.72	2.26	30.5	69.5
	Income (ref: Less than $55,000)							
	$55,000 to $74,999	2.04	.153	1.30	0.88	1.88	31.6	68.4
	$75,000 plus	5.97	.015	1.66	1.07	2.60	37.3	62.7
	Total Energy Intake	1.29	.256	1.00	1.00	1.00	-	-
	BMI	5.14	.023	1.02	1.00	1.05	-	-

The first step of the regression model, with only DASH quintiles predicting the dependent variable of cholesterol, correctly classified participants 70.5% of the time. The overall model for this step was not significant, $\chi^2(4) = 4.49$, $p = .344$, Nagelkerke $R^2 = 0.00$; the null hypothesis that DASH quintiles significantly predicted cholesterol levels was rejected. This indicates that DASH score alone does not predict the odds of having HC. This served as the comparison model, and the covariates were entered in the next step.

The full model of this regression correctly classified participants 70.6% of the time. The overall model was significant, $\chi^2(14) = 268.98$, $p < .001$, Nagelkerke $R^2 = 0.06$, indicating that the null hypotheses that the combination of predictor variables did not significantly predict cholesterol levels was rejected. There was not a significant DASH quintile variable. Table 12 presents the full results of this analysis

Table 12

Binary Logistic Regression with Categorical DASH Scores in Quintiles Predicting Cholesterol Levels

Step	Variable	Wald χ^2	*p*	OR	95% CI		Cholesterol	
					Lower	Upper	% High	% Low
1	DASH Quintiles (ref: First Quintile [≤1.50])							
	Second Quintile (2.00)	0.09	.769	0.89	1.07	1.79	31.0	69.0
	Third Quintile (2.50-3.00)	0.21	.648	0.98	0.89	1.53	27.1	72.9
	Fourth Quintile (3.50) (3.50)	0.01	.932	0.99	0.98	1.71	29.0	71.0
	Fifth Quintile (4.00-7.00)	0.33	.564	1.13	1.13	1.77	32.1	67.9
2	DASH Quintiles (ref: First Quintile [≤1.50])							
	Second Quintile (2.00)	0.14	.707	1.11	0.62	1.96	31.0	69.0
	Third Quintile (2.50-3.00)	0.07	.792	0.93	0.52	1.66	27.1	72.9
	Fourth Quintile (3.50) (3.50)	0.29	.591	1.16	0.64	2.12	29.0	71.0
	Fifth Quintile (4.00-7.00)	0.64	.425	1.19	0.75	1.91	32.1	67.9
	Age	35.77	< .001	1.02	1.01	1.03	-	-
	Physical Activity (ref: Moderate to High)							
	Very Low	0.02	.877	1.03	0.65	1.64	29.5	70.5
	Low	0.01	.910	1.03	0.62	1.70	30.6	69.4
	Gender (ref: Female)							
	Male	1.27	.260	0.87	0.66	1.13	27.9	72.1
	Education (ref: No High School Diploma)							
	High School Diploma	2.74	.098	1.52	0.89	2.63	31.5	68.5
	At Least Some College and Above	0.77	.382	1.27	0.71	2.24	30.5	69.5
	Income (ref: Less than $55,000)							
	$55,000 to $74,999	1.83	.177	1.28	0.87	1.91	31.6	68.4
	$75,000 plus	5.95	.015	1.67	1.07	2.61	37.3	62.7
	Total Energy Intake	1.16	.281	1.00	1.00	1.00	-	-
	BMI	5.16	.023	1.02	1.00	1.05	-	-

When considered categorically (in quintiles), the fourth DASH quintile significantly predicted BP levels but this association was attenuated and no longer significant in the fifth quintile. When considered continuously, DASH score does not significantly predict either BP or cholesterol levels, therefore the association between the DASH diet and BP levels may be non-linear. Also, DASH scores were not significantly associated with cholesterol level. The null hypotheses for Research Question 1 was rejected based on a potentially nonlinear association between DASH scores and blood pressure levels.

Research Question 2

To what extent does physical activity predict blood pressure levels and total cholesterol levels among African Americans after controlling for demographic factors, BMI, and energy intake?

