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The objective of this study was to investigate the consumption of dairy products in a sample of African American women at risk for type 2 diabetes, and participating in the D.R.E.A.M. study, a pilot feasibility study to evaluate the effectiveness of using trained peer educators to deliver a nutrition and lifestyle education program in a church setting.

A convenience sample of 29 African American women, aged 45 years or older was recruited from two local churches in Greensboro, NC: 18 participants in the usual care group (UCG), and 11 in the intervention group (IG). IG women participated in eight weekly, one-hour classes that focused on improving dietary practices and physical activity. Classes were delivered by two women from the intervention church. UCG participants received the same educational handouts used by the intervention group but did not attend classes. Face to face interviews with all participants, consisting of several questionnaires and a 24-hour recall, were conducted at baseline, 8 weeks, and 12 weeks. Analyses were performed to determine total dairy product consumption, type of dairy product eaten (high-fat vs. low-fat), and change in dairy intake throughout the study.

Demographic characteristics of the women were similar, with the exception that more women from the intervention were in the > 200 % poverty level category ($p = 0.001$). Average dairy product consumption was below the 2005 My Pyramid recommendation of 3 cups per day for both groups. All participants consumed more

high-fat than low-fat dairy products. No significant change in dairy product intake between groups occurred throughout the study ($p = 0.591$). Consumption of vitamin D, calcium, and magnesium was below the DRI for all women during the study.

This research demonstrates the need to improve consumption of dairy products among African American women at risk for type 2 diabetes. Efforts should focus on ways to help these women change from eating high-fat dairy products to low-fat ones, and improve their intake of foods containing vitamin D, calcium, and magnesium.

DAIRY PRODUCTS CONSUMPTION IN AFRICAN AMERICAN WOMEN AT RISK FOR TYPE 2 DIABETES PARTICIPATING IN A NUTRITION AND LIFESTYLE EDUCATION PROGRAM

by

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APPROVAL PAGE

This thesis has been approved by the following committee of the Faculty of The Graduate School at the University of North Carolina at Greensboro.

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TABLE OF CONTENTS

LIST OF TABLES

Page

CHAPTER I

INTRODUCTION

Diabetes is a debilitating disease affecting a large number of the United States population. Along with a large number of health complications arising from diabetes, one problem is the high medical cost of treating this disease. The estimated cost of diabetes in 2007 was $174 billion (1). Of this total, $116 billion represented direct medical costs, while $58 billion were indirect costs, such as disability, work loss or premature mortality (1).

Preventing diabetes is of great importance because it leads to other health complications. These include, but are not limited to, heart disease and stroke, high blood pressure, blindness, kidney disease, impaired sensation or pain in the feet and hands, amputations, dental disease, and complications of pregnancy (1). According to the National Institute of Diabetes and Digestive and Kidney Disease, cardiovascular disease accounts for 68 % of deaths of people suffering with type 2 diabetes (10). Also, individuals with diabetes are 2 to 4 times more likely to suffer a stroke or have heart disease than healthy individuals

Minorities develop more health complications from diabetes. Brancati et al. were able to show that African American women who developed diabetes had higher systolic and diastolic blood pressure (11). The authors used a sample of 2646 African Americans and 9461 white adults, age 45 to 64 years, with no diabetes at baseline, who comprised a

prospective cohort study from the ongoing Atherosclerosis Risk in Communities Study, which featured a 9 year follow-up. African American women in that study were more likely to have hypertension, along with higher levels of insulin and high-density lipoprotein cholesterol (HDL) compared to white females at the 9 year follow-up.

National estimates from the Centers for Disease Control and Prevention (CDCP) indicate that 23.6 million people of all ages in the United States suffered from diabetes in 2007, representing 7.8 % of the entire population (1). From this estimate, 17.9 million people have been diagnosed with the disease, while 5.7 million people remain undiagnosed and unaware of the dangers this condition imposes on their everyday life (1). Using data from the National Health Interview Surveys (NHIS; 1984-2000), Narayan et al. estimate that the number of individuals with diagnosed diabetes will increase by 165% between 2000 and 2050 (12). In North Carolina the Diabetes Intervention Reaching and Educating Communities Together (DIRECT) project found that the rates of diabetes doubled in Greensboro, from 9.3% to 18.6%, while in Raleigh, the prevalence increased from 10.5% to 16.7% between 1996 to 2004 (13).

Minority and elderly groups are at increased risk of developing diabetes mellitus. CDCP reports that 12.2 million people aged 60 years or older suffer from this disease, which represents 23.1 % of population in this age group (1). According to data from the 1999-2002 National Health and Nutrition Examination Survey (NHANES), the incidence of diagnosed and undiagnosed diabetes rose from 9.3% to 21.6 % in people over 65 years of age, compared to data from the 1988-1994 NHANES surveys (14). From the 23.6 million people diagnosed with diabetes in 2007, 14.1 million of those affected were non-

Hispanic whites aged 20 years or older (1). Non-Hispanic blacks were next, with a prevalence of 3.7 million people aged 20 years or older (1). The CDCP also reports that non-Hispanic blacks are 1.8 times more likely to have diabetes compared to non-Hispanic whites (1). Brancati et al. reported in their study that middle aged African Americans, especially women, were at a significantly higher risk for incidence of type 2 diabetes than their white counterparts (11). Cowie et al. also found that non-Hispanic blacks and Mexican Americans have almost twice the standardized prevalence of total diabetes compared to non-Hispanic whites and that this incidence has not declined in the past decade in US (14).

Dietary habits play a major role in the risk of development of diabetes. Epidemiological studies suggest that consumption of certain foods may be associated with a higher risk of developing and maintaining diabetes. Several studies looked at consumption of large amounts of potatoes and reported that this habit was positively associated with the risk of type 2 diabetes (2; 3). The Western dietary pattern, which includes consumption of butter, red meat, potatoes and whole milk, is also positively associated with the risk of type 2 diabetes (15; 16).

Calcium and vitamin D have been investigated as nutrients that reduce the risk of type 2 diabetes. Two studies found that women who consumed high levels of vitamin D and calcium had a lower risk of developing the disease (17; 18). Ford et al. discovered that people with low levels of serum concentrations of vitamin D [25(OH)D] had a higher incidence of the metabolic syndrome (19).

A number of studies have examined the association between consumption of dairy products and a reduction in the incidence of type 2 diabetes. Some of these studies have focused on the intake of both high and low-fat dairy products and used only women as the study population (5; 6). These studies found that the higher consumption of dairy products, especially low-fat dairy products, was associated with the reduction of incidence of diabetes. Choi et al. conducted a similar study in a male population and found dairy products consumption was inversely associated with diabetes incidence (20). Two studies also explored the association of dairy products with the metabolic syndrome (21; 22). Lower trends for the prevalence of metabolic syndrome were associated with intake of dairy products in both studies.

Dietary modifications have shown to be successful as preventive measures against diabetes mellitus. Raidl et al. conducted the Healthy Diabetes Plate study at the University of Idaho that used the plate format to instruct participants about the type and quantity of foods they should eat at each meal (23). The participants were 117 males and females, 26 to 83 years old. As the risk of developing diabetes increases in individuals 45 years or older, participants were divided into 2 groups: individuals aged 45 years or less versus individuals 45 years or older. This program was designed for those diagnosed with diabetes and for those who were caregivers of people with diabetes. The results showed that all participants were able to plan meals correctly and they also managed to significantly increase their fruit and vegetable consumption, an important modification of their diets (23).

Another successful study in changing the diet of adults with diabetes is the Diabetes Intervention Reaching and Educating Communities Together (DIRECT) in Raleigh, NC, conducted between 1997 (baseline) and 2003(follow-up) (24). This study offered nutrition and diabetes management classes, organized walking programs, and diabetes screenings. Results showed declines in high HbA1c levels from 79.2% to 55.7 % of the population. The proportion of participants with LDL cholesterol levels ≥ 130 mg/dl declined from 49.9 % to 18.5 %.

A follow-up of the Finnish Diabetes Prevention Study showed that it was successful in modifying the diet of participants with type 2 diabetes (25). In the original study, 522 middle-aged men and women, with a median age of 55 years, were randomized into two treatment groups, an intervention group with intensive diet-exercise counseling or control group. At the end of the intervention, which lasted from less than 1 year (indicating withdrawal from the first yearly visit) up to 6 years, 17 new diabetes cases occurred in the intervention group, and 13 new cases in the control group. Complete analysis of the overall 7 year follow-up showed that only 75 new cases were discovered in the intervention group compared to 110 in the control group. The authors concluded that the effect of lifestyle intervention on diabetes risk persisted after the counseling ended.

Diabetes is affecting a large number of Americans, especially minorities and older adults. The older population is steadily increasing in the state of North Carolina (26). In 2006, there were 852,941 residents aged 65 years and older. Certain dietary habits are associated with an increased risk of developing diabetes, such as consuming large

amounts of potatoes, red meats and fried foods. Others, such as dairy consumption are associated with lowered risk of type 2 diabetes. In the African-American population, consumption of dairy products has been noted to be low (7). This is an important issue which needs to be further addressed in this population, especially in African American women, since they have a high risk of developing type 2 diabetes later in life. Dietary modifications are successful measures to prevent the onset of diabetes in some populations (25; 13).

Purpose and specific aims

The purpose of the D.R.E.A.M (Diabetes Risk-Educating African American Matriarchs) project, a pilot feasibility study, is to evaluate the efficacy of an 8-week nutrition and lifestyle education program delivered by a peer-educator for risk education of Type 2 diabetes among African-American women ages 45 years or older. This project examined selected dietary variables obtained for the participants in the larger pilot feasibility study.

Aim 1: Investigate the consumption of dairy products by the women in both the usual care and treatment group to determine if they are meeting the recommendations of the 2005 My Pyramid that are appropriate for their age and gender.

Research Question: Do African American women, who are at risk for type 2 diabetes, consume the minimum servings of dairy foods that are stated in the My Pyramid?

Approach: Assess dietary intake using 24-hour recall obtained at baseline.

Statistical Analysis: Analyses were conducted using SPSS version 15.0, using descriptive statistics.

Aim 2: Determine the types of dairy products consumed by women in the usual care and treatment groups: high-fat dairy vs. low-fat dairy foods.

Research Question: Do African American women who are at risk of developing type 2 diabetes consume greater amounts of low-fat dairy products than high-fat ones?

Approach: Assess dietary intake using a 24-hour recall obtained at baseline.

Statistical Analysis: Analyses were conducted using SPSS version 15.0 using descriptive statistics.

Aim 3: Determine the intake of vitamin D, calcium, and magnesium by women in the usual care and intervention group.

Research question: What are the intakes of vitamin D, calcium, and magnesium by African American women, who are at risk for type 2 diabetes?

Approach**:** Assess dietary intake using a 24-hour recall obtained at baseline.

Statistical Analysis: Paired T-Test analyses were conducted using SPSS version 15.0 using descriptive statistics.

Aim 4: Determine whether dairy product consumption changes (amount and type) along with the intake of vitamin D, calcium, and magnesium, after participating in the nutrition and lifestyle classes (intervention group vs. usual care group).

