ABSTRACT

Association of Dietary Fiber Intake with Metabolic Risk Factors for Type 2 Diabetes in African American Men

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An insufficient amount of research has focused on the relationship between dietary intake and type 2 diabetes among African Americans (AA) which are disproportionately affected by the disease. This study examined the association of dietary fiber intake on metabolic risk factors for type 2 diabetes in AA men with a family history of type 2 diabetes. Measurements of anthropometry, blood pressure, DXA, and blood lipid profiles from the ARTIIS study (parent study) were used in the current study. Also, food frequency questionnaire and lifestyle history questionnaire were used. Outcomes indicated that dietary fiber intake is far below recommendations in AA men. Subjects that consumed higher dietary fiber had lower LDL-C ($P \leq 0.05$) and they self-reported currently exercising ($P \leq 0.05$). The relationship between dietary fiber and metabolic risk factors for type 2 diabetes was not evident. Our findings indicate the imperative need to further examine dietary patterns within AA and their influence on metabolic outcomes.

Association of Dietary Fiber Intake with Metabolic Risk Factors for Type 2 Diabetes in African American Men

by

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A Thesis

Approved by the Department of Human Science and Design

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Submitted to the Graduate Faculty of
Baylor University in Partial Fulfillment of the
Requirements for the Degree
of

Master of Science

Approved by the Thesis Committee

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December 2022

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ACKNOWLEDGMENTS

Thank you to April Stull, Ph.D., RDN, FAND, who has guided me through the process of scientific research and provided me with clarity and support throughout this project. Your support in exploring my interests in underserved populations and helping me pivot when outcomes were not expected was essential in developing this study. Your patience and guidance gave me the confidence to move forward with my thesis and meet my goals. Thank you to Robert L. Newton, Jr., Ph.D., principal investigator of the Aerobic Plus Resistance Training and Insulin Resistance in African American Men (ARTIIS) study, and supporting researchers, for providing the opportunity to employ research in an underserved and important population. Thank you to Anu Kannan, statistical analyst, for assisting with the interpretation of the data. An additional thank you and appreciation to committee members, LesLee Funderburk, Ph.D., RD, CSSD, CSCS and Stephanie Boddie, Ph.D.

CHAPTER ONE

Introduction

Background

The prevalence of type 2 diabetes mellitus has been steadily increasing in the United States.[1,2] In 2019, more than 37 million Americans were estimated to have diabetes.[1] By 2030, it is projected that the rate will increase to 54.9 million.[2] African Americans are at a disproportionate risk for developing type 2 diabetes. African Americans are twice as likely to be diagnosed with type 2 diabetes compared to Whites, and twice as likely to die from diabetes compared to Whites.[3–5] Among US African Americans, type 2 diabetes is the fourth leading cause of death in women, and the sixth in men.[6] In 2018, 13.0% of African Americans ages 18 and older had type 2 diabetes, while only 8.0% of Whites had type 2 diabetes.[5] Specifically, African American men are more greatly affected by type 2 diabetes than African American women. According to the 2018 National Health Interview Survey, 13.4% of African American men had diabetes while 12.7% of African American women had diabetes.[5] It is unclear why African Americans are disproportionately affected. Although there is genetic influence, including a family history of diabetes and increased susceptibility for particular ethnicities, the development of type 2 diabetes is primarily associated with different risk factors.[7]

There is a combination of risk factors that increase an individual's risk for developing type 2 diabetes. These risks include metabolic risk factors, behavioral factors, and lifestyle habits. Defined metabolic risk factors include elevated fasting blood glucose, elevated blood pressure, elevated triglycerides, elevated waist circumference, and low high-density lipoprotein cholesterol (HDL-C).[8] If a person has three of the five risk factors, they are diagnosed with metabolic syndrome which increases their risk of developing type 2 diabetes and cardiovascular disease. In addition, associated behavioral factors and lifestyle habits include dietary intake, physical activity, educational level, income level, and history of smoking and alcohol intake.[8] Many of these behavioral factors and lifestyle habits are modifiable, particularly dietary intake of specific foods that are high in fiber.