H_0. Physical activity does not predict BP levels and total cholesterol levels among African Americans.

H_1. Physical activity predicts BP levels total cholesterol levels among African Americans.

To answer this research question, two binary logistic regressions were performed with predictor variables of physical activity, DASH score, age, income, education, and gender, and dependent variables of BP and cholesterol, respectively. First, the predictor variable of physical activity was entered into the model, followed by the full model (i.e., physical activity plus covariates). The reference category of physical activity was “moderate-to-high intensity.” The dependent variable coding and demographic covariate reference categories remained the same as for the Research Question 1 analysis. The assumption of absence of multicollinearity was met for these models, as all VIF values were below 10.00 (Stevens, 2009; see Table 7).

The first step of the first regression model, with only physical activity predicting the dependent variable of BP, correctly classified participants 59.9% of the time. The overall model for this step was not significant, $\chi^2(2) = 0.48$, $p = .789$, Nagelkerke $R^2 = 0.00$, indicating that the null hypotheses that physical activity does not predict levels of BP was not rejected. This indicates that physical activity alone does not predict odds of having HBP. This served as the comparison model, and the covariates were entered in the next step.

The full model involving physical activity and covariates, with a dependent variable of BP, correctly classified participants 71.4% of the time. The overall model was significant, $\chi^2(11) = 518.36$, $p < .001$, Nagelkerke $R^2 = 0.26$, indicating that the null hypothesis that the combination of predictor variables did not significantly predict levels of BP was rejected. The main variable of interest, physical activity, was not significant ($p = .444$ and $.760$). Table 13 presents the full results of this analysis.

Table 13

Binary Logistic Regression with Physical Activity Predicting Blood Pressure Levels

Step	Variable	Wald χ^2	*p*	OR	95% CI		Blood Pressure	
					Lower	Upper	% High	% Low
1	Unadjusted Physical Activity (ref: Moderate to High)							
	Very Low	0.36	.550	1.13	0.73	1.75	60.1	39.9
	Low	0.47	.491	1.17	0.72	1.89	60.9	39.1
2	Full or adjusted model for Physical Activity (ref: Moderate to High)							
	Very Low	0.59	.444	0.85	0.53	1.35	60.1	39.9
	Low	0.09	.760	0.93	0.57	1.52	60.9	39.1
	DASH Score	1.43	.232	0.94	0.83	1.05	-	-
	Age	105.95	< .001	1.06	1.04	1.07	-	-
	Gender (ref: Female)							
	Male	14.78	< .001	2.38	1.47	3.87	67.2	32.8
	Education (ref: No High School Diploma)							
	High School Diploma	1.61	.204	0.83	0.60	1.14	61.1	38.9
	At Least Some College and Above	3.52	.061	0.72	0.49	1.05	56.2	43.8
	Income (ref: Less Than $75,000)	0.36	.547	1.21	0.62	2.33		
	$55,000 to $74,999	1.65	.199	0.74	0.45	1.22	63.8	36.2
	$75,000 plus	1.54	.214	1.00	1.00	1.00	54.1	45.9
	Total Energy Intake	1.49	.223	1.00	1.00	1.00	-	-
	BMI	28.66	< .001	1.05	1.03	1.07	-	-

The first step of the second regression model, with only physical activity predicting the dependent variable of cholesterol, correctly classified participants 70.5% of the time. The overall model for this step was not significant, $\chi^2(2) = 0.62$, $p = .734$, Nagelkerke $R^2 = 0.00$; the null hypothesis that physical activity alone does not predict levels of cholesterol was rejected. This indicates that physical activity alone does not predict odds of having HC. This served as the comparison model, and the covariates were entered in the next step.

The second regression model involving physical activity, with a dependent variable of cholesterol, correctly classified participants 70.3% of the time. The overall model was significant, $\chi^2(11) = 163.65$, $p < .001$, Nagelkerke $R^2 = 0.05$, indicating that the null hypothesis that the combination of predictor variables did not significantly predict cholesterol levels was rejected. However, physical activity was not a significant predictor ($p = .906$ and $p = .948$). Table 14 presents the full results of this analysis. As physical activity did not predict BP or cholesterol after controlling for the demographic factors, BMI, and energy intake, the null hypothesis for Research Question 2 cannot be rejected.

