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The *Dietary Guidelines for Americans* identify dietary recommendations designed to prevent and/or manage chronic disease among all persons two years of age and older. This study sought to determine dietary adherence among a convenience sample of community living older adults in central North Carolina to the 2005 *Dietary Guidelines for Americans*.

Selected variables of the Assessment of Dietary Intake, Health Status, and Biomarkers of Nutritional Status of Older Adults study (n = 101), a study that assessed nutritional status among older community living adults in central North Carolina, were evaluated. Eighty-eight participants met the study inclusion criteria (mean age 73.6$\pm$6.3 years). A food frequency questionnaire assessed dietary intake. Specific nutrient and dietary component recommendations outlined in the 2005 *Dietary Guidelines for Americans* were compared with calculated dietary intake data to determine percent of sample adherences to and percent of recommended intakes consumed by this sample.

The majority of the sample was female (84%) and Caucasian (74%), obtained a high school education or its equivalent (GED) (78%), reported a monthly income that was above the poverty threshold (78%), was overweight/obese (70%), reported being food secure (85%), and reported themselves as being more highly physically active (52%). Sixty-nine percent of this sample reported at least one nutrition-related chronic condition and 42% at least two.

Total sample percent of sample adherences to daily dietary recommendations of the 2005 *Dietary Guidelines for Americans* were lowest for whole grain (6%) and potassium (6%) recommendations, and highest for fat-related recommendations [total fat (58%), saturated fat (58%), and cholesterol (94%)]. Weekly vegetable subgroup percent of sample adherences were lowest for legumes (1%), orange (17%), and dark green (24%) vegetables, and highest for starchy (43%) and "other" vegetables (63%).

This research indicates nutrition education efforts should target the need for community living older adults in central North Carolina to increase whole grain intake, improve vegetable variety, and decrease sodium intake to improve dietary adherence to the 2005 *Dietary Guidelines for Americans*. Other messages are needed to emphasize the need for older adults in central North Carolina to further decrease their total fat and saturated fat intakes.

DIETARY ADHERENCE AMONG OLDER COMMUNITY LIVING ADULTS IN CENTRAL NORTH CAROLINA TO SPECIFIC DIETARY RECOMMENDATIONS OF THE 2005 *DIETARY GUIDELINES FOR AMERICANS*

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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CHAPTER I

INTRODUCTION

Older adults, persons aged 65 years and older, comprise the fastest growing population in the United States (U.S. Census Bureau, 2004). The fast growth in the number of older adults in North Carolina is expected to parallel that of the United States (U.S Census Bureau, 2005). High migration of older adults to North Carolina contributes to the growth of the older adult population in North Carolina (He & Schachter, 2003).

Because of the rapid growth of the older adult population, information about the nutritional and health status of this population is becoming increasingly important. Such information is especially important to older adults who wish to continue to live independently and have a high quality of life (AARP, 2002) in a time when American adults at age 65 are experiencing the highest life expectancy to date (Federal Interagency Forum on Aging Related Statistics, 2006).

Because age is an independent risk factor for chronic disease development (AARP, 2002), older adults are at an increased risk for developing nutrition-related chronic conditions/diseases (AARP, 2002), as characterized by high prevalences of obesity (Ogden et al., 2006), heart disease, stroke, cancer, and diabetes (NCHS, 2003) among this population. Nutrition-related chronic condition/disease prevalence differs among older adults by ethnicity (NCHS, 2003; Ogden et al., 2006) and gender (Federal

Interagency Forum on Aging-Related Statistics, 2006). It is also the case that older adults living in the Southern region of the United States are at a further increased risk for the development of certain chronic conditions/diseases (Howard et al., 1997) as a result of region-specific dietary intake (Hajjar & Kotchen, 2003).

Nutrition is a critical factor in chronic disease development, slowing disease progression, and reducing disease symptoms; it is also a factor involved in chronic disease prevention (American Dietetic Association, 2005a). A number of nutrients and foods are associated with chronic diseases. Some when consumed in higher amounts are associated with an increased risk for chronic disease, such as salt (Johnson et al., 2001; Sacks et al., 2001) and total fat, saturated fat, and cholesterol (Clarke et al., 1997; Howell et al., 1997; Marshall et al., 1997; Hu et al., 2001a). Others when consumed in higher amounts are associated with a reduced risk of chronic disease, such as fiber (Bazzano et al., 2003; Mozaffarian et al., 2003; Wolk et al., 1999), whole grains (Jenson et al., 2004; Liu et al., 1999; Meyer et al., 2000; Steffen et al., 2003), potassium (Morris et al., 1999; Schmidlin et al., 1999; Whelton et al., 1997) and fruits and vegetables (Appel et al., 1997; Bazzano et al., 2002).

National dietary intake data, however, indicate that older adults do not consume the recommended amount of specific food group servings and specific nutrients to reduce chronic disease risk. Older adults barely consume the recommended daily minimum number of total fruit and vegetable servings (Cook & Friday, 2005), and they do not consume the minimum number of whole grain servings (Cook & Friday, 2005). Older African Americans consume fewer fruit and vegetable servings (USDA-ARS, 1998), as

well as fewer whole grain servings (USDA-ARS, 1998), than older Caucasians. Regarding dietary potassium intake, older adults consume less than the 4700 mg/day RDA, with males consuming more than females, and Caucasian males and females consuming more than their African American counterparts (Bialostosky et al., 2002). Daily sodium intake among older adults exceeds the 1500 mg maximum designated to decrease risk for hypertension (USDHHS & USDA, 2005), with Caucasians consuming more than African Americans, and males more than females (Bialostosky et al., 2002). Furthermore, national dietary intake data indicate total fat intake (as percent of total daily calories) by older adults, regardless of gender and race (Caucasian and African American) (Bialostosky et al., 2002) approaches the 35% daily maximum recommended (USDHHS & USDA, 2005). Saturated fat intake by older adults exceeds the saturated fat recommendation (<10% of total daily calories), which is true for both males and females as well as among Caucasians and African Americans (Bialostosky et al., 2002). Cholesterol intake among older adults, however, is within the recommended daily range of < 300mg (USDHSS & USDA, 2005). This is true among males and females as well as Caucasians and African Americans, although intake by African American males (298 mg) is very close to the recommended maximum daily intake (Bialostosky et al., 2002).

The U.S. government promotes health through the *Dietary Guidelines for Americans*, guidelines published by the United States Department of Health and Human Services (USDHHS) and the United States Department of Agriculture (USDA) every five years which promote health and risk reduction for major chronic diseases through diet and physical activity (USDHHS & USDA, 2005). According to the Healthy Eating Index

(HEI), a score that indicates overall adherence to the 2000 *Dietary Guidelines*, the diets of older adults need improvement (Juan et al, 2004). The most recent edition (6th edition) of the *Dietary Guidelines for Americans* was published in January of 2005. Similar messages regarding dietary intake are presented compared to prior publications, with several changes evident: recommended fruit and vegetable intake is higher compared to prior recommendations, there is a specific total fat recommendation, there is a new recommendation for a specific number of whole grain servings to consume daily, there is a new recommendation for specific amount of legumes to be consumed weekly, the recommended maximum sodium intake has been reduced for the total population (with an even lower amount recommended for persons at increased risk for hypertension), and there is a new recommendation that stresses the consumption of potassium-rich foods to meet the potassium RDA (USDHHS & USDA, 2005).

Few studies have been published that have assessed adherence by Americans to the *Dietary Guidelines for Americans*. Several of these studies have assessed chronic disease risk in relation to dietary and/or physical activity adherence to the *Dietary Guidelines*, including cancer (McCullough et al., 2000a & 2000b; Harnack et al., 2002) and cardiovascular disease (McCullough et al., 2000a & 2000b). Although these studies suggest an association between dietary adherence to the *Dietary Guidelines for Americans* and a reduced risk for chronic disease, research is needed to determine dietary adherence to the newest *Dietary Guidelines for Americans* (6th edition, 2005). Furthermore, there is a need to assess regional variation in dietary adherence to the *Dietary Guidelines*. Since older adults are at an increased risk for chronic disease

(AARP, 2002), there is a need to evaluate dietary adherence among this population to the newest *Dietary Guidelines*. Nutrition education programs can utilize such information to target the needed dietary improvements among older adults so that their diets better adhere to the 2005 *Dietary Guidelines for Americans*.

Specific Aim

The purpose of this cross-sectional descriptive study was to determine the extent to which the diets of older community living adults in central North Carolina adhere to specific dietary recommendations of the 2005 *Dietary Guidelines for Americans*.

Research Question

1. To what extent do the diets of older community living adults in central North Carolina adhere to specific dietary recommendations of the 2005 *Dietary Guidelines for Americans*?

CHAPTER II

LITERATURE REVIEW

Growth of the Older Adult Population

The term "older adults" refers to persons aged 65 and older. The older adult population is the fastest growing population in the United States (U.S.) (U.S. Census Bureau, 2004). Projections by the U.S. Census Bureau estimate the number of older adults aged 65 and older will increase by approximately 247% between 2000 and 2050 (U.S. Census bureau, 2005).

The projected fast growth of older adults in North Carolina (NC) parallels the growth seen nationwide. The population of older adults aged 65 and older living in NC is expected to increase approximatley124% between 2000 and 2030 (U.S. Census Bureau, 2005). Migration of older adults to NC is also considerably high. NC had the 6th highest net migration rate within the U.S. among the population of persons 65 years and older between 1995 and 2000, and was ranked 2nd among the eight southeastern states of net immigration of persons 65 and older (He & Schachter, 2003).

Chronic Disease and Older Adults

Prevalence

Chronic disease is common among older adults, as the chance of developing at least one chronic condition escalates with age (AARP, 2002). Approximately 82% of adults aged 65 and older live with at least one chronic condition, with 65% having two or

more chronic conditions (Wolff et al., 2002). Many adults 65 years of age and older have heart disease (31%), hypertension (51%), cancer (20.7%), stroke (8.8%), and diabetes mellitus (16.2%) (NCHS, 2003).

Obesity, defined as a BMI $\geq$ 30 kg/m^2 (National Heart, Lung, and Blood Institute, 1998), is a nutritional disorder widely prevalent among older adults. Approximately 31% of older adults are obese, with an additional 40% overweight (BMI 25.0-29.9 kg/m^2; National Heart, Lung and Blood Institute, 1998) (Ogden et al., 2006). Obesity alone is a health concern since it is widely accepted to be associated with an increased risk of many common chronic diseases including coronary heart disease, stroke, some cancers, and diabetes mellitus, as well as with disease risk factors such as hypertension and dyslipidemia (National Task Force, 2000).

Prevalence by Race

Among the older adult population, chronic disease prevalence differs by race (NCHS, 2003). Among those 65 years of age and older, African Americans compared to Caucasians have a higher prevalence of hypertension (68% vs. 50%), stroke (9.5% vs. 8.7%), and diabetes mellitus (23.8% vs. 14.8%) (NCHS, 2003). Older Caucasians have a higher prevalence of heart disease (33% vs. 24%), coronary heart disease (22% vs. 17%), and cancer (23% vs. 11%) (NCHS, 2003).

National data further indicate overweight and obesity prevalence varies by race among older adults. According to NHANES 2003-2004 data, obesity prevalence is higher among African Americans 60 years and older compared to Caucasians the same age (45% vs. 30%, respectively), whereas overweight prevalence is higher among

Caucasians 60 years and older compared to African Americans the same age (41% vs. 34%, respectively) (Ogden et al., 2006).

Prevalence by Gender

Chronic condition prevalence further varies by gender among older adults. Adult males 65 years of age and older have a higher prevalence of several nutrition related chronic conditions compared to females the same age: heart disease (37% vs. 28%, respectively), stroke (10% vs. 9%, respectively), cancer (24% vs. 18%, respectively), and diabetes (20% vs. 15%, respectively) (Federal Interagency Forum on Aging-Related Statistics, 2006). However, older adult females have a higher prevalence than males for hypertension (55% vs. 48%, respectively) (Federal Interagency Forum on Aging-Related Statistics, 2006) and obesity (32% vs. 30%, respectively) (Ogden et al., 2006).

Prevalence by Region

The Southern region of the U.S. has a higher prevalence of certain nutrition-related chronic diseases than any other region of the U.S., creating a greater concern for chronic condition risk among older adults living in this region. Much of the Southeast comprises the "stroke belt," a region including between eight and ten states of the southeastern region of the U.S. which has a significantly higher stroke rate than the rest of the U.S. (Howard et al., 1997). Eastern North Carolina, in addition to the South Carolinian and Georgian coastal regions, is part of the "buckle" of the stroke belt which has stroke rates significantly higher than other areas in the stroke belt (Howard et al., 1997). Prevalence of other chronic conditions is similarly higher among persons living

in the stroke belt (Lackland & Moore, 1997), including diabetes and other cardiovascular diseases (Lackland & Moore, 1997).

Another component of the Southern region's designation as the "stroke belt" is a high regional sodium intake. High dietary sodium intake is associated with increased blood pressure, which is a risk factor for chronic diseases including stroke, diabetes, renal disease, and cardiovascular disease (Ezekowitz et al., 2003; Flack et al., 2003). Regional differences in sodium consumption exist, as documented by NHANES-III data, which indicate sodium consumption is the highest among Americans living in the South compared to those in the Northeast, Midwest, or West (Hajjar & Kotchen, 2003).

Costs Associated with Chronic Disease Among Older Adults

The most significant cost associated with chronic disease is mortality. Mortality rates increase with age for each of the 12 leading causes of death among Americans (Desai et al., 1999). The top three causes of death for Americans of all ages in 2003 were heart disease, cancer, and stroke (Hoyert et al., 2006). These three causes of death accounted for approximately 59% of all deaths among Americans 65 years of age and older, as determined from the calculated mean from 2003 death rate data (Hoyert et al., 2006).

Chronic disease greatly contributes to health care costs. Nearly 95% of health care expenditures among older adults are for chronic diseases (Merck Institute of Aging and Health, 2004). Health care costs for persons 65 years of age or older are reported to be three times higher than for persons younger than 65 years of age (Merck Institute of Aging and Health, 2004).

Nutrition and Quality of Life Among Community Living Older Adults

The definition of healthy and successful aging has undergone a recent shift from the "quantity" of years of life to the "quality" of those years of life (Butler, 1992). The World Health Organization's definition of "quality of life" incorporates the components of physical, mental, and social well-being in conjunction with the absence of disease (World Health Organization, 1948). Increasing the quality of life is a national priority, and is outlined as a goal by the U.S. Department of Health and Human Services' *Healthy People 2010* report (U.S. Department of Health and Human Services, 2000).

Quality of life and successful aging are of particular interest to older adults living in the 21st century as life expectancy for American adults at age 65 reached an all-time high of 81.8 years in 2003 (Federal Interagency Forum on Aging Related Statistics, 2006). Americans are now expected to live longer and more independently into their later years (AARP, 2002). But with increasing longevity comes the increased possibility of chronic disease which can bring about years of pain, disability, loss of function, and loss of independence, all of which lower health-related quality of life among older adults (Merck Institute of Aging and Health, 2004).

Preventing and controlling certain chronic diseases and related conditions are partly responsible for determining if the years towards the end of life are healthy, enjoyable, and productive (Sahyoun et al., 2001). Specifically, food intake and physical activity are two factors important in determining quality of life and well-being (Drewnowski & Evans, 2001). According to a position paper by the American Dietetic

Association, a diet that is nutritionally-sound improves the quality of life of older adults (Schiller & Bernadel, 2004).

Nutrition and its Role in Chronic Disease Development and Treatment

Nutrition plays an important role in contributing to the health of older adults. It is a major determinant of successful aging through maintenance of low risk of disease and disease-related disability, high mental and physical function, and active engagement of life (Rowe & Kahn, 1998). Poor diet is related to the development of diseases and conditions such as cardiovascular disease, hypertension, type 2 diabetes, and overweight and obesity (U.S. Preventive Services Task Force, 1996). Optimal diets, in contrast, are associated with a reduced risk of chronic disease, especially coronary heart disease, obesity, diabetes, and some types of cancer (Drewnowski & Evans, 2001). At least one source suggests that good nutrition could improve the chronic conditions of more than 85% of community living older adults (Institute of Medicine, 2000). Good nutrition patterns can be used to help promote health and functionality through primary prevention, and as secondary and tertiary prevention using medical nutrition therapy (MNT) as a disease management strategy to decrease the risk of chronic disease, slow disease progression, and reduce disease symptoms (American Dietetic Association, 2005b).

Nutrients and Foods Associated with Various Chronic Diseases

Specific nutrients and foods have been linked with various chronic diseases. Higher intakes of some nutrients and foods are associated with a reduced risk for chronic disease: potassium (Morris et al., 1999; Schmidlin et al., 1999; Whelton et al., 1997), dietary fiber (Bazzano et al., 2003; Mozaffarian et al., 2003; Wolk et al., 1999;), whole

grains (Liu et al., 1999; Meyer et al., 2000; Steffen et al., 2003; Jenson et al., 2004), and fruits and vegetables (Appel et al., 1997; Bazzano et al., 2002); higher intakes of others are associated with an increased risk for chronic disease: salt (sodium) (Johnson et al., 2001; Sacks et al., 2001), and saturated fat and cholesterol (Clarke et al., 1997; Howell et al., 1997; Hu et al., 2001; Marshall et al., 1997).