Studies have shown that higher consumption of dietary fiber decreases the risk of diabetes in the general population.[9,10] A large multiethnic cohort study of over 75,000 individuals followed for 14 years found that dietary fiber intake of >30g per day was associated with a reduced risk of diabetes.[11] Similar results were observed in a 10-year study where researchers found that a higher intake of fiber and whole grains was associated with a reduced risk of type 2 diabetes.[10] Furthermore, the Atherosclerosis Risk in Communities (ARIC) study found that amongst Whites, the incidence of diabetes decreased with an increase in total dietary fiber intake; however, this was not observed in African American individuals.[12] Type 2 diabetes imposes an enormous health burden and is associated with several other health risks and chronic diseases; therefore, prevention is critical. A reduction in metabolic risk factors associated with type 2 diabetes has the potential to result in a reduced risk of the disease. Fiber has been recognized to positively impact metabolic risk factors including blood glucose, insulin concentrations, body weight, blood pressure, HDL-C, and triglycerides in individuals with and without diabetes.[7,12]

Dietary Fiber and Obesity

Intake of fiber has been shown to be associated with weight reduction in obese and overweight individuals.[7] The effect of fiber on weight has been suggested to be related to reduced rate of nutrient absorption, increased satiation, appetite suppression, and reduced caloric intake.[7] A meta-analysis summarizing the relation of dietary fiber intake and the risk of metabolic syndrome reported that multiple studies found that intake of dietary fiber in overweight and obese individuals was associated with weight loss and prevented weight regain.[7] Furthermore, a higher body mass index (BMI) was associated with an increased risk for diabetes.[13] A retrospective cohort study examined the associations of BMI and fat distribution with diabetes risk and found that all participants who developed diabetes had a higher baseline BMI than those who did not.[13] Previous studies have shown that dietary intake influences weight outcomes and dietary fiber may have a supportive role in weight management.[7,13]

Dietary Fiber and Glucose

Physiologically, fiber has been shown to decrease postprandial insulin and glucose concentrations by slowing glucose absorption, thus reducing insulin secretion and sharp spikes in blood glucose.[3,9,10,12] A review of five studies that evaluated the impact of dietary fiber consumption on insulin resistance found relevant effects of fiber on reduced postprandial glucose excursions.[9] A cross-over study evaluated the effects of high fiber (25g fiber/1000 kcal) and low fiber (3g fiber/1000 kcal) meals on postprandial serum glucose and insulin in hypercholesteremic, overweight men.[14] Participants were fed a high fiber or low fiber meal for two days followed by a 4-day washout period.[14] After 1-hour post meal consumption, both serum glucose and insulin values were significantly lower with high fiber meals than with low fiber meals.[14] High fiber foods have a lower glycemic index, which results in reduced insulin activity, suggesting that a high fiber diet may have a role in controlling glycemic response, an outcome strongly related to type 2 diabetes.

Dietary Fiber and Lipids

Fiber can improve HDL-C concentrations and improve triglycerides by reducing fat absorption during digestion and binding to bile acids converting cholesterol to bile.[7,15] A cross-sectional study of 117 overweight and obese men and women found an inverse relationship between total dietary fiber and triglycerides after adjusting for age, sex, and visceral adiposity.[16] A meta-analysis evaluating the effects of dietary fiber on dyslipidemia reported that multiple observational studies observed a significant role of soluble fibers reducing serum cholesterol.[7] Dyslipidemia is commonly associated with many metabolic markers related to diabetes. A cross-sectional study evaluating the presence of metabolic syndrome in type 2 diabetic patients found that 33% of 150 patients had elevated triglyceride levels and 41% had lowered HDL-C.[17] In a study with 627 male and female African American participants, there was a significant correlation between moderate dietary fiber intake and improved HDL-C levels after adjusting for age, gender, and energy intake.[15] Dyslipidemia is commonly observed in diabetic patients. The current body of literature illustrates the role of dietary fiber in improving blood lipid profiles, thus reducing metabolic risk factors associated with the disease.