Table 14

Binary Logistic Regression with Physical Activity Predicting Cholesterol Levels

Step	Variable	Wald χ^2	p	OR	95% CI		Cholesterol	
					Lower	Upper	% High	% Low
1	Unadjusted Physical Activity (ref: Moderate to High)							
	Very Low	0.48	.490	1.15	0.74	1.78	29.5	70.5
	Low	0.60	.439	1.21	0.71	2.07	30.6	69.4
2	Full but adjusted Physical Activity (ref: Moderate to High)							
	Very Low	0.01	.906	1.03	0.65	1.63	29.5	70.5
	Low	0.00	.948	1.02	0.61	1.70	30.6	69.4
	DASH Score	0.76	.384	1.05	0.93	1.20	-	-
	Age	33.75	< .001	1.02	1.01	1.03	-	-
	Gender (ref: Female)							
	Male	1.28	.258	0.87	0.66	1.13	27.9	72.1
	Education (ref: No High School Diploma)							
	High School Diploma	2.77	.096	1.52	0.89	2.60	31.5	68.5
	At Least Some College and Above	0.82	.367	1.27	0.72	2.26	30.5	69.5
	Income (ref: Less than $55,000)							
	$55,000 to $74,999	2.04	.153	1.30	0.88	1.88	31.6	68.4
	$75,000 plus	5.97	.015	1.66	1.07	2.60	37.3	62.7
	Total Energy Intake	0.43	.512	1.00	1.00	1.00	-	-
	BMI	5.87	.015	1.03	1.00	1.05	-	-

Summary

A total of six binary logistic regressions were performed to answer the research questions. I used the first four binary logistic regressions to answer the first research question and determine whether DASH scores significantly predicted BP and cholesterol. When adjusting the model for covariates, DASH scores did not predict levels of HBP and cholesterol. When split into quintiles, the fourth DASH quintile (3.50) significantly predicted a lower chance of having HBP. DASH quintiles did not predict levels of cholesterol. The null hypothesis for Research Question 1 was not rejected. The continuous DASH scores did not show any significant association between DASH diet and BP levels. This evidence show a potential nonlinear association between DASH and BP.

The second two logistic regressions were used to answer the second research question and determine whether physical activity predicted BP and cholesterol adjusting for covariates. Physical activity was not a significant predictor of BP and cholesterol in these models. Because physical activity did not predict BP and cholesterol, the null hypothesis for Research Question 2 was not rejected.

The implications of the results in relation to similar studies or publications in Section 4 was discussed. I also discussed recommendations that may be helpful for professional practice among clinicians, public health advocates, policymakers, and implementers of health promotion programs by contributing to reducing the burden of HBP levels and HC levels among African Americans.

Section 4: Implication for Social Change and Professional Practice

Introduction

The purpose of this study was to examine the extent to which diet quality and physical activity predict BP and cholesterol levels among African Americans. In this section, I interpret the research findings and discuss the limitations of the study, recommendations, implications for professional practice and social change, and end with a conclusion. Data were collected from the 2013-2014 NHANES database for this study. SPSS Version 25 was used to provide descriptive and inferential analyses. For analytical purposes, the data for complex sampling including primary sampling unit and sampling strata were weighted, and the findings represent the total U.S. population of African-American adults for the years of data collection.

Interpretation of the Findings

Prevalence of Blood Pressure Levels and Cholesterol Levels

The dependent variables for the study included BP levels and total cholesterol levels. Almost two-thirds (64.2%) of the sample participants had HBP. This is consistent with other research. For example, Lackland (2014) reported that 45.2% of African Americans had HBP. Ortega et al. (2013) also noted that 74% African Americans had HBP. According to the CDC (2015a), 41.2 % of African Americans have HBP levels when compared to European Americans. Therefore, the findings of this study were consistent with the proposition that African Americans may disproportionately develop HBP when compared to European Americans.

