A FRUIT AND VEGETABLE EDUCATION INTERVENTION IN GEORGIA'S OLDER AMERICANS ACT NUTRITION PROGRAM IMPROVES INTAKE, KNOWLEDGE, AND BARRIERS RELATED TO CONSUMPTION

by

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(Under the direction of Joan G. Fisher)

ABSTRACT

Past research has shown that older adults in Northeast Georgia participating in the Older Americans Act Nutrition Program (OANP) do not consume the recommended number of servings each day of fruits and vegetables (Aspinwall 2000, Wade 2003). To address this problem, we conducted a fruit and vegetable education intervention in various Senior Centers participating in OANP throughout Georgia. Seventy-three participants completed the intervention (mean age = 76.4 ± 1.1 years). Food frequency questionnaires assessed participant consumption patterns of 25 fruit and vegetable groupings at pre- and post-test. A high percentage of participants reported barriers to consumption at pre-test. At post-test, increased consumption trends were evident for mean intakes of three categories of targeted fruit and vegetable groups, intake of targeted fruit items, and total fruit and vegetable servings per day. Intake of melon increased significantly, and more participants reported knowledge of fruits and vegetables after the intervention ($p=0.04$).

INDEX WORDS: nutrition, fruits, vegetables, elderly, Older Americans Act Nutrition Program, phytochemicals, Health Belief Model, nutrition education intervention

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CHAPTER I

INTRODUCTION

Over 40% of older Americans suffer from at least one chronic disease (CDC, 2004_c), and Georgia has one of the fastest growing elderly populations in the United States (Georgia Department of Human Resources, 2004). Nutrition is the number one modifiable risk factor for disease development (Millen, 2002), and the elderly are less likely to consume diets sufficient to meet their dietary needs (Gaston et al., 1999). Interventions among this population designed to increase disease awareness and prevention are necessary to decrease disease incidence and severity.

In order to address this problem, the Older American Act Nutrition Program (OANP) was developed to provide supportive services within senior centers, and was particularly aimed at those in rural areas with the highest economic and social need (AOA, 2004_b). Data from NHANES III identified elderly Americans in the lowest income group as least likely to have adequate nutrition (Cole & Fox, 2004). Senior centers provide home delivered meals to the homebound and congregate meals to ambulatory participants. Each meal is required to meet one third of the recommended dietary allowances, adequate intakes, and dietary guidelines for adults aged 60 and over. Other services provided to seniors to optimize health include nutrition education, exercise and fitness promotion, social services, and other health promotion programs designed to encourage healthy behaviors (AOA, 2004_b).

Large long-term studies have shown that diets high in fruits and vegetables result in decreased incidence of cardiovascular diseases (CVD); disorders associated with CVD, such as

hypertension, stroke, and high serum cholesterol; various forms of cancer; chronic obstructive pulmonary disorders and lung function; diabetes; and obesity (Arts et al., 2002; Miller et al., 2004; Tucker et al., 2002; Quatromoni et al., 2002). In 1991, a coalition of national organizations developed the Five A Day for Better Health Program. The Program was enacted in an attempt to encourage Americans to consume at least five servings of fruits and vegetables each day to reduce risk of disease (NCI, 2005). Due to current research which continues to support increased intake of fruits and vegetables for better health, the 2005 Dietary Guidelines for Americans recommend that all adults consume nine to thirteen servings of fruits and vegetables per day depending on individual caloric needs. The 2005 Dietary Guidelines also emphasize consumption of dark green and orange vegetables, starchy vegetables and legumes because they contain fiber, folate, antioxidant vitamins A and C, and potassium content (Center for Nutrition Policy and Promotion, 2005).

Previous studies examining OANP participants in Georgia found that participants had an average BMI outside the healthy range (Cheong et al., 2003) and were not consuming the recommended number of fruit and vegetable servings each day (McCamey et al., 2003; Aspinwall, 2001; Wade, 2003). Aspinwall (2001) reported OANP participants of Northeast Georgia had particularly low serum concentrations of beta-cryptoxanthin, lutein and zeaxanthin, and lycopene, leading to the conclusion that increased consumption of green vegetables, tomato products, and citrus fruits is necessary in this population.

The current study was conducted among OANP participants in Georgia to determine baseline consumption patterns of selected fruits and vegetables; identify perceived and actual barriers to fruit and vegetable consumption, and improve behaviors, attitudes, and knowledge related to fruit and vegetable intake by increasing disease prevention awareness, emphasizing

overall health benefits of fruits and vegetables, increasing self-efficacy, and providing practical ways to increase intake. The effectiveness of a nutrition intervention program designed for low-income, low literacy older adult population was determined by assessing change in intakes of selected fruits and vegetables (Wade 2003). The intervention consisted of eleven fruit and vegetable nutrition education lessons: Introduction to Fruits and Vegetables, Cruciferous Vegetables, Citrus Fruits, Berries, Canned and Frozen Fruits and Vegetables, Beans, Garlic and Onions, Leafy Greens, Squash and Pumpkin, and Tomatoes, and Drug/Food Interactions. Each module conveyed a common theme, "Five a Day, the Color Way," which emphasized the importance of consuming five servings of colorful fruits and vegetables per day in order to reduce risk of chronic disease and increase longevity. Participants completed pre- and post-test questionnaires, which included food frequency questionnaires and assessed knowledge of fruits and vegetables and barriers to consumption.

More than 50 percent of participants self-reported consuming 18 of 25 fruit and vegetable groupings less than once per week. Only 12 percent of participants reported consuming the recommended five or more servings per day of fruits and vegetables. Participants reported consuming 22 servings of the targeted fruits and vegetables per week or about 3.1 servings each day.

Several barriers to consumption were identified among participants at baseline, including lack of ability to use various kitchen tools, lack of ability to shop for groceries, and inability to plan their own meals. Older participants ($\geq$ 80 years) tended to experience more barriers, such as inability to use a pot of hot water, inability to shop for their own groceries and plan the meals they eat, compared to younger participants. Additionally, 41 percent of total participants (n=73) reported not having enough money to spend on fruits and vegetables.

Increased mean consumption trends were seen for three targeted fruits and vegetables, total fruit items, and total fruit and vegetable servings consumed each day, which increased by 2.47 servings per week ($p=0.12$). Notably, there was a significant increase in mean consumption of melons. At post-test, significantly more participants reported knowing that consumption of fruits and vegetables can help reduce their risk of cancer and were aware of the 5 A Day recommendation. Participants also increased their knowledge of the protective effects of fruits and vegetables on heart disease ($p=0.05$).

OANP participants are at high risk for disease development (Ponza et al., 1996), and educating the population on disease prevention and addressing barriers is especially important. Fruits and vegetables have been associated with reduced risk of many chronic diseases (Arts et al., 2002; Johnsen et al., 2003; Miller et al., 2004; Tucker et al., 2002; Quatromoni et al., 2002); however, intake among older Americans falls below recommendations (National Center for Chronic Disease Prevention and Health Promotion, 2000; McCamey et al., 2003). In our study, participant intake of fruits and vegetables and knowledge of fruits and vegetables in regards to disease states improved, and 94 percent of participants rated the fruit and vegetable education intervention as excellent, very good, or good. This finding demonstrates that the elderly population is able and willing to learn and adopt behaviors which would improve their health and quality of life.

CHAPTER II

LITERATURE REVIEW

Aging and Chronic Disease in the United States

By 2030, 70 million, or one in five, Americans will be 65 years of age or older (CDC, 2003). Georgia has the sixth fastest growing 60+ year old population and the fastest growing 80+ year old population in the United States, with those over 65 years making up approximately 20 percent of the population (Georgia Department of Human Resources, 2004). The elderly population is especially susceptible to disease development. In fact, the Centers for Disease Control and Prevention (CDC) recently found over 40 percent of the older population in the US to be suffering from one or more chronic diseases and decreased quality of life (CDC, 2004_b). Poor diets tend to increase the likelihood of disease development and severity. Therefore, it is imperative that the older population receive proper nutrition. Numerous studies, however, have shown that the diets of older adults are frequently not sufficient to maintain optimal health (Weimer, 1997). According to Gaston et al. (1999), with increasing age, there is a gradual increase in "poor" diets based on the Healthy Eating Index. Additionally, elderly residents in the South tend to consume fewer essential nutrients, including calories, protein, fat, and vitamins C and B_6, niacin, phosphorus, and magnesium when compared to their northern counterparts (Weimer et al., 1999). The elderly are particularly vulnerable to declining health when consuming poor diets. Malnutrition leads to lower strength, weaker immune systems, and increased risk of falls, accidents, and disease (James et al., 1997).

Older Americans Act Nutrition Program

The Older Americans Act (OAA) was passed in 1965 in order to provide care and services to the nation's elderly population. Nutrition is the number one modifiable risk factor for prevention of disease development (Millen, 2002), and many of the most prevalent nutrition related problems of the elderly are chronic conditions that benefit from diet therapy (Weimer, 1997). Thus, in 1972, the Act was revised to include the Elderly Nutrition Program (ENP), also called the Title III Nutrition Program or Older American Act Nutrition Program (OANP). This section of OAA requires state and area agencies on aging to provide supportive services within senior centers, and is particularly aimed at those in rural areas with the highest economic and social need (AOA, 2004_b). Low-income elderly are more likely to have inadequate food to eat, which leads to a high prevalence of nutrient deficiencies. When this is the case, consumption of nutrient dense foods is essential (Weimer, 1997). Data from NHANES III indicated that older adults in the lowest-income group were less likely to have enough to eat, more likely to skip meals, and more likely to have lower intakes of energy, vitamin C, iron, zinc, and calcium when compared to other income groups in the same age bracket. The same population was more likely to consume a "poor" diet as identified by the HEI and to be assessed as having poor health. The lowest income population was also more likely to have a higher BMI, high blood pressure, diabetes, congestive heart failure, and to have suffered a heart attack or stroke (Cole & Fox, 2004).

The aims of the OANP are to decrease malnutrition, and promote physical, mental, and social health to those aged 60 and over. Senior centers provide health services, home delivered meals for the homebound, and congregate meals to meet the goals of the program. The meals provided must meet one third of the recommended dietary allowances. Health services provided

include nutrition education, exercise and fitness promotion, and other health promotion programs aimed at encouraging healthy behaviors. These services help elderly individuals recover from illness and improve health, thus preventing further complications. The nutrition and health education services are provided by non-profit agencies, organizations, and institutions through grants funded by OAA (AOA, 2004_b; Wellman et al., 2002).