Dietary Fiber and Blood Pressure

Furthermore, intake of dietary fiber has been shown to improve blood pressure; however, the mechanisms of action are unclear.[7,15] The INTERMAP study, a cross sectional analysis evaluating dietary fiber intake and blood pressure, included 4680 men and women between 40 and 59 years. In the study, the higher intake of total dietary fiber was associated with lower systolic blood pressure independent of BMI and urinary potassium excretion.[18] A meta-analysis that evaluated three epidemiological studies found an inverse association between dietary fiber intake and blood pressure.[7] Elevated blood pressure is a common metabolic risk factor seen in patients with type 2 diabetes. A cross-sectional study found that 60% of 150 participants with type 2 diabetes had elevated systolic blood pressure.[17] Therefore, prevention of high blood pressure is an important preventative factor.[17]

African Americans and Dietary Fiber

In African Americans, dietary fiber intake is usually below the recommendations for American adults, 14g per 1000 kcal which is about 25g per day for adult females and 38g per day for adult males.[19–21] Researchers found that, on average, African American adults have 21% lower dietary fiber intake compared to Whites (13.7g vs 17.3g, respectively) and 26% compared to Hispanics (13.7g vs 18.4g, respectively).[19,22] African Americans are usually an understudied population in dietary intake studies, particularly African American men. Not including or having a limited number of different ethnic groups and genders in research studies reduces the generalizability of the study results. African American males are important in their community, having significant roles as husbands and fathers, and providers for their families.[23] To better understand the correlation between dietary fiber and metabolic outcomes in African American males, we conducted a sub-analysis using data from the Aerobic Plus Resistance Training and Insulin Resistance in African American Men (ARTIIS) study conducted by Newton et al.[24]

Objectives

Our primary objective was to determine the association of dietary fiber intake with metabolic risk factors for type 2 diabetes in African American Men. Our secondary aim was to determine the association between metabolic risk factors for type 2 diabetes and food groups that contribute carbohydrates and fiber to the diet.

Hypothesis

We hypothesized lower dietary fiber intake would be associated with an increase in metabolic risk factors for type 2 diabetes. Secondarily, we hypothesized that metabolic risk factors for type 2 diabetes would be associated with food groups that contribute carbohydrates and fiber to the diet

CHAPTER TWO

Materials and Methods

Study Inclusion

Data was obtained from subjects that participated in the ARTIIS study at Pennington Biomedical Research Center.[24] Participants were recruited from the Baton Rouge, LA area using a community-based approach. They were included in the study if they self-identified as an African American man that was insufficiently active (exercise ≤ 3 days a week for 20 minutes) and between the ages of 35 and 70 years with a BMI between 25.0 kg/m^2 and 45.0 kg/m^2 and family history of diabetes (nuclear family member).

Design and Methods

The research design and methods have been thoroughly described elsewhere.[24] The current study used a variety of baseline study measurements from the parent study. The measurements that were relevant to the current study included demographic information which included their lifestyle history (alcohol history, smoking history, exercise history, leisure television habits, and education and income levels), anthropometry (height, weight, and waist circumference), blood pressure, dual-energy X-ray absorptiometry (DXA) which measured body composition, and blood draws which were used to test lipid, glucose, and insulin levels .[24] Cardiorespiratory endurance, calculated by measuring VO_2 max, was used to validate self-reported physical activity. In addition, questionnaires evaluating dietary intake were administered. The study protocol was approved by the Pennington Biomedical Institutional Review Board and written informed consent was provided to the participants.

Dietary Intake Questionnaire

Dietary intake was assessed using a Block Food Frequency Questionnaire (FFQ).[25] The Block FFQ was used to estimate daily caloric intake of select nutrients and food group servings.[25] The Block FFQ assessed food habits, supplemental intake, sources of food groups, serving size, and frequency of consumption.[25] To measure food group consumption, commonly consumed foods were grouped by category and frequency and serving size is evaluated. The food groups included vegetables; fruit and fruit juices; breads, cereal, rice, and pasta; milk, yogurt, and cheese; meat, poultry, fish, and beans; fats, oils, sweets, and snacks. Additional questions about alcohol intake history were reported. The FFQ-measured dietary fiber intake was normalized by adjusting participants overall caloric intake using 14g of dietary fiber per 1000 kcal, the current recommendation for adults.[20,26] The adjusted fiber intake total was then used to separate the participants into two groups based on median fiber intake which was 6.75g per 1000 kcal. Participants were categorized as consuming less than median 6.75g fiber per 1000 kcal or consuming greater than or equal to median 6.75g fiber per 1000 kcal.