Research question: Does consumption of dairy products, vitamin D, calcium, and magnesium change following the presentation of materials on this theme in the intervention group vs. the usual care group?

Approach: Assess dietary intake through three 24-hour recalls (baseline, 8 weeks, and 12 weeks).

Statistical Analysis: Repeated ANOVA analyses between the two groups of women and paired T-Tests analyses within group for three time points (baseline-8 weeks, 8 weeks-12weeks, and baseline-12 weeks) were conducted using SPSS version 15.0.

CHAPTER II

LITERATURE REVIEW

Elderly population is increasing

The elderly population is increasing at a fast pace in the US. According to the AgingStat 2006 report, in 2004 there were 35 million people 65 and older in the US (23). By the year 2050, this number is projected to increase to 86.7 million. African Americans represent 8.4 % of this total number, which is expected to increase to 12 % by the year 2050 (27). For this age group, dietary quality, as measured by the Healthy Eating Index (a measure of diet quality that assesses conformance to federal dietary guidance), is rated as poor in 13.9% of the population, while 66.7 % need improvement in their current diet (28; 27). Perhaps related to this poor diet quality, 25% of African Americans between the ages of 65 and 74 have diabetes (29). One in four African American women over 55 years of age has diabetes. The older population is also increasing in the state of North Carolina (26). In 2006, there were 852,941 residents aged 65 years and older.

Struggles of older adults to follow a balanced diet

The elderly have a greater risk of developing type 2 diabetes. Since 12.2 million of people age 60 years or older suffer from this disease, it is imperative that steps are taken to help prevent the development of diabetes in this population group (1). One of the major issues of the older population is that they do not meet the Dietary Guidelines for Americans. In a study conducted by Vitolins et al. in two rural North Carolina

counties, the study population of 122 older adults, ages 65 to 93, did not meet the minimum servings of grains, fruits, vegetables, and dairy groups as recommended by the 2000 Food Guide Pyramid (8). Another study by Foote et al. looked at the dietary habits of 1740 healthy Southwestern U.S. adults, aged 51 to 85 years old, using the Arizona Cancer Center semi-quantitative food frequency questionnaire (30). The authors concluded that the participants consumed inadequate amounts of vitamin D, calcium, folate, and vitamin E. Also, only half of the population was meeting the "5 a Day" recommendations for fruit and vegetable servings. Vijan et al conducted a study using 197 participants, with a mean age of 62 years, to evaluate barriers to following dietary recommendations in patients with type 2 diabetes (9). Focus groups of 6-12 participants were formed to explore barriers to various types of diabetes self-management. Patients reported that even moderate dietary modifications are more burdensome than taking oral agents. Some of the other barriers mentioned by patients as important factors were difficulties in limiting food and beverage portion sizes, a decrease in quality of life, a lack of family support, dislike of the foods in the diet, and difficulty during holidays and special occasions. One focus group, made up of mostly African American participants, mentioned that communication with their providers was a major barrier to following recommendations for dietary modification. Savoca and Miller conducted a study that examined the food selection and eating patterns of people who were diagnosed with diabetes mellitus (31). These investigators wanted to study the attitudes and knowledge of people with type 2 diabetes concerning dietary recommendations, food choices, and eating patterns along with the daily patterns that influenced their diabetes self-

management performances. The participants included 45 men and women, between the ages 40 to 65 years old, diagnosed with type 2 diabetes for more than a year. Data were gathered through an in-depth interview during which participants were asked about their knowledge of diabetes before diagnosis, present lifestyle practices, views of diabetes self-management recommendations, and the social and institutional conditions that impact their diabetes care. Participants reported knowing of the recommended foods for their diet and of the eating patterns that needed to be followed. Strategies for healthful eating included food selection and preparation, meal planning strategies, and dining out strategies. The most important challenges for dietary pattern adherence included refraining from "favorite foods" and choosing healthful substitutions, controlling their weight, deviating from regular meal patterns, and restrict their intake. Social support coming from the spouses of the participants had a great impact on food choices and meal planning. The authors concluded that successful nutrition education programs for people with diabetes should include both education about food selection and meal planning. They also noted that inclusion of skill-building activities will help participants increase their self-efficacy (31).

To help prevent and better manage diabetes, it is very important to be aware of the food one is consuming. Montonen et al. conducted a study in 4303 Finish men and women, aged 40-69 years old, and reported that the consumption of all types of potato products in the highest quartile of intake was associated with increased risk of type 2 diabetes (P=0.03) (2). The authors also state that abundant potato intake is probably linked to diabetes development through a mechanism related to elevated postprandial

glucose levels, but the glycemic index of the potato depends on the methods of preparation. This association is further supported by Halton et al. in prospective study of 84,555 women, between the ages of 34-59 years, participating in the Nurses Health Study (3). The authors examined prospectively the association between consumption of potato products (baked, mashed, or French fries) and incidence of type 2 diabetes. The general consumption of potatoes, especially French fries, in the highest quintiles of intake (0.63 servings per day) was positively associated with the incidence of type 2 diabetes, especially in obese and sedentary participants who were more likely to suffer from insulin resistance (3). Other foods are also associated with the disease. Hodge et al. investigated the dietary patterns of 3,787 adults in Australia and performed factor analysis of participant food intake (4). The third factor that emerged from this study is known as the meat factor, but also includes consumption of foods such as pastries, fried eggs, fried fish and fried potatoes. This factor tended to be strongly associated with diabetes risk in the highest quintile of consumption ($P<0.0001$) (4). Montonen et al. analyzed the diets of a sample of 4, 304 Finish men and women, ages 40-69, and reported that a Western dietary pattern, which included butter, red meat, potatoes and whole milk, was associated with a higher risk of type 2 diabetes (15). The Health Professional Follow-up Study also examined the Western dietary pattern and found an increased risk of type 2 diabetes with the consumption of this diet ($P < 0.001$) (16). The study population was made up of 42,504 men, ages 40 to 75, who were followed for incidence of type 2 diabetes for 12 years.

Other studies looked at foods that are negatively associated with this disease. Montonen et al. conducted a study of 4,304 Finish men and women 40–69 years of age and found that consumption of vegetables (especially green vegetables), fruit, berries, margarine, oil, and poultry was associated with a reduced risk of diabetes (15). Liu et al. conducted a study looking at the consumption of fruits and vegetables in a population of women with diabetes who were enrolled in the Women's Health Study from 1993 to 2003 (32). The dietary information of 38, 018 women was analyzed, with diagnosis of type 2 diabetes being based on self-report. The investigators found that a high intake of green leafy or dark yellow vegetables (highest quintile of 1.43 and 1.00 servings per day respectively) was associated with reduced incidence of type 2 diabetes among overweight women (32).

Assessment of dietary practices

There are many techniques used to evaluate dietary intake of the elderly. Some of the most common techniques include 24-hour recall, Food Record or Diary, and Food Frequency Questionnaires (33). These techniques are used to assess the dietary intake of the general population and are not limited to older adults only.

With a 24-hour recall, a trained interviewer asks the respondent "to recall in detail all of the food and drink consumed in the previous 24 hour." Using a multiple pass approach, the interviewer helps the respondent remember all of the items consumed during the period of time and also assists with estimating portion sizes. After the interview, the recall is checked for omissions and mistakes. Several strengths are attributed to this assessment technique: it is quick and inexpensive to administer, it can

provide detailed information on specific food items, such as brand names, it only requires short term memory, and it is well accepted by respondents. However, there are also several limitations to the recall. Studies using populations of all ages have shown that there is underreporting/overreporting of certain foods. Omission of condiments and beverages are observed frequently, leading to low estimates of energy intake. Also, one recall may not be representative of the person's usual intake (33, page 82).

With a food record or diary, "the respondent records, at meal times, the identity and the amounts of all foods and beverages consumed for a period of time, usually ranging from 1 to 7 days." Portion sizes for food and beverage consumption can be estimated using household measures. Advantages of this method include not relying on memory since the respondent records the consumption of items at the time of eating, and it provides detailed food intake data and important information about eating habits. Some of the limitations are that this technique requires a literate population and a high degree of cooperation. Also, people can alter their dietary intake to facilitate recording of the items consumed (33, page 83).

Food frequency questionnaires "assess energy and/or nutrient intake by determining how frequently a person consumes a limited number of foods that are major sources of nutrients." The questionnaire consists of a list of approximately 150 or fewer individual foods or food groups. Respondents indicate how many times a day, week, month, or year that they usually consume the foods. There are three types of food frequency questionnaires: simple, nonquantitative; semi-quantitative; and quantitative. In a simple, nonquantitative questionnaire, no portion size is given. With a semi-

quantitative questionnaire, respondents choose a portion size that is being offered in the questionnaire. With a quantitative questionnaire, the participants give a serving size for the foods consumed. Strengths of this technique include that it is self-administered, it can be machine readable, and it is inexpensive for large sample sizes. It is also a method of choice for investigating the diet-disease relationship. Limitations include not being representative of usual foods or portion sizes consumed by the respondent. It is also dependent on the respondent's ability to describe his/her diet and past dietary practices (33, page 84).

My Pyramid and dairy recommendations

Since there is a lot of confusion about what should be eaten and in what amounts, people should turn to a helpful indicator of such practices, like the 2005 MyPyramid Food Guide. The MyPyramid Food Guidance System was developed by The Center for Nutrition Policy and Promotion of the United States Department of Agriculture (34). The Pyramid includes detailed description of foods included in each of its compartments, along with serving sizes recommended for each age group (34). As described in MyPyramid (35), the milk category includes milk, yogurt, cheese, and milk-based desserts, such as ice cream, ice milk, frozen yogurt, and puddings. The amount of food that should be consumed from the Milk Group depends upon age and physical activity. For women over the age of 45 years, who exercise less than 30 minutes per day, the recommended daily amount is at least 3 cups of dairy. The My Pyramid website is also very helpful in enumerating specific amounts that count as 1 cup in the milk group, such as ½ cup of ricotta cheese counting as 1 cup of milk, which is an advantage for people

who only consume certain dairy products. My Pyramid also states the importance of choosing low-fat or fat-free products due to the beneficial effects of these foods on conditions such as high cholesterol and coronary heart disease. Bronner et al. stated that nutrition education to increase calcium and dairy consumption in the elderly is very important, especially in African American communities (7). After a self-assessment of diet quality, most African-Americans believed that their calcium intake was "about right" and that at least 2 servings of dairy per day are "important". These authors recommend that in order to develop effective nutritional programs to increase dairy and calcium intake in this population, nutrition educators need to take into account nutritional status and food behaviors along with the social, economic, and cultural experience of the African American population.

African Americans in general do not consume dairy products. This is because approximately three fourths of this population suffers from lactose maldigestion, which is a symptom of lactose intolerance (36). In the year 2000, it was estimated that out of 35 million people who were African Americans in the US, 26 million were lactose maldigesters (37). This number is predicted to increase to 32 million people by the year 2050 as the number of African Americans increases in the US population. This condition can be managed if people who suffer from it consume small amounts of milk at each meal (e.g., a cup or less of milk) (37).