The OAA Nutrition Program has been shown to play a key role in participants' overall nutrition. The ENP participants have demonstrated higher levels of key nutrients such as energy, zinc, calcium, and vitamin B_6 compared to nonparticipants (Ponza et al., 1996). Millen et al. (2002) also found ENP participants to have significantly higher intakes of essential nutrients such as protein, vitamins C, D, E, folate, calcium, and magnesium. Additionally, Title III participants have on average 14 more social contacts per month compared to nonparticipants (Ponza et al., 1996), which may increase food consumption.

Nutritional Risk Factors of OANP Participants

The recipients of the OANP are excellent candidates for nutrition intervention. Davidson et al. (2004) found that approximately 35 percent of the recipients at five rural ENP sites in Illinois were either malnourished or at risk for malnutrition, which puts the population at increased risk of morbidity and mortality. Chronic health problems, social isolation, functional limitations, inadequate funds for food and elimination of certain food groups can contribute to nutritional risk. In 2002, Millen et al. reported that the recipients of ENP service suffered from two to three chronic health problems and considered themselves to be in fair or poor health. McCamey et al. (2003) found 32 percent of participants rated their own health as fair or poor. Millen et al. (2002) also determined that approximately two-thirds of recipients had a BMI outside the healthy range for older people (less than 18 or greater than 25), which is consistent

with the findings of Ponza et al. (1996) and Cheong et al. (2003). An elderly population in Georgia had an average body mass index (BMI) of 30 for males and 31.6 for females both in the age range of 65-74, which is indicative of obesity (Cheong et al., 2003). An evaluation of ENP found that 26 percent of Title III congregate meals participants experienced a hospital or nursing home stay in the year prior to interview and many reported health conditions which nutrition intervention may have prevented, such as heart disease, diabetes, and anemia (Ponza et al., 1996).

OANP participants are more likely to experience social isolation and have functional limitations thereby increasing their chance of nutritional deficiency. In 2001, the 775,000 elderly individuals were estimated to be living below the poverty level in Georgia (US Census Bureau, 2003). The income levels of eighty to ninety percent of ENP participants fall below 200 percent of the Department of Health and Human Services poverty level for those aged 65 years and older (Ponza et al., 1996).

Studies conducted using a sample of Georgia's ENP population found that 86 percent of study participants suffered from low intake of calcium rich foods, thereby increasing their risk of osteoporosis (Cheong et al., 2003). In a similar population in Georgia, the average number of fruit and vegetable servings consumed each day was 4.73 (McCamey et al., 2003), which does not meet recommended number of servings outlined by the current dietary guidelines. Further, Aspinwall (2001) reported that a sample of ENP participants in Northeast Georgia did not consume the recommended number of servings of fruits and vegetables per day, knowledge of the benefits of fruit and vegetable consumption was not related to intake, and serum concentrations of beta-cryptoxanthin, lutein and zeaxanthin, and lycopene were lower than a sample of older adults from NHANES III. These findings led to the conclusion that increased

consumption of green vegetables, tomato products, and citrus fruits, which are sources of lutein and zeaxanthin, lycopene, and beta-cryptoxanthin respectively, are necessary in this population (Aspinwall, 2001).

Benefits of Fruit and Vegetable Consumption

Large long-term studies have shown that diets high in fruits and vegetables result in decreased incidence of cardiovascular diseases (CVD), disorders associated with CVD, such as hypertension, stroke, and high serum cholesterol; various forms of cancer; chronic obstructive pulmonary disorders and lung function; diabetes; and obesity (Arts et al., 2002; Johnsen et al., 2003; Miller et al., 2004; Tucker et al., 2002; Quatromoni et al., 2002). Recent evidence has also suggested a role of fruits and vegetables in reduced risk of bone diseases, cognitive, and neurodegenerative diseases such as Alzheimer's disease, and cataracts (Hyson, 2002). For example, Quatromoni et al. (2002) found that women participants of the Framingham Offspring/Spouse cohort who followed a "Heart Healthy" diet over 12 years, consisting of approximately seven servings/day of fruits and vegetables, were less likely to be overweight, based on BMI, compared to those consuming an "Empty Calorie" diet, high in sweets and fat. Using data from the same cohort, Millen et al. (2004) found that women following a "Heart Healthy" diet also had a significantly lower incidence of heart disease at the 12 year follow-up compared to those consuming a "Less Heart Healthy" diet, consisting of higher intakes of fat and lower consumption of fruits and vegetables. Results of the NHANES I Follow-up study indicate a significantly decreased incidence of stroke and decreased mortality from stroke, cardiovascular disease, and all causes with consumption of at least three servings of fruits and vegetables per day compared to less than one serving per day (Bazzano et al., 2002). Data from NHANES III showed a significantly reduced incidence of angina pectoris for those in the highest quartile of

serum carotenoid concentrations, alpha-carotene, beta-carotene, and beta-cryptoxanthin (Ford & Giles, 2000). Also, a follow-up of the Danish Diet, Cancer, and Health Study (Johnsen et al., 2003) reported a significantly reduced risk of stroke with consumption of citrus fruits. Similarly, Kris-Etherton et al. (2002) reported vitamin C-rich foods and green leafy vegetables to be most protective against coronary heart disease. Finally, a review examining the beneficial effects of lycopene reported a 25 percent increase in in-vivo lipid oxidation in healthy humans with ingestion of two-week lycopene-free diet (Rao & Agarwal, 1999).

The protective effects of fruits and vegetables against some cancers has been known for many years (Block et al., 1992). Based on a compilation of epidemiological evidence, a panel of experts from World Cancer Research Fund in association with the American Institute for Cancer Research (1997) concluded that there is convincing evidence for an inverse relationship between fruit and vegetable consumption and mouth, pharyngeal, esophageal, lung, and stomach cancer, and an inverse association between vegetable intake and colorectal cancer. A meta-analysis of case-control studies indicated a significantly reduced risk of breast, esophageal, lung, stomach, and colorectal cancers with consumption of vegetables and a reduced risk of lung, bladder, stomach, colorectal, mouth, pharynx, larynx, and esophageal cancers with consumption of fruit. A protective effect of fruit in regards to cancers of the lung and bladder was confirmed in recent cohort studies (Riboli & Norat, 2003). A follow-up study was conducted among women who participated in the Iowa Women's Health Study (Arts et al., 2002). Women consuming a diet high in catechins, bioactive flavonoids in tea, fruits, and vegetables, had a significant decreased risk of developing rectal cancer and a nonsignificant decreased risk of developing upper digestive tract, pancreatic, and hematopoeitic cancer.

Vegetables, particularly raw vegetables, followed by allium vegetables, carrots, green vegetables, cruciferous vegetables, and tomatoes appear to be most protective against various forms of cancer (Steinmetz & Potter, 1996). In a review of epidemiologic data, Murillo and Mehta (2001) reported that 70 percent of prospective and case-control studies showed an inverse relationship between intake of cruciferous vegetables and cancer risk, specifically prostate and colon cancer and non-Hodgkin's lymphoma. Similarly, Kris-Etherton et al. (2002) reported cruciferous and yellow-orange vegetables to be associated with reduced risk of prostate cancer across various ethnic groups. Additionally, a review of epidemiologic evidence reported a strong inverse relationship between lycopene consumption and risk of prostate cancer and the protective effects of lycopene may be stronger in cases without a genetic component (Campbell et al., 2004). Rao & Agarwal (1999) reported similar evidence regarding lycopene and cancer risk. Interestingly, they reported that high intake of tomatoes in elderly Americans was associated with significantly reduced risk of cancer at all sites.

Due to potential health benefits of increased fruit and vegetable intake, the National Cancer Institute (NCI), and the Produce for Better Health Foundation (PBH) have worked together to develop the Five A Day for Better Health Program, which was enacted in 1991 (NCI, 2005). The Program's goal is to increase the average consumption of fruits and vegetables to five or more servings per day for each American to reduce risk of disease (CDC, 2004_c). Emphasis has also placed on consumption of colorful fruits and vegetables denoting the phytochemical content of the foods (Heber, 2004_b). Since the Program's launch in 1991, various governmental agencies have joined NCI and PBH in their efforts to increase awareness of the benefits of consuming fruits and vegetables for a healthier lifestyle, decreased risk of cancer, and introduce new ways of incorporating the foods into the diet of the benefits of fruits and

vegetables in disease prevention (CDC, 2004$_c$). In an evaluation of the 5 A Day Program, scientists found that there has been an increase in fruit and vegetable consumption in the US since implementation of the program, and the strongest predictors of dietary change are due to taste preference, knowledge of the recommendation, and self-efficacy (NCI, 2005).

Due to current research which continues to support increased intake of fruits and vegetables for better health, the 2005 Dietary Guidelines for Americans are urging all adults to consume seven to 13 servings per day of fruits and vegetables based on individual caloric needs for optimal nutrition and decreased disease risk. The 2005 Dietary Guidelines emphasize consumption of dark green and orange vegetables, starchy vegetables, and legumes because of their fiber, folate, antioxidant vitamins A and C, and potassium content. Potassium has been thought to help lower blood pressure, which may lead to decreased risk of vascular disorders (Center for Nutrition Policy and Promotion, 2005).

Fruits and vegetables may reduce risk of disease via numerous mechanisms. The protective effect may be largely due to the antioxidant capacity of the foods. Antioxidants scavenge free radicals in the body thus reducing oxidative stress (Craig, 1997; Hyson, 2002). Decreases in oxidative stress and free radical formation can result in decreased lipid peroxidation, and DNA mutations, factors which can decrease risk of cardiovascular disorders, cancer, and aging (Beckman et al., 1997; Fukagawa, 1999; Hyson, 2002; Smith et al., 1999; Walter et al., 1997). Further, some nutrients or phytochemicals present in fruits and vegetables may decrease disease risk by blocking hormone actions and metabolic pathways associated with increased risk of disease (Craig, 1997). Other possible anti-carcinogenic effects of fruits and vegetables include decreasing cell proliferation while increasing cellular apoptosis, decreasing tumor promotion, progression, and metastasis, and increasing levels of detoxification enzymes

(World Cancer Research Fund, 1997). Many vegetables contain folate, which is necessary to prevent increases in serum homocysteine, which may lead to decreased risk of vascular disorders (Koehler et al., 1997). Third, increased intake of fruits and vegetables will, most likely, lead to displaced consumption of foods high in calories, fat, and saturated fat. Finally, fruits and vegetables are high in fiber and water, which increases fullness, satiety, and reduces risk of disease. With decreased risk of disease, longevity and quality of life is increased (Hyson, 2002).