Statistical Analysis

Baseline characteristic data were separated into two groups by median dietary fiber intake and expressed as means and standard deviation (Mean ± SD) for continuous data. A Welch two-sample t-test was conducted on the two dietary fiber groups to assess significant differences. A Welch two-sample t-test or an ANOVA was run to assess the differences between groups of categorical lifestyle variables. The correlations between dietary fiber intake and metabolic risk factors were calculated using Pearson's correlation coefficient. The regression coefficients and 95% confidence intervals were calculated using a multiple linear regression analysis after multivariate adjustment for potential confounding factors, such as age, % body fat, energy intake, fat intake, and VO_2 Max. Model assumptions were checked, and normality was a concern. The data appeared skewed, so a square root transformation and log transformation were applied, but this did not change the results of the analysis. IBM SPSS Statistics 27 and R 4.1.1 (2017, R Core Team, Vienna, Austria) was used in data preparation and analysis. Values of $P \leq 0.05$ were considered statistically significant in all of the analysis.

CHAPTER THREE

Results

Participants

Characteristics of participants are presented in Table 1. Participants were middle age and obese. Twenty-seven percent of the population had metabolic syndrome with majority of subjects having an elevated waist circumference and 50% of subjects having hypertension (systolic blood pressure: ≥130 mmHg or diastolic blood pressure: ≥ 85 mmHg). Participants had near optimal low-density lipoprotein cholesterol (LDL-C) and participants who consumed less than the median fiber intake had statistically significant higher LDL-C than those who consumed greater than or equal to the median fiber intake ($P<0.05$).

Table 1 Characteristics of Participants by Dietary Fiber Intake Categories

Variable	All n=103	<6.75g/1000kca l n=51	≥6.75g/1000kca l n=52
Age, y	51.8 ± 9.0	50.8 ± 9.1	52.8 ± 8.9
BMI, kg/m^2	31.6 ± 5.3	31.6 ± 5.1	31.6 ± 5.4
Weight, kg	99.4 ± 18.2	98.4 ± 17.9	100.3 ± 18.7
Waist Circumference, cm	105.8 ± 14.0	106.0 ± 13.9	105.5 ± 14.2
Body fat, %	32.0 ± 6.4	32.5 ± 6.5	31.5 ± 6.3
Fat body mass, kg	32.8 ± 11.6	33.0 ± 12.1	32.6 ± 11.3
Lean body mass, kg	63.7 ± 8.7	62.5 ± 8.2	64.9 ± 9.2
Glucose, mg/dL	94.3 ± 8.8	94.6 ± 7.7	94.1 ± 9.8
Insulin, uU/mL	12.3 ± 7.2	12.8 ± 7.4	11.8 ± 7.0
Triglycerides, mg/dL	91.5 ± 45.2	91.5 ± 45.2	88.5 ± 46.5
Cholesterol, mg/dL	172.5 ± 37.2	179.0 ± 36.0	166.1 ± 38.1
LDL-C, mg/dL	107.3 ± 30.2	**113.3 ± 31.1***	**101.5 ± 28.4**
HDL-C, mg/dL	47.2 ± 11.5	47.4 ± 9.0	46.9 ± 13.5
Systolic Blood Pressure, mmHg	123.6 ± 11.7	122.2 ± 11.2	125.1 ± 12.1
Diastolic Blood Pressure, mmHg	81.7 ± 8.0	81.2 ± 7.7	82.2 ± 8.3
Peak relative VO2 (VO2 Max) mL/kg/min	24.5 ± 5.5	24.7 ± 5.9	24.3 ± 5.0
Metabolic Syndrome, %	27	29	25
Risk Factors			
Waist Circumference ≥ 40 in, %	62.1	63.0	60.0
Triglycerides ≥ 150 mg/dL, %	9.7	12.0	8.0
HDL-C < 40 mg/dL, %	28.2	24.0	35.0
Systolic Blood Pressure ≥ 130 mmHg, %	34.0	29.0	37.0
Diastolic Blood Pressure ≥ 85 mmHg, %	36.9	31.0	40.0
Systolic Blood Pressure, mmHg or Diastolic Blood Pressure, mmHg	50.5	43.1	57.7
Glucose ≥ 100 mg/dL, %	24.3	29.0	21.0