Potassium

Potassium is another nutrient that can affect blood pressure in that increased potassium intake can help decrease blood pressure (Morris et al., 1999; Schmidlin et al., 1999; Whelton et al., 1997). The current recommendation for potassium intake is 4,700 mg/day for older adults (Institute of Medicine, 2004). According to calculated mean potassium intake among adults aged 60 and older, NHANES III (1988-1994) data indicate this group consumes only 57% (2660 mg) of the recommended amount (Bialostosky et al., 2002). Although both males and females, as well as African Americans and Caucasians, do not meet the potassium recommendation, NHANES III (1988-1994) data indicate that Caucasians 60 years and older consume more than their African American counterparts for both males (3032 mg vs. 2265 mg, respectively) and females (2495 mg vs. 2030 mg, respectively) (Bialostosky et al., 2002). Additionally, Caucasian and African American males consume more than their respective female counterparts (Bialostosky et al., 2002).

Dietary Fiber

Diets that are high in dietary fiber (nondigestable carbohydrates from plant foods; USDHHS & USDA, 2005) are associated with decreasing the risk of coronary heart

disease (Bazzano et al., 2003; Mozaffarian et al., 2003; Wolk et al., 1999) and possibly risk for type 2 diabetes (Hu et al., 2001b; Montonen et al., 2003). Foods rich in fiber include whole fruits and vegetables, legumes, and whole grains (USDHHS & USDA, 2005).

According to the 2005 *Dietary Guidelines for Americans,* Americans should consume 14 grams of dietary fiber per 1000 calories consumed (USDHHS & USDA, 2005). However, NHANES III (1988-1994) data indicate adults 60 years and older do not meet this recommendation, with a calculated mean consumption of only 9.8 g/1000 kcal (Bialostosky et al., 2002). Although these data further indicate the fiber recommendation are not met by gender or race (African American and Caucasian) for adults 60 years and older, females consume more fiber per 1000 calories than males among both Caucasian (10.4 g/1000 kcal vs. 9.4 g/1000 kcal, respectively) and African American ethnicities (9.7 g/1000 kcal vs. 7.7 g/1000 kcal, respectively), and Caucasian males and females consume more fiber per 1000 calories than their respective African American counterparts (Bialostosky et al., 2002).

Whole grains

Whole grain consumption may lower the risk for heart disease (Jensen et al., 2004; Liu et al., 1999; Steffen et al., 2003), type 2 diabetes (Fung et al., 2001; Meyer et al., 2000;), and certain cancers (La Vecchia et al., 2003; Slatterly et al., 2004). Consumption of whole grains is a key component to achieving current daily fiber intake recommendations (Dietary Guideline Advisory Committee, 2005). To meet the daily dietary fiber recommendation, Americans are encouraged to consume at least half (at

least 3 ounce-equivalents of whole grains) of their recommended number of grain servings as whole grains daily (USDHHS and USDA, 2005).

National data (NHANES 1999-2002) estimates indicate older adults do not meet the daily whole grain serving recommendation (Cook & Friday, 2005). Calculated mean intakes for males and females 60 years and older estimate males consume more whole grain servings than females (1.1 whole grain servings consumed per day vs. 0.8) (Cook & Friday, 2005). Regarding race among the older adult population with respect to whole grain intake, the Continuing Survey of Food Intakes by Individuals (CSFII) (1994-96) data estimate Caucasian men and women 60 years and older consume more whole grain servings than their African American counterparts: Caucasian men consume 1.3 servings compared to African American men who consume 0.6 servings; Caucasian females consume 1.0 servings compared to African American females who consume 0.7 (USDA-ARS, 1998).

Fruits and Vegetables

Fruit and vegetable consumption is associated with a reduced risk of several chronic diseases, including cardiovascular disease (Joshipura et al., 2001; Bazzano et al., 2002; Johnson et al., 2001), hypertension (Appel et al., 1997; John et al., 2002), and some cancers (WCRF/AICR, 1997). In addition, fruits and vegetables can help to maintain weight since they tend to be low in fat and calories and high in dietary fiber (Fey-Yensan et al., 2004). This is important since maintenance of a healthy weight has been found to be inversely associated with chronic disease risk (Fey-Yensan et al., 2004).

The National Cancer Institute (NCI) and the Produce for Better Health Foundation together created the 5-a-Day for Better Health Program ("5-a-Day") in 1991, which encourages Americans to consume at least 5 servings of fruits and vegetables (combined) daily to promote cancer and chronic disease prevention (National Cancer Institute, 1991). National data (NHANES 1999-2002) estimates indicate older adults (60 years and older) meet the 5-a-Day recommendation of total vegetable (including dry beans and peas) and total fruit by consuming 5.3 servings of vegetables and fruit per day, with males consuming more than females (5.5 servings vs. 5.0 servings) (Cook & Friday, 2005).

Vegetable variety, however, according to NHANES 1999-2002 data, is low for older adults. There are five vegetable subgroups: dark green vegetables (i.e., broccoli, romaine lettuce, spinach, collard greens), deep yellow vegetables (i.e., carrots, carrot juice, pumpkin, sweet potato, winter squash, yams), dry beans and peas (i.e., black beans, chickpeas, kidney beans, pinto beans), starchy vegetables (i.e., white potatoes, rutabaga, green peas, corn, immature lima beans), and "other" vegetables (i.e., asparagus, beets, celery, green beans, mushrooms, onions, tomatoes) (Cook & Friday, 2005). Vegetable subgroups with particularly low mean calculated serving intakes for males and females 60 years and older include dark green vegetables (0.2 and 0.3 servings, respectively), deep yellow vegetables (each 0.2 servings), and dry beans and peas (0.2 and 0.1 servings, respectively) (Cook & Friday, 2005). Older males and females are estimated to have a higher intake of the other remaining vegetable subgroups for starchy vegetables (1.2 and

1.5 servings, respectively) and "other" vegetables (1.7 and 1.6 servings, respectively) (Cook & Friday, 2005).

Older Caucasian men and women consume more fruit and vegetable servings than their African American counterparts (USDA-ARS, 1998). More specifically, older (60 years and older) Caucasian men and women consume 5.8 and 4.8 servings, respectively, of fruits and vegetables, while older African American men and women consume 4.6 and 4.0, respectively (USDA-ARS, 1998).

Salt, Total fat, Saturated fat, and Cholesterol

Dietary intake of salt, a condiment rich in sodium, is associated with high blood pressure, and thus, with other chronic diseases such as stroke, diabetes, and cardiovascular disease (Ezekowitz et al, 2003; Flack et al., 2003). A direct relationship between salt intake and blood pressure exists in some people: the higher an individual's salt intake, the higher their blood pressure (Johnson et al., 2001; Sacks et al., 2001).

The national recommendation for sodium intake is less than 2300 mg/day for most Americans, and less than 1500 mg/day for certain populations, including persons with hypertension, African Americans, and middle-aged and older adults who either have hypertension or are at increased risk for hypertension (USDHHS & USDA, 2005). According to National Health and Examination Survey (NHANES) III (1988-94) data, calculated mean sodium intake for adults 60 years and older (2782 mg) exceeds the 1500 mg recommendation, regardless of race (African American or Caucasian) or gender for this population (Bialostosky et al., 2002). More specifically, calculated mean sodium intakes for older adults 60 years and older indicates African Americans consume less

sodium than Caucasians (2297 mg vs. 2815 mg, respectively), and females consume less than males for both African American (2089 mg vs. 2622 mg, respectively) and Caucasian (2467 mg vs. 3295 mg, respectively) races (Bialostosky et al., 2002).

Saturated fat and cholesterol have also been linked to chronic disease. High intake of saturated fat and cholesterol increase the risk for dyslipidemia, which may increase coronary heart disease risk (Hegsted et al., 1993; Clarke et al., 1997; Howell et al., 1997). High fat intake (> 35% of calories) generally results in an increased intake of saturated fat and makes avoiding excess caloric consumption difficult (USDHHS & USDA, 2005).

According to calculated mean total fat intake (as percent of total calories) for adults 60 years and older, NHANES III (1988-1994) data indicate older adults meet the total fat recommendation (≤ 35% of total calories), with a mean percent of total calories from fat of 32% (Bialostosky et al., 2002). These data further indicate that older males and females as well as older African Americans and Caucasians alike have total fat intakes (as percent of total calories) less than the recommended maximum, with females having a slightly lower intake compared to males for both Caucasians (32% vs. 33%, respectively) and African Americans (32% vs. 33%, respectively). Although the percent of total calories from fat among older African American and Caucasian males and females was less than 35%, and thus not considered to be "high fat," each group consumed at least 32% of their total calories from fat (Bialostosky et al., 2002), which is approaching the 35% recommended maximum.

Although dietary surveys indicate dietary intake of total fat among older adults meets the total fat recommendation, saturated fat intake (percent of total calories) among older adults exceeds the maximum recommendation (<10%). Calculated mean saturated fat intake among adults 60 years and older, according to NHANES III (1988-1994) data, indicates this group consumes a mean intake of 11% of their total calories from saturated fat (Bialostosky et al., 2002). These data further indicate that females 60 and older have a slightly lower saturated fat intake (as percent of total calories) than males for both Caucasian (10.5% vs. 11.2%, respectively) and African American (10.3 vs. 11%, respectively) races (Bialostosky et al., 2002).

The daily cholesterol recommendation for health is daily intake of < 300 mg (USDHHS & USDA, 2005). Calculated mean dietary cholesterol intake data among adults 60 years and older according to NHANES III (1988-94), older adults meet this recommendation, with a consumption of 221 mg/day (Bialostosky et al., 2002). Among adults 60 and older, total male (276 mg) and female (183 mg) daily cholesterol intakes as well as male and female intake by race among African Americans (298 mg vs. 219 mg, respectively) and Caucasians (274 mg vs. 179 mg, respectively) are below the recommended 300 mg daily maximum, although males consume more than females for each race, and African American males and females consume more than their Caucasian counterparts (Bialostosky et al., 2002). However, cholesterol intake by African American males (294 mg/day) is very close to the recommended daily maximum of 300 mg (Bialostosky et al., 2002).

Summary of Food Group Servings and Specific Nutrient Intakes Among Older Adults

To summarize the national dietary intake data for specific food group servings and specific nutrient intakes among older adults, older adults meet the minimum number of 5-a-Day fruit and vegetable servings combined (Cook & Friday, 2005), although several vegetable subgroups have low intakes (Cook & Friday, 2005); they do not consume enough whole grain servings (Cook & Friday, 2005); they consume less than the RDA for potassium for their age group (Bialostosky et al., 2002); and they consume less fiber per calorie basis than recommended (Bialostosky et al., 2002). Additionally, older adults consume sodium in excess of the amount recommended to decrease risk for developing hypertension (Bialostosky et al., 2002). Further data indicate older adults have a daily total fat intake (percent of total calories) that approaches the maximum recommended amount, a daily saturated fat intake (percentage of total calories) that exceeds the recommended amount, and a daily cholesterol intake that is less than the recommended maximum (Bialostosky et al., 2002).

Regarding race comparisons for dietary intake related to these food group servings and nutrients among older Caucasian and African American adults, Caucasians exhibit a daily dietary pattern that better models daily dietary recommendations for specific food groups and nutrients: they consume more fruit and vegetable servings daily (USDA-ARS, 1998), more whole grain servings daily (USDA-ARS, 1998), more daily fiber per calorie basis (Bialostosky et al., 2002), more potassium daily (Bialostosky et al., 2002), less cholesterol daily (Bialostosky et al., 2002), and they have a lower total fat intake (percent of total calories) (Bialostosky et al., 2002). By contrast, older African

Americans have a more optimal dietary sodium intake (a lower daily intake) compared to Caucasians (Bialostosky et al., 2002).

Regarding gender comparisons, older adult males compared to females have a more optimal daily dietary intake pattern for several food groups and nutrients: they consume more vegetable, fruit, and whole grain servings daily (Cook & Friday, 2005), as well as more potassium per day (Bialostosky et al., 2002). Older adult females compared to males, on the contrary, have a more optimal daily dietary intake pattern for several nutrients: they consume less sodium (Bialostosky et al., 2002), more fiber per calorie basis (Bialostosky et al., 2002), less cholesterol (Bialostosky et al., 2002), and they have a lower percentage of their total calories derived from total and saturated fats (Bialostosky et al., 2002).

Barriers to Healthy Dietary Habits Among Older Adults

There are a number of factors that can impair dietary intake by older adults, and thus impact their ability to meet dietary recommendations for health. Such factors are related to older adults experiencing a number of changes in their lives compared to younger adults (Sahyoun et al., 2005). Factors which may hinder the ability of older adults to consume adequate amounts of recommended dietary components include a number of factors related to availability and access to food, as well as to certain lifestyle and health-related changes that often occur during the later years of life. Transportation, functional disability, and financial status/food insecurity can each impact the availability and/or access to food among older adults (ADA, 2005). Related to lifestyle changes, a number of older adults live alone, particularly older females. Research indicates persons

eating alone have lower dietary intakes than those who eat with other people (Thomas et al., 2004). Further posing risk for decreased dietary intake, which can impact meeting dietary recommendations by older adults, is a high prevalence of depressive symptoms reported among this population (Federal Interagency Forum on Aging-Related Statistics, 2006), which can decrease appetite and result in decreased caloric intake (Weissenburger, 1986).

Governmental Nutrition Recommendations

The U.S. Government promotes health and disease risk reduction through programs dealing with Federal food, nutrition education, and health information (Dietary Guidelines Advisory Committee, 2005). Federal nutrition policy is based on the *Dietary Guidelines for Americans*, which are intended to promote health and risk reduction for chronic disease (Dietary Guidelines Advisory Committee, 2005).

The *Dietary Guidelines for Americans*, first published in 1980 and re-published every five years to offer the most current scientifically-based advice to healthy Americans age two and older, promotes health and risk reduction for major chronic diseases by means of diet and physical activity (USDHHS & USDA, 2005). The *Dietary Guidelines for Americans* can be used in primary prevention to prevent the beginning of certain diseases, in secondary prevention to prevent the progression of preclinical disease or risk factors into chronic disease, and in tertiary care to help persons with established chronic disease manage their diseases (U.S. Preventative Services Task Force, 1996).

The most recent *Dietary Guidelines for Americans* were published in January 2005, providing the most up-to-date dietary and exercise recommendations for health

promotion and chronic disease prevention. Nine key messages were ultimately developed by the Dietary Guidelines Advisory Committee upon their review of the evidence, with specific recommendations within each message (Dietary Guidelines Advisory Committee, 2005)

Several key changes are apparent in the 2005 *Dietary Guidelines for Americans* compared to prior publications. This newest version has a new structure. Prior publications contained 10 or fewer major points which were explained individually in chapters. The 2005 *Dietary Guidelines* have 41 recommendations (23 of which are for the general population and 18 for specific populations such as pregnant women, children, and the elderly) that are grouped within nine focus areas. In addition, portion recommendations are now relative to common household measures (cup amounts) instead of servings (USDHHS & USDA, 2005).

Other changes to the *Dietary Guidelines* relate to the development of new recommendations and revisions made to previous recommendations. There is a new recommendation of the *Dietary Guidelines for Americans* advocating the consumption of a specific number of whole grain servings in which three or more ounce-equivalents of whole grain products (or at least half the grain servings) are recommended to be consumed daily. There is now a recommendation for a specific amount of legumes to be consumed weekly: at least three cups per week for a 2000 calorie diet. Last, there is a new recommendation stressing the consumption of potassium-rich foods to meet the RDA for potassium (USDHHS & USDA, 2005).

Revised recommendations include those for intakes of total fruit and vegetable, sodium, and total fat. The minimum recommendation for fruit and vegetable servings has increased to nine servings (four and a half cups) for a 2000 calorie diet (USDHHS & USDA, 2005). Furthermore, the sodium recommendation has been reduced from 2400 mg/day to 2300 mg/day for healthy populations, with a further reduced intake of 1500 mg/day recommended for persons with hypertension, African Americans, and middle-aged and older adults (USDHHS & USDA, 2005). Regarding fat intake, there is now a new recommendation specifying a specific amount of total fat to consume daily (between 20% and 35% of total daily calories) instead of the previous recommendation of "moderate" fat intake (Harvard School of Public Health, 2005).

The Healthy Eating Index (HEI), developed by the USDA in 1995, measures the conformity of Americans' diets to the 2000 *Dietary Guidelines for Americans* and the original Food Guide Pyramid (Basiotis et al., 2004). HEI scores higher than 80 indicate a good diet, scores between 51 and 80 indicate a diet that needs improvement, and scores lower than 51 indicate a poor diet (Basiotis et al., 2004). A study of persons 65 years and older reported participants had a mean HEI score of 67.6, indicating their diets were in need of improvement (Juan et al., 2004).