Barriers to Fruit and Vegetable Intake in the Elderly Population

In 2000, only approximately 32 percent of those age 65 years or older in the US consumed the recommended five or more servings of fruits and vegetables per day. A majority of the older population consumed three to four servings per day. In Georgia, the consumption trends were similar, with only 30 percent of the older population consuming five or more servings of fruits and vegetables per day, and approximately 36 percent consuming three to four servings per day (National Center for Chronic Disease Prevention and Health Promotion, 2000).

There are many reasons for low intake of fruits and vegetables in the elderly population. A primary barrier to intake is simply lack of knowledge of the benefits of fruit and vegetable intake and negative attitudes toward the foods; however, more complex barriers are present and are more likely to influence intake (Wade, 2003).

Socioeconomic status is a major consumption barrier. Lower income groups tend to favor foods higher in fat and sugar. These foods are more energy dense and cost less per unit of energy compared to fruits and vegetables (James et al., 1997). Lack of transportation is also a factor in food consumption. The elderly may not be able to get to the store to buy food, leading to malnutrition (Higgins & Barkley, 2004_a). Lack of formal education, more common in lower income groups, may also lead to decreased intake of fruits and vegetables. Weimer (1998) found

that consumption of nutrients increased with increased formal education of the primary decision maker.

The anorexia of aging, or decreased desire to eat as one ages, contributes to decreased food intake (Popper et al., 2003). Altered taste is a factor that may contribute significantly to decreased fruit and vegetable intake. Aging generally decreases the sense of smell which impacts taste and flavor perception. Therefore, a reduction in sense of smell leads to a decreased sense of taste, and, most likely, decreased food intake. Many medications contribute to altered taste, and can result in decreased food consumption as well (Popper et al., 2003).

Other factors associated with aging that may lead to decreased fruit and vegetable intake include decreased ability to chew, denture use, dry mouth, and social isolation. Denture use makes food harder to chew, and eating alone, which often occurs with increasing age due to death of family and friends, could decrease the amount of food consumed. It has been shown that food consumption increases in the presence of others (Popper et al., 2003). For example, Donkin et al. (1998) found older males living alone in Upper Nottingham had greatest nutrient deficiencies compared to older females living alone and older individuals living with others; however, this finding may not be applicable to the United States population. Interestingly, Cole and Fox (2004) found that the elderly in the lowest income group were less likely to engage in social isolation compared to two higher income groups.

A decrease in functionality, including cognitive functioning, sight and reading ability, and strength often occurs with aging, and may result in decreased ability and desire to prepare meals. Convenience becomes the major determinant in food consumption and may result in decreased fruit and vegetable intake (Anderson et al., 1998; Donkin et al., 1998; Popper et al., 2003, Higgins & Barkley, 2004_a). There may be an interaction between income and

functionality. Lower income older adults were rated as less likely to be able to perform a variety of tasks ranging from small motor movements to physically active tasks, such as gardening, without difficulty, based on their own experience and physical assessments (Cole & Fox, 2004). Higgins and Barkley (2004_a) reported that elderly in rural Southern states were less likely to possess functionality to prepare vegetables, possibly leading to decreased intake.

Interestingly, health professionals can be another barrier to increased fruit and vegetable intake in the elderly population. Many professionals downplay the importance of educating this population because they believe the elderly are resistant to change or have decreased capacity to learn. The elderly population can acquire knowledge, but the information must be tailored to account for changes in the learning process that occurs with age. Additionally, many professionals do not know the nutritional concerns of the older population, which leads to a misinformed population (Higgins & Barkley, 2004_a).

Fruit and Vegetable Intervention Studies in Older Americans

In an effort to increase fruit, vegetable, and calcium-rich food consumption in an elderly population in Boston, Bernstein et al. (2002) assigned either a home-based nutrition education program or a home-based exercise program (control) to a group of participants over the age of 69. After a six-month intervention, results indicated that participants in the nutrition education group consumed increased amounts of folate, vitamins A and C, beta- and alpha-carotene, lutein and zeaxanthin, and lycopene after the intervention. The nutrition education group also had significantly higher levels of serum carotenoids after the intervention, whereas serum levels of carotenoids in the exercise group did not change ($p<0.05$). The nutrition education group reportedly increased their fruit and vegetable intake by one serving per day, and reported eating

more citrus fruits, orange vegetables, tomatoes, and other vegetables compared to the exercise group.

A study conducted by Smith et al. (2004) focused on identification of barriers to fruit and vegetable consumption and increasing intake in homebound seniors in the state of Washington. Twenty-seven senior citizens participated in the study. The study took place over five months and involved ten deliveries of fruit and vegetable baskets from local farmers to participants' homes along with a newsletter describing foods delivered, food preparation and safety, and recipes. Interviews were conducted prior to the intervention to identify barriers to fruit and vegetable intake. Results of the study indicate that participants significantly increased fruit and vegetable consumption by 1.04 servings per day ($p<0.001$). The increase in consumption is thought to be due to the change in attitude among participants regarding fruits and vegetables. Increases in consumption may have also been the result of food deliveries to participants' residence. The seniors acknowledged that they enjoyed the program, felt healthier, appreciated the food, and utilized the newsletter.

A study conducted among African American church-goers in North Carolina examined the effects of a 20-month fruit and vegetable education intervention. The study included a control group, not receiving nutrition education until completion of the follow-up survey, and an intervention group. Participants' ages ranged from 18 years to over 66 years, and the average age of participants was 53.8 years. Both the control group and the intervention group completed a survey including a food frequency questionnaire, demographic information, knowledge of recommended intake of fruits and vegetables daily, availability of fruits and vegetables, and self-efficacy for eating "5-a-day." The survey was completed at baseline and year two to assess increases in fruit and vegetable intake. After the first year of the intervention, a sample of the

total sample population completed the survey. At the one year follow-up, the intervention group reportedly increased consumption of fruits and vegetables by one serving per day. After year two, the intervention group consumed 0.87 more servings per day of fruits and vegetables compared to the control group. Thirty-three percent of participants in the intervention group reported consuming five servings of fruits and vegetables per day, a 10 percent increase from baseline, compared with 21 percent in the control group. The largest increases in consumption were found among those ages 66 and older and holding an education beyond high school (Campbell et al., 1999).

A study conducted by Stevens et al. (2002) focused on reducing risk of breast cancer through dietary change in a group of women age 40-70 in Portland, Oregon. The participants were divided into intervention and control groups. The intervention group included two computer-based education modules, two telephone contacts, and focused on decreasing barriers to consumption of low-fat foods and fruits and vegetables. The control group received instruction on breast self exams and two telephone contacts. Telephone contacts assessed participants' behavior change, potential behavior change, and provided guidance for overcoming barriers to consumption. Dietary measurements were assessed through food frequency questionnaires and a 24-hour recall. Results indicate that more diet intervention participants attempted to change behaviors compared to controls. Additionally, fruit and vegetable intake increased in the intervention group and decreased in the control group, resulting in a mean difference of 1.04 servings of fruit and vegetables per day.

In a review of nutrition education interventions for older adults Sahyoun et al. (2004) emphasized that in order for nutrition education interventions for older adults to be successful, the program must contain messages that are simple, practical, and targeted to the specific needs

of the population. A program which addresses concerns of its population is more likely to be successful. The review found that programs tend to be more successful when they are based on a theoretical model. These models help to identify an individual's readiness to change and helps set achievable goals. Additionally, hands-on activities are helpful as well because they allow participants to realize how incorporate changes into their own lives. It is evident that age was not a barrier to increased knowledge since increased knowledge was apparent in several of the studies reviewed (Sahyoun et al., 2004).

Fruit and Vegetable Studies in Georgia OANP

A study conducted by Aspinwall (2001) found that a majority of participants of OANP in several Northeast Georgia counties were not consuming the recommended number of servings of fruits and vegetables each day. Only 32.8 percent of participants reported consuming five or more servings of fruits and vegetables each day according to the Block food frequency questionnaire. Based on serum carotenoid concentrations, it was evident that the population consumed low amounts of green vegetables, tomato products, and citrus fruits.

In a similar population of OANP participants in Northeast Georgia, McCamey et al. (2003) found that only 37 percent of participants consumed five or more servings of fruits and vegetables each day. Through nutrition education, the researchers were able to significantly increase knowledge of the recommended number of servings of fruits and vegetables to be consumed each day.

To address the needs mentioned among the OANP participants in Northeast Georgia, Wade (2003) examined the role of a fruit and vegetable education program on dietary choices, barriers to consumption, and knowledge of the benefits of fruits and vegetables in the elderly participants of the Northeast Georgia OANP. Forty-seven seniors, whose ages ranged from 60-

97 years, completed the intervention. A series of eleven fruit and vegetable lessons were delivered to participants over a seven month time period. The health belief model (HBM) is the theoretical basis for the program. The lessons were preceded by a pre-test food frequency questionnaire with knowledge and barriers to intake questions and followed by a similar post-test food frequency questionnaire and knowledge questions. The post-test was provided to assess knowledge gained and changes in fruit and vegetable intake after the lessons. Handouts were given to each participant prior to the lesson that consisted of the main points of the lesson and healthy recipes that incorporated the targeted fruit or vegetable. Results showed significant increases in consumption of total fruits and vegetables; peaches, nectarines, and apricots; cranberry, apple, or purple grape juice; beans; canned vegetables; and total fruit items ($p<0.05$). Knowledge of benefits of the fruit and vegetable consumption also improved, demonstrating reduced barriers to intake; however, these results were not significant.

Health Belief Model

Dietary interventions should be based on a theoretical model. Theoretical models help in designing dietary intervention programs because they identify information needed for the program to be effective. HBM is one of several theoretical bases for behavior change (Glanz, 2001) and is the theoretical basis for the intervention presented in this thesis. The Model was developed by public health psychologists in the 1950's who were searching for an explanation of the public's poor usage of health services (Sutton, 2004). HBM is based on the assumption that diseases are feared and people change behavior when the benefits of behavior change outweigh the consequences in relation to disease reduction. HBM consists of four elements that include the individual's perceived severity of the disease, perceived susceptibility of disease development, perceived barriers to change, and perceived benefits of behavior change.