Data are expressed as mean ± SD; *Indicates statistically significant difference between <0.65g fiber and ≥0.65g fiber (P<0.05); HDL-C, high-density lipoprotein cholesterol and LDL-C, low-density lipoprotein cholesterol

Dietary Intake Characteristics

The participants' dietary intake is presented in Table 2. Participants were categorized based on median fiber intake (g per kcal). On average, participants total energy intake was approximately 1500 kcal per day, with 42% calories from carbohydrates, 39% from fat, and 17% from protein. Participants who consumed less than median 6.75g fiber consumed more calories, fat, and protein per day compared to participants who consumed greater than or equal to median 6.75g fiber ($P \leq 0.5$). The carbohydrate intake did not change between the different fiber categories. The average intake of fiber was 7.4g per 1000 kcal. Participants who consumed greater than or equal to the median fiber intake on average consumed 9.7g per 1000 kcal, while participants under the median fiber intake consumed 5.1g per 1000 kcal ($P=.004$). Additionally, participants who consumed greater than median 6.75g fiber on average consumed significantly more vegetables and fruits and less meats and fats/sweets when compared to participants who consumed less than median 6.75g fiber ($P \leq 0.05$). There were no changes in the bread/pasta, milk/cheese, and alcohol beverage groups.

Table 2 Dietary Intake of Participants

Variable	Total n=103	<6.75 g/1000 kcal n=51	≥ 6.75 g/1000kcal n=52	P-value
Dietary Intake				
Energy, kcal/day	1522.2 ± 917.8	1742.4 ± 1000.6	1306.2 ± 779.2	**0.015**
Fat, g/day	66.9 ± 41.3	80.0 ± 45.4	54.0 ± 32.4	**0.001**
Protein, g/day	64.5 ± 38.7	73.1 ± 43.3	56.2 ± 31.8	**0.026**
Carbohydrates, g/day	161.0 ± 103.8	176.3 ± 112.1	146.1 ± 93.7	0.141
Total dietary fiber, g/day	10.3 ± 6.1	8.6 ± 4.8	12.0 ± 6.8	**0.004**
Adjusted dietary fiber, g/1000kcal	7.4 ± 3.4	5.1 ± 1.1	9.7 ± 3.3	**0.001**
Food Groups				
Vegetable, servings/day	1.6 ± 0.9	1.4 ± 0.8	1.7 ± 0.9	**0.040**
Fruit and Fruit Juice, servings/day	1.0 ± 0.8	0.6 ± 0.5	1.3 ± 0.9	**0.001**
Bread, Cereal, Rice, and Pasta, servings/day	1.9 ± 1.0	2.0 ± 1.1	1.7 ± 0.9	0.120
Milk, Yogurt, and Cheese, servings/day	1.0 ± 1.1	1.2 ± 1.1	0.9 ± 1.2	0.140
Meat, Poultry, Fish, and Beans, servings/day	2.3 ± 1.3	2.7 ± 1.5	1.9 ± 0.9	**0.002**
Fats, Oils, Sweets, Snacks, servings/day	2.6 ± 2.2	3.4 ± 2.4	1.8 ± 1.5	**0.001**
Alcohol Beverages, servings/day	0.2 ± 0.3	0.3 ± 0.4	0.2 ± 0.3	0.233

Data are expressed as mean ± SD

Lifestyle History and Dietary Fiber Intake

The lifestyle history and dietary fiber intake of the participants are presented in Table 3. The majority of participants do not currently smoke and 50% consume alcohol. Almost 70% of participants self-reported being sedentary and those individuals that self-reported they currently exercised consumed 23% more fiber than individuals that were sedentary ($P \leq 0.05$). Socioeconomic factors did not significantly affect dietary fiber consumption between categories with 45% of participants having at least a college degree and almost 70% earning at least $50,000 annually. Regardless of education status or income level, dietary fiber intake remained relatively comparable between groups. Additionally, participants who never or seldomly watched TV in their leisure time consumed on average 20% more dietary fiber compared to those who sometimes, often, or always watched TV. However, this observation was not statistically significant.