Fulgoni et al. conducted a study that evaluated the consumption of dairy foods by African Americans, and compared this to the intake of dairy products by non-African Americans (38). Dairy consumption was analyzed using data from the CSFII 1994-1996,

1998, and NHANES 1999-2000, using subjects between 2-51 years of age or older. Results from the CSF 1994-1996, and 1998 showed that African Americans males of all age groups had significantly lower dairy intakes than did the non-African American (1.31 vs. 1.98 servings/day) ($P< 0.05$). Also, African American females ages 2 to 18 years and 31 to 51 years consumed significantly less dairy compared to the non-African American counterparts (1.42 vs. 1.94 and 0.07 vs. 1.15 servings/day)($P<0.05$). Similar results were seen when data from NHANES 1999-2000 were analyzed.

One example of a successful education intervention to increase the consumption of dairy in African Americans was the DASH Trial (39). This was a multicenter, randomized study to determine the effects of certain dietary patterns on blood pressure. The study population was 60 percent African American. The intervention phase took place over eight weeks in which the subjects followed three assigned diets: a control diet, a fruit and vegetable diet, and a combination diet of fruits, vegetables, and low-fat dairy. The combination diet reduced systolic blood pressure by 5.5 mm Hg and diastolic blood pressure by 3.0 mm Hg more than control diet ($P< 0.001$ for each). The same diet reduced systolic blood pressure by 2.7 mm Hg ($P=0.001$) and diastolic blood pressure by 1.9 mm Hg ($P=0.002$) compared to the fruit and vegetable diet.

Even though dairy products consumption is low in the African American population, studies have shown that an increase in this practice is beneficial. An important example is the findings from the DASH Trial, which showed that consumption of low-fat dairy products, along with a healthy diet, can improve blood pressure in this population.

Vitamin D and calcium intake and risk reduction of diabetes

Vitamin D and calcium are two of the nutrients of interest in the battle against diabetes. Isaia et al. performed an observation study using 799 ambulatory postmenopausal Italian women to evaluate the incidence of hypovitaminosis D and calcium deficiency (17). The double antibody radioimmunoassay method was used to determine the levels of 25(OH)D3, while calcium consumption was obtained via a questionnaire. From the total sample of the women, it was determined based on medical history that 66 had type 2 diabetes. The diabetic participants had significantly lower levels of 25(OH)D when compared to the rest of the group (9 ± 11.3 vs. 11 ± 9.8 ng/ml, $P < 0.008$). The same results were observed with calcium, with significantly lower consumption by the diabetic women (679 ± 316.9 mg/day vs. 792.9 ± 400.9 mg/day, $P< 0.020$). These authors suggested that low intake of vitamin D and calcium can result in the deterioration of the disease.

Pittas et al. were also interested in exploring the link between vitamin D and calcium consumption and the risk of type 2 diabetes (18). They studied 83, 779 women participating in the Nurses' Health Study, who were followed for 20 years. Dietary intake of the participants was obtained using a validated semiquantitative Food Frequency Questionnaire administered in 1980, 1984, 1986, 1990, 1994, and 1998. Consumption of vitamin D and calcium was obtained by multiplying the frequency of intake of each food item with the nutrient composition of each food. Multivitamin and vitamin D/calcium supplement intakes were added to the consumption of these nutrients

from food sources in order to determine the total intake of each. Ascertainment of diabetes was done during the 2 year dietary questionnaire series, with the participants being asked if they had a diagnosis of diabetes. If the participants stated that they suffered from this disease, a supplemental questionnaire was sent inquiring about symptoms, diagnostic tests, and treatments. For statistical analysis, relative risks (RRs) were obtained as the rate of incidence of type 2 diabetes in each category of vitamin D and calcium consumption; 95% CIs were also calculated. During the 20 year interval of this study follow-up, 4, 843 cases of diabetes were reported. The authors determined that women who were eating 800 IU of total vitamin D per day had a 23% lower risk of developing diabetes than women who consumed < 200 IU per day. The same results were obtained with calcium, with the women who consumed ≥ 1, 200 mg/day total calcium having a 21% lower risk of diabetes compared to women who ate < 600mg/day. In addition, women with the highest intake of vitamin D (> 800 IU/day) and calcium (≥ 1200 mg/day) had the lowest risk of diabetes (RR = 0.67). The authors concluded that consumption of both of these nutrients is inversely related with the risk of type 2 diabetes.

Vitamin D has also been related to the risk of developing the metabolic syndrome (19). Ford et al. studied this relationship in a large sample of the US population that participated in the NHANES III survey. A total of 8, 421 men and nonpregnant women were examined. To obtain the serum concentrations of vitamin D [25(OH)D], a radioimmunoassay method was used. The authors determined that the risk of developing

metabolic syndrome diminished across increasing quintiles of 25(OH)D concentration ($P<0.001$).

Dairy intake and risk reduction of diabetes

In the fight against diabetes, eating the amounts of foods recommended by My Pyramid can be helpful. Numerous studies have shown that consuming the recommended amount of dairy foods, especially low-fat or fat-free products, seems to have a beneficial effect on reducing risk of diabetes. Liu et al. conducted a study to evaluate if dairy intake has an additional effect on diabetes incidence independent from that of calcium and vitamin D in a large prospective cohort of middle aged women participating in the Women's Health Study (WHS) (5). This was a randomized, double-blind placebo controlled trial originally designed to test the efficacy of low-dose aspirin and vitamin E in the primary prevention of cancer among 39, 876 female health professionals. Dietary assessment for 37,183 females was obtained using a validated semiquantitative food frequency questionnaire which included 131 food and beverage items. The average daily intakes of dairy items were combined to compute dairy intake for both low-fat products and high-fat products. The authors determined that women who consumed high-fat dairy products tended to have less healthy lifestyle patterns, such as less physical activity and greater overall fat intake. After a 10-year follow-up, the authors reported that 1,603 women had type 2 diabetes. After adjustment for a number of risk factors for diabetes, the relative risk (RR) of the women in the highest quintile of dairy intake (> 2.9 servings per day) was 0.79 ($P =0.007$). If a person increased their servings-per-day of dairy foods, this was associated with a 4% lower risk of type 2

diabetes (RR= 0.96). This association was mainly seen with low-fat dairy products, with a RR of 0.64 (P= 0.0001). The authors concluded that in this study, a higher intake of dairy products was prospectively associated with a lower risk of type 2 diabetes, especially if low-fat dairy products were consumed by middle-aged or elderly women.

Van Dam et al. conducted a study which examined the association between magnesium, calcium, and major food sources in relation to the risk of type 2 diabetes in African-American women (6). The study included 41,186 women participating in the Black's Women Health Study of Boston University and Howard University, a prospective cohort study in which data were obtained using biennial mailed questionnaires. Diets of these women were assessed using a 68-item baseline Block food frequency questionnaire. Dairy consumption was calculated by adding the daily number of servings of individual items in this food category. The dairy products were separated into low-fat foods, which included reduced-fat milk, reduced fat yogurt, and reduced-fat frozen yogurt, while high-fat dairy included the remaining. Incidence of type 2 diabetes was determined from follow-up questionnaires that were sent to the participants. Of these participants, 134 women reported being diagnosed as having type 2 diabetes. The investigators found that dairy consumption (2 or more servings per day), especially low-fat dairy products, was associated with a lower risk of developing type 2 diabetes (P trend= 0.13).

Fung et al. looked at the association between major dietary patterns and risk of type 2 diabetes among women in the Nurses Health Study (40). This prospective cohort study started in 1976 and included female nurses aged 30 to 55 years. For this study, 65

554 women completed a food frequency questionnaire that contained 116 food items. During the 14 year follow-up, 4303 cases of diabetes were documented. In this study, the investigators determined that two major dietary patterns emerged. One is the prudent pattern, which contains higher intakes of fruits, vegetables, fish, poultry, whole grain and low-fat dairy products. The second pattern is known as the Western pattern and contains higher intakes of red and processed meats, refined grains, desserts and sweets, and high-fat dairy products. These authors found that the Western dietary pattern, which included consumption of high-fat dairy products, was positively associated with the risk of type 2 diabetes ($P<0.001$).

Choi et al. were interested in testing the relation between dairy intake and incidence of type 2 diabetes in a male population (20). The participants in their prospective longitudinal study were 41,254 males, 40 to 75 years old, enrolled in the Health Professionals Follow-up Study. Dietary intake was assessed using a 130 food and beverage item semi-quantitative food frequency questionnaire which also distinguished high-fat and low-fat dairy products. Ascertainment of type 2 diabetes was done via supplementary follow-up questionnaires. The relative risk of men in the top quintile of total dairy intake (4.1 servings per day) was 0.82 ($P =0.003$) compared to the ones in the lowest quintile (0.5 servings). This finding supports the claim that persons who consume more dairy products will have a lower risk of developing diabetes compared to people who eat dairy products in small amounts. Results of this study also noted that each serving per day increase in dairy consumption was associated with a 9% lower risk for

type 2 diabetes (RR= 0.91). Also, a significant inverse association was found with consumption of low-fat dairy products, especially with skim milk (RR=0.90).

Dairy products consumption has also been inversely associated with the prevalence of the metabolic syndrome. Azadbakht et al. conducted a study in a Tehranian adult population to assess the association between dairy consumption and metabolic syndrome (21). For this part of the study, 827 men and women, 18 to74 years old participated. Dietary intake was assessed using a 168 item Willett semiquantitative food frequency questionnaire. Dairy products were defined according to the 2000 US Food Guide Pyramid. The investigators observed that the frequency of the metabolic syndrome was highest in the quintile ($\geq$ 3.1 servings per day) with the lowest dairy intake ($P<0.05$). People who consumed higher amounts of dairy tended to have a healthier lifestyle, such as consuming more fruits, vegetables, whole grains, and fiber.

Liu et al. were also interested in the prevalence of metabolic syndrome in US women (22). They investigated the relationship between dietary calcium and vitamin D intake and the incidence of the metabolic syndrome in 10,066 women enrolled in the Women's Health Study, a large cohort of middle-aged and older US women. These women were not diagnosed with diabetes at entry into the study, but had all of the five components of the metabolic syndrome. Dietary assessment was done via a 131-item semiquantitative food frequency questionnaire. The authors also examined the direct relationship between major dairy products and the metabolic syndrome and concluded that total milk intake ($P=0.01$), consumption of total dairy products ($P<0.0001$), and

consumption of low-fat dairy products ($P<0.0001$) were related to a lower prevalence of metabolic syndrome.

In summary, as the population gradually ages, the risk of disease increases. Higher rates of type 2 diabetes are found in people over the age of 60, with minorities having the highest rates, especially African Americans. Older adults report difficulties in eating a balanced diet and do not always follow dietary guidelines, such as the MyPyramid Food Guide. With chronic metabolic diseases such as diabetes, it is important to be aware of food consumption patterns that can increase the risk of developing the disease, and also of the patterns that are associated with a decreased incidence of the condition. Several studies have revealed that consumption of calcium, vitamin D, and dairy products, especially low-fat products, is associated with a decreased incidence of type 2 diabetes. More studies need to be conducted to assess the consumption of dairy products in populations that have been documented to consume low amounts of such products, such as African American women. Consumption of low-fat dairy products, in conjunction with other lifestyle factors, may help this population reduce the incidence of the type 2 diabetes.