Perceived severity of the disease involves morbidity or mortality associated with the disease, susceptibility includes likelihood of developing the disease, perceived barriers to change involve items which decrease one's probability of adopting the recommended behavior, and perceived benefits include health benefits of adopting the recommended behavioral change in order to decrease risk of disease. The potency of each element is dependent on the individual's self-efficacy, or a person's self-confidence for behavior change (Clarke et al., 2000; Glanz, 2001; Strecher et al., 2002). HBM is more useful in interventions among those with pre-existing risk factors for disease, such as hypertension and hyperlipidemia as opposed to a primary prevention technique because healthcare professionals can link diet recommendations to decreases in risk (Glanz, 2001).

Rational, Specific Aims, and Hypothesis

Adopting a healthy lifestyle, which includes a diet rich in fruits and vegetables, has been found to be beneficial in reducing risk of chronic disease (CDC, 2003; Arts et al., 2002; Millen et al., 2004; Tucker et al., 2002; Quatromoni et al., 2002). Currently, the older American population is not consuming the recommended number of fruit and vegetable servings each day (National Center for Chronic Disease Prevention and Health Promotion, 2004). OANP participants are an ideal population for nutrition education because they typically experience increased barriers to consumption compared to non-participants (Ponza et al., 1996), which could lead to a greater decrease in consumption of fruits and vegetables.

The phytochemical content of fruits and vegetables has been thought to be responsible for decrease disease risk in individuals with high consumption (Hyson, 2002). National recommendations emphasize consumption of citrus fruits, cruciferous vegetables, and green and yellow vegetables due to their high phytochemical content (Heber, 2004_a). The OANP

population of Northeast Georgia has demonstrated particularly low consumption of fruits and vegetables and in particular dark green and cruciferous vegetables, citrus fruits, and tomato products (McCamey et al., 2003; Aspinwall, 2001).

The older adult population has been the focus of few nutrition education intervention programs; however, nutrition education interventions have been successful in changing dietary behaviors of the population (Bernstein et al., 2002; Campbell et al., 1999; Cheong et al., 2003; McCamey et al., 2003; Smith et al., 2004; Stevens et al., 2002; Wade, 2003). This study used the HBM as a model to study dietary change. This model states that changing dietary behaviors may be achieved through an increase in knowledge, decrease in perceived barriers to consumption, and increased confidence in one's self for behavior change.

The specific aims of the study were:

1. To determine baseline consumption patterns of selected fruits and vegetables.
2. To identify perceived and actual barriers to fruit and vegetable consumption, and improve behaviors, attitudes, and knowledge related to fruit and vegetable intake through disease prevention awareness, emphasis of the overall health benefits of fruits and vegetables, increased self-efficacy, and providing practical ways to increase intake.
3. To determine the effectiveness of a nutrition intervention program designed for low-income, low literacy older adult population by assessing change in intakes of selected fruits and vegetables (Wade, 2003).

The hypotheses of the study were:

1. Participants will increase mean intakes of ≥ 3 of the 31 fruit and vegetable items assessed in the intervention.

2. After completion of the curriculum, knowledge related to fruit and vegetable consumption will increase (Wade, 2003).

CHAPTER III

A FRUIT AND VEGETABLE EDUCATION INTERVENTION IN GEORGIA'S OLDER AMERICANS ACT NUTRITION PROGRAM IMPROVES INTAKE, KNOWLEDGE, AND BARRIERS RELATED TO CONSUMPTION[1]

[1] Garcia JM, Fischer JG, Johnson MA. To be submitted to *Journal of Nutrition for the Elderly*.

Abstract

Past research has shown that older adults in Northeast Georgia participating in the Older Americans Act Nutrition Program (OANP) do not consume the recommended number of servings each day of fruits and vegetables (Aspinwall 2000, Wade 2003). To address this problem, we conducted a fruit and vegetable education intervention in various Senior Centers participating in OANP throughout Georgia. Seventy-three participants completed the intervention (mean age = 76.4 ± 1.1 years). Food frequency questionnaires assessed participant consumption patterns of 25 fruit and vegetable groupings at pre- and post-test. A high percentage of participants reported barriers to consumption at pre-test. At post-test, increased consumption trends were evident for mean intakes of three categories of targeted fruit and vegetable groups, intake of targeted fruit items, and total fruit and vegetable servings per day. Intake of melon increased significantly, and more participants reported knowledge of fruits and vegetables after the intervention ($p=0.04$).

INDEX WORDS: nutrition, fruits, vegetables, elderly, Older Americans Act Nutrition Program, phytochemicals, Health Belief Model, nutrition education intervention

Introduction

By the year 2030, the elderly population in the United States is expected to reach 70 million. Cancer and heart disease are the leading causes of death in Americans (CDC, 2005), and the elderly are at increased susceptibility to these and other chronic diseases. In 2001, 3.4 million older Americans were living below the poverty level (AOA, 2002). Cole and Fox (2004) reported that low-income older adults are more likely to assess their own health status as fair or poor, have suffered from heart-related diseases, are less likely to consume three meals each day, and are more likely to have functional limitations which limit their daily activities. Adequate

nutrition is necessary to prevent disease and maintain physical and cognitive functioning (Wellman et al., 2002). Fruit and vegetable consumption in particular has been shown to reduce risk of many chronic diseases including cardiovascular diseases (CVD); disorders associated with CVD, such as hypertension, stroke, and high serum cholesterol; various forms of cancer; chronic obstructive pulmonary disorders and lung function; diabetes; and obesity (Arts et al., 2002; Miller et al., 2004; Tucker et al., 2002; Quatromoni et al., 2002). Data from the Nurses' Health Study and Health Professionals' Follow-Up Study (Joshipura et al., 2001) revealed that consumption of at least four servings per day of fruits and vegetables was associated with a slight decrease for coronary heart disease and further reduced risk seemed to occur with consumption of at least eight servings of fruits and vegetables per day. Similarly, Johnsen et al. (2003) reported decreased risk of stroke with the highest quintile of fruit and vegetable intake ($p=0.04$). Further, fruit and vegetable intake has been associated with decreased risk of various forms of cancer including prostate, lung, stomach, oral and esophageal, and colorectal cancers (Block et al., 1992; Steinmetz & Potter, 1996; Kris-Etherton et al., 2002; Riboli & Norat, 2003).

The Older Americans Act Nutrition Program (OANP) was established to decrease malnutrition, promote health, reduce social isolation, and provide nutritionally complete meals to our nation's elderly (Wellman et al., 2002). The Program targets rural elderly, who are at greater economic and social need (AOA, 2004_b) and tend to experience more barriers to consumption compared to rural non-participants (Ponza et al., 1996). Previous research has shown inadequate fruit and vegetable consumption among OANP participants in Georgia (Aspinwall, 2001; McCamey et al., 2003; Wade, 2003).

Nutrition education interventions have been successful in changing dietary behaviors among older Americans (Bernstein et al., 2002; Campbell et al., 1999; Cheong et al., 2003;

McCamey et al., 2003; Smith et al., 2004; Stevens et al., 2002). This study was designed to determine the effectiveness of a fruit and vegetable education program in low-income, low-literacy older adults in Georgia. Our goals were to determine baseline fruit and vegetable consumption patterns, to identify perceived and actual barriers to fruit and vegetable consumption, and improve behaviors, attitudes, and knowledge related to fruit and vegetable intake. The Health Belief Model, which states that changing dietary behaviors may be achieved through an increase in knowledge, decrease in perceived barriers to consumption, and increased confidence in one's self for behavior change (Glanz, 2001), was used as a theoretical basis for this research. Eleven educational modules were delivered to participants, and were developed based on previous research among OANP participants in a similar population in Georgia (Aspinwall, 2001; McCamey et al., 2003). This fruit and vegetable education program continues to be conducted in various Senior Centers throughout Georgia in an effort to increase knowledge and change behaviors related to fruit and vegetable intake among the elderly population. The program is available for download at: http://www.arches.uga.edu/~noahnet.

Methods

Subjects

A convenience sample of 97 individuals receiving congregate meals was recruited from seven senior centers located in both urban and rural counties of Northeast and South Georgia. Counties included in the study were Elbert, Greene, Morgan, Oconee, Oglethorpe (Wade, 2003), Cobb, and Camden counties, Georgia. The sample was 55 percent African American, ages ranged from 59-98, and 87 percent of participants were female. Participants needed to be able to participate in the educational program and comply with testing procedures. All participants were provided information on the purpose, procedures, and benefits of the study, and written informed

consent was obtained from each person. Participants were advised they could withdraw from the study at any time. All procedures used in the study were approved by The University of Georgia and Georgia Department of Human Resources Institutional Review Board on Human Subjects.

Intervention and Assessment

The Health Belief Model was used as the theoretical basis for the study (Clarke et al., 2000; Glanz, 2001; Strecher et al., 2002). The elements of the model incorporated into the intervention include perceived susceptibility to disease, perceived severity of disease, perceived barriers, and self-efficacy. Perceived susceptibility and severity of disease were addressed by emphasizing chronic diseases and other health conditions that can be reduced by consumption of fruits and vegetables. Perceived barriers and self-efficacy were addressed by demonstrating and reinforcing the importance and ease of incorporating a variety of fruits and vegetables into the diet. Perceived benefits of behavior change were addressed by emphasizing positive benefits of increasing fruit and vegetable intake for decreased disease risk. Questionnaires and other instructional materials were developed and reviewed for content validity and cultural appropriateness by faculty members and registered dietitians in the Department of Foods and Nutrition at The University of Georgia. Graphics for educational materials were developed by a graphic artist at The University of Georgia. All questionnaire and consent forms are included in the appendix.