Research Related to Adherence to the *Dietary Guidelines for Americans*

Few published studies have assessed dietary adherence among Americans to food and nutrient guidelines outlined by the *Dietary Guidelines for Americans*. Several studies have examined the relationship between dietary guideline adherence and risk for chronic disease development in prospective cohorts (Harnack et al., 2002; McCullough et

al., 2000a; McCullough et al., 2000b). The findings of these studies suggest a relationship between greater adherence to the *Dietary Guidelines for Americans* and reduced risk for certain nutrition-related chronic disease development. McCullough et al. detected a significant reduction in risk for development of major chronic disease (cardiovascular disease, cancer, or other non-traumatic related death) among males ($P < 0.001$) (2000b) participating in the Health Professionals Follow up Study and among females ($P < 0.001$) (2000a) participating in the Nurses' Health Study who had higher dietary adherences to the 1995 *Dietary Guidelines for Americans*, as measured using total score for the Healthy Eating Index from food frequency questionnaire data. Another study (Harnack et al., 2002) assessed the relationship between adherence to the 2000 *Dietary Guidelines for Americans*, including both dietary and physical activity recommendations, and risk for development of cancer among a prospective cohort of post-menopausal females. Females with higher dietary guidelines index scores, which corresponded to greater adherence to the 2000 *Dietary Guidelines for Americans*, experienced a significant ($P < 0.01$) reduction in risk for developing cancer, as well as for developing certain site-specific cancers ($P < 0.01$) including cancers of the colon, bronchus and lung, breast, and uterus.

Nutrition Intervention and Education

Nutrition knowledge and beliefs about foods and health are the most modifiable factors that affect dietary choices (Thomas, 1991). An increase in knowledge about the nutrient content of foods and an increased awareness about diet-health relationships can result in an improvement in healthy eating (Variyam et al., 1998).

Older adults are a population that benefits from nutrition intervention. Many older adults acknowledge there is a relationship between good nutrition and good health (Ho et al., 1991). Furthermore, more than any other age group, older adults seek information about health and are willing to change their behaviors to retain their health and independence into the later years of life (U.S. Department of Health and Human Services, 1998).

Research has demonstrated that nutrition education is effective in improving nutrition knowledge and diets of older adults. Bernstein et al. (2002) found that a home-based nutrition intervention program among Boston community dwelling older adults increased dietary intake of fruits, vegetables, and calcium-rich foods. McCamey et al. (2003) reported that a community-based, statewide intervention program in Georgia significantly ($P < 0.05$) improved nutrition-related knowledge of the recommended number of daily fruit and vegetable servings, as well as significantly ($P <0.05$) increased mean daily servings of vegetable and milk intake. Another study conducted in Georgia reported that an education intervention significantly ($P \leq 0.05$) improved nutrition knowledge related to identifying whole grain foods among an older adult sample, as well as significantly ($P \leq 0.05$) increased dietary whole grain intake (Ellis et al., 2005).

Results reported from a long term, large-scale intervention trial consisting of a 20 month intervention with two years of follow-up has similarly found nutrition education to improve the diets of older adults (Campbell et al., 1999). The Black Churches United for Better Health Project was a 20 month multi-component intervention designed to increase fruit and vegetable intake among rural African American church members in North

Carolina (n = 2519 adults; average age 53.8 years). Fifty participating churches in 10 counties were pair matched and randomly assigned to the 5-a-Day intervention program, a multi-component 20 week intervention which targeted individual, social network, and community level activities regarding various aspects related to fruit and vegetable consumption, or to a delayed intervention group in which participants received the intervention program activities upon completion of the 2-year follow-up survey (Campbell et al. 1999). Among adults 66 years and older, the intervention group consumed significantly (P = 0.0001) more total fruit and vegetable servings than the delayed intervention group at the two-year follow-up (Campbell et al., 1999).

Furthermore, other research indicates a community-based nutrition education program focusing on a specific nutrition-related chronic disease beneficially impacted older adults. Older adults with Type 2 diabetes attending a nutrition education program led by a dietitian experienced an improvement in glycemic control (fasting plasma glucose and glycosylated hemoglobin) (Miller et al., 2002).

Gaps in the Literature

Although several studies indicate the potential beneficial impact of consuming diets in compliance with the *Dietary Guidelines for Americans* on decreasing chronic disease (particularly CVD risk among males), no research has been found which specifically investigates dietary guideline adherence to identify guidelines for which nutrition education efforts need to target in order improve dietary intake among populations of interest. Of particular interest would be assessing the diets of older adults who are at increased risk for developing chronic disease (AARP, 2002). Therefore, there

is a need to assess current dietary habits among older adults in relation to the *Dietary Guidelines*. Such information would be beneficial for nutrition educators so that programs can be designed that target the needed improvements by this population so that their diets better adhere to the *Dietary Guidelines*. With the recent release of the newest edition of the *Dietary Guidelines for Americans* (6th edition) in 2005, there is a further need to assess dietary adherence with respect to the most up-to-date recommendations designed to promote health and reduce chronic disease risk. Furthermore, assessments of region specific dietary adherence to the *Dietary Guidelines for Americans* are needed so that nutrition education programs can account for regional variations in dietary intake to better target the needs of specific populations.

Summary

This review of the literature suggests that older adults are at an increased risk for chronic disease, especially within the "stroke belt" which includes North Carolina, with prevalence for certain chronic conditions differing by gender and race (Caucasian and African American). The high life expectancy projected for American adults at age 65, coupled with the rapid growth of the older adult population, highlight the importance for older adults to maintain a high quality of life so that they may continue to live independently. Increased prevalence of chronic conditions and declining health with age decrease the functional status of older adults and thus the quality of life associated with the later years of life. Nutritional well-being contributes to quality of life, and is associated with decreased chronic disease development and improved treatment. The *Dietary Guidelines for Americans* outline specific diet and exercise recommendations

designed to promote health and reduce chronic disease risk. National dietary intake data specific to older Americans indicate this population has dietary intakes for specific nutrients and foods associated with chronic disease which do not meet their corresponding intake recommendations. There are differences in nutrient and food intakes, which are associated with chronic disease among older adults by gender and race (Caucasian and African American). Studies focusing on *Dietary Guideline* adherence are limited. These studies suggest the potential association between dietary adherence to the *Dietary Guidelines for Americans* and reduced risk for chronic disease. Studies are needed to assess dietary adherence to the most recent edition of the *Dietary Guidelines* so that nutrition education efforts can target the needs of Americans. Particularly, dietary adherence to the 2005 *Dietary Guidelines for Americans* by older adults, who are at increased risk for developing nutrition-related chronic diseases, is needed so that nutrition education programs, which have been demonstrated to be effective in improving nutrition knowledge and healthy eating habits among this population, can target their needed improvements.

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CHAPTER III

RESEARCH ARTICLE

Introduction

Adults 65 years of age and older are the fastest growing population in the United States (U.S. Census Bureau, 2004). Chronic condition prevalence increases with age (AARP, 2002): 82% of adults aged 65 and older have at least one chronic condition, and 65% have at least two (Wolff et al., 2002). Nutrition is widely accepted to be involved in the etiology of many chronic conditions (U.S. Preventive Services Task Force, 1996) commonly experienced among older adults, including heart disease (31%), hypertension (51%), cancer (21%), stroke (9%), and diabetes (16%) (NCHS, 2003). Furthermore, the prevalence of diet-related chronic conditions, including stroke, other cardiovascular diseases, and diabetes, are significantly higher in the Southern region of the United States compared to other regions (Howard et al, 1997; Lackland & Moore, 1997). Older adults who live in this region, frequently referred to as the "stroke belt," are at an even greater risk for developing such conditions (Howard et al, 1997).

The most recent *Dietary Guidelines for Americans* (6^{th} edition) was released in January, 2005. These national dietary and physical activity recommendations are published jointly by the United States Department of Health and Human Services and the United States Department of Agriculture to promote health and reduce the risk for

developing major chronic diseases (Dietary Guidelines Advisory Committee, 2005). Specific dietary recommendations are outlined in these guidelines to help decrease the risk of developing certain nutrition-related chronic diseases, as well as to help manage established nutrition-related chronic diseases. Some recommendations advocate minimum daily intakes of such foods/food components as fruit, vegetables, whole grains, fiber, and potassium to decrease the risk of developing certain chronic diseases. Other recommendations promote consumption of other foods/food components in moderation, including sodium, total fat, saturated fat, and cholesterol to decrease the risk of developing certain chronic diseases (USDHHS & USDA, 2005).

Limited research related to adherence to the *Dietary Guidelines for Americans* has been published. Several researchers have reported a potential association to exist between dietary adherence to the *Dietary Guidelines for Americans* and a reduced risk for chronic disease (McCullough et al., 2000a and 200b; Harnack et al., 2002). To our knowledge, no research has explicitly assessed the dietary adherence among older adults to the *Dietary Guidelines for Americans* despite the fact that this rapidly growing population is at increased risk for developing at least one diet-related chronic condition (AARP, 2002).

North Carolina's older adult population is expected to parallel the national growth of older adults with an estimated 124% increase between 2000 and 2030 (U.S. Census Bureau, 2005). Older adults living in North Carolina are at an even greater risk for developing certain nutrition-related chronic diseases such as stroke and diabetes since North Carolina is in the "stroke belt." Therefore, there is a need to evaluate dietary

adherence to the 2005 *Dietary Guidelines for Americans* among older adults living in this region. The purpose of this cross-sectional descriptive study was to determine the extent to which the diets of older community living adults in central North Carolina adhere to specific dietary recommendations of the 2005 *Dietary Guidelines for Americans*. These findings can be used to help guide the development of region-specific nutrition education programs that target the needed improvements among older adults in this region so that their diets better meet dietary recommendations outlined by the *Dietary Guidelines for Americans*.

Materials and Methods

Subjects

This study assessed dietary adherence to specific dietary recommendations of the 2005 *Dietary Guidelines for Americans* among older adults who participated in the Assessment of Dietary Intake, Health Status, and Biomarkers of Nutritional Status of Older Adults study. A convenience sample of older adults was recruited from Guilford and Forsyth Counties of North Carolina through response to flyers and presentations given at local senior citizen centers (Elderly Nutrition Programs), Rural Outreach sites, YMCAs, churches, and the Retired and Senior Volunteer Program of Senior Resources of Guilford. Referrals from participants also were used to recruit additional participants. Participant recruitment took place between May, 2002 and April, 2005 in four recruitment periods. Across the four recruitment periods, a total of 129 individuals initially expressed interest, and 101 participated who met the following inclusion criteria, as assessed through a screening questionnaire: 1) were at least 65 years of age; 2) were

free-living within the community; and 3) resided in Guilford or Forsyth counties. Of the 101 participants included, 34 were enrolled between May and June of 2002, 6 during April of 2003, 36 between June and July of 2004, and 25 between February and April of 2005.

Eighty-eight of the 101 participants included in the Assessment of Dietary Intake, Health Status, and Biomarkers of Nutritional Status of Older Adults study formed the final sample used in analyses for this research. Response data from 13 participants was considered unusable due to: 1) missing Diet History Questionnaire (DHQ) data (n = 4); 2) low (< 20 points) Mini Mental State Examination (MMSE) score which is indicative of cognitive impairment (n = 4); and 3) calculated daily energy intake of either <500 or >3500 calories which were caloric cutoffs chosen to represent under- or over-reporters (n = 5). Participant profiles by recruitment site was determined (Appendix A).

Materials

General Questionnaire

A general health questionnaire, the General Questionnaire, was compiled to obtain an array of health-related information from participants in the Assessment of Dietary Intake, Health Status, and Biomarkers of Nutritional Status of Older Adults study, including the following: socio-demographics, height and weight measurements, self-report of physical activity and health conditions, food insecurity assessed using a three question measure (Lee & Frongillo, 2001), cognitive functioning assessment using the Mini-Mental State Examination (MMSE) (Folstein et al, 1975), depression assessment using the Geriatric Depression Scale (Yesavage et al, 1983), assessment of

functional capacity using the Katz Activities of Daily Living and the Five-Item Instrumental Activities of Daily Living Screening Questionnaires (Fillenbaum, 1985; Katz, 1963), and other health related information such as medication use, appetite, and history of recent weight loss (Appendix B). Outcome variables obtained from this questionnaire that were assessed in this research included socio-demographic information, food security status, Mini-Mental State Examination score, chronic condition prevalence, physical activity, and height and weight measurements.

Socio-demographic information was obtained through self-report by participants. Socio-demographic variables included: age, gender, ethnicity, monthly income, and education.

Food insecurity prevalence among study participants for the six month time period prior to interviewing was assessed using the 3-item food insecurity measure used in the Nutrition Survey of the Elderly in New York State (1994) (Lee & Frongillo, 2001). Participants were determined to be "food insecure" when responding to at least one of these three questions as: "Do you have enough money to buy the food you need most of the time? (No = food insecurity), "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? (Yes = food insecurity), and "In the past 6 months, have you had to choose between buying food or paying bills or buying something else you needed?" (Yes = food insecurity). The content and construct validity of this food insecurity assessment tool were established by Burt (1993) and Quandt & Rao (1999), as cited by Lee & Frongillo (2001).

Cognitive functioning among sample participants was assessed using the Mini-Mental State Examination (MMSE). The MMSE, created by Folstein et al. in 1975, contains a total of 30 questions focusing on cognitive aspects of mental functions that are designed to test five cognitive functions: concentration, language, orientation, memory, and attention (Gallo et al, 2006). Scores range from 0 to 30, with 30 being the highest (Folstein et al, 1975). Gallo et al. (2006) reported a cut-off score of 23 was able to distinguish impaired cognition from normal among 126 neurological/neurologic ward patients with 76% sensitivity. For the purposes of this study, we chose a cut-off score of 20 to increase the number of individuals who are likely to be in the normal range of cognitive functioning (Gallo et al., 2006).

Self-reported nutrition-related health conditions were assessed based on the respondent answering yes or no to having a history of the following health conditions: coronary heart disease or acute myocardial infarction (heart attack, coronary heart disease, heart bypass surgery or angioplasty, angina), stroke, high blood pressure or hypertension, diabetes, or cancer.

Self-reported physical activity was documented according to participant response to the following question: "In an average week, how many times do you engage in physical activities for at least 20 minutes? (Specifically, exercises or activities which are hard enough to make you breathe heavier and your heart beat faster)" (Appendix B). Participants selected one of the following options: "four or more times per week, three times per week, 1 or 2 times per week, or less than one time per week" (Appendix B).

Height and weight were obtained using standard methods and equipment. These measurements were taken in duplicate, and the averaged values were used to calculate body mass index (BMI).

Diet History Questionnaire

The National Cancer Institute's (NCI) Diet History Questionnaire (DHQ) (NCI, 2006), a semi-quantitative food frequency questionnaire, was used to assess dietary intake among participants over the 12 months prior to their participation (n = 97) (Appendix B). The DHQ takes approximately one hour to complete, contains 124 food items, and includes both portion size and dietary supplement intake questions (NCI, 2006). The DHQ has been determined to be just as good as or superior to two other Food Frequency Questionnaires (FFQs) that were widely utilized at the time of its validation, including the 1995 Block FFQ and the "purple version" of the Willet FFQ, regarding most nutrient intake (Subar et al., 2001). The DHQs were analyzed using Diet*Calc v. 1.4.2 (NCI, 2004), a software program created by the NCI which is specific to this particular food frequency questionnaire. The food list and nutrient database for the DHQ was developed using the USDA's 1994-96 Continuing Survey of Food Intakes by Individuals (NCI, 2006). Dietary data analysis results from Diet*Calc includes specific daily nutrient amounts, food group servings, and percentage of total calories consumed from macronutrients; these items which have specific recommendations outlined in the 2005 *Dietary Guidelines for Americans* served as the dietary assessment outcome variables.

Data Collection

The data collection protocol for this study was approved by the Institutional Review Board of the University of North Carolina at Greensboro. Participants were contacted via telephone or in person to schedule the first meeting, which was conducted in their homes. During this meeting, the General Questionnaire was completed by face-to-face interview. Participants were then given a copy of the DHQ to self-administer after receiving oral instructions from the interviewer. Finally, participants were scheduled for their second meeting to be conducted at their convenience, typically within the following week.

For the second meeting, participants met the researcher at a local laboratory to have a fasting blood sample obtained and analyzed for selected indicators of nutritional status (data not included here). To help ensure fasting compliance among study participants, participants were called the day before their blood draws to remind them about the need to fast for 12 hours prior to the scheduled appointment. The second meeting additionally entailed the interviewer reviewing the participant self-completed DHQ for completeness, with any unanswered questions completed by interview. If a participant was unable to complete the DHQ on his or her own, the interviewer completed it using a one-on-one interview format with that participant during this meeting. If needed, a second visit (third meeting) at the participant's home was scheduled to finish data collection not completed at the second meeting.