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CHAPTER III

RESEARCH ARTICLE

Introduction

Diabetes is a devastating disease affecting a large proportion of the United States population. This condition is not only expensive to treat, with total medical costs topping $174 billion in 2007, but also causes numerous other health complications such as heart disease, kidney disease, high blood pressure, and impaired nerve sensation or pain in the feet and hands (1). According to the Centers for Disease Control and Prevention (CDCP), 23.6 million people of all ages in the United States suffered from diabetes in 2007 representing 7.8% of the entire population. Minority and elderly groups are at increased risk of developing diabetes mellitus. In 2007, 12.2 million people aged 60 years or older had this medical condition, which accounts for 23.1% of the population in this age group. Also, non-Hispanic blacks are 1.8 times more likely to develop diabetes as compared to non-Hispanic whites, while Hispanics/Latinos, are 1.7 times as likely to have the disease as their Caucasian counterparts (2).

Dietary habits play a major role in the risk of development of diabetes. Epidemiological studies suggest that consumption of certain foods may be associated with a higher risk of developing and maintaining diabetes. Several studies looked at consumption of large amounts of potatoes and reported that this practice was positively associated with the risk of type 2 diabetes (3; 4). Consumption of butter, red meat,

potatoes and whole milk, which are part of the Western dietary pattern, is also positively associated with the risk of type 2 diabetes (5; 6). Studies have also shown that dietary modifications have proven to be successful as preventive measures against diabetes mellitus. In addition, people who participated in intensive diet-exercise counseling developed fewer cases of diabetes and maintained these lifestyle changes after the counseling sessions ended (7).

Several nutrients, such as calcium and vitamin D, have been explored for potential risk reduction of type 2 diabetes. Two studies found that women who consumed high levels of vitamin D and calcium had a lower risk of developing the disease (8; 9). Researchers have also examined the association between consumption of dairy products and the reduction in the incidence of type 2 diabetes. Some of these studies have focused on the intake of both high and low-fat dairy products and used only women as the study population (10; 11). These studies found that higher consumption of dairy products, especially low-fat dairy products, was associated with a reduced incidence of diabetes. Other studies investigated the link between dairy products and metabolic syndrome and found that participants who ate more dairy products had a lower prevalence of type 2 diabetes (12; 13).

African Americans do not consume enough dairy products (14). Compared to non-African Americans, both male and female African Americans eat fewer dairy servings per day (14). Successful intervention programs have increased the consumption of dairy products in this population (15). The purpose of this study was to examine the consumption of dairy products in a population of African American women over the age

of 45, at risk for type 2 diabetes, and participating in a nutrition and lifestyle education program.

Methods

Design

This project used data collected as part of a larger project (D.R.E.A.M Study), a pilot feasibility study with a two (treatment and control) by three (pretest, posttest, and follow-up) factorial design. The primary aim was to assess the effect of a peer-led, nutrition and lifestyle education program (based on Small Steps, Big Rewards, 2006) on the risk of Type 2 diabetes in older African American women (16). The participants for the study were recruited from two local churches in Guilford County, predominantly African American, which were randomly assigned to be either the usual care or intervention site.

Subjects

For the purpose of the D.R.E.A.M study, the total number of participants to be recruited was 60 women, 30 in the usual care group, and 30 in the intervention group. The inclusion criteria of the participants were that they had to be women, African American, over the age of 45 years, at risk for diabetes, and residents of Guildford County, NC. They also had to be free of any significant illness that could prohibit them from making dietary changes or from participating in physical activity. The participants were recruited with the help of the congregational nurse, who was working with both churches.

Intervention group

The women in the intervention group participated in eight weekly, one-hour classes, held in the social hall of the intervention church. The classes addressed lifestyle strategies involving diet modification such as reduced calorie and fat intakes, portion control, and recipe modification, and exercise such as walking to increase physical activity. The classes were delivered by two women from the intervention church who were trained as peer educators to administer the program which is based on the Small Steps, Big Rewards (SSBR) educational program (16). The SSBR campaign encourages people at risk for diabetes and those with pre-diabetes to make modest lifestyle changes (lose weight, participate in physical activity, reduce fat and calorie intake) that can delay and prevent the onset of the disease.

Usual care group

The usual care group received the educational handouts used by the intervention group but did not participate in the classes taught by the peer educator. These participants also received 3 and 6 weeks mailings from the research team. At the 3 week time point, they received some handouts illustrating healthy recipes, and at 6 weeks they received Fat and Calorie trackers which allowed them to estimate the amount of fat consumed in their diet.

Data Collection

The data collection protocol of this study was approved by the Institutional Review Board of the University of North Carolina at Greensboro. After initial screening of diabetes risk using the Diabetes Risk Test via telephone, interested participants scheduled a face to face baseline interview with the research assistants, either in their

home or in a research laboratory at UNCG. During the initial meeting, the participants signed copies of the Informed Consent form (Appendix). This interview, which was comprised of the General Health Questionnaire, Stages of Change for Healthy Eating, Food Habit Factors, Physical Activity Recall, and a 24-hour recall, lasted from 45 to 60 minutes. Participants also had blood work done at Spectrum Laboratory after they had fasted at least 8 hours. At the 8 and 12 week follow-up, all participants underwent the same interview and also had blood work performed.

Monetary compensation was offered for completion of each data collection period (baseline, 8 weeks, and 12 weeks) in the form of gift cards to a local grocery store. All participants also received a pedometer to track their physical activity.

Data Instruments

Diabetes risk test

All participants completed a preliminary screening to assess diabetes risk, which was the first step in the interview procedure at the baseline time point of the study. The women were called by a member of the research team and this test was administered to determine if they qualified for the project. This tool, the American Diabetes Association Risk Assessment, was developed by the Centers for Disease Control and Prevention based on a 1995 study that used a large sample of the US population from the NHANES II study (17). The researchers were able to develop classification trees which allowed for the identification of individuals with a higher risk of undiagnosed diabetes. The classification tree incorporated age, sex, history of macrosomic infant, obesity, sedentary lifestyle, and family history of diabetes. Results indicated sensitivity, specificity, and

predictive positive value as 79%, 65%, and 10%, respectively. For racial and ethnic minority populations that include non-Hispanic Blacks, sensitivity and specificity were 80% and 61 % correspondingly.

General Health Questionnaire

All participants completed a general health questionnaire that included socio-demographics, self-reported physical activity, self-reported chronic conditions, and three food security questions. Height, weight, hip and waist circumferences, sagittal diameter measurements were obtained by trained research assistants and recorded on this form as well. This questionnaire was designed by our research group for use in research conducted with older adults residing in Guildford and Forsyth county, NC (18;19)(see Appendix).

Nutrition and Lifestyle Education Program

The Small Step, Big Rewards (SSBR) was developed based on the Diabetes Prevention Program (DPP) study conducted by the National Institutes of Health (16). The DPP study found that people with an elevated risk of diabetes can prevent or delay the onset of this condition by losing 5 to 7 percent of their body weight through increased exercise and by eating a low-fat and reduced calorie diet. The SSBR program promotes modest lifestyle modifications that could delay and possibly prevent the onset of diabetes. This SSBR program was used to develop the detailed scripts for the eight classes offered to the intervention group and to develop the education handout materials provided to both groups.

Stages of Change for Healthy Eating

The stages of change behavior model explains that behavior change does not take place in one step, but rather, people are inclined to advance through different stages of behavior change at their own rate (20). This 5-item questionnaire was developed by Nothwer et al. as a result of their study that assesed the distribution of behavioral strategies across stages of healthful eating using 407 people who participated in face-to face interviews (21). The women in the D.R.E.A. M. study completed the 5-item questionnaire to identify stage of change in terms of healthful eating (see Appendix). The assessment tool was first used at baseline, and then at the 8 week and 12 week interview to determine the progression of the participants through stages of dietary behavior change.

Food Habit Factors

Savoca et al. derived 4 food habit factors and 15 associated habits linked to glycemic control among people with type 2 diabetes (22). The associated habits were divided into 4 categories: 1) basic eating practices that include limiting the amount of high-sugar foods, limiting portion sizes, and eating low-fat foods for breakfast, 2) behavior associated with challenges of eating, such as eating at buffets, fast-food, and large chain restaurants, consuming meals that are high in fat and carbohydrates, 3) meal preparation habits like eating low-fat foods for lunch and planning meals in advance, and 4) vegetable and carbohydrate eating strategies which include eating vast amounts of vegetables and limiting the intake of specific carbohydrates. Using a questionnaire derived from the 15 food habits categorized by Savoca et al., the food habits of the

participants were assessed to determine possible risk reduction approaches (see Appendix). These data are not addressed in this paper.

Physical Activity Recall

This tool was developed by Sallis et al. to quantify and describe physical activity habits in community based health education trials (23). This recall also calculates physical activity in populations, offers information on allotment of activity habits, and can identify changes over time. This tool was used to assess the work, sleep habits, and physical activity (moderate, hard, very hard) of the participants (see Appendix). These data are not addressed here.

Dietary intake

All women completed a total of three 24-hour dietary recalls, one recall per interview. Face-to-face interviews were conducted during the three time points of the study (baseline, 8 weeks, and 12 weeks). Dietary intake data were coded and analyzed using the Nutrition Data System for Research (NDSR) software version 2007, developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN. The NDS-R system divides dairy products into whole fat, reduced fat, and low fat foods. Whole fat dairy products include milk products that have 3.5% fat (whole milk, whole flavored milk, cheeses with 24-33 % fat (natural and processed), cottage cheese with 4% fat, yogurt with 3-4% fat (sweetened whole milk yogurt, artificially sweetened whole milk yogurt), and frozen dairy desserts. Reduced fat dairy products include milk products that have 2% fat (reduced fat milk, reduce fat flavored milk), cheeses with 8-16% fat (natural and processed), yogurt with 1-2% fat (sweetened whole milk yogurt, artificially

sweetened whole milk yogurt). Low fat dairy products include milk products with <1% fat (low fat milk, fat free milk, low fat flavored milk, fat free flavored milk), cheese with 1% fat (low fat cheese, fat free cheese), yogurt with < 1% (sweetened milk yogurt, artificially sweetened milk yogurt).

Data analysis

All analyses were conducted using SPSS for Windows version 15.0. Means were computed for age, monthly household income, BMI, and chronic conditions. Chi square analysis was performed for age group, education, poverty level, BMI category, reported physical activity, and chronic conditions. Any variable that will be significantly different between groups will be used as a covariate. For nutrient intake at baseline, univariate analysis of variance was conducted. Descriptive statistics were used to determine the percent of women in both the usual care and the intervention group consuming the recommended My Pyramid servings of dairy foods. Descriptive analyses were also used to determine the type of dairy products (high-fat dairy vs. low-fat foods) consumed by the women in both groups. Repeated ANOVA analysis was used to detect differences between the two groups of women in terms of total dairy, high fat dairy, low fat dairy product consumption at the three time points of data collection (baseline, 8 weeks, and 12 weeks). The same analysis was conducted to determine change in the intake of vitamin D, calcium, and magnesium for the two groups of women during the three time points of the study. Paired T-Test analyses were performed to determine if any differences took place within each group of women in terms of consumption of total dairy, high fat dairy,

low fat dairy, vitamin D, calcium, and magnesium at any of the three time points of the study, baseline to 8 weeks, 8 weeks to 12 weeks, and baseline to 12 weeks.