The study consisted of three phases: pre-testing, intervention (delivery of lessons), and post-testing. The pre-test collected demographic information (age, gender, and ethnicity), fruit and vegetable consumption patterns, and barriers to consumption. The interviewers read the questions to participants and recorded responses. A food frequency questionnaire was used to determine the frequency of intake for selected fruits and vegetables; occasions when fruits and

vegetables were consumed (i.e. as a snack); frequency of canned, fresh, and frozen fruit and vegetable consumption; and how often fruits and vegetables were consumed at home. Fruits and vegetables included in the food frequency questionnaire were chosen because previous studies had documented low intakes of these foods in the population (Aspinwall, 2001; McCamey et al., 2003), epidemiological studies have associated intake with reduced risk of chronic disease (Block et al., 1992; Steinmetz and Potter, 1996; Quatromoni et al., 2002; Millen et al., 2004; Bazzano et al., 2002; Arts et al., 2002), and the foods are high in phytochemical content (USDA Nutrient Database for Standard Reference, 2004, see appendix). The food frequency format and questions were based on the Block Food Frequency Questionnaire, which has been tested for reproducibility and validity (Longnecker et al., 1994; Subar et al., 2001). The food frequency questionnaire used was not validated; however, questionnaires developed for similar studies in our laboratory have been proven valid (Aspinwall, 2001; Cheong et al., 2003). Frequency categories were less than one serving consumed per week, one, two, three, four, five, and six servings per week, one serving per day, two servings per day, and don't know. Yes/No questions were used to examine participant's knowledge of the benefits of fruit and vegetable consumption and five a day recommendations, and barriers to consumption, such as attitudes about fruit and vegetable intake and availability, economic, and physical limitations. Questions regarding current and past diseases were also included in the pre-test.

Following pre-testing, the nutrition education program, NOAHNET: Nutrition for Older Adults' Health, the Fruit and Vegetable Series, was initiated. Eleven fruit and vegetable consumption lessons were delivered to participants over a six to nine month time period. Lessons were developed by nutrition experts in the area of nutrition and gerontology at The University of Georgia, Department of Foods and Nutrition. The curriculum was designed to be

culturally and educationally appropriate for the population. The eleven modules were: Introduction to Fruits and Vegetables, Cruciferous Vegetables, Citrus Fruits, Berries, Canned and Frozen Fruits and Vegetables, Beans, Garlic and Onions, Leafy Greens, Squash and Pumpkin, Tomatoes, and Drug/Nutrient Interactions. Every module conveyed a common theme, "Five a Day, the Color Way," which emphasized the importance of consuming five servings of colorful fruits and vegetables in order to reduce risk of chronic disease and increase longevity. Each lesson was approximately 20 minutes in length and addressed the benefits of consumption for each fruit and/or vegetable targeted, proper food selection in the grocery store, proper storage techniques, serving sizes, and nutrients present. Food demonstrations were included in the lesson and participants could observe different ways to prepare the targeted fruit and/or vegetable and sample the product. Handouts were given to participants outlining the main points of the lesson, ways to incorporate the food into the diet, and recipes. Fruit and vegetable cartoon characters were included as part of each module. Each lesson was given once in each senior center, and the number of sessions attended by each participant was recorded. The curriculum is available at http://www.arches.uga.edu/~noahnet.

After delivery of the nutrition education modules, post-tests were conducted to assess changes in consumption behavior, knowledge, and participant satisfaction. The post-test included the same food-frequency questionnaire and knowledge questions as the pre-test, but added thirteen open-ended and yes/no questions to assess changes in behavior as well as participant satisfaction. Questions asked whether the participant increased consumption of fruits and vegetables, could identify diseases states which could be reduced by fruit and vegetable consumption, tried to follow a healthier diet, and willingness to try new and different fruits and vegetables and recipes (see appendix).

Statistical Analysis

SAS software (version 8.2, SAS Institute, Cary, North Carolina) was used to analyze data. Descriptive statistics, including frequencies, means, and standard error were generated at baseline for all participants completing the pre-test and at Time 1 (pre-test) and Time 2 (post-test) for participants who completed the entire study. Chi-squared analyses, Signed Rank Tests, and paired T-tests were used to analyze change from Time 1 to Time 2. Spearman correlations were used to identify correlations and possible predictors of change in fruit and vegetable intake, knowledge, and/or self-efficacy. A p-value of <0.05 was considered a significant difference in consumption, and a p-value = 0.05-0.15 was considered a trend. Stepwise regression analysis and logistic regression analysis were used to determine specific predictors of change in mean intake of targeted fruits and vegetables and knowledge of fruits and vegetables in relation to cancer and heart disease risk and the 5 A Day recommendation at post-test. To examine all key factors influencing change in targeted fruit and vegetable intake and increased knowledge at post-test, a significance level of 0.20 was selected as the entry criteria of a variable into each model created with stepwise regression analysis.

Results

Ninety-seven participants enrolled in the study. Of those, 96 participants completed pre-test measures and 73 participants completed post-test measures. Participants did not complete post-testing for one of the following reasons: cognitive inability to answer questions (n=6), died (n=1), did not attend the Senior Center for any post-test sessions (n=7), no longer attended the senior center due to personal or poor health reasons (n=19). When possible, participants who were not able to attend the Senior Center for post-testing were tested over the phone (n=10). Eighty-three percent of participants attended at least three of the lessons.

Those completing the intervention (completers) and those who did not complete the intervention (non-completers) did not differ in age, gender, and ethnicity. At Time 1 non-completers (n=23) reported consuming significantly more 100 percent orange juice, spaghetti or lasagna, sweet potatoes or yams, beans, vegetables as a snack, frozen vegetables at home, and all fruit items.

Baseline characteristics of all participants are shown in **Table 1**. The participants were predominately female (87%) and African American (55%). Hispanic participants were grouped with Caucasian participants due to the low number of Hispanics enrolled in the study (n=1). The following health conditions were self reported: hypertension (59%), high cholesterol (44%), diabetes (37%), heart disease or heart attack (21%), and cancer (13%).

Participant responses on the pre-test measure for all participants at the beginning of the study are shown in **Table 2**. Previous research in this population demonstrated few significant differences in fruit and vegetable intake due to ethnicity (Wade 2003). Therefore, effects of ethnicity were not examined. Baseline characteristics of fruit and vegetable consumption showed low consumption patterns for various items. The following were self-reported as being consumed once a week or less by ≥ 50 percent of participants: 100 percent cranberry, apple, or purple grape juice (57.9%); berries such as strawberries, blueberries, or blackberries (74.7%); nectarines, peaches, or apricots (57.9%); cantaloupe or honeydew (79.8%); corn (64.8%); cooked or stewed tomatoes (59.4); spaghetti or lasagna (82.1%); squash or zucchini (72.6%); spinach (73.7%); sweet potatoes or yams (60.6%); carrots (50.0%); baked beans, pintos, black-eyed peas, or other beans (60.4%); fruit for dessert (51.1%); vegetables as a snack (68.8%); consumption of frozen fruit at home (84.2%); consumption of frozen vegetables at home (54.4%); and consumption of canned vegetables at home (50.5%). Age had little effect on consumption

patterns with the exception of spaghetti or lasagna, which was consumed more by the younger age group ($p=0.04$). Trends were seen for greater consumption of cantaloupe or honeydew; canned fruit at home; and total fruit items among those over 80 years of age. Participants less than 80 years of age tended to consume more corn; total vegetable items; total items high in vitamin A and carotenoids; and total items high in lycopene. The mean intake of total fruits and vegetables in this population was 24 servings each week, or approximately 3.4 servings each day.

Between 66-69 percent of participants believed that consuming more fruits and vegetables would help reduce their risk of cancer and heart disease; however only 23 percent of participants knew that five or more servings each day of fruits and vegetables is recommended. Eighty-one percent believed they would be healthier if they improved the way they eat. Greater interest in learning about fruits and vegetables was evident in the younger population. A greater number of younger participants were interested in learning different ways to cook vegetables ($p=0.02$) and wanted healthy menus to take home ($p=0.01$).

Younger participants tended to report that they enjoyed the way vegetables taste, and older participants reported more barriers to consumption compared to the younger age group. A greater number of older participants reported inability to use a can opener ($p=0.02$) or a pot of hot water ($p=0.05$), did not shop for their own groceries ($p=0.01$), and did not plan the meals they eat ($p=0.01$).

At baseline, barriers to consumption were correlated. Inability to use a sharp knife, can opener, and pot of hot water were correlated ($p<0.0008$), and participants who lacked ability to shop for groceries were also not able to plan and cook meals consumed ($p<0.0001$).

Additionally, the participants' ability to plan and cook their own meals tended to correlate with the total fruit and vegetable items consumed at baseline.

Baseline characteristics for participants who completed the study (n=73) are shown in **Table 3**. Similar to characteristics of total participants, participants completing the study were predominately female (89%) and African American (58%). Additionally, more than half of the population reported suffering from hypertension (59%) and approximately 40 percent had diabetes.

Pre-test consumption patterns of participants who completed both pre-test and post-test measures are shown in **Table 4**. The fruits and vegetables which were self-reported as being consumed once a week or less by ≥ 50 percent of participants among the total sample were consumed less than once a week in this sample of participants with the addition of canned fruit consumption at home (50.0%). Only about 12 percent of participants reported consuming five or more servings per day of the fruits and vegetables included on this food frequency. Participants had a mean intake of 22 servings per week or about 3.1 servings each day.

Participant post-test responses are reported in **Table 5**. Fifty percent or more participants reported consuming the following fruits and/or vegetables once a week or less: 100 percent cranberry, apple, or purple grape juice (52.8%), berries such as strawberries, blueberries, or blackberries (76.1%); broccoli, cabbage, or cauliflower (50.7%); cantaloupe or honeydew (55.6%); leafy green such as mustard, turnip, or collard greens (51.4%); corn (65.2%); cooked or stewed tomatoes (56.3%); spaghetti or lasagna (72.9%); squash or zucchini (69.4%); spinach (77.6%); sweet potatoes or yams (63.9%); carrots (51.4%); baked beans, pintos, black eyed peas, or other beans (56.2%); consumption of fruit for dessert (53.5%); consumption of vegetables as a snack (69.6%); frozen fruit consumption at home (82.4%); and consumption of frozen vegetables

at home (57.1%). Over 50 percent of participants reported that because of the information they learned in the fruit and vegetable lessons, they now eat more fruits and vegetables because they believe the foods are good for them (80%), feel more strongly now than before that consumption of fruits and vegetables will help reduce their risk of disease (80%), and have tried to follow a healthier diet (69%). Participant satisfaction with the program is also included in Table 4.