The first interview lasted approximately one hour, the food frequency questionnaire took the participants between one and two hours to complete, and the

meeting to obtain a blood sample which also included reviewing the DHQ with the participant lasted approximately thirty minutes. Participants received a $15 gift card to a local grocery store, their dietary assessment results from the analyzed DHQs, and their blood test results for participation in the study.

Dietary Analysis

The DHQs were first coded by the researcher from the paper-based forms into an ASCII file as individual cases to be analyzed by Diet*Calc (v. 1.4.2) (NCI, 2004), a software program developed by the NCI which is specific to the DHQ. Dietary analysis results from Diet*Calc included specific nutrient amounts, food group servings, and percentage of total calories consumed from macronutrients. Categorical variables for adherence to the *Dietary Guidelines for Americans* were created using the continuous dietary analysis results from Diet*Calc so that the dietary data were coded as either meeting or not meeting the dietary recommendations of interest (USDHHS & USDA, 2005). Vegetable sub-group variables consistent with the 2005 *Dietary Guidelines for Americans* (USDHHS & USDA, 2005) were created using the vegetable sub-group variables generated as output variables by Diet*Calc. Food group servings for each of total fruit, total vegetable, and the vegetable subgroups were converted to cup amounts, which is the unit of measurement for these food groups according to the 2005 *Dietary Guidelines for Americans* which is consistent with the new Food Guide Pyramid, MyPyramid (USDA, 2006). Because MyPyramid now specifies that a ½ cup of fruit or vegetable juice is equivalent to ½ cup of fruit or vegetables (or to one fruit or vegetable serving) (USDA, 2006), whereas the 1992 Food Guide Pyramid specified ¾ cup of fruit

or vegetable juice was equivalent to one fruit or vegetable serving, calculated total fruit or vegetable cup amounts from the DHQ data may slightly underestimate the amount of fruit or vegetables consumed by this sample. However, it is assumed that the mean intake of fruits and vegetables among this older adult sample is still a representative estimate, and that for those who do consume fruit and vegetable juice, such consumption would only account for a small difference in intake when fruit and vegetable servings are calculated to the measure of cups.

Primary Outcome Variables

Dietary adherence to the 2005 *Dietary Guidelines for Americans* by this sample was assessed using the analyzed DHQ data for individual nutrients and dietary components which have specific dietary recommendations outlined by the 2005 *Dietary Guidelines for Americans*. These individual nutrients and dietary components obtained from DHQ analysis served as the primary outcome variables for this research (Table 1). Some variables denote recommendations which specify daily intake amounts, others specify weekly intake amounts. Variables (nutrients or dietary components) for which the *Dietary Guidelines* advocate consumption of a minimum amount per day were called minimal recommendations (total fruit, total vegetable, whole grains, fiber, potassium, and vegetable subgroups for dark green, orange, legume, starchy, and other vegetables); those for which the *Dietary Guidelines* advocate a maximum dietary intake not to be exceeded were called maximal recommendations (sodium, total fat, saturated fat, and cholesterol). Total fruit, total vegetable, vegetable subgroup, and whole grain recommendations differ by gender. The recommended amounts for these food groups were determined using the

USDA Food Guide for the daily calorie patterns for sedentary males (2000 calories) and females (1600 calories) 51 years of age and older.

Table 1. Dietary Recommendations of the 2005 *Dietary Guidelines for Americans* for Specific Nutrients and Dietary Components by Gender.

Guideline	Recommendation	
	Males	Females
Minimal Daily Guidelines		
Total Fruit[1]	2 cups	1.5 cups
Total Vegetable[1]	2.5 cups	2 cups
Whole grains[1]	3 oz-equivalents	3 oz-equivalents
Fiber	14g/1000 calories	14g/1000 calories
Potassium	≥4700 mg	≥4700 mg
Minimal Weekly Vegetable Subgroup Guidelines		
Dark Green[1]	3 cups	2 cups
Orange[1]	2 cups	1.5 cups
Legume[1]	3 cups	2.5 cups
Starchy[1]	3 cups	2.5 cups
Other[1]	6.5 cups	5.5 cups
Maximal Daily Guidelines		
Sodium	≤1500 mg	≤1500 mg
Total Fat	20-35% of total calories	20-35% of total calories
Saturated Fat	<10% of total calories	<10% of total calories
Cholesterol	<300 mg	<300 mg

[1] Minimum recommendations for daily total fruit, total vegetable, and whole grain intakes and weekly vegetable subgroup intakes are age, gender, and physical activity level specific. The calorie levels for sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide were used to determine the minimum recommended amounts for these dietary components.

Assessment of Dietary Adherence to the 2005 *Dietary Guidelines for Americans*

Dietary adherence to the 2005 *Dietary Guidelines for Americans* by this sample was assessed using two different approaches. First, the percent of sample adherence to each of the recommendations (Table 1) was determined. Gender specific recommendations were considered for variables which specified different recommendation amounts by gender (total fruit, total vegetable, and vegetable sub-groups). Recommendations which had at least 50% of the sample in adherence were considered to have high adherence since the majority of the sample met the recommended intake for such recommendations; those having less than 50% of the sample in adherence were considered to have low adherence.

To further investigate dietary adherence by this sample to the 2005 *Dietary Guidelines for Americans*, the second approach entailed calculating the percent of recommended intakes consumed by the sample for each of the recommendations (Table 1). For minimal recommendations, percent of recommended intakes that were at least 100% were indicative of meeting their respective recommendations according to mean intake by the sample. On the contrary, percent of recommended intakes for maximal recommendations that were $\geq$ 100% were indicative of the sample not meeting such recommendations since mean intake by the sample for such recommendations would be in excess of the maximal recommended amount.

Data Analysis

Data analyses were conducted using SPSS for Windows 13.0 (Chicago, Illinois). Descriptive analyses were used to determine percent of sample adherence to individual

dietary recommendations of the 2005 *Dietary Guidelines for Americans* as well as the percent of recommended intakes by the total sample. Additional analyses were conducted to compare subgroups of the total sample for percent of sample adherence to recommendations and percent of recommended intakes by gender, race [for the female sample only due to a small number of male participants (n = 14 out of 88)], BMI classification and self-reported physical activity level (each of which only included analyses for the total sample due to small sample sizes for the sub-groupings) in order to further investigate dietary adherence to the *Dietary Guidelines* by this sample. Because males and females had different recommendations for total fruit, total vegetable, and vegetable subgroup intakes, deviance scores were also calculated to help evaluate percent of recommended intake according to mean intake by gender. This involved subtracting the gender specific recommendation (USDHHS & USDA, 2005) for total fruit in cups, total vegetable in cups, and each of the vegetable subgroups in cups (dark green, orange, legume, starchy, and other) from the respective male and female daily or weekly intake amounts as calculated from the DHQ analysis for these food groups. Deviance score values with positive numbers indicated the mean intake by either males or females met their minimum recommended intake amounts, with the specific amount representing the mean amount consumed in excess of the minimum recommended amount; those with negative numbers, on the contrary, represented the mean amount male or female mean intakes were short of meeting these minimum recommendations. Categorical variables were analyzed using chi square analyses. Analyses for which one variable was categorical and the other continuous used independent sample t-tests. For both chi square

analyses and independent sample t-tests, P values $\leq$ 0.05 were considered significant, and P values < 0.10 but > 0.05 were considered to be a trend.

Results

Demographic Information

Total Sample

The demographic characteristics of the study sample are presented in Tables 2-4. The majority of the sample was female and Caucasian, obtained a high school education or its equivalent (GED), reported a monthly income that was classified as being above the poverty threshold according to 2004 criteria for adults 65 and older (U.S. Census Bureau, 2004), were overweight or obese [defined as a BMI $\geq$ 25 kg/m^2 (70%; mean BMI 28.5 kg/m^2 $\pm$ 5.77 kg/m^2)], reported being food secure, and reported being more highly active ($\geq$ 4 times per week for at least 20 minutes) (Table 2). The mean number of self-reported nutrition-related chronic conditions among the sample was 1.4 $\pm$ 1.20, with 69% of the total sample having at least one nutrition-related chronic condition, and 42% at least two (Table 2).

Table 2. Total Sample Demographic Characteristics.

Characteristic	Total Sample (n=88)
Average age (y; mean ± SD)	73.6 ± 6.3
Race	
Caucasian (%)	74
African American (%)	26
Chronic Conditions[1]	
Number (mean ± SD)	1.4 ± 1.20
≥ 1 (%)	69
≥ 2 (%)	42
Education	
Less than high school (%)	22
High school graduate/GED (%)	78
Monthly Income (Reported)	
Dollars (mean ± SD)	2247 ± 1976.5
≤ Poverty Threshold[2] (%)	22 (n=86)
BMI (kg/m^2; mean ± SD)	28.5 ± 5.77
BMI category	
18.5-24.9 kg/m^2 (%)	29
25.0-29.9 kg/m^2 (%)	33
≥ 30.0 kg/m^2 (%)	38
BMI category	
18.5-24.9 kg/m^2 (%)	30
≥ 25 kg/m^2 (%)	70
Food Insecure (%)	15
Physical Activity (Reported)[3]	
Lightly Active (%)	48
Highly Active (%)	52

[1]Total number of chronic conditions was calculated by summing the following diet-related chronic conditions: obesity determined from BMI (calculated from height and weight measurements) and self-reported prevalence of stroke, hypertension, heart disease, diabetes, or cancer; Chronic condition prevalence sub-grouped as either ≥1 or ≥2 pertains to the prevalence of these chronic conditions;
[2]Poverty thresholds 2004 (U.S. Census Bureau, 2004) criteria for adults 65 years and older were used to determine income less than or equal to the poverty threshold
[3]Self-reported physical activity: Lightly active = ≤ 3times times per week of physical activity ≥ 20 min/day; Highly active = ≥ 4 times per week of physical activity ≥ 20 min/day

Gender

Gender comparisons between males and females regarding demographic information were significant only for income, for which males reported a significantly (P=0.001) higher monthly income (dollars) than females (Table 3).

Table 3. Demographic Characteristics by Gender.			
Characteristic	Males (n=14)	Females (n=74)	P value
Average age (y; mean ± SD)	73.1 ± 4.2	73.7 ± 6.7	0.735[1]
Race			
Caucasian (%)	64	76	0.374[2]
African American (%)	36	24	
Chronic Conditions[3]			
Number (mean ± SD)	1.6 ± 1.22	1.3 ± 1.20	0.328[1]
≥ 1 (%)	79	68	0.413[2]
≥ 2 (%)	57	39	0.212[2]
Education			
Less than high school (%)	21	22	0.987[2]
High school graduate/GED (%)	79	78	
Monthly Income (Reported)			
Dollars (mean ± SD)	3867 ± 2668.7	1940 ± 1669.9	**0.001**[1]
≤ Poverty Threshold[4] (%)	21	22 (n=72)	0.948[2]
BMI (kg/m^2; mean ± SD)	27.6 ± 3.02	28.7 ± 6.16	0.534[1]
BMI category			
18.5-24.9 kg/m^2 (%)	21	31	0.334[2]
25.0-29.9 kg/m^2 (%)	50	30	
≥ 30.0 kg/m^2 (%)	29	39	
BMI category			
18.5-24.9 kg/m^2 (%)	21	31	0.468[2]
≥ 25 kg/m^2 (%)	79	69	
Food Insecure (%)	21	14	0.444[2]
Physical Activity (Reported)[5]			
Lightly Active (%)	36	50	0.326[2]
Highly Active (%)	64	50	

[1]P value for t-test analyses
[2]P value for x^2 analyses
[3]Total number of chronic conditions was calculated by summing the following diet-related chronic conditions: obesity determined from BMI (calculated from height and weight measurements) and self-reported prevalence of stroke, hypertension, heart disease, diabetes, or cancer; Chronic condition prevalence sub-grouped as either ≥1 or ≥2 pertains to the prevalence of these chronic conditions;
[4]Poverty thresholds 2004 (U.S. Census Bureau, 2004) criteria for adults 65 years and older were used to determine income less than or equal to the poverty threshold
[5]Self-reported physical activity: Lightly active = ≤ 3times times per week of physical activity ≥ 20 min/day; Highly active = ≥ 4 times per week of physical activity ≥ 20 min/day

Females and Race

Additional analyses conducted by race among the female sample detected statistically significant differences for reported monthly income in terms of the poverty threshold, food security classification, and education, with a trend detected for reported monthly income (Table 4). Compared to Caucasian females (CF), significantly (P = 0.001) more African American females (AAF) reported having a monthly income less than or equal to the poverty threshold, significantly (P = 0.005) more were food insecure, and significantly (P= 0.007) less reported graduating from high school. AAF reported earning less (P = 0.073) in monthly income than CF.

Table 4. Demographic Characteristics by Race (Female Sample Only).			
Characteristic	CF[1] (n=56)	AAF[2] (n=18)	P value
Average age (y; mean ± SD)	73.9 ± 6.85	73.2 ± 6.32	0.729[3]
Race			
Caucasian (%)	100	0	N/A[4]
African American (%)	0	100	
Chronic Conditions[6]			
Number (mean ± SD)	1.3 ± 1.24	1.4 ± 1.25	0.602[3]
≥ 1 (%)	66	72	0.628[5]
≥ 2 (%)	38	44	0.600[5]
Education			
Less than high school (%)	14	44	**0.007**[5]
High school graduate/GED (%)	86	56	
Monthly Income (Reported)			
Dollars (mean ± SD)	2137 ± 1756.5	1327 ± 1211.3	**0.073**[3]
≤ Poverty Threshold[7] (%)	13 (n=54)	50	**0.001**[5]
BMI (kg/m^2; mean ± SD)	28.6 ± 6.25	28.8 ± 6.02	0.899[3]
BMI category			
18.5-24.9 kg/m^2 (%)	34	22	0.281[5]
25.0-29.9 kg/m^2 (%)	25	45	
≥ 30.0 kg/m^2 (%)	41	33	
BMI category			
18.5-24.9 kg/m^2 (%)	34	22	0.351[5]
≥ 25 kg/m^2 (%)	66	78	
Food Insecure (%)	7	33	**0.005**[5]
Physical Activity (Reported)[8]			
Lightly Active (%)	48	56	0.588[5]
Highly Active (%)	52	44	

[1]CF = Caucasian Females
[2]AAF = African American Females
[3]P value for t-test analyses
[4]N/A = Not Applicable; Race classification as CF or AAF is mutually exclusive;
[5]P value for x^2 analyses
[6]Total number of chronic conditions was calculated by summing the following diet-related chronic conditions: obesity determined from BMI (calculated from height and weight measurements) and self-reported prevalence of stroke, hypertension, heart disease, diabetes, or cancer; Chronic condition prevalence sub-grouped as either ≥1 or ≥2 pertains to the prevalence of these chronic conditions;
[7]Poverty thresholds 2004 (U.S. Census Bureau, 2004) criteria for adults 65 years and older were used to determine income less than or equal to the poverty threshold
[8]Self-reported physical activity: Lightly active = ≤ 3times times per week of physical activity ≥ 20 min/day; Highly active = ≥ 4 times per week of physical activity ≥ 20 min/day

Percent of Sample Adherences to Recommendations

Total Sample

The majority of the daily recommendations had low (<50%) percent of sample adherences by the total sample (whole grain, total vegetable, fruit, fiber, sodium, and potassium) (Table 5). Daily recommendations that had the lowest percent of sample adherences included whole grain and potassium. High percent of sample adherences (≥50%) were observed for the fat-related recommendations (total fat, saturated fat, and cholesterol), with the cholesterol recommendation having the highest adherence by the total sample.

For the weekly vegetable subgroup recommendations, adherence by the total sample was low (<50%) for dark green vegetables, orange vegetables, legumes, and starchy vegetables, with legumes having the lowest percent of sample adherence by the total sample (Table 5). High (≥ 50%) adherence by the total sample was determined for only the "other" vegetable recommendation.

Table 5. Percent of Total Sample Adherences to Specific Dietary Recommendations of the 2005 *Dietary Guidelines for Americans.*	
Recommendation	Total Sample (n=88) %
Daily	
Whole grain[1] (Males and Females: 3 oz equivalents)	6
Total Vegetable[1] (Males 2.5 cups; Females 2 cups)	36
Fruit[1] (Males 2 cups; Females 1.5 cups)	21
Fiber (14g/1000kcal)	30
Sodium (<1500 mg)	21
Potassium (≥4700 mg)	6
Total fat (20-35% of total kcal)	58
Saturated fat (<10% of total kcal)	58
Cholesterol (<300 mg)	94
Weekly	
Dark green vegetables[1] (Males 3 cups; Females 2 cups)	24
Orange vegetables[1] (Males 2 cups; Females 1.5 cups)	17
Legume vegetables[1] (Males 3 cups; Females 2.5 cups)	1
Starchy Vegetables[1] (Males 3 cups; Females 2.5 cups)	43
Other Vegetables[1] (Males 6.5 cups; Females 5.5 cups)	63
[1]Recommended minimum daily whole grain, total vegetable, total fruit, and weekly vegetable subgroup recommendations were determined using the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).	