Results

Participant characteristics

The demographic information of the women participating in this study through August 2008 is presented in Table 1. At the time of the analysis, 18 women were included in the usual care group and 11 in the intervention group, out of the total of 60 women targeted to be recruited for the study. The two groups of women were similar in age (57.9 ± 6.8 years vs. 63.3 ± 10.6 years, $p = 0.105$). All participants had at least a high school education. Participants in both the usual care and intervention groups were overweight or obese (BMI $\geq$ 25 kg/m^2) (84% and 91%, respectively), reported exercising less than 30 minutes per day (55% and 82%, respectively), and had at least one chronic health condition (67% and 55%, respectively). The only characteristic for which these two groups differed was the poverty level, with more persons in the intervention group being in the category > 200 percent above the poverty level than the usual care group (27% and 91%, $p = 0.001$). Poverty level was used as a covariate for the analyses that followed.

Table 1. Demographic Characteristics (Baseline)

	Usual Care group	**Intervention group**	**p value**
	(N=18)	(N= 11)	
Average age (y) (mean ± standard deviation)	57.9 ± 6.8	63.3 ± 10.6	0.105[1]
Age category			
45-50	1 (6%)	2 (18%)	0.108[2]
51-70	16 (89%)	6 (55%)	
≥ 71	1 (5%)	3 (27%)	
Education			
High school or GED	15 (83%)	4 (36%)	0.099[2]
Vocational training or associates degree	1 (6%)	2 (18%)	
BS degree or above	2 (11%)	5 (46%)	
Monthly household income			
Dollars (mean ± standard deviation)	2742 ± 2331	3919 ± 2682	0.223[1]
<200% of poverty level[3]	13 (72%)	1 (9%)	**0.001[2]**
> 200% of poverty level	5 (28%)	10 (91%)	
BMI (kg/m²) (mean ± standard deviation)	31.6 ± 7.7	34.8 ± 8.2	0.305[1]
BMI category			
18.5-24.9 kg/m²	3 (16 %)	1 (9%)	0.413[2]
25-29.9 kg/m²	6 (39%)	4 (36%)	
≥30 kg/m²	9 (45%)	6 (55%)	
Reported physical activity			
<30 min	10 (55%)	9 (82%)	0.245[2]
30-60 min	3 (17%)	0 (0%)	
>60min	5 (28%)	2 (18%)	
Chronic conditions			
Number (mean ± standard deviation)	1.2 ± 1.1	1.6± 1.5	0.391[1]
≤1	12 (67%)	6 (55%)	0.429[2]
≥2	6 (33%)	5 (45%)	

[1] P value for t-test analyses
[2] P value for χ^2 analyses
[3] Income guidelines published in the Federal Register on January 23, 2008

Estimated nutrient intake at baseline

Table 2 presents the estimated nutrient intake of the women at baseline. The two groups did not differ in their intake of total calories, protein, fat, carbohydrates, vitamin D, calcium, and magnesium. The only significant difference between the two groups was the polyunsaturated fatty acids (PUFAs) consumption, with the intervention group eating a higher amount of this nutrient than the usual care group (18.45 ± 2.52gm vs. 9.98 ± 1.59 gm; $p = 0.016$). Even though both groups were consuming similar food items that contain PUFAs (e.g., chicken, bread, mayonnaise, oil, salad dressing), the intervention group was eating larger amounts of these foods than did the usual care group.

Table 2. Calculated Dietary Nutrient Intake at Baseline (mean ± SE)[1]

	Usual Care	Intervention	DRI (51-70 years)	p value[2]
	N=18	N=11	(women)	
Kcal[3]	1365.35 ± 129.08	1644.38 ± 168.15	1900	0.260
Protein (gm)	61.01 ± 6.75	66.52 ± 8.25	46	0.471
Fat (gm)	51.05 ± 7.40	76.05 ± 9.17	65	0.105
CHO (gm)[4]	171.71 ± 14.66	176.87 ± 19.09	130	0.641
SFA (gm)[5]	17.89 ± 2.91	21.19 ± 2.93	20	0.677
MFA (gm)[6]	18.41 ± 2.80	29.98 ± 4.58	42	0.079
PUFA (gm)[7]	9.98 ± 1.59	18.45 ± 2.52	42	**0.016**
Vitamin D (mcg)	2.94 ± 0.48	3.39 ± 1.14	10	0.611
Calcium (mg)	597.45 ± 83.49	567.91 ± 76.07	1200	0.453
Magnesium (mg)	214.90 ± 20.60	236.05 ± 26.26	320	0.378

[1] Daily intake based on one-24 hour recall performed during the baseline interview
[2] P-value based on univariate analysis of variance controlling for poverty level
[3] Kcal = total calories
[4] CHO = carbohydrates
[5] SFA = saturated fatty acids
[6] MFA = monounsaturated fatty acids
[7] PUFA = polyunsaturated fatty acids

Dietary sources of vitamin D, calcium, and magnesium

A variety of food sources that supplied vitamin D, calcium, and magnesium in the diets of the women participating in the D.R.E.A.M. study, based on analysis of the 24 hour recalls (Table 3). Using the NDS-R system, analysis of food sources that contained at least 0.15 mcg of vitamin D, 15 mg of calcium, and 15 mg of magnesium was conducted (24). For vitamin D, some of the foods that provided this nutrient in higher quantities were chicken, milk, eggs, fish, beef, bread, pork, cereals, and ice cream. Sources of calcium included water (bottled), chicken, cheese, milk, greens (turnips and collard greens), eggs, romaine lettuce, orange juice (regular and fortified), bread (white, wheat, biscuits, and buns), cereal, fish, yogurt, oatmeal, cookies and pies, and ice cream. Foods that supplied magnesium were chicken, bread, fruit (banana), potatoes, orange juice, beans, greens, beef, cereals, fish, yogurt, peanuts, milk, and some vegetables (green beans, tomatoes, broccoli).

Table 3. Dietary sources of Vitamin D, Calcium, and Magnesium per serving

Vitamin D	**Calcium**	**Magnesium**
chicken	water	chicken
milk	chicken	bread
egg	cheese	fruit (banana)
fish	milk (milk + soymilk)	potatoes
beef	greens (turnips + collard greens)	orange juice
bread	eggs	beans
pork	romaine lettuce	greens
cereals	orange juice (regular + fortified)	beef
ice cream	bread (white, wheat, biscuits, buns)	cereals
	mixed vegetables (frozen)	fish
	cereal	yogurt
	fish	peanuts
	yogurt	milk
	grits	vegetables (green beans, tomatoes, broccoli)
	oatmeal	
	cookies + pies	
	green beans	
	ice cream	

Intake of Dairy products

Dairy consumption of the two groups of women is presented in Table 4. As observed with selected nutrient intake, average consumption of dairy products was below what is recommended for women aged 45-70 years, which is 3 cups of dairy products per day.

Between group analysis

No statistically significant differences were detected between the two groups of women during the three time intervals of data collection using repeated ANOVA, and while controlling for the mean household income, for total dairy products ($p = 0.591$), whole fat dairy products (0.381), and low fat dairy products ($p = 0.933$) (Table 4).

Table 4. Average dairy product[1] consumption at baseline, 8 weeks, 12 weeks (mean ± SE)[2]		
	Usual care	**Intervention**
	N=18	N=11
Baseline (# of servings)		
Total dairy products	1.19 ± 0.25	1.09 ± 0.27
High fat dairy products[3]	0.98 ± 0.23	0.89 ± 0.30
Low fat dairy products[4]	0.12 ± 0.06	0.09 ± 0.09
8 weeks (# of servings)		
Total dairy products	1.04 ± 0.30	1.78 ± 0.63
High fat dairy products	0.88 ± 0.28	1.01 ± 0.50
Low fat dairy products	0.06 ± 0.04	0.56 ± 0.33
12 weeks (# of servings)		
Total dairy products	1.26 ± 0.31	1.14 ± 0.55
High fat dairy products	0.96 ± 0.26	0.91 ± 0.55
Low fat dairy products	0.14 ± 0.06	0.15 ± 0.10
Overall p-values[5]		
Total dairy products	p = 0.591	
High fat dairy products	p = 0.381	
Low fat dairy products	p = 0.933	

[1] Daily recommendation of dairy products based on 2005 My Pyramid is of 3 cups (http://www.mypyramid.gov/pyramid/milk.html)

[2] Poverty level was used as a covariate for the analysis

[3] High fat dairy products = milk products that have 3.5% fat (whole milk, whole flavored milk, cheeses with 24-33 % fat (natural and processed), cottage cheese with 4% fat, yogurt with 3-4% fat (sweetened whole milk yogurt, artificially sweetened whole milk yogurt), and frozen dairy dessert

[4] Low fat dairy products = milk products with <1% fat (low fat milk, fat free milk, low fat flavored milk, fat free flavored milk), cheese with 1% fat (low fat cheese, fat free cheese), yogurt with < 1% (sweetened milk yogurt, artificially sweetened milk yogurt).

[5] P-value based on repeated ANOVA analysis

Within group analysis

Using paired T-test analysis, for the usual care group, the intake of total dairy products did not significantly change from baseline to the 8 week interval (p =0.650) and from the 8 week to the 12 week time point (p =0.537) (Table 5). The same was observed with the intake of high fat dairy products; no difference was seen from baseline to 8 weeks (p =0.785) nor from the 8 week time point to the 12 week one (p =0.824). For low fat dairy products consumption, there were no change from baseline to 8 weeks (p = 0.866) or from this time point to the 12 week follow-up (p = 0.266).

For women in the intervention group, no difference in consumption of total dairy products occurred from baseline to the 8 week interval (p=0.261), or from the 8 week to the 12 week time point (p =0.459). Intake of high fat dairy products did not significantly differ from baseline to the 8 week time point (p =0.760) nor from the 8 week to the 12 week time point (p=0.907). The same was observed with consumption of low fat dairy, with no change taking place from baseline to the 8 week time point (p =0.201) or from 8 week to the 12 week time interval (p =0.219) (Table 5).