Pre- and post-test mean differences in fruit and vegetable consumption are shown in **Table 6**. Significant increases in consumption occurred for cantaloupe or honeydew (0.9 ± 0.2 at Time 1 vs. 1.8 ± 0.2 at Time 2, p=0.003). Participants tended to consume more apple, cranberry, or purple grape juice (p=0.08); peaches, nectarines, or apricots (p=0.08); beans (p=0.12); total fruit items (p=0.07); and all fruits and vegetables (p=0.12). Significant decreases in consumption were seen for leafy greens (p=0.02) and fruit and vegetable items high in lutein and zeaxanthin (p=0.02).

Responses regarding change in knowledge about fruits and vegetables are shown in **Table 7**. More participants reported understanding that eating fruits and vegetables will help reduce risk of cancer (67% at Time 1 vs. 82% at Time 2, p=0.04) and were aware of the 5 A Day recommendation (21% at Time 1 vs. 36% at Time 2, p=0.04) after the intervention. An increase was evident for knowledge that consumption of fruits and vegetables can help reduce risk of heart disease (69% at Time 1 vs. 82% at Time 2, p=0.05) as well.

Correlation analysis was used to examine relationships between variables at Time 1 and Time 2. There was a correlation between participant interest in knowing more about how fruits and vegetables are good for their health at Time 1 and an increase in knowledge of the benefits of fruits and vegetables in regards to heart disease and cancer risk (p=0.03). Also, at Time 2 there was a positive trend toward participant knowledge of amount of fruit and vegetable

servings to be consumed each day and the change in mean intake of total fruits and vegetables consumed.

Initially, age; intake of targeted fruits and vegetables; knowledge of the benefits of fruit and vegetable intake on cancer and heart disease risk; knowledge of the 5 A Day recommendation; barriers to consumption including tooth or mouth problems which could influence fruit and vegetable intake, adequate income to spend on fruits and vegetables, interest in fruit and vegetable education, ability to use a sharp knife, can opener, or a pot of hot water, ability to shop for groceries, ability to plan meals, and ability to cook meals; and disease states, all of which were assessed at pre-test, were studied as predictors of change in mean intake of targeted fruits and vegetables were examined using stepwise regression analysis. The same independent variables excluding the barriers ability to use a sharp knife, can opener, and pot of hot water were examined in a second model as predictors of knowledge of fruits and vegetables on heart disease and cancer risk and the 5 A Day recommendation at post-test were then examined. Results are shown in **Table 8**. Since many variables tested were not continuous variables, logistic regression analysis examined the same models. Results are shown in **Table 9**.

Discussion

Few studies have examined the effectiveness of educational interventions designed to increase fruit and vegetable intake. With healthcare costs continuing to rise and the decreased quality of life that can occur with increasing age, nutrition education among the elderly population should be encouraged (Higgins & Barkley, 2004_a). Those served at ENP sites are excellent candidates for nutrition education interventions. Low income elders typically have poor nutritional status, suffer from chronic health conditions (Cole and Fox, 2004), and are a

high risk population (Millen, 2002). Research conducted by Neyman et al. (1998) found 67 percent to 88 percent of ENP participants were at moderate to high nutritional risk.

This study was designed to determine typical consumption patterns of fruits and vegetables associated with disease risk reduction and to determine whether a nutrition education intervention could improve behaviors, attitudes, and knowledge related to fruit and vegetable intake. The intervention focused on disease prevention awareness, emphasis of the overall health benefits of fruits and vegetables, decreasing barriers to consumption, and increasing self-efficacy. Major findings of the study included: 1) Over 50 percent of participants (n=73) reported consuming 18 of 25 targeted fruit and vegetable groups less than once per week at baseline, and 2) Participants reported experiencing several barriers to consumption at baseline, and 3) older participants (≥ 80 years) reported significantly more barriers compared to younger participants (< 80 years). Following an educational intervention, trends toward increased consumption of cranberry, apple, or purple grape juice; peaches, nectarines, or apricots; beans; all fruit measures; and all fruit and vegetable measures were seen; significant increase in melon consumption was reported; more participants reported knowledge of the relationship between fruits and vegetables and risk of cancer and the 5 A Day recommendation; and more participants tended to report knowledge of the relationship between fruits and vegetables and risk of heart disease. Results discussed in this section include only participants who completed the study (n=73).

At baseline, participants reported consumption of only 3.1 servings of targeted fruits and vegetables each day, and 18 of 25 fruit and vegetable groupings were consumed less than once per week by at least 50 percent of the population. Low consumption of fruits and vegetables corresponds with the findings of McCamey et al. (2003) and Aspinwall (2001). Because this

study assessed fruit and vegetable intake only from targeted fruit and vegetable groups, actual intake of fruits and vegetables may be higher than reported. The National Center for Chronic Disease Prevention and Health Promotion (2002) reported that only 32 percent of older Americans (> 65 years) were consuming the recommended five servings of fruits and vegetables each day, with the majority (49%) consuming three to four servings per day.

Carotenoid-rich foods have been shown to decrease risk of many chronic diseases. Green leafy vegetables and vitamin C-rich fruits and vegetables have been associated with noticeable protective effects against heart disease (Joshipura et al., 2001; Kris-Etherton et al., 2002) and stroke (Johnsen et al., 2003). Steinmetz & Potter (1996) reported that allium vegetables, carrots, green vegetables, cruciferous vegetables, and tomatoes seem to be most beneficial in reducing risk of cancer. Also, increased consumption of cruciferous vegetables has been associated with decreased risk of cancer, specifically prostate and colon cancer (Murillo & Mehta, 2001). The latest edition of the Dietary Guidelines for Americans specifically recommends increasing intake of dark green and orange vegetables (Center for Nutrition Policy and Promotion, 2005). Unfortunately, over 50 percent of participants reported consumption of fruits and vegetable groups high in carotenoids and vitamin A, carotenoids and cruciferous vegetables, lutein and zeaxanthin, and lycopene less than once per week. Low consumption of these foods is consistent with the findings of Aspinwall (2001) in a similar population in Georgia. Ledikwe et al. (2004) also reported lower intakes of dark green and deep yellow vegetables and citrus fruits, melons, and berries among older adults in Pennsylvania who consume a low nutrient dense diet ($p<0.05$).

At baseline, 33 and 32 percent of participants did not know that fruit and vegetable intake could help decrease risk of heart disease and cancer, respectively, and 79 percent could not correctly respond when asked how many fruits and vegetables should be consumed each day.

Additionally, a majority of participants believed that adults should be consuming only three servings of fruits and vegetables each day (27%). Nutrition knowledge is often low in older adults. Only 39 percent of elderly participants correctly responded to questions related to nutrition knowledge at pre-test in a study by Taylor-Davis et al. (2000). Likewise, Miller et al. (2002) reported low nutrition knowledge scores (13.4 ± 0.7 out of a possible 30) at baseline among older adult diabetes patients participating in a diabetes nutrition education intervention. Confusion among nutrition messages, lack of nutrition expertise, and decreased cognitive function could all influence lack of nutrition knowledge among the elderly (Higgins and Barkley, 2004_a).

The second leading barrier to consumption reported was inadequate income to purchase fruits and vegetables (41%). In 1999-2001, 775,000 adults aged 65 years and older were living below the poverty level in Georgia (United States Census Bureau, 2003). Sharpe et al. (1996) reported 60 percent of congregate meal participants in a South Carolina county lived below the poverty level. In a profile of congregate nutrition site program participants in rural North Carolina lack of money was cited as the fourth leading risk factor for malnutrition (McClelland et al., 2002). Since the ENP targets low-income populations, many of the participants are eligible to receive federal aid for food, however, the older adult population is least likely to enroll in the food stamp program (Higgins & Barkley, 2004_a). Anderson et al. (2001) found that when coupons for fruits and vegetables were given to low-income adults, participants were more likely increase intake of the foods and to believe that fruits and vegetables were more accessible.

Ability to use a can opener was related to a positive change in fruit and vegetable intake in our study. This is one of our logistic regression measures of functional ability, which was related to intake of fruits and vegetables ($p=0.02$). Indeed, a high rate of functional disability

may have contributed to low intakes of fruits and vegetables. Ponza et al. (1996) reported that 64 percent of ENP participants receiving home delivered meals have difficulty shopping for food and 49 percent of home delivered and congregate meal participants experienced difficulty when preparing meals. Additionally, research conducted by Cole and Fox (2004) indicated that low-income elders are more likely to have functional limitations that can inhibit daily activities. Twenty-two percent of participants in our study reported inability to shop for groceries, and between 15-16 percent of participants experience difficulty using knives, can openers, and pots of hot water.

Logistic regression models predicted change in mean intake of targeted fruits and vegetables. Participants who reported lower intakes of targeted fruits and vegetables at pre-test increased their mean intake of targeted fruits and vegetables more than others. This is plausible since participants who already consumed high levels of targeted fruits and vegetables may not have thought they needed to increase consumption or felt they could not consume any more fruits and vegetables.

Following the intervention, increased consumption of several fruit and vegetable groupings was seen in the population, including an increase in all fruit items and total fruit and vegetable measures of 2.47 servings per week. Additionally, participants did report increased consumption of legumes following the intervention ($p=0.12$). Other fruit and vegetable interventions among older adults have reported greater increases in intake compared to our study (Campbell et al., 1999; Bernstein et al., 2002; Smith et al., 2004; Stevens et al., 2002). These studies used more intense approaches to increase consumption such as providing participants with fruits and vegetables (Campbell et al., 1999; Smith et al., 2004) and conducting follow-up

phone interviews (Bernstein et al, 2002; Stevens et al., 2002), which could have influenced the larger increases in fruit and vegetable intake.

Participant pre-testing was completed in the fall and winter, the intervention took place during spring and summer, and post-testing was completed in late summer and early fall. The peak season for many fresh fruits and vegetables was during the intervention and post-testing. Seasonality of fruits and vegetables could have influenced consumption behavior, especially the increase in melon consumption and the trend toward increased consumption of peaches, nectarines, or apricots and total fruits and vegetables. Seasonality could have also been a factor contributing to few significant increases in fruit and vegetable consumption and the decrease in consumption of leafy greens ($p=0.02$). Participants may have been consuming fruits and vegetables that were in season in place of leafy greens. Another reason for the decrease in leafy green consumption could have been due to misinterpretation of the "Drug-Food Interactions" lesson. Emphasis was placed on consistent intake of vitamin K-rich foods for those taking drugs such as Coumadin and Warfarin. Participants on these medications may have misinterpreted this advice and decreased consumption of leafy greens.