Gender

Males and females had a similar pattern for percent of sample adherences to *Dietary Guideline* recommendations (Table 6). The majority of the daily recommendations had low (<50%) percent of sample adherences among both genders (whole grain, total vegetable, fruit, fiber, sodium, and potassium), with the whole grain and potassium recommendations having the lowest adherences by both males and females. Daily recommendations which had high ($\geq$ 50%) percent of sample adherences by both males and females included the fat related recommendations (total fat, saturated fat, and cholesterol), with both groups having the highest adherence to the cholesterol recommendation.

For the weekly recommendations, percent of sample adherences for both males and females was low (<50%) for each of the dark green, orange, and starchy vegetable subgroup recommendations, with the legume recommendation having the lowest adherence by both genders (Table 6). Only the "other" vegetable recommendation had high ($\geq$ 50%) percent of sample adherences by both males and females. Chi square analyses conducted for daily and weekly recommendation percent of sample adherences by gender detected no statistically significant differences.

Table 6. Percent of Sample Adherences to Specific Dietary Recommendations of the 2005 *Dietary Guidelines for Americans* by Gender.

Recommendation	Males (n=14) %	Females (n=74) %	P value[2]
Daily			
Whole grain[1] (Males and Females: 3 oz equivalents)	7	5	0.797
Total Vegetable[1] (Males 2.5 cups; Females 2 cups)	36	35	0.967
Fruit[1] (Males 2 cups; Females 1.5 cups)	14	22	0.533
Fiber (14g/1000kcal)	36	30	0.656
Sodium (<1500 mg)	7	24	0.152
Potassium (≥4700 mg)	7	5	0.797
Total fat (20-35% of total kcal)	57	58	0.947
Saturated fat (<10% of total kcal)	64	57	0.601
Cholesterol (<300 mg)	93	95	0.797
Weekly			
Dark green vegetables[1] (Males 3 cups; Females 2 cups)	14	26	0.359
Orange vegetables[1] (Males 2 cups; Females 1.5 cups)	14	18	0.765
Legume vegetables[1] (Males 3 cups; Females 2.5 cups)	7	0	N/A[3]
Starchy Vegetables[1] (Males 3 cups; Females 2.5 cups)	43	43	0.979
Other Vegetables[1] (Males 6.5 cups; Females 5.5 cups)	64	61	0.807

[1]Recommended minimum daily whole grain, total vegetable, total fruit, and weekly vegetable subgroup recommendations were determined using the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).
[2]P Value for gender-specific x^2 analyses
[3]N/A = Not Applicable; Conditions for x^2 analysis not appropriate due to 0% adherence for at least one group;

Females and Race

Caucasian females (CF) and African American females (AAF) had similar recommendation percent of sample adherence patterns (Table 7). For the daily recommendations, both CF and AAF had low (<50%) percent of sample adherences to the majority of the recommendations (whole grain, total vegetable, fruit, fiber, sodium, and potassium), with the lowest adherences observed for the whole grain and potassium recommendations by both CF and AAF. Both CF and AAF had high ($\geq$ 50%) percent of sample adherences to the daily fat related recommendations (total fat, saturated fat, and cholesterol), with the highest adherences observed by both groups for the cholesterol recommendation.

For the weekly vegetable subgroup recommendations, both CF and AAF had low (< 50%) percent of sample adherences to the majority of the recommendations (dark green, orange, legume, and starchy) (Table 7). Although CF had a high ($\geq$ 50%) percent of sample adherence to the "other" vegetable recommendation, AAF had a low percent of sample adherence. Both groups had the highest percent of sample adherences for the "other" and starchy vegetable recommendations, and the lowest percent of sample adherence to the legume recommendation. CF had higher percent of sample adherences to each of the vegetable subgroup recommendations compared to AAF with the exception of the legume recommendation for which both groups had percent of sample adherences of 0%.

Analysis of adherence to the percent of sample adherences to the daily and weekly *Dietary Guideline* recommendations by race among the female sample indicated

that CF had a significantly (P = 0.001) higher adherence to the weekly "other" vegetable recommendation, and a higher adherence (P = 0.059) to the total daily vegetable recommendation compared to AAF (Table 7). No other percent of sample adherences to the recommendations by race were significant.

Table 7. Percent of Sample Adherences to Specific Dietary Recommendations of the 2005 *Dietary Guidelines for Americans* by Race (Female Sample Only).

Recommendation	CF[2] (n=56) %	AAF[3] (n=18) %	P Value[4]
Daily			
Whole grain[1] (Males and Females: 3 oz equivalents)	5	6	0.974
Total Vegetable[1] (Males 2.5 cups; Females 2 cups)	41	17	**0.059**
Fruit[1] (Males 2 cups; Females 1.5 cups)	21	22	0.943
Fiber (14g/1000kcal)	32	22	0.423
Sodium (<1500 mg)	21	33	0.306
Potassium (≥4700 mg)	5	6	0.974
Total fat (20-35% of total kcal)	61	50	0.423
Saturated fat (<10% of total kcal)	59	50	0.506
Cholesterol (<300 mg)	96	89	0.218
Weekly			
Dark green vegetables[1] (Males 3 cups; Females 2 cups)	29	17	0.315
Orange vegetables[1] (Males 2 cups; Females 1.5 cups)	20	11	0.408
Legume vegetables[1] (Males 3 cups; Females 2.5 cups)	0	0	N/A[5]
Starchy Vegetables[1] (Males 3 cups; Females 2.5 cups)	48	28	0.128
Other Vegetables[1] (Males 6.5 cups; Females 5.5 cups)	71	28	**0.001**

[1]Recommended minimum daily whole grain, total vegetable, total fruit, and weekly vegetable subgroup recommendations were determined using the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005)
[2]CF = Caucasian Females
[3]AAF = African American Females
[4]P Value for race-specific x^2 analyses for the female sample
[5]N/A = Not Applicable; Conditions for x^2 analysis not appropriate due to 0% adherence for at least one group

Body Mass Index

Normal weight (NW) and overweight/obese (OO) participants had a similar pattern for percent of sample adherences to the daily and weekly *Dietary Guidelines* recommendations, with few exceptions (Table 8). For both groups, the majority of the daily recommendations had low (< 50%) percent of sample adherences (whole grain, total vegetable, fruit, and potassium), with the whole grain and potassium recommendations having the lowest adherences. Both groups had high (≥ 50%) percent of sample adherences to the fat related daily recommendations (total fat, saturated fat, cholesterol), with the cholesterol recommendation having the highest adherence by both NW and OO participants. Regarding classification as either high or low percent of sample adherences to the daily recommendations, one difference was observed: NW participant percent of sample adherence to the daily fiber recommendation was high (≥50%) whereas percent of sample adherence among OO participants was low (<50%).

For the weekly vegetable subgroup recommendations, NW and OO participants had a similar pattern for percent of sample adherences (Table 8). Only the "other" vegetable recommendation had a high (≥ 50%) percent of sample adherence by both groups. The remaining other weekly vegetable subgroup recommendations (dark green, orange, legume and starchy) each had low (<50%) percent of sample adherences, with legumes having the lowest percent of sample adherence by both groups.

Chi square analyses conducted for percent of sample adherences to the daily and weekly recommendations of the *Dietary Guidelines* by BMI classification as either NW or OO identified two statistical differences: a significant difference for the daily fiber

recommendation (P = 0.011) and a trend (P = 0.063) for the daily total fat recommendation (Table 8). NW participants had higher percent of sample adherences compared to OO participants for each. Total daily calorie intake did not significantly differ between these two groups. No statistical differences for percent of sample adherences to the other daily and weekly recommendations were indicated by BMI.

Table 8. Percent of Total Sample Adherences to Specific Dietary Recommendations of the 2005 *Dietary Guidelines for Americans* by Body Mass Index (BMI) Groups.

Recommendation	BMI		P value[4]
	NW[2] (n=26)	OO[3] (n=62)	
Total calories	1454±550.5	1562±635.4	0.451
Daily			
Whole grain[1] (3 oz equivalents)	8	5	0.598
Total Vegetable[1] (Males 2.5 cups; Females 2 cups)	27	39	0.291
Fruit[1] (Males 2 cups; Females 1.5 cups)	19	21	0.854
Fiber (14g/1000kcal)	50	23	**0.011**
Sodium (<1500 mg)	15	24	0.360
Potassium (≥4700 mg)	4	7	0.630
Total fat (20-35% of total kcal)	73	52	**0.063**
Saturated fat (<10% of total kcal)	65	55	0.361
Cholesterol (<300 mg)	100	92	0.136
Weekly			
Dark green vegetables[1] (Males 3 cups; Females 2 cups)	27	23	0.663
Orange vegetables[1] (Males 2 cups; Females 1.5 cups)	12	19	0.374
Legume vegetables[1] (Males 3 cups; Females 2.5 cups)	0	2	N/A[5]
Starchy Vegetables[1] (Males 3 cups; Females 2.5 cups)	42	44	0.915
Other Vegetables[1] (Males 6.5 cups; Females 5.5 cups)	62	61	0.983

[1]Recommended minimum daily whole grain, total vegetable, total fruit, and weekly vegetable subgroup recommendations were determined for the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).
[2]NW = Normal weight (BMI 18.5-24.9 kg/m^2)
[3]OO = Overweight or obese (BMI ≥25 kg/m^2)
[4]P value for BMI-specific x^2 analyses
[5]N/A = Not Applicable; Conditions for x^2 analysis are not appropriate due to 0% adherence for at least one group

Self-reported Physical Activity Level

Participants who self-reported being more lightly physically active had a similar pattern of percent of sample adherence to daily and weekly recommendations of the *Dietary Guidelines* as those who reported being more highly physically active (Table 9). The majority of the daily recommendations had low (< 50%) percent of sample adherences by both groups (whole grain, total vegetable, fruit, fiber, sodium, and potassium), with the whole grain and potassium recommendations having the lowest percent of sample adherences by both groups. Daily recommendations with high (≥ 50%) percent of sample adherences by both lightly and highly active participants included the fat-related recommendations (total fat, saturated fat, and cholesterol), with the cholesterol recommendation having the highest percent of sample adherences by both groups.

For the weekly vegetable subgroup recommendations, both lightly and highly active participants had high (≥ 50%) percent of sample adherences to only the "other" vegetable recommendation (Table 9). The remaining other weekly vegetable subgroup recommendation each had low (<50%) percent of sample adherences (dark green, orange, legume, and starchy), with the legume recommendation having the lowest percent of sample adherence for both groups.

Chi square analyses for percent of sample adherences to *Dietary Guidelines* recommendations by self-reported physical activity level detected highly active participants had a significantly (P = 0.018) higher adherence to the weekly orange vegetable recommendation compared to lightly active participants (Table 9). A trend (P=0.051) was detected for which highly active participants consumed more total calories

than lightly active participants. No statistical differences for percent of sample adherences to the other daily and weekly recommendations were indicated by self-reported physical activity level.

Table 9. Percent of Total Sample Adherences to Specific Dietary Recommendations of the 2005 *Dietary Guidelines for Americans* by Self-Reported Physical Activity Level.

Recommendation	Self-reported Physical Activity Level[2]		P value[3]
	Lightly Active (n=42)	Highly Active (n=46)	
Total calories	1398±486.1	1652±688.3	**0.051**
Daily			
Whole grain[1] (3 oz equivalents)	0	11	N/A[4]
Total Vegetable[1] (Males 2.5 cups; Females 2 cups)	29	41	0.212
Fruit[1] (Males 2 cups; Females 1.5 cups)	14	26	0.170
Fiber (14g/1000kcal)	24	37	0.182
Sodium (<1500 mg)	21	22	0.972
Potassium (≥4700 mg)	2	9	0.201
Total fat (20-35% of total kcal)	57	59	0.883
Saturated fat (<10% of total kcal)	52	63	0.311
Cholesterol (<300 mg)	98	91	0.201
Weekly			
Dark green vegetables[1] (Males 3 cups; Females 2 cups)	21	26	0.609
Orange vegetables[1] (Males 2 cups; Females 1.5 cups)	7	26	**0.018**
Legume vegetables[1] (Males 3 cups; Females 2.5 cups)	2	0	N/A[4]
Starchy Vegetables[1] (Males 3 cups; Females 2.5 cups)	45	41	0.710
Other Vegetables[1] (Males 6.5 cups; Females 5.5 cups)	55	67	0.224

[1]Recommended minimum daily whole grain, total vegetable, total fruit, and weekly vegetable subgroup recommendations were determined for the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).
[2]Self-reported Physical Activity Level: Lightly active = ≤ 3times times per week of physical activity ≥ 20 min/day; Highly active = ≥ 4 times per week of physical activity ≥ 20 min/day
[3]P value for x^2 analyses specific to self-reported physical activity level
[4]N/A = Not Applicable; Conditions for x^2 analysis are not appropriate due to 0% adherence for at least one group

Percent of Recommended Intakes

Tables 10, 11 and 12 display the percent of recommended intakes for the recommendations assessed in this research by the total sample and by gender and race. Percent of recommended intakes for each recommendation were calculated by dividing the mean intake of the sample (either the total sample, or samples by gender and race) by the recommended minimum or maximum amount. For minimal daily and weekly recommendations (whole grain, total vegetable, fruit, fiber, potassium, and the vegetable subgroups), higher percent of recommended intakes are more desirable, with values ≥100% indicating consumption of nutrients or dietary components in an amount by the sample which meets the minimum amount recommended. On the contrary, lower percent of recommended intakes are desirable for maximal daily recommendations (sodium, total fat, saturated fat, and cholesterol). For these recommendations, percent of recommended intakes ≥100% are indicative of the sample consuming such nutrients and/or dietary components in amounts that exceed the maximum daily amount recommended.

Total Sample

For the daily minimal recommendations, the lowest percent of recommended intake by the total sample was observed for the whole grain recommendation for which the sample's mean intake was less than half of that recommended (Table 10). The highest percent of recommended intake was observed for the fiber daily minimal recommendation.

For the daily maximal recommendations, only mean intakes for total fat (percent of total calories) and cholesterol had percent of recommended intakes that were <100%

by the total sample (Table 10). Recommendations that had percent of recommended intakes ≥100% included sodium and saturated fat.

Table 10. Calculated Nutrient and Dietary Component Intake Amounts and Percent of Recommended Intakes for the Total Sample.

Nutrient or Dietary Component	Total Sample (n = 88)	
	mean ± SD	%[2]
Total calories	1531 ± 610.5	N/A[3]
Daily Recommendation (Minimal)		
Whole grain[1] (3 oz-equivalents)	1.3 ± 0.93	43
Fiber (14g/1000kcal)	12.4 ± 3.86	89
Potassium (≥ 4700 mg)	2823 ± 1094.8	60
Daily Recommendation (Maximal)		
Sodium (≤ 1500 mg)	2467 ± 1077.3	164
Total fat (20-35% of total calories)	33 ± 6.6	94
Saturated fat (< 10% of total calories)	10 ± 2.3	100
Cholesterol (< 300 mg)	161 ± 89.1	54

[1]Recommended minimum daily whole grain intake was determined using the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).
[2]Percent of Recommended intake; calculated by dividing mean intake of the total sample by recommended minimum or maximum amount.
[3]N/A = Not Applicable; Total calorie recommendations differ by gender (USDA, 2005)

Gender

Males and females had similar percent of recommended intake patterns to the *Dietary Guidelines* daily minimal and maximal recommendations (Table 11). For the daily minimal recommendations, both males and females had the lowest percent of recommended intake for the whole grain recommendation, for which only male whole grain intake was at least half of the recommended amount. The highest percent of recommended intake by both males and females was observed for the daily minimal fiber recommendation.

Daily maximal recommendations which were met by both males and females according to percent of recommended intake values (<100%) included total fat and cholesterol (Table 11). Recommendations not met by males and females (those having percent of recommended intakes $\geq$ 100%) included sodium and saturated fat, with sodium having the highest percent of recommended intake.

Independent sample t-tests for mean intake amounts by gender detected a trend (P= 0.078) for mean whole grain intake, with males having a higher mean intake than females (Table 11). There were no significant differences detected for the other nutrients or dietary component mean intakes by gender.

Table 11. Calculated Nutrient and Dietary Component Intake Amounts and Percent of Recommended Intakes by Gender.