Findings from this study also show that more than a quarter (30%) of the population had HC. According to Ortega et al. (2013) and Saab et al. (2015), one of the health problems facing African Americans is HC levels. According to the American Heart Association (2013), the prevalence of HC levels among African American was 32% compared to 30 % for European Americans. Although the finding supports the proposition that African Americans develop HC levels when compared to European Americans, its prevalence was relatively lower when compared to HBP levels. The high prevalence of HBP levels and HC levels among African Americans when compared to European Americans may be supported by lifestyle disparities. For instance, Cockerham, Bauldry, Hamby, Shikany, & Bae (2017) showed a link between unhealthy lifestyles and CVD among African Americans (hazard ratio, 1.60) when compared to European Americans (hazard ratio, 3.12).

Research Question 1

To what extent does the DASH dietary pattern predict BP levels and total cholesterol levels among African Americans after controlling for demographic factors, BMI, and energy intake?

The goal of the DASH diet is to increase the consumption of five nutrients (i.e., protein, fiber, magnesium, calcium, and potassium) and decrease the intake of four (i.e., total fat, saturated fat, sodium, and cholesterol) for optimal health (Mellen et al., 2008). The single predictor of DASH scores with BP as the dependent variable showed that the main variable of interest, DASH score, was not a significant predictor BP levels. However, when the categorical DASH scores were split into quintiles, only the fourth quintile (3.50) significantly predicted the odds of having HBP ($p < 0.001$). The single predictor of DASH scores with cholesterol levels as a dependent variable showed that the main variable of interest, DASH, was not a significant predictor of cholesterol levels. In addition, when split into quintiles, none of the categorical DASH scores were significant predictors of cholesterol levels.

The findings of this study show that there was a significant nonlinear association between DASH and BP levels. This finding implies that moderately high DASH level could lower BP levels but very high DASH level may not necessarily lower BP levels. This finding was consistent with a previous study by Harrington et al. (2013), who found a significant inverse relationship between DASH quintile scores and BP levels when treated independently. Harrington et al. (2013) further explained that the inverse association remained the same after controlling for lifestyle behaviors with both univariable and multivariable analysis. There were also differences in BP levels across DASH quintile scores. Harrington et al. (2013) found differences in BP levels among population levels with high-quality and poor-quality groups. The findings of this study show a potential nonliniear association between the fourth DASH quintile score and HBP levels after controlling for demographic factors, BMI, and energy intake. The results of this study show that dietary patterns on their own do not directly affect BP and cholesterol levels. In effect, the combined factors of demographic and socioeconomic characteristics of a population as well as energy intake and BMI may influence the development of HBP levels and HC levels.

Despite the findings of this study that dietary patterns do not directly affect BP and HC, a suboptimal diet is a leading cause of health risk, including HBP levels and HC levels (Mozaffarian, 2016). Complying with the DASH diet may lower the risk of HBP levels and total cholesterol levels. The DASH diet is one of the well-known dietary patterns designed to prevent the development of chronic diseases including conditions such as BP levels and HC levels (Chiu et al., 2016). For instance, Chiu et al. (2016) found a significant association between the DASH diet and BP levels using a randomized crossover trial with a standard DASH diet and compared with a controlled diet. The study by Chiu et al. (2016) was limited because the sample size used was relatively small and the period of intervention was relatively short. However, there was high dietary compliance among participants. This finding is also consistent with the findings by Tiong et al. (2018) and Del Gobbo et al. (2015), who found significant associations between DASH quintile scores and BP levels among Malaysian and Philippines adults. Similar to NHANES used in the current study, Tiong et al. (2018) used the National Nutrition and Health Survey to collect personal and sociodemographic and cross-sectional data for the study.

Bell et al. (2013), Chan et al. (2015), and Saab et al. (2015) indicated that the general dietary pattern of African Americans comprised the high intake of dietary cholesterol and minimal intake of dietary fiber when compared to European Americans. According to Di Noia et al. (2013), African Americans disproportionately develop CVD risk factors including HBP levels and HC levels partly due to dietary factors. These findings are consistent with the current study which showed significant association between high diet quality and low BP levels.