The Health Belief Model states that with awareness of perceived severity, susceptibility, and benefits of disease and decreased barriers to consumption, increases in self-efficacy can occur leading to behavior change (Glanz, 2001). A review of nutrition education interventions for older adults (Sahyoun et al., 2004) reported that increased nutrition knowledge was the most successful outcome in the observed studies, and behavior change was variable. This was the case for our intervention. Miller et al. (2002) reported significant increases in self-efficacy as identified by decreases in barriers and increases in promoters to self-management of diabetes following a nutrition education intervention. Participants experienced many barriers to

consumption that would be difficult to change (income, inability to use kitchen tools, inability to shop for groceries, and inability to prepare and cook their own meals). Despite those barriers, after the intervention, participants reported trying different ways of preparing fruits and vegetables (49%), trying a fruit or vegetable that they thought they did not like before (28%), and felt more strongly that eating fruits and vegetables would help reduce risk of disease (80%). This suggests that modifiable barriers (knowledge and attitudes) were decreased, which could potentially lead to behavior change.

Logistic regression predicted the influence of several factors assessed at pre-test on knowledge of fruits and vegetables at post-test. Younger age was positively related to familiarity with the benefits of fruits and vegetables on cancer and heart disease risk at post-test. It is possible that younger participants were more cognitively stable, leading to greater ability to retain knowledge gained. Those who reported adequate income to purchase fruits and vegetables increased their knowledge of fruits and vegetables regarding cancer risk as well. Using a sample population of individuals at least 60 years old from CSFII, Weimer (1998) reported socioeconomic status of individuals was associated with nutrient intake and knowledge. Presence of heart disease and high serum cholesterol was positively related to post-test knowledge of heart disease risk. It is possible, as suggested in the Health Belief Model, that presence of the disease was related to a person's interest in additional knowledge associated with disease prevention. Knowledge of the benefits of fruits and vegetables on cancer risk at pre-test also predicted knowledge of the 5 A Day recommendation at post-test.

There were several limitations to this study. First, attendance was not mandatory. If participants were absent, handouts were left at the senior center for them; however, records were not kept to see if the participant received handouts. Thus, absent participants may not have

received handouts and may not have been exposed to information presented. Second, cognitive ability and education level were not assessed. In an effort to overcome this limitation, the educational materials were developed based on an eighth grade reading level. Next, seasonality of fruits and vegetables was not accounted for when assessing food intake patterns. Additionally, our sample was rather limited. The population was composed of predominantly African American females; therefore, our findings may not be applicable to other ethnic or racial backgrounds. Lastly, follow-up on the participants was not conducted, so whether further behavior change and maintenance of gains occurs will be unknown.

This study as well as many others has shown that older adults, especially the low income elderly, experience many barriers to consumption of fruits and vegetables which may increase risk of disease development (Ponza et al., 1996; Campbell et al., 1999; Miller et al., 2002; Higgins and Barkley, 2004_a; Smith et al., 2004). We found that insufficient income, functional limitations, and lack of nutrition knowledge were prominent barriers to consumption. Keeping that in mind and also considering nutrition as a primary modifiable risk factor for disease development (Millen, 2002), nutrition intervention programs need to be designed to overcome this barrier. Few research studies have focused on the outcomes of nutrition intervention programs among older adults and future research should focus on novel ways to reach this population.

Finally, studies have not examined the long-term effects of increases in fruit and vegetable intake in older adults; therefore the effectiveness of fruit and vegetable education interventions in older adults remains unknown. Shorter trials in adults have demonstrated positive effects on markers associated with disease states. Esposito et al. (2004) conducted a two-year trial comparing the effects of consumption of a Mediterranean style diet (intervention

diet), emphasizing intake of a diet composed of 50-60 percent carbohydrate, 15-20 percent protein, less than 30 percent total fat, less than 10 percent saturated fat, less than 300 mg cholesterol, 250-300 grams of fruit, and 125-150 grams of vegetables per day, versus a control diet, which was composed of 50-60 percent carbohydrate, 15-20 percent protein, and less than 30 percent fat. Mean age of participants receiving the intervention and control diets were 44.3 ± 6.4 years and 43.5 ± 5.9 years, respectively, at baseline. Results indicated participants who followed the intervention diet consumed higher amounts of fruits and vegetables compared to the control diet and significantly decreased blood pressure, blood glucose, insulin, total cholesterol, and triglyceride levels and significantly increased HDL cholesterol levels compared to the control group. Further, results from the three week DASH-intervention trial (Appel et al., 1997) indicated that consumption of an intervention diet consisting of eight to ten servings of fruits and vegetables each day decreased systolic blood pressure by 2.8 mmHg ($p<0.001$) and diastolic blood pressure by 1.1 mmHg ($p=0.07$) compared to the control diet. Mean age of participants was 45 ± 11 years for the intervention group and 44 ± 11 years for the control group. Additionally, participants consuming the fruit and vegetable diet experienced reductions in blood pressure within two weeks of adopting the intervention diet. Finally, Ard et al. (2004) reported participants following the DASH diet, consisting of high intakes of fruits and vegetables and two to three servings of low-fat dairy per day (mean age of participants was 53.6 years), increased insulin sensitivity by 50 percent over the six-month intervention. Participants also significantly decreased their fasting blood glucose levels by 3.83 ± 9.91 mg/dL from baseline (average fasting blood glucose was measured at 98.28 mg/dL), and decreased systolic blood pressure by 16.55 ± 9.07 mmHg, and diastolic blood pressure by 8.75 ± 6.78 mmHg. Short-term health outcomes in adults achieved by changes in diet could lead to increase quality of life, and it is not unlikely to

believe that maintenance of behaviors resulting in short-term changes could potentially decrease risk of diseases such as heart disease and diabetes over time.

Through this intervention, we hoped to improve attitudes and behaviors regarding fruits and vegetables among a population of older adults with the ultimate goal of improved quality of life. Although few knowledge and behavior changes were observed in our study, even small changes may ultimately improve health in this population. Participants were satisfied with the fruit and vegetable education program. Ninety-four percent of participants rated the program as excellent, very good, or good. These findings provide encouragement to continue education efforts among older adults. All educational materials are available for download at http://www.arches.uga.edu/~noahnet.

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Table 1. Participant Characteristics at Time 1 (n=96)

Age	**n**	**%**
59-69	24	25
70's	30	31
80's	34	35
90+	8	8
Gender	**n**	**%**
Male	12	13
Female	83	87
Ethnicity	**n**	**%**
Caucasian*	43	45
African American	53	55
A52-A56 Do you have or have you had any of the following diseases or conditions? (% yes)	**n**	**%**
Cancer	12	12.8
Heart disease/Heart attack	20	21.1
Diabetes	35	37.2
High cholesterol	41	43.6
Hypertension	55	58.5

*Caucasian includes Hispanic

Table 2. Participant Responses on Pre-test Questionnaires (n=96)

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
A7	100% orange juice				
	0-1 serving/week	36.2	44.2	26.2	
	2-3 servings/week	14.9	11.5	19.1	
	4 or more servings/week	48.9	44.2	54.8	
	Mean ± S.E.	4.0 ± 0.4			
	n	94	52	42	0.17
A8	100% cranberry, apple, or purple grape juice				
	0-1 serving/week	57.9	64.2	50.0	
	2-3 servings/week	26.3	22.6	31.0	
	4 or more servings/week	15.8	13.2	19.1	
	Mean ± S.E.	1.8 ± 0.3			
	n	95	53	42	0.38
A9	Berries such as strawberries, blueberries, or blackberries				
	0-1 serving/week	74.7	76.9	73.2	
	2-3 servings/week	17.9	16.7	19.5	
	4 or more servings/week	7.4	7.4	7.3	
	Mean ± S.E.	1.1 ± 0.2			
	n	95	54	41	0.94
A10	Nectarines, peaches, or apricots				
	0-1 serving/week	57.9	54.7	61.9	
	2-3 servings/week	33.7	37.7	28.6	
	4 or more servings/week	8.4	7.6	9.5	
	Mean ± S.E.	1.5 ± 0.2			
	n	95	53	42	0.64
A11	Broccoli, cabbage, or cauliflower				
	0-1 serving/week	43.8	44.4	42.9	
	2-3 servings/week	39.6	38.9	40.5	

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	4 or more servings/week	16.7	16.7	16.7	
	Mean ± S.E.	2.2 ± 0.2			
	n	96	54	42	0.99
A12	Cantaloupe or honeydew				
	0-1 serving/week	79.8	86.8	70.7	
	2-3 servings/week	11.7	5.7	19.5	
	4 or more servings/week	8.5	7.6	9.8	
	Mean ± S.E.	1.0 ± 0.2			
	n	94	53	41	0.10†
A13	Leafy greens such as mustard, turnip, collard greens				
	0-1 serving/week	39.6	38.9	40.5	
	2-3 servings/week	46.9	44.4	50.0	
	4 or more servings/week	13.5	16.7	9.5	
	Mean ± S.E.	2.1 ± 0.2			
	n	96	54	42	0.59
A14	Corn				
	0-1 serving/week	64.8	56.9	75.7	
	2-3 servings/week	35.2	43.1	24.3	
	4 or more servings/week	0	0	0	
	Mean ± S.E.	1.3 ± 0.1			
	n	88	51	37	0.07†
A15	Cooked or stewed tomatoes				
	0-1 serving/week	59.4	59.3	59.5	
	2-3 servings/week	31.3	31.5	31.0	
	4 or more servings/week	9.4	9.3	9.5	
	Mean ± S.E.	1.7 ± 0.2			
	n	96	54	42	1.00
A16	Spaghetti or lasagna				
	0-1 serving/week	82.1	77.4	88.1	

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	2-3 servings/week	15.8	22.6	7.1	
	4 or more servings/week	2.1	0.0	4.5	
	Mean ± S.E.	0.7 ± 0.1			
	n	95	53	42	0.04*
A17	Onions				
	0-1 serving/week	43.2	40.7	46.3	
	2-3 servings/week	30.5	31.5	29.3	
	4 or more servings/week	26.3	27.8	24.4	
	Mean ± S.E.	2.8 ± 0.3			
	n	95	54	41	0.86
A18	Squash or zucchini				
	0-1 serving/week	72.6	71.7	73.8	
	2-3 servings/week	23.2	22.6	23.8	
	4 or more servings/week	4.2	5.7	2.4	
	Mean ± S.E.	1.0 ± 0.1			
	n	95	53	42	0.73
A19	Spinach				
	0-1 serving/week	73.7	68.5	80.5	
	2-3 servings/week	20.0	25.9	12.2	
	4 or more servings/week	6.3	5.6	7.3	
	Mean ± S.E.	1.0 ± 0.1			
	n	95	54	41	0.25
A20	Sweet potatoes or yams				
	0-1 serving/week	60.6	58.5	63.4	
	2-3 servings/week	36.2	39.6	31.7	
	4 or more servings/week	3.2	1.9	4.9	
	Mean ± S.E.	1.3 ± 0.1			
	n	94	53	41	0.57
A21	Carrots				
	0-1 serving/week	50.0	46.3	54.8	