Nutrient or Dietary Component	Males (n = 14)		Females (n = 74)		P value[3]
	mean ± SD	%[2]	mean ± SD	%[2]	
Total calories	1764 ± 501.3	88[4]	1487 ± 622.1	93[4]	0.120
Daily Recommendation (Minimal)					
Whole grain[1] (3 oz-equivalents)	1.7 ± 0.82	57	1.2 ± 0.94	40	**0.078**
Fiber (14g/1000kcal)	12.1 ± 3.29	86	12.5 ± 3.99	89	0.720
Potassium (≥ 4700 mg)	3179 ± 1025.4	68	2756 ± 1101.1	59	0.187
Daily Recommendation (Maximal)					
Sodium (≤ 1500 mg)	2814 ± 910.5	188	2393 ± 1098.9	160	0.186
Total fat (20-35% of total calories)	33 ± 6.0	94	33 ± 6.0	94	0.777
Saturated fat (< 10% of total calories)	10 ± 3.0	100	10 ± 2.1	100	0.950
Cholesterol (< 300 mg)	192 ± 91.8	64	155 ± 88.0	52	0.163

[1]Recommended minimum daily whole grain intake was determined using the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).
[2]Percent of Recommended intake; calculated by dividing mean intake of the total sample by recommended minimum or maximum amount.
[3]P value for gender-specific independent sample t-tests for nutrients and dietary components
[5]Percent of total calories for gender groups were calculated using the estimated calorie level for sedentary adults 51 years and older (males, 2000 calories; females, 1600 calories) (USDA, 2005)

Because fruit and vegetable recommendations differed by gender, fruit and vegetable intakes and percent of recommended intakes for these dietary components are presented separately from the other recommendations (Table 12). Males and females had similar percents of recommended intakes for the daily minimal fruit and vegetable recommendations as well as for the weekly vegetable subgroup minimal recommendations. A majority consumed at least half of the daily minimal recommended total vegetable and fruit intakes, with total vegetable having a higher percent of the recommended intake than total fruit.

For the weekly vegetable subgroup recommendations, only the starchy and "other" vegetable subgroups had percent of recommended intakes by males and females $\geq$ 100% (Table 12). Lower percent of recommended intakes were observed for the dark green, orange, and legume vegetables. Legume intake had the lowest percent of recommended intake for both males and females.

Table 12. Fruit and Vegetable Intake (mean ± SD) and Percent of Recommended Intakes by Gender.

Recommendation	Males (n = 14)		Females (n = 74)	
	Absolute Intake (mean ± SD)	%[1]	Absolute Intake (mean ± SD)	%[1]
Daily Recommendation (Minimal)[2]				
Total Vegetable (Males 2.5 cups; Females 2 cups)	2.2 ± 0.91	88	1.8± 1.09	90
Fruit (Males 2 cups; Females 1.5 cups)	1.3 ± 0.59	65	1.2 ± 0.74	80
Weekly Recommendation (Minimal)[2]				
Dark green vegetables (Males 3 cups; Females 2 cups)	1.5 ± 1.34	50	1.5 ± 1.54	75
Orange vegetables (Males 2 cups; Females 1.5 cups)	1.1 ± 0.72	55	1.0 ± 1.03	67
Legume vegetables (Males 3 cups; Females 2.5 cups)	1.0 ± 1.15	33	0.6 ± 0.63	24
Starchy Vegetables (Males 3 cups; Females 2.5 cups)	3.0 ± 1.98	100	2.6 ± 1.89	104
Other Vegetables (Males 6.5 cups; Females 5.5 cups)	8.6 ± 4.57	132	7.2± 4.49	131

[1]% = Percent of Recommended intake; calculated by dividing mean intake of the total sample by recommended minimum or maximum amount.

[2]Recommended minimum total vegetable, total fruit, and weekly vegetable subgroup recommendations were determined using the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).

Deviance scores were also calculated for males and females in order to compare mean dietary intakes for fruits and vegetables by gender (Table 13). Independent sample t-tests conducted for deviance scores by gender detected a significant (P = 0.032) difference in mean intake for the weekly minimal dark green recommendation, and a trend (P = 0.059) for the daily minimal total fruit recommendation for which female mean intakes were closer to their corresponding recommendations than males for each of these dietary components. There were no significant differences detected for the other daily and weekly minimal recommendation deviance scores by gender.

Table 13. Deviance Score Calculated From Mean Intakes for Daily and Weekly Fruit and Vegetable Recommendations by Gender.

Recommendation	Deviance Score[1]		P value[3]
	Males (n = 14)	Females (n = 74)	
Daily Recommendation (Minimal)[2]			
Total Vegetable (Males 2.5 cups; Females 2 cups)	-0.3 ± 0.91	-0.2 ± 1.09	0.589
Fruit (Males 2 cups; Females 1.5 cups)	-0.7 ± 0.59	-0.3 ± 0.74	**0.059**
Weekly Recommendation (Minimal)[2]			
Dark green vegetables (Males 3 cups; Females 2 cups)	-1.5 ± 1.34	-0.5 ± 1.54	**0.032**
Orange vegetables (Males 2 cups; Females 1.5 cups)	-0.9 ± 0.72	-0.5 ± 1.03	0.161
Legume vegetables (Males 3 cups; Females 2.5 cups)	-2.1 ± 1.15	-1.9 ± 0.63	0.630
Starchy Vegetables (Males 3 cups; Females 2.5 cups)	0.0 ± 1.98	0.1 ± 1.87	0.867
Other Vegetables (Males 6.5 cups; Females 5.5 cups)	2.1 ± 4.57	1.7 ± 4.49	0.789

[1]Deviance scores were created to compare male and female fruit and vegetable intakes since these recommendations differ by gender gender-specific recommendations exist; the corresponding gender-specific recommendations for each of the daily and weekly fruit and vegetable amounts were subtracted from male and female fruit and vegetable intakes;
[2]Recommended minimum daily whole grain, total vegetable, total fruit, and weekly vegetable subgroup recommendations used in calculating deviance scores were determined using the daily estimated calorie patterns of sedentary males (2000 calories) and females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).
[3]P value for gender-specific independent sample t-tests for deviance scores;

Females and Race

CF and AAF had similar percent of recommended intakes for daily and weekly minimal recommendations in addition to the daily maximal recommendations of the *Dietary Guidelines*, with few exceptions (Table 14). For the daily minimal recommendations, CF and AAF had the lowest percent of recommended intake for whole grain for which less than half of the recommended amount was consumed by both groups. Each of the other daily minimal recommendations (total vegetable, total fruit, fiber, and potassium) had percent of recommended intakes that were at least 50%, with only the CF having a percent of recommended intake $\geq$100% to the total vegetable recommendation.

For the daily maximal recommendations, the highest percent of recommended intake for both groups was sodium for which both groups had percents of recommended intakes $\geq$100% (Table 14). Although percent of recommended intake for saturated fat by CF did not exceed the recommended amount, AAF had a percent of recommended intake for the saturated fat that was $\geq$100%. The total fat and cholesterol daily maximal recommendations had percent of recommended intakes <100% for both CF and AAF, with the lowest percent of recommended intake observed for the cholesterol recommendation by both groups.

For the weekly minimal vegetable subgroup recommendations (for which higher percent of recommended intakes are desirable), both CF and AAF had the highest percent of recommended intakes for "other" vegetables followed by starchy vegetables, for which only the percent of recommended intake by CF for these recommendations were $\geq$100%

(Table 14). The lowest percent of recommended intakes by CF and AAF was observed for the legume recommendation for which each group's intake was less than half of that recommended. Both CF and AAF had percent of recommended intakes for the dark green vegetable and orange vegetable recommendations which were at least 50%. CF had higher percent of recommended intakes for each of the weekly vegetable subgroup recommendations compared to AAF.

Independent sample t-tests for mean intake by race for the females detected significant differences for daily total vegetable (P = 0.047) and the weekly "other" vegetable (P = 0.018) intakes, with CF having higher intakes than AAF for these dietary components (Table 14). Additionally, trends were detected for CF having a higher (P = 0.093) daily fiber (g/1000 kcal) intake compared to AAF, with AAF having a higher (P = 0.077) saturated fat intake (as percent of total calories) than CF. There were no other significant differences detected for other mean nutrient and dietary component intakes by race among the females.

Table 14. Calculated Nutrient and Dietary Component Intake Amounts and Percent of Recommended Intakes for Females by Race.

	CF[1] (n = 56)		AF[2] (n = 18)		
Nutrient or Dietary Component	mean ± SD	%[3]	mean ± SD	%[3]	P value[4]
Total calories	1484 ± 582.1	93[5]	1495 ± 751.9	93[5]	0.950
Daily Recommendation (Minimal)					
Whole grain (3 oz-equivalents)	1.2 ± 0.88	40	1.2 ± 1.13	40	0.818
Total vegetables (2 cups)	2.0 ± 1.07	100	1.4 ± 1.04	70	**0.047**
Total fruit (1.5 cups)	1.2 ± 0.66	80	1.2 ± 0.95	80	0.821
Fiber (14g/1000kcal)	12.9 ± 3.93	92	11.1 ± 3.91	79	**0.093**
Potassium (4700 mg)	2868 ± 1028.4	61	2408 ± 1270.7	51	0.124
Daily Recommendation (Maximal)					
Sodium (1500 mg)	2440 ± 1049.5	163	2264 ± 1263.8	151	0.556
Total fat (20-35% of total kcal)	33 ± 6.4	94	34 ± 7.7	97	0.484
Saturated fat (10% of total kcal)	9 ± 2.0	90	10 ± 2.4	100	**0.077**
Cholesterol (300 mg)	153 ± 76.8	51	162 ± 118.9	54	0.690
Weekly Recommendation (Minimal)					
Dark green vegetables (2 cups)	1.6 ± 1.61	80	1.2 ± 1.29	60	0.433
Orange vegetables (1.5 cups)	1.0 ± 1.03	67	0.8 ± 1.04	53	0.391
Legumes (2.5 cups)	0.6 ± 0.66	24	0.5 ± 0.52	20	0.460
Starchy Vegetables (2.5 cups)	2.7 ± 1.90	108	2.2 ± 1.75	88	0.301
Other Vegetables (5.5 cups)	7.9 ± 4.27	144	5.1 ± 4.58	93	**0.018**

[1]CF = Caucasian females
[2]AAF = African American females
[3]Percent of Recommended intake; calculated by dividing mean intake of female race subgroups by recommended minimum or maximum amounts.
[4]P value for race-specific independent sample t-tests for mean ± SD of nutrients and dietary components
[5]Recommended minimum daily whole grain, total vegetable, total fruit, and weekly vegetable subgroup recommendations were determined using the daily estimated calorie patterns of sedentary females (1600 calories) 51 years and older according to the USDA Food Guide (USDA, 2005).

Discussion

Diet-related chronic conditions are widely prevalent among older adults. The *Dietary Guidelines for Americans* outline specific dietary recommendations designed to reduce the risk for developing certain chronic conditions. The purpose of this research was to determine the extent to which the diets of older community living adults in central North Carolina adhere to specific dietary recommendations of the 2005 *Dietary Guidelines for Americans*. The findings from this research are intended to help guide the focus of region-specific nutrition programs designed to improve dietary intake to prevent and or manage nutrition-related chronic diseases among this population. Two different approaches were used to acquire insight as to the extent of which the diets of this study's older sample adhered to specific dietary recommendations of the *Dietary Guidelines*: 1) percent of sample adherences to the recommendations; 2) percent of recommended intakes consumed using mean participant intakes calculated from a food frequency questionnaire, the NCI's Diet History Questionnaire (NCI, 2002).

Dietary patterns of older adults living in central North Carolina need improvement in order to better meet national dietary recommendations outlined in the 2005 *Dietary Guidelines for Americans*. Regarding the first approach to assessing dietary adherence to the *Dietary Guidelines* for which percent of sample adherences to the recommendations were determined, the majority of the daily recommendations had low (<50%) percent of sample adherences (whole grain, total fruit, total vegetable, fiber, potassium, and sodium) by the total sample, with the lowest percent of sample adherences observed for the whole grain (6%) and potassium (6%) recommendations.

Daily recommendations that had high (≥50%) adherences were for the fat-related recommendations (total fat, saturated fat, and cholesterol), with the cholesterol recommendation having the highest percent of sample adherence (94%).

For the weekly vegetable subgroup recommendations, the highest percent of sample adherences were observed for the starchy (43%) and "other" (63%) vegetable subgroup recommendations for which only the "other" vegetable subgroup recommendation had a high (≥50%) percent of sample adherence. The remaining vegetable subgroup recommendations (dark green, orange, and legumes) had low (<50%) percent of sample adherences which were each less than 25%, with the legumes having the lowest percent of sample adherence (1%) by the total sample.

To further investigate dietary adherence among this sample to the *Dietary Guidelines*, percent of recommended intakes calculated from mean dietary intakes by the total sample was calculated. Of the daily minimal recommendations (whole grain, fiber, total fruit, total vegetable, and potassium), the whole grain recommendation had the lowest percent of recommended intake (43%) by the total sample (Table 10). This is not surprising, since NHANES 1999-2002 data estimate adults 60 and older consume approximately one-third (one ounce-equivalent) of the recommended three ounce equivalents of whole grains per day (Cook & Friday, 2005). Although only 43% of our sample consumed the recommended amount of whole grain servings daily, mean fiber intake by our sample was 89% of the recommended 14 g/1000 calories (Table 10), suggesting our sample is not far from meeting the minimal recommended amount of daily fiber intake. This rather high percent of recommended intake for fiber consumed by our

sample is likely attributed to multiple sources of fiber contributing to mean total fiber intake including fiber consumed from fruit, vegetable, and whole grain sources. This finding suggests that older adults in Central North Carolina could better meet their minimal daily recommendation for fiber intake by increasing their whole grain intake.

While a low percentage of males (36%) and females (35%) adhered to the daily vegetable recommendation, both males and females had high mean intakes expressed as a percent of recommended intake of their gender-specific recommended amounts for total vegetables (males, 88%; females, 90%), thus indicating they are not far from meeting the total vegetable recommendation. However, our sample needs to improve their vegetable variety intake according to percent of recommended intakes for the vegetable subgroup recommendations. Consistent with our finding that starchy and "other" vegetables had the highest percent of sample adherences, it is not surprising that the percent of recommended intakes for these two vegetable subgroups were at least 100% by both males and females, indicating mean weekly consumption of these vegetable types meet their recommended minimum intake. Additionally, the weekly vegetable subgroups recommendations that had the lowest percent of recommended intakes were for the dark green, orange, and legume recommendations which ranged between 24% and 75% for males and females, with legume intake having the lowest percent of recommended intake by males (33%) and females (24%). These findings indicate the need for this sample to improve their profile of vegetable subgroup intake by incorporating more dark green, orange, and especially legume vegetables into their vegetable selections.

This profile of vegetable subgroup intake by our sample is similar to that of national dietary intake data among adults aged 60 and older (NHANES 1999-2002) who consumed the bulk of their vegetable intake as starchy vegetables and "other" vegetables, with a lower amount of each of dark green and orange vegetables comprising their total vegetable intake, and with the lowest contribution to total vegetable intake derived from legumes (Cook & Friday, 2005). These findings are also similar to the recent findings published by Guenther et al. (2006) who reported the estimated mean total vegetable and vegetable subgroup intakes for the U.S. population using NHANES 1999-2000 data. Guenther et al. (2006) reported intakes for orange, dark green, and legume vegetables that are much less than the MyPyramid recommendations (which are the same as vegetable subgroup recommendations of the 2005 *Dietary Guidelines for Americans*) for adults 51 years and older, with starchy vegetable consumption exceeding its recommended amount.

Regarding the percent of recommended intakes for the daily maximal fat-related recommendations, the saturated fat recommendation had a value that was 100%, indicating this sample's mean intake exceeds the recommended daily amount of <10% of total calories. In addition, the total fat intake was 94% of the recommended upper limit of 35% of total calories from dietary fat. These findings also support national dietary intake data: NHANES III (1988-1994) data estimate that adults 60 and older consume approximately 92% of the maximum recommended total fat intake, and 110% of the maximum saturated fat recommendation, according to calculated mean intake data for this age group (Bialostosky et al., 2002).

The sodium recommendation had the highest percent (164%) of recommended intake among the daily maximal recommendations by the total sample, which combined with our finding of only 21% of the total sample having sodium intakes that meet the 1500 mg daily maximum recommended according to the *Dietary Guidelines*, suggest the need for this sample to greatly decrease their sodium intake to better meet the sodium recommendation. This finding supports national dietary intake data for sodium. The calculated mean sodium intake (2782 mg) for adults 60 and older according to NHANES III (1988-1994) data is 185% of the current 1500 mg daily maximum recommended (Bialostosky et al., 2002). Interestingly, additional analyses indicated more than twice as many older adults in our sample (47%) met the previous sodium recommendation of 2400 mg/day from the 2000 *Dietary Guidelines for Americans* (USDHHS & USDA, 2000) (data not shown). This finding indicates the need for this sample of older adults to decrease their sodium intake to better meet the newer, more stringent 1500 mg sodium recommendation.

Analyses conducted to compare percent of sample adherences to the recommendations by subgroups (gender, ethnicity, BMI, physical activity) indicated similar profiles for all subgroups compared to the total sample: recommendations having the lowest percent of sample adherences by all groups included daily whole grain and potassium, and weekly legume; recommendations with the highest percent of sample adherences by all groups included the fat related recommendations (total fat, saturated fat, and cholesterol).