Diet quality can reduce the development of blood pressure. Livingstone and McNaughton (2016) also reported a significant association between the DASH dietary pattern and BP levels. Similar to the current study, the study was population-based and utilized two 24-hour dietary recall to assess the intake of food and beverages. However, five food groups were classified for the study. In addition, data-driven methodology was used together with dietary adherence among the population for analysis. Although the current study was population-based, the findings were consistent with those by Livingstone and McNaughton (2016). Diet quality was more significantly associated with HBP with men than with women. In addition, the odds of having HBP was lower in men who were overweight. Livingstone and McNaughton (2016) further explained that the dietary guideline index and the recommended food score used for the study might have contributed to HBP variations between both sexes.

The intake of certain food types can influence cardiovascular health. Liu et al. (2013) found an association between “Southern food” and “fast food” with BP levels and cholesterol levels. The finding of the current study was consistent with the finding by Liu et al. (2013) who found a significant association of diet quality with BP levels. Unlike the finding by Liu et al.(2013), I did not find any significant association between diet quality and cholesterol levels. The study by Liu et al. was designed to examine the dietary patterns within the southern population of the United States, unlike the current study that was not regionally oriented. The association of “Southern food” and “fast food” patterns with BP levels and cholesterol levels was evident because the dominant African American population in the region was more likely to be associated with this dietary pattern.

The influence of dietary patterns is important in CVD risk studies. Sotos-Prieto et al. (2015) found an association of diet quality with BP levels. This finding was consistent with the findings of the current study. Unlike this study, Sotos-Prieto et al. (2015) found a significant association between diet quality and cholesterol levels. However, the current study showed that DASH quintile score was only significantly associated with BP levels. Although Sotos-Prieto el al. (2015) used food groups, I used nutrients to assess diet quality. Sotos-Prieto et al. (2015) further reported that the decrease in BP levels and cholesterol levels with diet quality was more evident in the longer term than in the shorter term. This report may suggest that using that using 24-hour dietary recall may not be appropriate for assessing diet quality with BP levels and cholesterol levels.

Diet quality on its own may not influence the development of blood pressure. Najafi and Sheikhvatan (2013) reported an insignificant association between diet quality with BP levels among Iranian adults with coronary artery disease. Despite variations in smoking, physical activity, BMI, and energy intake, participants shared a common healthy dietary pattern that included high proportions of cereals, fruits, and vegetables. Najafi and Sheikhvatan (2013) further reported findings on participants with and without CVD risk factors. No significant differences were observed. This finding might suggest that adherence to a diet high-quality diet alone may not influence CVD risk factors including BP. This finding indicates that that diet quality alone was not a significant predictor of BP levels, which coincides with the current study. Though one difference to note is that I used categorical DASH scores for analysis unlike Najafi and Sheikhvatan.

The fourth quintile of the categorical DASH scores significantly predicted BP levels after adjusting for covariates. In addition, age (p = < 0.001), gender (p = < 0.001), and BMI (p = < 0.001) were also significant predictors of blood pressure levels. However, only age (p = < 0.001) significantly predicted cholesterol levels. This finding was consistent with a report by Psaltopoulou et al. (2017), who found associations of age, BMI, and gender with BP levels and cholesterol levels. Allport, Kikah, Saif, Ekokobe, and Atem, (2016) and Mannocci et al. (2015), reported that the risk of developing HBP levels and HC levels increases as an individual advances in age. This study did not find any significant association of gender with BP levels and cholesterol levels. However, Everett and Zajacova (2015) and Najafi and Sheikhvatan (2013) reported that women were more likely to develop CVD risk factors, including BP levels and cholesterol levels than men. Also, this study did not find any significant association of income levels with BP levels and cholesterol levels. However, Kiang, Vallibhakara, Attia, McEvoy, and Thakkinstian (2017) reported on the contrary that individuals with lower income levels were less likely to develop HBP levels and HC levels when compared to individuals with higher income levels. On the other hand, Sagner et al. (2017) concluded that low-income levels were associated with the high prevalence of BP levels and cholesterol levels. However, Oguoma, Nwose, Skinner, Digban, Onyia, and Richards (2015) found that there was no association between income levels and the prevalence of HBP and HC levels in a study of Nigerian adults.

The results of this study show that in general, high diet quality may reduce HBP levels. Thus, this study gives importance to diet quality recommendations to reduce CVD risk within the overall population.

Research Question 2

To what extent does physical activity predict blood pressure levels and total cholesterol levels among African Americans, after controlling for demographic factors, BMI, and energy intake?