Table 3 Lifestyle History and Dietary Fiber

Variable	% Participants	Fiber g/1000 kcal	P-value
Smoke History			0.430
No	87.4	7.5	
Yes	12.6	6.7	
Alcohol History			0.098
No	49.5	8.0	
Yes	50.5	6.9	
Exercise History			**0.004**
No	68.9	6.8	
Yes	31.1	8.8	
Leisure TV			0.174
Never/Seldom	12.6	9.0	
Sometimes	41.7	7.3	
Often/Always	45.6	7.1	
Education			0.928
Some HS, Diploma/GED	19.6	7.2	
Some College	35.3	7.3	
College Degree	25.5	7.5	
Post Graduate Degree	19.6	7.8	
Income			0.847
$0 to $29,999	15.7	6.7	
$30,000 to $49,000	15.7	7.1	
$50,000 to $79,000	28.4	7.5	
$80,000 to $99,000	13.7	7.8	
$100,000 and above	26.5	7.8	

n=103 for all variables except for education and income (n=102)

Dietary Fiber and Metabolic Risk Factors

The correlation between dietary fiber intake and metabolic risk factors are presented in Table 4. The correlation between participants adjusted dietary fiber intake and the five evaluated metabolic risk factors were insignificant. After adjusting for potential confounding factors, such as age, % body fat, energy intake, fat intake and VO_2 max, the insignificant correlation remained (data not shown; objective #1). In addition, there were no relationships between carbohydrate and fiber-rich food groups (vegetables, fruits, and bread/pasta) and metabolic risk factors (data not shown; objective #2).

Table 4 Correlation Between Dietary Fiber and Metabolic Risk Factors

Metabolic Risk Factors	Correlation	P-value
Waist Circumference	-0.03	0.73
Triglycerides	-0.09	0.36
HDL-C	0.12	0.22
Systolic Blood Pressure	0.07	0.46
Diastolic Blood Pressure	0.01	0.94
Glucose	-0.02	0.84

Data were expressed using Pearson correlation; n=103: HDL-C, high-density lipoprotein cholesterol

CHAPTER FOUR

Discussion

This study examined the relationship between dietary fiber intake and the prevalence of metabolic risk factors for type 2 diabetes in African American men. Our results did not suggest a correlation between dietary fiber intake and metabolic risk factors and food groups contributing carbohydrates and fiber to the diet. However, we found that the men in the current study consumed an average dietary fiber intake of 7.4g per 1000 kcal (adjusted) or 10.3g per day which is below the 14g per 1000 kcal, or 38g (men) per day which is the recommendation for adults. The LDL-C levels of participants in the current study were higher in the lower median fiber category compared to higher median fiber category.[20,26] Additionally, we found that dietary fiber intake was 23% higher amongst participants who self-reported that they currently exercised versus participants who did not exercise.

Average dietary fiber intake of African Americans reported in other studies are inconsistent. Amongst African American adult males, Storey et al. reported an average fiber intake of 15.0g per day, while Sekgala et al. reported intake of 4.6g per day.[15,19] According to *What We Eat in America* NHANES 2017-2022, the average dietary fiber intake was 16g per day, approximately half of the recommended intake and even lower in African Americans, 13.5g per day.[20,22] This is a 24% higher dietary fiber intake than participants within the current study which consumed 10.3g per day.

Our findings are consistent with other studies that indicate African Americans have insufficient intakes of dietary fiber and consume higher calories and fat.[19,22,27] The subjects in the current study that were in the lower median fiber category had a higher consumption of calories, fats, sugars, oils, and snacks compared to subjects in the higher median fiber category. Similar findings were reported by Ma et al. in type 2 diabetic patients.[28] Ma et al. reported participants dietary patterns consisted of high-fat (45% of total calories from fat) and low dietary fiber intake (11g per day).[28] Bazzano et al. also found that participants who consumed less dietary fiber consumed higher amounts of saturated fat and total calories compared to their counterparts consuming more total dietary fiber.[29] These findings were consistent with Lepping et al. that studied African American women and their dietary fiber intake. The women that did not meet their daily fiber recommendations had higher total energy intake compared to those meeting daily fiber intake recommendations.[30]

The Dietary Guidelines for Americans (2020-2025) recommends adults following a 2,200 calorie diet consume three servings of vegetables and two servings of fruits daily.[21] In general, US adults do not meet dietary recommendations. A study reporting dietary quality of Americans by assessing healthy eating index (HEI) scores found that all African American adults ages 19 to 64 years, were meeting only half of the recommended total fruit and total vegetable intakes.[27] Similar to the previous study, participants in the current study also consumed less than half of the recommended fruit and vegetable servings.