Several differences, however, were detected between subgroups related to subgroup percent of sample adherences to dietary recommendations of the *Dietary Guidelines* and/or mean intake comparisons. A trend (P = 0.059) was detected for which Caucasian females had higher percent of sample adherence to the daily total vegetable recommendation compared to African American females. In addition, Caucasian females had a significantly (P = 0.047) higher mean total daily vegetable intake in cups compared to AAF. This finding is similar to national (CSFII 1994-1996) total vegetable intake data, which indicates Caucasian females consume more vegetables servings than African American females (3.6$\pm$0.14 vs. 3.2$\pm$0.14), respectively (Champagne et al., 2004). Furthermore, regional daily vegetable intake data specific to older African Americans living in central North Carolina assessed in Project DIRECT (Diabetes Interventions Reaching and Educating Communities Together) determined vegetable intake was less than optimal among African American females 50 years and older (1.9 $\pm$ 0.06; mean $\pm$ standard error) (Gary et al, 2004). Converting vegetable serving intake of African Americans 50 years and older in Project DIRECT to cup intake using the same method we used to convert vegetable servings to cups for our analyses indicates this sample's intake (1.0 cup) is even lower than recorded for our sample of African American females (1.4$\pm$1.04). This may be due to a small sample size of African American females included in our study (n = 18 of 74), or a difference in age of which our sample included adults 65 and older, whereas the intake for older adults in Project DIRECT was for those 50 years and older.

With respect to BMI subgroup comparisons, it is not surprising that normal weight participants had a more optimal recommendation adherence profile than overweight/obese participants with respect to several recommendations of which adherence to fiber and total fat recommendations were statistically significant. Research suggests that dietary patterns less consistent with certain Food Guide Pyramid recommendations are associated with an increased incidence in obesity over time (Quatromoni et al, 2002), or through cross-sectional analysis, are positively associated with BMI (Park et al., 2005), whereas those more consistent with certain Food Guide Pyramid recommendations are associated with lower annual increase in BMI (Newby et al., 2003). Among overweight/obese adults, dietary intake of certain nutrients with specific recommendations in the 2005 *Dietary Guidelines for Americans* is poorer than among normal weight adults (Davis et al, 2006; Howarth et al, 2005).

Similarly, research indicates physical activity is associated with dietary patterns that are more consistent with certain Food Guide Pyramid recommendations (Park et al, 2005). Therefore, it was not surprising that our sample's more highly active participants had higher adherences for a number of the recommendations compared to the less active participants, and was significantly higher for the weekly orange vegetable recommendation. However, the more highly active participants may have higher adherences to these recommendations compared to the less active participants because they consumed more calories ($P = 0.051$). Further, it is important to note that physical activity was assessed through a single self-reported question, thus indicating the need to interpret these associations regarding physical activity with caution.

Limitations

There are several limitations to this research which must be acknowledged. One such limitation was that the data are based on a convenience sample of volunteer adults. Convenience samples may not recruit a representative sample of the target population. Although this study used a convenience sampling design, a variety of recruitment sites were targeted to help recruit a diverse sample of older adults from Guilford and Forsyth counties regarding race and income levels. Such sites included targeting lower income older adults from Elderly Nutrition Programs and rural older adults from Rural Outreach Sites. Although our sample contained nearly three times the number of Caucasian older adults than African Americans, we believe we obtained a representative distribution of Caucasian and African Americans of Guilford and Forsyth counties since the racial percentages of these races in this sample were similar to that of census data for Guilford and Forsyth counties, for which our sample actually had a slightly lower percentage of Caucasians (74% vs. 80%, respectively) (North Carolina State Data Center, 2005).

Because a large majority of this study's sample was female (84%) and Caucasian (74%), the applicability of the findings is limited to primarily older adult Caucasian females. A small percentage of the sample was African American (26%) or male (16%). The results related to these subgroups should therefore be interpreted with caution. Furthermore, because a small sample (n = 88) was recruited, the generalizability of this study's results are limited.

A third limitation the application of the reported findings was the use of a food frequency questionnaire (FFQ), the NCI's Diet History Questionnaire, to assess dietary

intake. Research indicates FFQs may underestimate calorie intake (Bedard et al., 2004; Subar et al., 2003; Wilfalt et al., 1998). However, a measure was taken to limit under-reporting among sample participants: participants with calculated daily dietary intakes less than 500 calories were excluded from this study's analyses. Another concern with using the DHQ, especially with an older adult sample, is that this dietary measure relies on the ability of the sample to accurately recall their dietary intake information for the prior 12 months to completing it. However, participants who were determined to be cognitively impaired from completing the Mini-Mental State Examination, a cognitive impairment screening tool (Folstein et al., 1975) frequently used with older adults, were excluded from this dietary analysis so that participants who were included were assumed to have been able to accurately recall their dietary intake information for the prior 12 months. Because FFQs are designed to assess habitual dietary intake, we feel this particular dietary assessment measure was appropriate for assessing dietary adherence to the *Dietary Guidelines*, which advocate a dietary pattern designed to ideally prevent the development of certain chronic diseases.

Last, another limitation to this study's design is that physical activity was only minimally addressed. Assessment of adherence to dietary recommendations outlined by the 2005 *Dietary Guidelines for Americans* among this study's older adult sample was therefore made using gender-specific recommendations for sedentary adults aged 51 and older (USDA & USDHHS, 2005; USDA, 2005) according to total calorie needs specified by MyPyramid (USDA, 2005). Consequently, we used more conservative minimal whole grain serving and fruit and vegetable cup amounts to meet their corresponding

recommendations, thus potentially overestimating adherence among this study's older adult sample to these recommendations. The sedentary physical activity level was selected to avoid underestimating recommendation adherences. While the majority of this sample (52%) reported themselves to be more active according to the single physical activity question used, given the high proportion of our sample that was categorized as overweight/obese (70%) using BMI, we do not believe that we have overestimated dietary guideline adherence for our study sample by using the total calorie guidelines for sedentary adults ages 51 years and older.

Future Research

Future research is needed to assess factors associated with poorer and/or better dietary adherence to the 2005 *Dietary Guidelines for Americans* among older adults, which can be considered in developing nutrition education programs for this population. Older adults are at increased risk for poor dietary intake, which can impact their ability to meet dietary recommendations for health. A number of factors may contribute to poor dietary intake among older adults which include those related to availability and access to food such as transportation, functional disability, financial status, and food insecurity (ADA, 2005). Other factors include those related to lifestyle and health changes commonly experienced with age, such as changes in living arrangements related to living alone (Larrieu et al., 2004) and depressive symptoms (Weissenburger, 1986). Further research is needed to explore the relationship between such factors and dietary adherence to the *Dietary Guidelines* among older adults so that nutrition education programs can be effectively designed that target the needed improvements of older adults. Additionally,

future research is needed to further assess dietary adherence among older males and African Americans in this region of North Carolina to determine if similar findings for dietary intake are observed since our sample contained a small number of males (N=14 out of 88) and African Americans (N = 23).

Conclusions and Implications

Our results indicate the diets of community living older adults in central North Carolina need improvement to better meet specific dietary recommendations of the 2005 *Dietary Guidelines for Americans*, regardless of gender, ethnicity, BMI classification, and self-reported physical activity level. Because many older adults acknowledge there is a relationship between good nutrition and good health (Ho et al 1991), and because this population, more than any other age group, seeks information about health and is willing to change their behaviors to preserve their health and independence into the later years of life (U.S. Department of Health and Human Services, 1998), nutrition education can potentially be a pivotal means through which to help older adults improve their diets so that they better adhere to dietary recommendations of the 2005 *Dietary Guidelines for Americans*.

This research indicates nutrition education efforts especially need to target the need for community living older adults in central North Carolina to increase whole grain intake, improve vegetable variety (incorporating more dark green, orange, and especially legume vegetables into their diets), and decrease sodium intake. Furthermore, other messages are particularly needed to emphasize the need for older adults in central North Carolina to further decrease their total fat and saturated fat intakes to have better

adherence to the *Dietary Guidelines*. Because the fat-related recommendations had higher sample adherence rates compared to the other recommendations, possibly due to the direct positive association between fat intake and cardiovascular disease which research has well established (Hegsted et al., 1993; Clarke et al., 1997; Howell et al., 1997), and in part to the dietary action these recommendations advocate (limiting intake), there is a need for nutrition education efforts to emphasize the recommendations of the other food groups and dietary components (fruits and vegetables, whole grains, and fiber) for which there is a growing body of research suggesting the association between increasing intake of such items to help prevent chronic disease. Such nutrition education should address ways to help incorporate higher amounts of fruits, vegetables, whole grains, and fiber into the diet since the recommendations for these foods and nutrients advocate a different dietary action than that of the fat-related recommendations, that of increasing intake.

A possible dietary pattern that could be used as a model by nutrition education programs to emphasize dietary eating habits to older adults that exemplify the dietary recommendations of the *Dietary Guidelines* is the DASH (Dietary Approaches to Stop Hypertension) Eating Plan. The DASH diet was initially devised to study the impact of a dietary pattern on preventing and treating hypertension (USDHHS & USDA, 2005). In a clinical trial, the DASH diet was found to significantly lower systolic and diastolic blood pressures among hypertensives and non-hypertensives (Appel et al., 1997). This dietary pattern advocates the consumption of a diet rich in fruits and vegetables (8-10 servings per day), and low-fat dairy foods (2-3 servings) (Appel et al., 1997). The DASH diet

provides a smaller amount of total fat, saturated fat, and cholesterol, and larger amounts of potassium, calcium, magnesium, dietary fiber, and protein compared to the typical American diet (Sacks et al., 2001). To account for differing needs for various age and gender groups, the DASH Eating Plan specifies dietary patterns for a range of calorie levels (USDHHS & USDA, 2005). This diet plan can thus be used to help educate older adults about healthy dietary choices that will decrease their risk of chronic diseases and follow the principle recommendations of the 2005 *Dietary Guidelines for Americans*.

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CHAPTER IV

EPILOGUE

I first began my research-related work the first semester I arrived. Dr. Taylor was working on an on-going project in the local community titled Assessment of Dietary Intake, Health Status, and Biomarkers of Nutritional Status of Older Adults. This project involved the work of several students working in conjunction with Dr. Taylor to recruit a convenience sample of independently living older adults in the local community (Guilford and Forsyth Counties) to assess a variety of health-related aspects, such as diet, depression, functional ability, social support, food insecurity, medication use, nutrition-related blood biomarkers, and chronic condition status. Because this project was on-going when I arrived, I was able to work with the data that already had been collected. This work involved coding and data entry work related to the questionnaires, blood analysis results, and dietary information obtained from a food frequency questionnaire. I think this was a wonderful opportunity for me. In working with the data, I became very familiar with the different kinds of information the project assessed, which was beneficial for developing the aim of my project.

Because the recruitment goal of this project was to recruit approximately 100 older adults, which was still in progress when I arrived, I was given the opportunity during my second semester to actively help in the recruitment and interviewing of participants during the last recruitment period of this project. Dr. Taylor and other

students had previously recruited at a variety of sites to help recruitment efforts derive a diverse group of older adults, including senior centers, rural outreach sites, and churches. We continued recruitment during my second semester to obtain the last quarter (approximately 25) of participants to meet the previously set recruitment goal. We began recruitment during this recruitment period by introducing the project at a local church at a lunch attended by older adult church members, which resulted in a recruitment response that allowed us to recruit just under half of the number we were hoping for. Following scheduling and interviewing these participants, we needed to consider other recruitment strategies to meet the recruitment goal. After a few more recruitment presentations of this type, we experienced a lag in recruitment. We realized it was necessary to try recruiting through other means. Luckily, networking with community contacts resulted in improving our recruitment response. We found success through fliers supplied to the Senior Resources of Guilford's Retired and Senior Volunteer Program. Further success was encountered in presenting to classes at local YMCAs which predominantly older adults attended, after which we met the recruitment goal. In doing recruitment work with this project, I learned recruitment may sometimes require targeting less conventional sites.

Following finishing participant recruitment and interviewing, I was left with deciding on a research question I wanted to be the focus of my thesis research. There was a lot of information to consider. However, my data work during my first semester provided me with insight to the information we had. I was particularly interested in the food frequency questionnaire data. It was around this time the 2005 *Dietary Guidelines*

for Americans was published. Therefore, I developed the idea to analyze dietary adherence among this older adult sample to the latest edition of the *Dietary Guidelines for Americans*. My work from here led to analyzing the food frequency questionnaires and developing new variables to analyze dietary guideline adherences, which formed the bulk of my research efforts to answer my research question.

This thesis research assessed dietary adherence among an older adult convenience sample drawn from Guilford and Forsyth counties in North Carolina to the 2005 *Dietary Guidelines for Americans*. A review of the dietary variables contained from the dietary assessment used in this research with the 2005 *Dietary Guidelines for Americans* resulted in identifying a number of recommendations to assess dietary adherence for. The results from this research identified the recommendations in need of the greatest improvement, which nutrition education efforts can target to ideally help older adults improve their diets so that they meet recommendations designed to prevent and/or manage chronic disease, which older adults are at increased risk for. The findings from our study indicate the need for nutrition education targeting older adults needs to focus on older community living adults in central North Carolina decreasing their sodium and saturated fat intakes, and increasing whole grain and potassium intake, with some focus on increasing fruit and vegetable, and fiber intakes.

In conducting this research, one item in particular stood out for which having more information for would have solidified an ideal condition for assessing diet with respect to the 2005 *Dietary Guidelines for Americans*. This item is physical activity. Physical activity was assessed by the Assessment of Dietary Intake, Health Status, and

Biomarkers of Nutritional Status of Older Adults study. However, this variable was only minimally addressed through self-report by the participant for a single physical activity question. The new Food Guide Pyramid (MyPyramid), which is designed to help disseminate the messages of the *Dietary Guidelines for Americans,* stresses individualization related to appropriate intake amounts of specific food groups, which is based on one's estimated calorie level. The calorie level best suited for an individual relies on gender, age, and physical activity. Since our physical activity question was not in terms of the physical activity specifications of MyPyramid, we chose to use a sedentary physical activity level, which equates to the lowest minimum number of gender and age specific dietary recommendations, so as to not underestimate adherence. However, this did not allow for the individualization component of MyPyramid and the 2005 *Dietary Guidelines for Americans.* Ideally, a more in depth assessment of physical activity level is needed so that an individualized approach can be applied to assessing adherence with respect to the *Dietary Guidelines*. Such an assessment could either entail self-reported physical activity with respect to the physical activity level specifications of MyPyramid, or even more ideal, the latter used in conjunction with a more in-depth physical activity assessment, such as tools validated with this population.

Future research is therefore needed to assess dietary adherence among older adults to the *Dietary Guidelines for Americans* with an individualized approach to establishing minimal serving amounts for fruits, vegetables, and whole grains, which must be met in order to have recommendation adherence. Furthermore, future research is needed to identify factors associated with better/poorer adherence to the *Dietary*

Guidelines among older adults so that nutrition education efforts can further target the needs of this diverse group. Future work is also needed to develop and implement nutrition education programs that target the dietary improvement needs of older adults living in central North Carolina to help improve their dietary intake to better match the recommendations outlined by the 2005 *Dietary Guidelines for American* to help prevent and/or manage chronic disease.

APPENDIX A

SUPPLEMENTARY TABLE

Table 1. Participant Profile by Recruitment Site

	N = 101		N = 88	
Recruitment Site	N	%	N	%
Elderly Nutrition Programs	47	46	36	41
Rural Outreach Sites	22	22	22	25
Churches	17	17	17	19
YMCAs	9	9	7	8
Other[1]	6	6	6	7

[1]Participants recruited from other sites included those from the Retired and Senior Volunteer Program (RSVP) of the Senior Resources of Guilford (n = 2), or through referral from participants (n = 4).

APPENDIX B

FORMS AND QUESTIONNAIRES

The University of North Carolina at Greensboro

CONSENT TO ACT AS A HUMAN SUBJECT

Long Form

Project Title: Dietary Intake and Health of Older Adults

Project Director: Martha Taylor, Ph.D., Associate Professor

Project Assistants: Melissa Soban, Carinthia Cherry, Graduate Research Assistants

Participant's Name: _____

Date of Consent: _____

DESCRIPTION AND EXPLANATION OF PROCEDURES:

The purpose of this study is to learn what older adults eat and how this might be related to their health conditions. This information will help nutrition and health educators develop programs for older adults to improve their nutritional health and quality of life. You will be asked to complete one questionnaire during a face-to-face interview. This is a general questionnaire with questions about your current family and health situation. It will take about 45-60 minutes for this interview. You will also be asked to complete a diet history questionnaire that asks about the types of foods you eat and how much of those foods you usually eat when you eat them. We will give you this questionnaire at our first meeting. You can complete it on your own. It will take about 60 minutes to complete this questionnaire. We will go over it or help you complete it at our second meeting. The appointments for conducting the interviews to complete these questionnaires will be made at your convenience. Also, you will be asked to provide one

blood sample so we can measure specific nutrient components in your blood. These components will help give us an idea of your nutritional health. If you choose not to provide a blood sample, you can still complete the other components of the project. You may also be asked to complete a 24-hour recall of all foods and drinks you consume as a follow-up to this main project. If you agree to complete the 24-hour recall, you will receive the results of that dietary analysis and a small gift in partial compensation of your time for assisting us.