The logistic regression models showed that independently, physical activity was not a significant predictor of BP levels and cholesterol levels. However, after adjusting for covariates, age (p = < 0.001), gender (p = < 0.001), and BMI (p = < 0.001) were significant predictors of BP levels. However, only age (p = 0.001) significantly predicted cholesterol levels after adjusting for covariates.

These findings were consistent with a report by Babbitt et al. (2017) and Braun et al. (2016), who reported that lifestyle physical activity engagement was not predictive of HBP and HC levels. Babbit et al. (2017) explained that participants in the study were subjected to dietary stabilization prior to the 6-month study. In addition, the sample size was small due to participant exclusions to create a homogenous group. However, a large randomize and a nationally representative sample was used for the current study. This finding was consistent with the findings by Diaz et al. (2017) and Feairheller et al. (2014), who did not find any significant association between overall physical activity and BP levels. In addition, Brown et al. (2016) and Crichton and Alkkerwi (2015) did not find any significant association linking physical activity with BP levels and HC levels.

Similar to the current study, Brown et al. (2016) used a cross-sectional data from a nationally representative sample for their study. Brown et al. explained that because 1 year of data was used for the study, their ability to establish an association between physical activity with BP levels and cholesterol levels was limited. Brown et al. (2016) further suggested that longitudinal data could have provided a better understanding of the influence of physical activity on BP levels and cholesterol levels. In contrast, Crichton et al. (2015) used data from between 2007 and 2009 from a nationally representative sample, yet observed no statistically significant association between physical activity BP levels and cholesterol levels .

Unlike the current study, Bell, McIntyre, and Hadley (2014) utilized an experimental approach to their study. Bell et al. (2014) reported that long-term physical activity could reduce BP levels and cholesterol levels significantly. Also, Mann et al. (2014) reported that prolonged moderate-intensity physical activity could reduce BP levels and cholesterol levels.

Limitations of the Study

The nationally representative sample of African American population is a strength of this study. However, several factors may limit the study. The participants may not be a true demographic representation of African Americans in the United States. All participants for the study were legal residents of the United States.

The current study was cross-sectional and may not be used to establish the cause and effect association between the variables used. The study design was appropriate to describe the current situation among African Americans within a specified point in time to predict the significance of diet quality and physical activity with BP levels and cholesterol levels, with consideration to socioeconomic factors. Because the data were collected simultaneously with both exposures and outcomes, it obstructs the capacity to establish with certainty the predictive ability of diet quality and physical activity for BP levels and cholesterol levels among African Americans. In addition, the study cannot conclude that the association of age, gender, and BMI with BP levels and cholesterol levels was based on the principle of cause and effect.

NHANES collected information on dietary intake and physical activity based on interviews and self-reported data. Trained technicians used physical examinations and laboratory tests to collect information on blood pressure levels and cholesterol levels respectively. Information obtained through self-reported data may not be accurate because participants may not provide accurate information on their health and behavioral status, and that may result in poor response rate and bias. Although Short et al. (2009) acknowledged the importance of self-reported data on health status for research, the accuracy and validity of such data are minimal despite their widespread use. For example, the 24-hour dietary recall used to assess dietary intake may not be representative of the long-term dietary patterns of participants. Raina (2013) noted that the 24-hour dietary recall is used retrospectively to assess dietary patterns; therefore, the method cannot be used to represent the dietary pattern at an individual level, but it may be used to estimate the mean dietary intake of a large group. According to Raina (2013), a study to assess dietary methods in the United Kingdom recommended the use of four

24-hour dietary recalls. In addition, a study among Australian adults recommended the use of eight repeated 24-hour dietary recalls in order to notice any dietary variations.

Another limitation to this study was the use of total cholesterol as disease markers. Total cholesterol comprise of LDL and HDL. However, Upadhyay (2015) noted that there are other biomarkers based on serum lipid, glucose and hormone biomarkers serum lipid, glucose and hormone profile that may increase CVD risk.