The current findings highlighted that participants who self-reported they currently exercised had a significantly higher dietary fiber intake when compared to those individuals that do not exercise. This association has not been well researched, however a retrospective study using data from the Nurses' Health Study of 62,036 women found that individuals who reported daily physical activity were in the highest quintile of dietary fiber intake (20g daily) compared to individuals whose physical activity was reported as less than once weekly (7g daily).[31] In contrast, Bazzano et al. did not find a significant difference in total dietary fiber intake in 6,531 men and women with different levels of physical activity.[29]

Previous research supports the interaction between dietary fiber intake and LDL-C.[32–36] A randomized, double-blind, controlled study of 155 subjects with elevated LDL-C found that intake of 6-10g of fiber per day was associated with a significant decrease in LDL-C.[36] At baseline, participants had moderately elevated LDL-C between 130 and 190 g/L, whereas participants in the current study had near optimal average LDL-C levels.[36] Thus, the effect of dietary fiber on LDL-C may be effective regardless of the status of the baseline LDL-C levels (near optimal or high). In a randomized, cross-over study with a 4-day wash out period conducted by Anderson et al., ten non-obese hypercholesterolemic men were randomized to a high fiber or low fiber meal.[14] The serum LDL-C values decreased significantly on all days, but did not differ significantly between participants consuming high fiber and low fiber meals.[14]

In the current study, dietary fiber intake and metabolic risk factors were not correlated which does not support the current body of literature. In a dietary fiber study of 117 predominantly White overweight and obese individuals, but otherwise healthy, 7-day food records were recorded and relationships between dietary fiber and individual metabolic syndrome risk factors were assessed.[16] Similar to the current study, Hannon et al. evaluated subjects with normal blood triglyceride levels. However, in contrast to the current study, there was a significant correlation between total and soluble dietary fiber intake and blood triglyceride concentrations.[16] In an African American population of 627 participants, Sekgala et al. reported a significant association between total dietary fiber intake and fasting blood glucose and systolic blood pressure.[15] A study of 213 African American women with a mean age of 58 years and an average total dietary fiber intake of 10.3g, found a higher prevalence of metabolic syndrome in participants not meeting daily fiber recommendations compared to those meeting daily fiber recommendations.[30] The discrepancies between the significant findings in previous studies and the current study may be due to the methods used to assess the participants dietary intake and different metabolic characteristics at baseline. Hannon et al. provided detailed instructions and oversight from a registered dietitian using 7-day food records, while the current study used self-reported FFQ.[16] Lepping et al. study had a participant population with a higher prevalence of metabolic syndrome, which was 59% compared to 27% of participants in the current study having metabolic syndrome.[30]

This study has several strengths. The participants in the study are from an underserved population and African American men are usually underrepresented in studies. Additional strengths included clinical measurements, such as measured VO_2 max to support the self-reported exercise history. There were several study limitations which may have influenced the outcomes. First, the sample size was small and the subjects did not have elevated glucose and lipid levels, which may have limited our ability to observe a significant relationship between dietary fiber intake and metabolic risk factors. Also, self-reported FFQs were used and it is well known that subjects underreport their dietary intake. Additionally, the subjects in this study were mostly educated with a middle class income which is not reflective of the food access challenges that lower socioeconomic populations may face.[37] Although, the participants were educated and not affected by poverty, they still had a below average dietary fiber intake and under consumed fruits and vegetables.

CHAPTER FIVE

Conclusion

Although, we did not find statistically significant associations between metabolic risk factors for type 2 diabetes and dietary fiber intake, this study still provided valuable information about the dietary, physiological, and lifestyle characteristics of a population vastly underrepresented in research. The current study results indicated that a higher dietary fiber intake resulted in lower LDL-C levels and those individuals that self-reported they exercised had higher median fiber intakes when compared to sedentary individuals. Future research should evaluate metabolic risk factor associations in larger populations of African Americans. Details regarding household size and zip code should be a part of collected lifestyle information and considered relative to income and food accessibility. Additionally, the association between lifestyle behaviors and dietary fiber intake and general dietary patterns amongst African Americans should be further explored.

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