Table 5. Mean Change Score for Calculated Dietary Consumption of Dairy Products Servings

	Usual care group N= 18		**Intervention group** N=11	
	Mean change ± SE	p value	Mean change ± SE	p value
Baseline - 8 weeks				
Total dairy products	-0.15 ± 0.32	0.650	0.68 ± 0.57	0.261
High fat dairy products	-0.08 ± 0.30	0.785	0.12 ± 0.39	0.760
Low fat dairy products	-0.06 ± 0.06	0.399	0.46 ± 0.34	0.201
8 weeks - 12 weeks				
Total dairy products	0.22 ± 0.35	0.537	-0.63 ± 0.82	0.459
High fat dairy products	0.08 ± 0.33	0.824	-0.10 ± 0.81	0.907
Low fat dairy products	0.09 ± 0.08	0.266	-0.41 ± 0.31	0.219
Baseline -12 weeks				
Total dairy products	0.07 ± 0.35	0.841	0.05 ± 0.67	0.938
High fat dairy products	-0.01 ± 0.29	0.977	0.03 ± 0.66	0.970
Low fat dairy products	0.03 ± 0.05	0.582	0.06 ± 0.14	0.705

Consumption of Vitamin D, Calcium, and Magnesium

The women did not significantly change their consumption of vitamin D, calcium, and magnesium throughout the duration of the study (Table 6).

Between group analysis

No statistically significant differences were detected, after controlling for the mean household income, using repeated ANOVA between the two groups at any of the three time points of the study for consumption of vitamin D ($p = 0.768$), calcium ($p = 0.216$), and magnesium ($p = 0.949$) (Table 6).

Table 6. Vitamin D[1], Calcium[2], and Magnesium[3] Intake from Diet at Baseline, 8-weeks, and 12-weeks[4].
(mean ± SE)

	Usual Care	Intervention
	N=18	N=11
Baseline		
Vitamin D-µg/d	2.94 ± 0.48	3.39 ± 1.14
Calcium-mg/d	597.45 ± 83.49	567.91 ± 76.07
Magnesium-mg/d	214.90 ± 20.60	236.05 ± 26.26
8 weeks		
Vitamin D-µg/d	2.59 ± 0.68	3.32 ± 1.32
Calcium-mg/d	468.65 ± 65.11	496.66 ± 110.28
Magnesium-mg/d	181.85 ± 21.41	199.51 ± 22.09
12 weeks		
Vitamin D-µg/d	2.36 ± 0.40	2.17 ± 0.57
Calcium-mg/d	543.14 ± 83.13	554.72 ± 81.24
Magnesium-mg/d	172.51 ± 13.76	230.15 ± 24.71
Overall p-values[5]		
Vitamin D	p = 0.768	
Calcium	p = 0.216	
Magnesium	p = 0.949	

[1] DRI for Vitamin D = 10 µg/d (51-70y) (http://www.iom.edu/Object.File/Master/21/372/0.pdf)
[2] DRI for calcium = 1200 mg/d (51-70y) (http://www.iom.edu/Object.File/Master/7/294/0.pdf)
[3] DRI for magnesium = 320 mg/d (51-70y) (http://www.iom.edu/Object.File/Master/7/294/0.pdf)
[4] Poverty level was used as a covariate for the analysis
[5] P-value based on repeated ANOVA analysis

Within group analysis

In terms of vitamin D intake, the usual care group did not significantly change consumption from baseline to the 8 week interval (p =0.630) or from 8 week to the 12 week time points (p=0.747) (Table 7). For calcium, the same group did not significantly change the consumption of this nutrient from baseline to the 8 weeks (p=0.145) or from the 8 week to the 12 week time point (p=0.155). With magnesium, no significant differences in intake were observed from baseline to 8 weeks (p =0.192) or from the 8 week to the 12 week time point (p=0.632).

The intervention group had no significant change in terms of vitamin D consumption from baseline to 8 week (p =0.958) or from the 8 weeks to the 12 week time point (p=0.436). No significant difference in terms of calcium intake were observed from baseline to the 8 week interval (p = 0.688) or from 8 weeks to the 12 weeks (p =0.649). For magnesium, this group of women did not significantly change their intake from baseline to 8 weeks (p = 0.278) or from 8 week to the 12 week time interval (p=0.342) (Table 7).

Table 7. Mean Change Score for Calculated Dietary Consumption of Vitamin D, Calcium, and Magnesium

	Usual care group N= 18		**Intervention group** N=11	
	Mean change ± SE	p value	Mean change ± SE	p value
Baseline - 8 weeks				
Vitamin D	-0.35 ± 0.71	0.630	-0.07 ± 1.21	0.958
Calcium	-128.80 ± 84.30	0.145	-71.25 ± 172.09	0.688
Magnesium	-33.05 ± 24.33	0.192	-36.54 ± 31.88	0.278
8 weeks - 12 weeks				
Vitamin D	-0.23 ± 0.71	0.747	-1.16 ± 1.42	0.436
Calcium	74.49 ± 19.14	0.155	58.06 ± 123.93	0.649
Magnesium	-9.34 ± 81.20	0.632	30.63 ± 30.71	0.342
Baseline -12 weeks				
Vitamin D	-0.58 ± 0.49	0.250	-1.22 ± 1.18	0.326
Calcium	-54.31 ± 23.22	0.586	-13.19 ± 105.46	0.903
Magnesium	-42.38 ± 98.52	0.086	-5.91 ± 30.53	0.851

Adherence to the DRI recommendations

In terms of the Dietary Reference Intakes (DRIs), mean intakes of both groups of women did not meet the recommended intakes for vitamin D, calcium, and magnesium, with the intake of vitamin D being the lowest out of the three (< 35 % DRI) (Table 8). In addition, no changes were seen in terms of the adherence to the DRI over time for both groups of women.

Table 8. % Recommendation of the two groups to the DRI[1]		
	% DRI Usual Care	**% DRI Intervention**
Baseline		
Vitamin D	29.40	33.90
Calcium	49.80	47.30
Magnesium	67.20	73.80
8 weeks		
Vitamin D	25.90	33.20
Calcium	39.10	41.40
Magnesium	56.80	62.30
12 weeks		
Vitamin D	23.60	21.70
Calcium	45.30	46.20
Magnesium	53.90	71.90

[1] DRI for calcium, vitamin D, and magnesium (http://www.iom.edu/Object.File/Master/7/294/0.pdf)

Discussion

In this study, African American women ages 45 years and older did not meet the 2005 My Pyramid recommendation of three servings of dairy products per day (22). These women also consumed more servings of high-fat than low-fat dairy products, and did not improve significantly their intake of total servings of dairy products as a result of the participation either in nutrition and lifestyle intervention classes (intervention group) or after receiving the class handouts to review on their own (usual care group).

MyPyramid Food Guidance System, which was created by the United States Department of Agriculture (25), is a useful tool for people to determine if they are consuming the suggested amounts of foods in the different categories of the pyramid. For the Milk category, which includes products such as milk, yogurt, cheese, and milk-based desserts, such as ice cream, ice milk, frozen yogurt, and puddings, the quantity of food that should to be eaten is related to the age and physical activity of a person. For the group of participants enrolled in the D.R.E.A.M. study, who are women over the age of 45 and who on average exercise less than 30 minutes per day, the daily recommended amount is at least three cups of dairy products. At baseline, neither group consumed the recommended minimum three cups of dairy products per day. Ranganathan et al. (26) report that African American women over the age of 30 years consume 1.19 mean servings of dairy per day, which is similar to what our women were consuming at baseline, 1.19 mean servings for the usual care group and 1.09 mean servings for the intervention group. The participants in the D.R.E.A.M. study reported consuming more dairy foods compared to African American women, over the age of 51 years, who

participated in the CSFII 1994-1996,1998 (0.69 mean servings) and African American women, over the age of 51 years from the NHANES 1999-2000 (0.63 mean servings). Fulgoni et al. and Ranganathan et al. also report that African Americans consume significantly fewer servings of milk, cheese, and yogurt compared to Caucasians (14; 26). These authors note that these findings can likely be explained by the fact that the African American population has a high incidence of lactose intolerance (27, 28). The design of project D.R.E.A.M., did not inquire about the prevalence of lactose intolerance of the participants.

For both groups of women in this study, more servings of high-fat dairy products versus low-fat ones were consumed. Similarly, Ranganathan et al. (26) also reported that African Americans prefer consuming whole-fat dairy products instead of low-fat ones. A study by James conducted focus groups with 40 African American men and women and reported that a long-term belief of the participants was to "drink whole milk instead of skim or low-fat milk" (29). However, the results from this study reported here do not agree with the findings of Appel et al. in which African Americans who participated in the DASH trial did change their consumption of dairy to low-fat products (15).

Throughout the duration of this study, the two groups of women did not improve their total intake of dairy products and did not increase their intake of low-fat dairy products instead of high-fat ones. While the women in the intervention group did increase their consumption of total dairy products, high fat dairy products, and low fat dairy products from baseline to the 8 week interval, this practice decreased at the 12 week time point. Even though these results are not statistically significant, they do suggest that

the intervention has potential beneficial effects for this group of women. A possible explanation for not seeing a significant increase in this area of the diet is because the D.R.E.A.M. study educational materials did not specifically target an increase in consumption of dairy products in this population which is at risk for type 2 diabetes. One of the aims of this study was to have the women improve their dietary practices overall (reduce total calorie intake, reduce dietary fat intake, and reduce percent of total calories from fat) and to achieve a more defined pattern of eating, such as consumption of three daily meals and a snack. The only instance when information on dairy foods intake was presented during the study was in Week 4, when the 2005 My Pyramid was discussed. The participants received a handout on Calcium Rich Foods, which promoted consumption of dairy products, with particular attention placed on low-fat alternatives. Tips were also offered to women who were lactose intolerant to consume cheese, yogurt, or lactose free milk or take the enzyme lactase before eating dairy products. Other reasons why no significant increase in dairy product intake was observed may be due to the high prevalence of lactose intolerance and lactose maldigestion in the African American population (27; 28). The sample size of the current study is small, with only 18 women enrolled in the usual care group and 11 in the intervention group, and could be another reason why no significant differences were seen between the two groups of women. Also, the D.R.E.A.M. study is a pilot feasibility study, whose main purpose is to evaluate the effectiveness of peer-led nutrition and lifestyle education on the risk of type 2 diabetes in the participating women. Because of this design, one of the main aims of the project involves process evaluation to discover how well the intervention is delivered

and received and to provide data on what, how, why, and for whom this program works. This study was not designed to alter consumption of dairy products specifically, which may help explain why no significant difference in dairy product consumption was detected between the two groups of women.

Analysis of the energy and selected nutrient intake related to dairy products was also performed. At all time points of the study, the women in both groups were consuming less than the DRIs for vitamin D, calcium, and magnesium and no improvements were seen at the 8 week or 12 week time intervals. This finding is supported by Harris and Moore et al. who state that vitamin D intake is low in the African American population due to low consumption of milk and milk products (30; 31). Other studies report that intake of vitamin D from food of African American women, over the age of 50 is of 3.3 μg and 3.7 μg per day (26; 30). The intake of vitamin D from diet for the women in both the usual care and intervention group was less at baseline compared to the other studies (2.94 μg and 3.39 μg, respectively) and continued to decline as the study progressed. For calcium and magnesium intake, similar results were reported by Fulgoni et al. who discovered that African Americans have lower mean daily intakes of calcium (495 mg) and magnesium (198 mg) compared to non-African Americans, and that the intake of these two nutrients in the same population increases as the number of dairy servings increase (14; 26). At the baseline time point, the women in both the usual care and intervention groups had higher intakes of calcium (597.5 mg vs. 567.9 mg, respectively) and magnesium (214.9 mg vs. 236.1 mg, respectively) compared to the women in the study Fulgoni et al.