Recommendations

Although several researchers have used different methods in their studies with mixed results, the current study used a cross-sectional tresearch design. Based on the literature reviews for this study, I recommend that a longitudinal research design be used for further studies on predictors of BP and cholesterol with particular focus on African Americans. Unlike cross-sectional, longitudinal study designs may be conducted over many years and not at a point in time. In addition, to establishing sequences of occurrences, longitudinal studies ia able to establish causes and effects in a study (Carauna, Roman, Hernandez, & Solli (2015).

A limitation of the study was the use of self-reported data on individual behavior as well as health status. Participants' responses to questions on dietary intake and physical activity may have been exaggerated and thus affected the findings of the study. Rosenman, Tennekoon, and Hill (2011) noted that the use of self-reported data for a study might result in response biases, which may not provide credible results. This limitation may be addressed in future studies by using participants' recorded dietary intakes as well as physical activity engagements. Shim, Oh, and Kim (2014) noted that the use of self-recorded dietary intake may provide accurate information because participants do not have to rely on their memories to provide responses.

Data for the current study show that only 16% of the sample population engaged in moderate-to-high intensity physical activity. However, Bell et al. (2014) and Brown et al. (2016) suggested that moderate to high-intensity physical activity could improve BP levels and cholesterol levels. Future studies should further explore physical activity patterns among African Americans. Lanier et at. (2016) noted that physical activity improves quality of life, therefore, future researchers should investigate the low rate of physical activity among African Americans.

There are markers which may be used for further studies other than total cholesterol. I recommend that researchers use other markers including serum lipid, glucose and hormone biomarkers serum lipid, glucose and hormone profile, for studies associated with CVD. Upadhyay (2015), further staed that plasma levels, serum, and blood are important biomarkers for CVD.

Implications for Professional Practice and Social Change

HBP levels and HC levels may lead to other cardiovascular diseases including stroke if left uncontrolled (Satoh et al., 2015). Satoh et al. also noted that HBP levels and HC levels occurring at the same time can combine to increase the risk of heart-related death. The results of this study show that almost two-thirds of African Americans have HBP. Therefore, there is a need for health professionals, policymakers and public health advocates to educate the public on the dangers of these risk factors.

The study focused on lifestyle behaviors (adherence to diet quality and physical activity engagements). The results of this study showed that age was a significant predictor of BP levels ($p < 0.001$) and cholesterol levels ($p < 0.001$). African Americans should be conscious of their health and engage in healthy behaviors as they advance in age. In addition, individuals need to pursue further education to improve their earnings. Higher education levels may lead to higher (discretionary) income with which African Americans could afford healthy foods including fruits and vegetables as well as engage in other aspects of a healthy lifestyle. Although physical activity did not significantly predict BP levels and cholesterol levels in the current study, Lanier et al. (2016) and Mann et al. (2016) noted that physical activity improves well-being and could improve BP levels and cholesterol levels. African Americans should understand the beneficial effects of healthy dietary intake and physical activity for improved quality of life. The use of the socioecological model for the study may be beneficial to African Americans because age, gender, and income predicted BP levels and cholesterol levels. Therefore, public health professionals may use the interactions of the role of the individual and CVD risk factors to promote social change among African American communities.

Conclusion

The current study examined the extent to which diet quality and physical activity predict BP levels and cholesterol levels among African-American adults. The findings show that independently, diet quality was a significant predictor of HBP levels but not of HC levels. Physical activity was not a significant predictor of both HBP levels and HC levels. However, age, gender, and income levels were significant predictors of BP levels and cholesterol levels. These variables may be of fundamental importance to the study of CVD risk factors, including BP levels and cholesterol levels, among African Americans.

The literature review showed that DASH diet significantly improved BP levels. In addition, age, income levels, and BMI influence the development of BP levels. The findings are consistent with the finding of this study, which indicates that DASH diet alone may not predict blood pressure levels. The findings show that it is important to consider demographic factors and BMI, in CVD related studies.

It is important that the individual, the family, and the community understand the benefits of taking actions to prevent the development of CVD risk factors. Therefore, researchers and public health advocates may use their understanding of the sociodemographic variables to develop programs to reduce the burden of HBP levels and HC levels among African Americans. The prevalence of CVD risk factors cuts across races; therefore, it is equally essential that public health officials extend health awareness beyond the African-American community.

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