RISKS AND DISCOMFORTS:

To the best of our knowledge, participation in this research activity poses no physical, psychological, or social harm to you. All of the information you give us will be identified by a code number rather than your name. Your name will never be placed on any material. You may refuse to answer any questions on the questionnaires. Taking blood samples can hurt. You may have some bruising around the place on your arm where the needle was placed. However, the people who take your blood are trained in how to do this to reduce the discomfort and bruising.

POTENTIAL BENEFITS:

Most people find the face-to-face interviews during which the questionnaires are given to be enjoyable. We learn from you. The information will be used to develop educational programs for older adults. You will receive a $15 gift certificate honorarium for completing the study. Also, you will receive

a copy of your dietary intake results and the results of your blood analysis at no charge to you.

COMPENSATION/TREATMENT FOR INJURY:

I understand that, in the event of injury resulting from this investigation, neither financial compensation nor free medical treatment is provided for such an injury.

CONSENT:

By signing this consent form, I agree that I understand the procedures and any risks and benefits involved in this research. I am free to refuse to participate or to withdraw my consent to participate in this research at any time without penalty or prejudice; my participation is entirely voluntary. My privacy will be protected because I will not be identified by name as a research participant in this project.

The research and this consent form have been approved by the University of North Carolina at Greensboro Institutional Review Board which insures that research involving people follows federal regulations. Questions regarding my rights as a participant in this project can be answered by calling Mr. Eric Allen at (336)256-1482. Questions regarding the research itself will be answered by Dr. Martha Taylor or her assistants, Melissa Soban or Carinthia Cherry, by calling 336-256-0326 or 336-334-5313. Any new information that develops during the project will be provided to me if the information might affect my willingness to continue to participate in this project.

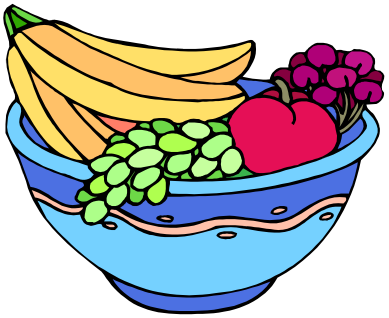
By signing this form, I agree to participate in this project as described to me by Melissa Soban, Carinthia Cherry, or Dr. Martha Taylor.

Subject's Signature

_____

Witness to Signature

_____



Nutrition and Health in Older Adults

The elderly are at higher risk for nutritional problems. Understanding their nutritional status is very important for the planning of nutrition programs to improve their health.

Here is your chance to help us understand the nutritional health of the elderly!

If you are:

1. At least 65 years old
2. Living in the community (not in a nursing home)
3. Willing to answer nutrition-related questions

Please call:

Department of Nutrition and Foodservice Systems
University of North Carolina at Greensboro

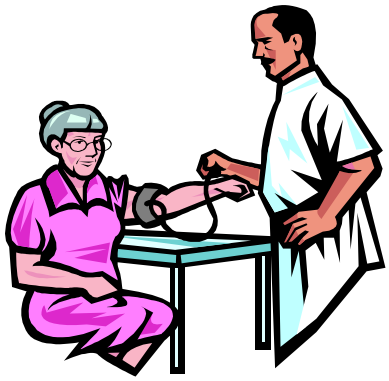
336-256-0326

Dr. Martha Taylor, R.D., L. D. N.

Melissa Soban, B.S. or Carinthia Cherry, M.S.

Monday – Friday
Please leave a message.

Dietary Intake and Health in Older Adults



Elderly persons made up 12.5% of the population of North Carolina in 1995, and that percentage is expected to increase to 21.4% by 2025. With the increasing number of the elderly, knowledge about their health status will become more and more important in the future.

Adequate nutrition is essential for maintaining good health, improving some existing health problems and maintaining independence, especially for older adults who are sensitive to the effects of improper nutrition. Understanding their nutritional health will help us design nutrition education and invention programs for the elderly to address their nutritional needs.

The purpose of this study is to understand the nutritional health of non-institutionalized older adults. Two visits are needed for the questionnaires, each visit will last about one hour. We will ask you some questions about your health status and dietary intake. To better understand your nutritional status, a blood sample will be useful. If you would like to donate a very small amount (about 1 tablespoon) blood, we will set up the third visit to draw blood. If you cannot, you may participate in the questionnaire part of this study. We appreciate your attention and time.

ID: _____

Dietary Intake and Health in Non-institutionalized Older Adults

Preliminary Questionnaire

Department of Nutrition and Foodservice System
UNC-GREENSBORO

Date: _____

1) Name _____

2) Age: _____years

3) Gender: F M

4) Where do you live now?
1.own home/apartment (or with child) 2. nursing home 3) Assisted living

5) Married status: 1. married 2. widowed/divorced/separated
3. never married 9. N/A

6) What are your health concerns? _____

Interviewer:
a. If the subject is living in community and 65 or more than 65 years old, continue the questionnaire.

b. If not, end the conversation politely.

7) What are your telephone number and address?

Telephone Number: _____

Address: _____

8) When would be the best time to call you or visit you? (Day of week and time of day)

_____

9) Could we schedule the date of the first visit now?

_____

ID number: _____

Date: _____

Dietary Intake and Health in Older Adults

Department of Nutrition and Foodservice Systems

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 your some questions about your basic information, usual dietary intake and other health related information. There are two questionnaires altogether, the first questionnaire concerns information about you and health-related information such as health status, mood status and physical function, this will be finished by this visit; the second questionnaire is about your usual dietary intake. We will leave with you the dietary intake questionnaire, which you will fill in by yourself. At the next visit, we will collect and check the questionnaire with you.

Before we begin, let me remind you of some ground rules. This is strictly a research project to understand the nutritional status of the elderly in Guilford County. Please answer questions based on your own situation. There are no right or wrong answers. We are only interested 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 some questions now? If you have any questions about our project or our questionnaire, please ask me whenever you want.

There are a total of three sections in today's questionnaire. Now I am going to begin the first section. This section will help us gain a little understanding of your general activities and health status.

PART-I

I. Sociodemographics

101. Age: _____years

102. Gender: M F

103. Race (by observation): 1. African American
2. Caucasian
3. Hispanic American
4. Asian
5. others
9. N/A

104. How many years of school did you complete?

1. <= 8th grade
2. same 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
9. N/A

105. What is your household monthly income? _____

106: How many people live in your household? _____

107: What is your marital status?

1. married
2. widowed/divorced/separated
3. never married
9. N/A

II. Social Support

_____Total points

201:How often did someone help you if you were confined to bed?

1) none of the time
2) a little of the time
3) some of the time
4) most of the time
5) all of the time

202: How often did someone take you to the physician if you needed it?

1) none of the time
2) a little of the time
3) some of the time
4) most of the time
5) all of the time

203: How often did someone prepare your meals if you were unable to do it by yourself?

1) none of the time
2) a little of the time
3) some of the time
4) most of the time
5) all of the time

204: How often did someone help with daily chores if you were sick?

1) none of the time
2) a little of the time
3) some of the time
4) most of the time
5) all of the time

III. General Health

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

301. Height: _____ inches (0.5)
_____ inches (0.5) (average: _____inches)

302. Weight: _____ pounds (0.5)
_____ pounds (0.5) (average: _____pounds)

303. In an average week, how many times do you engage in physical activities for at least 20 minutes? (Specifically, exercises or activities which are hard enough to make you breathe heavier and your heart beat faster).

1) 4 or more times per week
2) 3 times per week
3) 1 or 2 times per week
4) less than 1 time per week

304: Has your appetite changed during the past 6 months?

1) No 2) Yes

304a: If yes, has it:

1) Decreased 2) Increased

305: During the last 12 months, how often did you eat fish?

1) None
2) 1-6 times per year
3) 7-11 times per year
4) 1 time per month
5) 2-3 times per month
6) 1 time per week
7) 2 times per week
8) 3-4 times per week
9) 1 time per day
10) 2 or more times per day

306: Over the last 12 months, did you take fish oil in a supplement?

1) Yes 2) No

306a: If yes, what is the name? How often, how long and how many?

Product name: _____

How long: _____

How often: _____

How many: _____

Write down the ingredient of the supplement: _____

_____

_____

307: Which of the following statements best describes your current sleeping habits?

1) I sleep as well as usual
2) I don't sleep as well as I used to
3) I wake up 1-2 hours earlier than usual and find it hard to get back to sleep
4) I wake up several hours earlier than I used to and cannot get back to sleep

308: Have you lost weight over the past 6 months?

1) No 2) Yes

307a: If yes, were you trying to lose weight?

1) No 2) Yes

309. Do you smoke? 1) Yes 2) No

309a: If yes, how many cigarettes, packs, cigars, pipes etc per week?

_____

IV. Health Status

401. Which of the following health conditions do you have? (circle all the conditions)

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 the lung)
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 _____

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

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

403: Are you currently taking any prescription drugs?

1) Yes 2) No 9) N/A

403a. If yes, what are they and how often?

_____

_____

_____

_____

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

1) Yes 2) No 9) N/A

404a. If yes, what are they and how often?

_____

_____

_____

_____

_____

405: Do you have enough money to buy the foods you need at most of the time?

1) Yes 2) No

406: 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

407: In the past 6 months, have you had to choose between buying food and paying bills or buying something else you needed?

1) Yes 2) No

Now we have finished the first section. We will move on the second section. These are simple questions that are going to help us understand how you are feeling about your life. You will be asked to do something with the interview. Again there are no right or wrong answers. Please answer the questions based on your own situation.

PART - II

Part-2A.

Score

1.What is the year, month, season, date, and day? (5) _____

2. Where are we? State, country, town, address. (4) _____

3. What is your birth date? (1) _____

4. Name three objects (e.g. apple, table, clock) (3) _____

5. Serial 7s: count backward from 100 by 7, stop after 5 answers.

Give 1 point for each correct answer (5) _____

6. Ask to repeat the names of the three objects in # 4 (3) _____

7. Name 2 objects: pen and watch (2) _____

8. Repeat the phrase "No ifs, ands, or buts" (1) _____

9. Follow the three-stage command: Take a paper in your right hand,

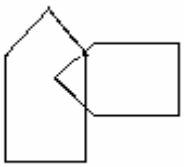
fold it in half, and put it on the floor (3) _____

10. Read and obey the following: (1) Close your eyes _____

11. Write a sentence (1) _____

12: Copy this design: (1) _____

Total: _____



Next I am going to ask you some questions. For every question you just need to answer yes or no to best describe how you felt over the past week. Please base your answer to the following questions on your own situation.

Part-2B.

1. Are you basically satisfied with your life? yes/no

2. Have you dropped many of your activities and interests? yes/no

3. Do you feel that your life is empty? yes/no

4. Do you often get bored? yes/no

5. Are you hopeful about the future? yes/no

6. Are you bothered by thoughts that you just cannot get out of your head? yes/no

7. Are you in good spirits most of the time? yes/no

8. Are you afraid that something bad is going to happen to you? yes/no

9. Do you feel happy most of the time? yes/no

10. Do you often feel helpless? yes/no

11. Do you often get restless and fidgety? yes/no

12. Do you prefer to stay at home at night, rather than going out and doing new things? yes/no

13. Do you frequently worry about the future? yes/no

14. Do you feel that you have more problems with your memory than most? yes/no

15. Do you think it is wonderful to be alive now? yes/no

16. Do you often feel downhearted and blue? yes/no

17. Do you feel pretty worthless the way you are now? yes/no

18. Do you worry a lot about the past? yes/no

19. Do you find life very exciting? yes/no

20. Is it hard for you to get started on new projects? yes/no

21. Do you feel full of energy? yes/no

22. Do you feel that your situation is hopeless? yes/no

23. Do you think that most people are better off than you are? yes/no

24. Do you frequently get upset over little things? yes/no

25. Do you frequently feel like crying? yes/no

26: Do you have trouble concentrating? yes/no

27: Do you enjoy getting up in the morning? yes/no

28: Do you prefer to avoid social gatherings? yes/no

29: Is it easy for you to make decisions? yes/no

30. Is your mind as clear as it used to be? yes/no

Total: _____

Now we are going to move on to the last section. Before we start, do you want a break? (If not, continue).

These questions are about your daily activities and any help you might need to do these things. Again, please answer each question based on your own situation.

PART- III

1. Can you get to places beyond walking distance?

   1= without help (can travel alone on bus, taxi or drive car)

   0= with some help (need someone to help you or go with you when traveling) or are you unable to travel unless emergency arrangements are made for a specialized vehicle such as an ambulance?

2. Can you go shopping for groceries or clothes (assuming you have transportation)

   1= without help (taking care of all your shopping needs yourself)

   0= with some help (need someone to go with you on all shopping trips) or are you completely unable to do any shopping?

3. Can you prepare your own meals:

   1= without help (plan and cook meals yourself)

   0= with some help (can prepare some things but unable to cook full meals yourself) or are you completely unable to prepare any meals?

4. Can you do your housework:

   1= without help (can scrub floors, etc)

   0= with some help (can do light housework but needs help with heavy work).

5. Can you handle your own money:

   1= without help (write checks, pay bills, etc)

   0= with some help (manage day-to-day buying but need help with managing your checkbook and paying your bills), or are you completely unable to handle money?

6. Do you need help when you are bathing?

Yes= need assistance in bathing more than one part of the body and in getting in or out of the tub or dose not bath yourself

No= need assistance only in bathing a single part or bathes self completely

7. Do you need help in getting dressed?

Yes= does not dress self or remain partly undressed

No= gets clothes from closets and drawers; puts on clothes, outer garments, braces, manages fasteners; act of tying shoes is excluded

8. Do you need help in your toileting (going to the restroom and using toilet)?

Yes= Use bedpan or commode or receives assistance in getting to and using toilet

No= Gets to toilet, gets on and off toilet; arrange clothes, cleans organs of excretion (may manage own bedpan used at night only and may not be using mechanical supports).

9. Do you need help in transferring ?

Yes=Assistance in moving in and out of bed and/or chair; dose not perform one or more transfers.

No=Moves in and out of bed and/or chair independently with or without mechanical Support.

10. Do you need help in continence (getting urine or feces out of your body)?

Yes= Partial or total incontinence in urination or defecation, partial or total control by enemas, catheters or regulated used of urinal and /or bedpans.

No= Urination and defecation entirely self-controlled

11. Do you need help in feeding?

Yes= Assistance in act of feeding; does not eat at all or parental feeding.

No= Gets food plate or its equivalent into mouth (precutting meat and preparation of food such as buttering bread are excluded from evaluation).

Thank you very much for your time and patience. We have finished our today's questions now. I will leave the Diet History Questionnaire for you. You can finish this in one sitting or several sittings. If you have any questions about this questionnaire, you can write down your questions; or if you are not very clear about how to answer any questions, you can mark that. During my next visit, I will answer your questions or work with you to finish the questionnaire. By the end of this project, we will give you a copy of the results of your daily nutrient intake.

Do you have questions now?

If not, could we schedule the next visit?

Date: _____

Time: _____

Once again, thank you very much for your time and cooperation

DIET HISTORY QUESTIONNAIRE

ID: _____ Date: _____

Thank you for your agreeing to fill in this questionnaire. This questionnaire asks you about the food you usually ate during the past twelve months. There are no right or wrong answers. Please answer each question based on your own situation. Here are a few points to help you answer the questions.

- When answering the question about how often did you eat a food in the past 12 months, you need to estimate the average number of times per year or per month or per week or per day in the past year, depending on which is easiest for you to count.
- Answer each question as best as you can. If you do not remember exactly the number of times or how much you have eaten, please estimate the best you can. A guess is better than leaving a blank.
- When you meet the choices such as 2-3 times per week, 4-5 times per week etc, while your answer is 3-4 times per week, you should choose the latter choice, 4-5 times per week.
- If you choose "Never" or "No" for a question, please follow any answers or instructions that direct you to the next question.
- Use the following serving size guides to help you estimate how much of a food you eat when you eat it.

1 cup = 8 ounces (about size of your fist)

1 can = 12 ounces

1 ounce of cheese = about the size of your thumb

3 ounces of meat = about the size of women's palm

4 ounces of meat = about the size of men's palm

1 teaspoon = about the size of your thumb tip

3 teaspoons = 1 tablespoon.

*Followed by the Diet History Questionnaire (DHQ), which contains 124 food items and includes both portion size and dietary supplement questions. Because the DHQ is very long (36 pages), this thesis will not include this questionnaire.

The Diet History Questionnaire is distributed by the National Cancer Institute, and is available at:
http://riskfactor.cancer.gov/DHQ/forms/files/shared/dhq1.2002.sample.pdf. Accessed October 29, 2006.