Limitations

There are several limitations to this research which should be recognized. One of these is the small number of participants included in this analysis. Although the target for project D.R.E.A.M. is 30 women in each of the two groups, at the time of the analysis only 18 women were enrolled in the usual care group and 11 in the intervention group. A larger sample may permit detection of significant differences between the two groups of participants.

Another limitation is the use of the 24 hour recall method to estimate dietary intake. Some of the issues encountered with this intake method include underreporting or overreporting of certain food items (32, page 82). Also, one recall might not be representative of a person's usual intake and only one recall per interview was done at each of the three time points. The NDS-R system, a multiple pass interview, was used to obtain the reported intake of the participants because it addresses this limitation through a question probing whether the previous day's intake was representative of the usual diet. However, the 24 hour recalls obtained were identified as being representative of the women's usual diet. In addition, it was assumed that participants were truthful in reporting their 24 hour intakes and did not report what the researchers "wanted to hear". To help assure this, the researchers emphasized the importance of accurate reporting and no judgments of "good" or "bad" foods were conveyed to the participants during the 24 hour recall data collection.

Future research

Future research is needed to evaluate the associations between dietary intake, physical activity and risk reduction of diabetes in African American women so that appropriate nutrition education programs can be developed for this particular population. Since this population has an increased risk of developing type 2 diabetes, special attention should be paid to their dietary practices. Dietary modifications have proven to be successful as preventative measures against diabetes mellitus (7). Certain food items, such as dairy products, and specific nutrients have been associated with a risk reduction of diabetes (9; 10; 11; 12; 13;). More research is needed to explore the link between intake of dairy products in African Americans and any reduction in the incidence of diabetes. To date, only one study has focused on consumption of this food group in African American women, while another used a mixed population sample to explore this relationship in terms of risk reduction of diabetes (11; 12; 13). Additional research is needed to discover ways of improving dairy product consumption in the African American population, which is known to consume low amounts of these products overall (14; 26). Furthermore, new investigations need to be conducted to identify ways to motivate this population to change from consuming high-fat dairy to low-fat dairy products, which have been shown to have greater effects on the risk reduction of diabetes. A last possible area of research is to investigate whether dairy products that are offered as alternatives for people suffering from lactose intolerance (Lactaid products) have the same beneficial effects on risk reduction of diabetes as the regular dairy products.

Conclusion and implications

African American women who participated in the D.R.E.A.M. study were not consuming the recommended amounts of dairy products that are appropriate for their age. Also, these women appear to have a preference for consuming high-fat dairy products instead of low-fat ones. Likely, due to the decreased consumption of dairy products, their intake of vitamin D, calcium, and magnesium from food are below the recommended DRIs. Since African American women aged 45 years and older have an increased risk for type 2 diabetes, nutrition education to improve dietary intake of dairy products and their associated nutrients may help reduce the incidence of this disease. More research to clearly discover effective ways of preventing diabetes through diet and physical activity is needed.

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CHAPTER IV

EPILOGUE

I started working on my research under the guidance of Dr. Taylor during the second year of my master's degree program. My fellow colleague, Carinthia Cherry was developing her research project for the doctoral program at UNCG, and Dr. Taylor introduced her topic to me. Carinthia's main research interest was to evaluate the efficacy of an 8-week nutrition and lifestyle education program delivered by a peer-educator for risk reduction education about Type 2 diabetes among African-American women ages 45 years or older. After reviewing this proposal, I started thinking about a dietary component that is important in the risk reduction of diabetes, and after researching several foods I decided to focus on the impact of dairy products on this disease. I read several articles that focused on the consumption of dairy foods and their positive impact of lowering the risk of diabetes. I decided that this was an interesting topic to explore in the population of the study. I thought these were beneficial foods also due to the fact that women have increased risk of developing other health conditions related to dairy product consumption, such as osteoporosis, as they get older.

To formulate my research questions for my proposal, I investigated further the topic of diabetes, older adults, dairy product consumption in older populations, and the challenges older adults have in meeting a healthy diet appropriate for their age. This literature search gave me a new insight on the issues of disease and diet in the elderly. I

decided to explore the consumption of dairy products in the women's population participating in the study and to see if this dietary practice improves after receiving nutritional information on different aspects of eating.

During the fall semester of my second year in the master degree program, I spent part of my time working on formulating my proposal and the research questions for my part of the project. I reviewed the general concept of the D.R.E.A.M (Diabetes Risk-Educating African American Matriarchs) project and became familiar with the scope of the intervention. I also actively participated in the development of handouts for the different topics of the project (Traditional Breakfast, Fast Food Breakfast, Building a Better "Healthy" Lunch). Part of my research time was spent working on the creation of the lessons for the 8-weeks of the Peer Educator Manual for the intervention group.

During spring 2008 we actively started recruitment of the participants from the two churches that had agreed to take part in our study. We also chose two women from the intervention church to be the peer-educators of the 8-week classes. These women and the research team were trained by a Certified Health Educator Specialist at UNCG on the principles of being a peer educator. The interviews started initially with participants in the usual care group, and then 6 women were interviewed for enrollment in the first 8 week-class held at the intervention church (intervention group). All participants were interviewed at the 8 and 12 week follow-up. It was easier to get people enrolled in the control group, since these women only had to go through 3 interviews with the researchers and to get 3 blood draws at a local laboratory. The intervention group was harder to recruit since they had to devote an extra 8 hours of class time to the project in

addition to the interviews and the blood draws. We relied on the peer educator and other participants to help enlist future women for our study, in addition to the congregational nurse who supported our project.

Following completion of recruitment of 18 participants in the control group and 11 in the intervention group, I started to analyze the data based on the three research questions I formulated in the proposal. I was interested in the consumption of dairy products by the women in both groups at baseline, and the types of products they were eating (low-fat vs. high-fat dairy products). In addition, I investigated if all of the women had changed their dietary habits and consumed more low-fat dairy products instead of high-fat ones, and if there was any difference in this practice between the two groups (control vs. intervention).

One of the most interesting parts of this research for me was the 24-hour recalls conducted on the diets of the women. The Nutrition Data System for Research (NDSR) software package was the most important tool used to get an accurate dietary profile of the participants. I was impressed by the choice of foods that were offered by the program and of the nutrient analysis that it performed. With the help of this software I was able to see the exact consumption of dairy products of the participants, along with the nutrients deficiencies and excesses of the women.

While carrying out this study, I learned new information about community based research. First, it is important to establish partnerships within the community. This was a significant aspect of our research because it helped with the recruitment of participants and it helped to gain the trust of the women interested in the program. Also, I learned

some of the difficulties associated with recruitment for long term projects. Some of the inconveniences expressed by the participants in the intervention group included the time involved in attending the classes, along with the difficulties in scheduling to have the blood work performed. In addition, it is critical to share the results of the research with the participants, along with their progression throughout the study in order to encourage them to continue performing the new dietary and physical habits they developed while enrolled in the program.

I also had the opportunity to learn about foods that are being consumed in the African American community. Before I participated in this study, there were certain foods, such as collard greens and turnip greens, that I was not familiar with. After conducting the 24 hour recalls, I observed that these are some of the favorite foods for our participants and I got some insight on the cooking techniques used with these products. Another interesting fact for me to acknowledge was that the two African American churches that are part of our study are of different religion (one church is Lutheran and the other one is Baptist). I come from a country where we have just two religions: Catholics and Eastern Orthodox. Here in the US there are many and diverse religions, and I learned that it is important to be respectful of everyone's beliefs.

More research is needed to help prevent the risk of type 2 diabetes in the elderly and in ethnic minorities. More interventions need to be applied to improve the diets of older adults who are at risk for chronic diseases, such as diabetes. It is important to explain the reasons for making these changes, because sometimes participants receive information on certain dietary adjustments they should make but do not get enough

explanation on why it is important to make these changes. Also, it is essential to stress the importance of calcium and vitamin D not only for diabetes, but also in preventing the risk of other diseases, such as osteoporosis. There are varieties of food products that are good sources of these two nutrients but the public is not aware of them and continues to believe that only dairy products are the main dietary sources. Future research should focus on further examination of the connection between dairy product consumption in African American women and risk reduction of diabetes, modes of improving dairy product intake in African Americans, and ways to help this population to consume low-fat dairy products instead of high-fat ones.

APPENDIX A

SUPPLEMENTARY TABLE

Table 1. Dairy product and dietary nutrient intake at baseline (mean ± SE)		
	Usual Care Group N= 18	**Intervention Group** N=11
Baseline measure		
Total dairy products	1.19 ± 1.05	1.09 ± 0.88
High fat dairy products[1]	0.98 ± 0.98	0.89 ± 0.99
Low fat dairy products[2]	0.12 ± 0.27	0.09 ± 0.30
Vitamin D-µg/d[3]	2.94 ± 2.05	3.39 ± 3.79
Calcium-mg/d[4]	597.45 ± 354.25	567.91 ± 252.29
Magnesium-mg/d[5]	214.90 ± 87.39	236.05 ± 87.08

[1] High fat dairy products = milk products that have 3.5% fat (whole milk, whole flavored milk, cheeses with 24-33 % fat (natural and processed), cottage cheese with 4% fat, yogurt with 3-4% fat (sweetened whole milk yogurt, artificially sweetened whole milk yogurt), and frozen dairy dessert

[2] Low fat dairy products = milk products with <1% fat (low fat milk, fat free milk, low fat flavored milk, fat free flavored milk), cheese with 1% fat (low fat cheese, fat free cheese), yogurt with < 1% (sweetened milk yogurt, artificially sweetened milk yogurt).

[3] DRI for Vitamin D = 10 µg/d (51-70y) (http://www.iom.edu/Object.File/Master/21/372/0.pdf)

[4] DRI for calcium = 1200 mg/d (51-70y) (http://www.iom.edu/Object.File/Master/7/294/0.pdf)

[5] DRI for magnesium = 320 mg/d (51-70y) (http://www.iom.edu/Object.File/Master/7/294/0.pdf)

APPENDIX B

FORMS AND QUESTIONNAIRES

Diabetes Risk Test

	Yes	**No**
1. My weight is equal to or above that listed in the chart below.	5pts	0pts
2. I am under 65 years of age **and** I get little or no exercise during a usual day?	5pts	0pts
3. I am between 45 and 64 years of age.	5pts	0pts
4. I am 65 years old or older.	9pts	0pts
5. I am a woman who has had a baby weighing more than nine pounds at birth?	1pt	0pts
6. I have a sister or brother with diabetes.	1pt	0pts
7. I have a parent with diabetes.	1pt	0pts
Total Points:	_____	

What your score means:

0-2	Very low risk	**3-9**	Low to medium risk	**10+**	High risk

At-Risk Weight Chart

Height in feet and inches without shoes	**Weight in pounds without clothing**
4'10"	129
4'11"	133
5'0"	138
5'1"	143
5'2"	147
5'3"	152
5'4"	157
5'5"	162
5'6"	167
5'7"	172
5'8"	177
5'9"	182
5'10"	188
5'11"	193
6'0"	199
6'1"	204
6'2"	210
6'3"	216
6'4"	221

General Health Questionnaire
ID Number: _____
Date: _____

Project D.R.E.A.M.

(Diabetes Risk- Educating African American Matriarchs)

Department of Nutrition
UNC – Greensboro

Welcome to our session. We are very glad that you are willing to help us with this project. My name is _____ and I represent the University of North Carolina at Greensboro. Assisting me is _____, also from the University of North Carolina at Greensboro. We will ask you a few questions about yourself and current health related information. We should be able to complete this session in 45 minutes or less.

Before we begin, let me remind you of some ground rules. This is strictly a research project to help us better understand the nutritional status of older adults in Guilford County. Please answer the questions based on your own situation. There are no right or wrong answers. We are interested only in your own situation. Everything will be kept strictly confidential; your name will not be associated with any of the information we assemble.

Do you have any questions now? If you have any questions about our project or our questionnaire, please ask me whenever you want.

I. Sociodemographics

1a. Age: _____ years

2a. How many years of school did you complete?

1. ≤ 8th grade
2. some high school
3. high school or GED
4. vocational training (beauty school; truck driver, etc.)
5. associate degree (2 years)
6. B.S. degree (4 years) or above

3a. What is your household monthly income? _____

4a. How many people live in your household? _____

5a. What is your marital status?

1. married
2. widowed/divorced/separated/single

II. General Health

(Use the calibrated scale and measuring equipment to obtain measures of weight and height)

1a. Height: _____cm (+/- 0.1)
_____cm (+/- 0.1) [Average: _____cm]

2a. Weight: _____kg (+/- 0.1)
_____kg (+/- 0.1) [Average: _____ kg]

3a. Waist circumference: _____cm(+/- 0.1)
_____cm(+/- 0.1) [Average: _____cm]

4a. Hip circumference: _____cm(+/- 0.1)
_____cm(+/- 0.1) [Average: _____ cm]

5a. Sagital Diameter: _____cm(+/- 0.5)
_____cm(+/- 0.5) [Average: _____cm]

6a. What is your amount of moderate or vigorous activity (such as brisk walking, jogging, biking, aerobics, or yard work) you do in addition to your normal routine, **most days**?

1. < 30 minutes
2. 30-60 minutes

3. > 60 minutes

7a. Has your appetite changed during the past 6 months.
1. No 2. Yes

7b. If yes, has it:

1. Decreased 2. Increased

8a. Have you lost weight over the past 6 months?

1. No 2. Yes

8b. If yes, you trying to lose weight?

1. No 2. Yes

9a. Do you smoke? 1. No 2. Yes

9b. If yes, how many cigarettes, packs, cigars, pipes, etc., per week? _____

III. Health Status

1a. Which of the following health conditions do you have or have had?
(Circle all the conditions that apply)

1. Coronary heart disease or acute myocardial infarction (heart attack, coronary heart disease, heart bypass surgery or angioplasty, angina)
2. Chronic obstructive pulmonary disease (chronic bronchitis, emphysema)
3. Chronic heart failure (heart failure, enlarged heart, fluid in lungs)
4. Stroke
5. Asthma
6. High blood pressure or hypertension
7. Diabetes
8. Arthritis
9. Cancer
10. Cataracts
11. Hearing trouble/using a hearing aid
12. Hip Fracture
13. Other _____

1b. Does your spouse or someone in your immediate household have diabetes?

1. No 2. Yes

1c. If yes, who?

_____
_____
_____
_____
_____

2a. How do you think your own health status compares with others at your same age?

1. Excellent
2. Good
3. Fair
4. Poor

3a. Are you currently taking any prescription drugs?

1. Yes 2. No

3b. If yes, what are they and how often do you take them?

_____
_____
_____
_____
_____
_____

4a. Are you currently taking any non-prescription drugs? (aspirin, allergy medicine, other over-the-counter drugs, etc.)

1. Yes 2. No

4b. If yes, what are they and how often do you take them?

_____
_____
_____
_____
_____

5a. Do you have enough money to buy the foods you need most of the time?

1. Yes 2. No

6a. In the past 6 months, have you skipped one or more meals because you had no food in the house or you thought that soon you might not have enough food?

1. Yes 2. No

7a. In the past 6 months, have you had to choose between buying food and paying bills or buying something else that you needed?

1. Yes 2. No

IV. Other

1a. Have you ever or are you currently participating in any nutrition or lifestyle education programme?

1. Yes 2. No

1b. If yes, when, where, and who provided the programme?

_____
_____
_____
_____
_____

Thank you very much for your time and patience. We have finished today's questions. Do you have any questions? Once again thanks for your time and cooperation.

ID#:_____
Date: _____

Stages of Change for Healthy Eating

Interviewer: *Ask the participant to give you their 'definition' of a healthy diet. Record responses below.*

Interviewer: *I am going to read five statements aloud once, then read through the statements again. Stop me when you hear the statement that best represents your situation based on 'your' definition of a healthy diet.*

The statements are:

1. I do not eat a healthy diet, and I do not plan to change in the next 6 months.
2. I am thinking about changing my diet, and I will begin in the next 6 months.
3. I am planning to change my diet in the next 30 days.
4. I am eating a healthy diet, and I made these changes in the past 6 months.
5. I am eating a healthy diet, and I made these changes more than 6 months ago.

1 = Precontemplation
2 = Contemplation
3 = Preparation
4 = Action
5 = Maintenance

ID#:_____
Date: _____

Food Habit Factors Questionnaire

1. Do you limit or restrict the amount of high-sugar foods that you eat?
   1 = Yes **2= No**

   Which foods?

2. Do you limit the size of the portions that you eat?
   1 = Yes **2= No**

   Any particular foods you do this with?

3. Do you eat desserts?
   1 = Yes **2= No**

3b. How frequently?

4. Do you limit the amount of high-fat foods that you eat?
   1 = Yes **2= No**
   Which foods?

5. Do you choose low-fat menu items?
   1 = Yes **2= No**
   Which foods?

6. Do you eat low-fat foods for breakfast?
   1 = Yes **2= No**
   Which foods?

7. Do you often you eat at buffets, fast-food, and large chain restaurants?
1 = Yes **2= No**

7b. How many times per week and which nights?

7c. What restaurants do you go out to eat most often?

8. When eating out, do you eat high-fat and high-carbohydrate menu items?
1 = Yes **2= No**
Which foods?

9. Do you eat main course items with red meat, fried meat, seafood, fish, and sandwich meats?
1 = Yes **2= No**
Which foods?

10. Do you regularly eat 3 meals per day?
1 = Yes **2= No**

11. Do you eat low-fat foods for lunch?
1 = Yes **2= No**
Which foods?

12. Do you take time to plan meals in advance?
1 = Yes **2= No**
Which things do you do?

13. Do you eat two vegetables for dinner or a combination of one vegetable and a salad at the main meal of the day?
1 = Yes **2= No**
Which do you do?

14. Do you often eat vegetables at both lunch and dinner?

1 = Yes **2= No**

14b. Do you eat more than one vegetable serving a day?

1 = Yes **2= No**

How do you do that?

15. Do you limit the amount of starchy food or bread that you eat?

1 = Yes **2= No**

Which foods?

ID#:_____
Date:_____

The Seven-Day Activity Recall

First, I would like to ask you some general questions about your work.

1. *Were you employed in the last seven days?* ____No (skip to Q#4)
   ____Yes

2. *How many days of the last seven did you work?* ____days

3. *How many total hours did you work in the last seven days?* ____hours last week

4-5. *What two days do you consider your weekend days?* _____

_____

Now, we would like to know about your physical activity during the past 7 days. But first, let me ask you about your sleep habits.

6. *On the average, how many hours did you sleep each night during the last five nights (Sunday-Thursday)?* _____hours

7. *On the average, how many hours did you sleep each night last Friday and Saturday nights?* _____hours

Now, I am going to ask you about your physical activity during the past 7 days, that is, the last 5 weekdays, and the last weekend, Saturday and Sunday. We are not going to talk about light activities such as slow walking, light housework, or unstrenuous sports such as bowling, archery, or softball. Please look at this list which shows some examples of what we consider moderate, hard, and very hard activities. (*Interviewer: hand subject card and allow time for the subject to read it over*.) People engage in many other types of activities, and if you are not sure where one of your activities fits, please ask me about it.

8. First, let's consider moderate activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these moderate activities or others like them? Please tell me to the nearest half hour. _____hours

9. Last Saturday and Sunday (or "days off" *if Saturday and Sunday are not days off*), how many hours did you spend on moderate activities and what did you do? (*Probe*: Can you think of any other sports, job, or household activities that would fit into this category?) _____hours

10. Now, let's look at hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these hard activities or others like them? Please tell me to the nearest half hour. _____hours

11. Last Saturday and Sunday (or "days off" *if Saturday and Sunday are not days off*), how many hours did you spend on hard activities and what did you do? (*Probe*: Can you think of any other sports, job, or household activities that would fit into this category?) _____hours

12. Now, let's look at very hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these very hard activities or others like them? Please tell me to the nearest half hour. _____hours

13. Last Saturday and Sunday (or "days off" *if Saturday and Sunday are not days off*), how many hours did you spend on very hard activities and what did you do? (*Probe*: Can you think of any other sports, job, or household activities that would fit into this category?) _____hours

14. Compared with your physical activity over the past 3 months, was last week's physical activity more, less, or about the same?
    _____More
    _____Less
    _____About the same

Interviewer: Please list any activities reported by the subject which you don't know how to classify. Flag this record for review and completion.

Activity (brief description)	Hours: workday	Hours: weekend or day off

Examples of Activities in Each Category

Moderate activity produces feelings similar to those accompanying brisk or fast walking.

Hard activity produces feelings that are between the feelings that go with moderate and very hard activities.

Very hard activity produces feelings similar to those of running and jogging.

Moderate Activity

Occupational tasks:

1) delivering mail or patrolling on foot
2) house painting; and
3) truck driving (making deliveries, lifting and carrying light objects).

Household activities:

1) raking the lawn;
2) sweeping and mopping;
3) mowing the lawn with a power mower; and
4) cleaning windows.

Sports activities (actual playing time):

1) volleyball;
2) Ping-Pong;
3) brisk walking for pleasure or to work (3 miles/hour) or 20 minutes each time;
4) golf, walking and pulling clubs; and
5) calisthenics or aerobic exercises.

Hard Activity

Occupational tasks:

1) heavy carpentry;
2) construction work, doing physical labor.

Household activities:

1) scrubbing floors.

Sports activities (actual playing time):

1) tennis doubles;
2) disco, square, or folk dancing.

Very Hard Activity

Occupational tasks:

1) very hard physical labor, digging or chopping with heavy tools; and
2) carrying heavy loads such as bricks or lumber.

Sports activities (actual playing time):

1) jogging or swimming;
2) singles tennis;
3) racquetball; and
4) soccer