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	2-3 servings/week	38.5	40.7	35.7	
	4 or more servings/week	11.5	13.0	9.5	
	Mean ± S.E.	1.9 ± 0.2			
	n	96	54	42	0.69
A22	Baked beans, pintos, black-eyed peas, other beans				
	0-1 serving/week	60.4	61.1	59.5	
	2-3 servings/week	35.4	35.2	35.7	
	4 or more servings/week	4.2	3.7	4.8	
	Mean ± S.E.	1.4 ± 0.1			
	n	96	54	42	0.96
A23	How often do you eat fruit as a snack?				
	0-1 serving/week	19.2	17.0	22.0	
	2-3 servings/week	29.8	32.1	26.8	
	4 or more servings/week	52.1	50.9	51.2	
	Mean ± S.E.	4.6 ± 0.4			
	n	94	53	41	0.77
A24	How often do you eat fruit as dessert?				
	0-1 serving/week	51.1	50.0	52.5	
	2-3 servings/week	29.8	29.6	30.0	
	4 or more servings/week	19.2	20.4	17.5	
	Mean ± S.E.	2.1 ± 0.2			
	n	94	54	40	0.94
A25	How often do you eat vegetables as a snack?				
	0-1 serving/week	68.8	70.4	66.7	
	2-3 servings/week	20.8	20.4	21.4	
	4 or more servings/week	10.4	9.3	11.9	
	Mean ± S.E.	1.4 ± 0.2			
	n	96	54	42	0.90

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
A26	When you are at home, how often do you eat fresh fruit?				
	0-1 serving/week	16.0	19.2	11.9	
	2-3 servings/week	29.8	30.8	28.6	
	4 or more servings/week	54.3	50.0	59.5	
	Mean ± S.E.	4.5 ± 0.3			
	n	94	52	42	0.55
A27	When you are at home, how often do you eat frozen fruit?				
	0-1 serving/week	84.2	83.0	85.7	
	2-3 servings/week	11.6	15.1	7.1	
	4 or more servings/week	4.2	1.9	7.1	
	Mean ± S.E.	0.7 ± 0.2			
	n	95	53	42	0.24
A28	When you at home, how often do you eat canned fruit?				
	0-1 serving/week	49.5	46.3	53.7	
	2-3 servings/week	37.9	46.3	26.8	
	4 or more servings/week	12.6	7.4	19.5	
	Mean ± S.E.	1.8 ± 0.2			
	n	95	54	41	0.07[†]
A29	When you are at home, how often do you eat fresh vegetables?				
	0-1 serving/week	22.3	21.2	23.8	
	2-3 servings/week	33.0	36.5	28.6	
	4 or more servings/week	44.7	42.3	47.6	
	Mean ± S.E.	4.1 ± 0.3			
	n	94	52	42	0.72
A30	When you are at home, how often do you eat frozen vegetables?				

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	0-1 serving/week	54.4	54.7	53.9	
	2-3 servings/week	30.4	32.1	28.2	
	4 or more servings/week	15.2	13.2	18.0	
	Mean ± S.E.	1.9 ± 0.3			
	n	92	53	39	0.80
A31	When you are at home, how often do you eat canned vegetables?				
	0-1 serving/week	50.5	49.1	52.5	
	2-3 servings/week	34.4	34.0	35.0	
	4 or more servings/week	15.1	17.0	12.5	
	Mean ± S.E.	2.2 ± 0.3			
	n	93	53	40	0.83
All FV	Summary score for total fruit and vegetable items, excluding A16 (spaghetti or lasagna) and A22 (beans)				
	0-13 servings/week	19.3	17.7	21.6	
	14-20 servings/week	20.5	23.5	16.2	
	21-28 servings/week	27.3	27.5	27.0	
	29-34 servings/week	15.9	15.7	16.2	
	≥ 35 servings/week	17.1	15.7	18.9	
	Mean ± S.E.	24.1 ± 1.2			
	n	88	51	37	0.93
All Fr	Summary score for total fruit items: A7-A10, A12				
	0-6 servings/week	33.7	42.3	22.5	
	7-13 servings/week	43.5	40.4	47.5	
	≥14 servings/week	22.8	17.3	30.0	
	Mean ± S.E.	9.2 ± 0.6			
	n	92	52	40	0.11[†]
All Veg	Summary score for total vegetable items:				

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	A11, A13-15, A17-21				
	0-6 servings/week	10.0	5.8	15.8	
	7-13 servings/week	34.4	28.9	42.1	
	14-20 servings/week	35.6	46.2	21.1	
	≥ 21 servings/week	20.0	19.2	21.1	
	Mean ± S.E.	15.1 ± 0.8			
	n	90	52	38	0.06†
Hi VitACar	Summary score for total items high in vitamin A and/or carotenoids: A13, A19, A20, A21				
	0-6 servings/week	63.4	56.6	72.5	
	≥ 7 servings/week	36.6	43.4	27.5	
	Mean ± S.E.	6.2 ± 0.4			
	n	93	53	40	0.12†
Hi Car Cru	Summary score for total items high in carotenoids and cruciferous vegetables: A13, A19, A20, A21, A11				
	0-6 servings/week	45.2	41.5	50.0	
	≥ 7 servings/week	54.8	58.5	50.0	
	Mean ± S.E.	8.4 ± 0.5			
	n	93	53	40	0.42
Hi VitC	Summary score for total fruit and vegetable items high in vitamin C: A7, A9, A11-A13, A15, A20				
	0-6 servings/week	22.0	23.1	20.5	
	≥ 7 servings/week	78.0	76.9	79.5	
	Mean ± S.E.	13.0 ± 0.7			
	n	91	52	39	0.77
Hi LutZea	Summary score for total items high in lutein and zeaxanthin: A13, A19				

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	≤ 2 servings/week	50.5	50.0	51.2	
	≥ 3 servings/week	49.5	50.0	48.8	
	Mean ± S.E.	3.1 ± 0.3			
	n	95	54	41	0.91
Hi Lycop	Summary score for total items high in lycopene: A15, A16				
	≤ 2 servings/week	61.1	54.7	69.1	
	≥ 3 servings/week	39.0	45.3	31.0	
	Mean ± S.E.	2.4 ± 0.2			
	n	95	53	42	0.15†
A32	Do you think that eating more fruits and vegetables will help reduce your risk of cancer?				
	Yes	66.7	68.5	64.3	
	No	10.4	13.0	7.1	
	Don't know	22.9	18.5	28.6	
	n	96	54	42	0.39
A33	Do you think that eating more fruits and vegetables will help reduce your risk of heart disease?				
	Yes	68.8	72.2	64.3	
	No	7.3	5.6	9.5	
	Don't know	24.0	22.2	26.2	
	n	96	54	42	0.64
A34	Do you think if you improved the way you eat, that you would be a much healthier person?				
	Yes	81.3	85.2	76.2	
	No	12.5	9.3	16.7	
	Don't know	6.3	5.6	7.1	

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	n	96	54	42	0.50
A35	Do you think that your grocery store has a wide selection of fruits and vegetables?				
	Yes	91.2	94.2	88.1	
	No	4.3	3.9	4.8	
	Don't know	4.3	1.9	7.1	
	n	94	52	42	0.44
A36	How many fruits and vegetables should people eat each day?				
	1 per day	8.4	7.6	9.5	
	2 per day	14.7	11.3	19.1	
	3 per day	23.2	22.6	23.8	
	4 per day	12.6	11.3	14.3	
	5 or more per day	23.2	26.4	19.1	
	Don't know	17.9	20.8	14.3	
	n	95	53	42	0.80
A37	Do you like the way most vegetables taste?				
	Yes	85.4	90.7	78.6	
	No	14.6	9.3	21.4	
	n	96	54	42	0.09[†]
A38	Do you have tooth or mouth problems that make you usually eat easy-to-chew fruits and vegetables?				
	Yes	22.9	24.1	21.4	
	No	77.1	75.9	78.6	
	n	96	54	42	0.76
A39	Do you have enough money to spend on fruits and vegetables?				
	Yes	63.7	58.0	70.7	

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	No	36.3	42.0	29.3	
	n	91	50	41	0.21
A40	Would you like to know more about which fruits and vegetables are good for your health?				
	Yes	87.5	87.0	88.1	
	No	12.5	13.0	11.9	
	n	96	54	42	0.88
A41	Would you like to know more about different ways to cook vegetables?				
	Yes	69.8	79.6	57.1	
	No	30.2	20.4	42.9	
	n	96	54	42	0.02*
A42	Would you like a handout with healthy menus to take home?				
	Yes	86.2	94.4	75.0	
	No	13.8	5.6	25.0	
	n	94	54	40	0.01*
	Which of these kitchen tools can you easily use to cook vegetables at home?				
A43	Sharp knife?				
	Yes	84.4	87.0	81.0	
	No	15.6	13.0	19.1	
	n	96	54	42	0.42
A44	Can opener?				
	Yes	85.4	92.6	76.2	
	No	14.6	7.4	23.8	
	n	96	54	42	0.02*
A45	Pot of hot water?				
	Yes	84.4	90.7	76.2	

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	No	15.6	9.3	23.8	
	n	96	54	42	0.05†
A46	Do you shop for your own groceries?				
	Yes	72.6	83.0	59.5	
	No	27.4	17.0	40.5	
	n	95	53	42	0.01*
A47	If you answered no, then who shops for you?				
	Spouse	3.2	1.9	4.9	
	Other family	20.2	15.1	26.8	
	Friend	0.0	0.0	0.0	
	Other	3.2	0.0	7.3	
	N/A	73.4	83.0	61.0	
	n	94	53	41	0.05†
A48	Do you plan the meals you eat?				
	Yes	79.2	88.9	66.7	
	No	20.8	11.1	33.3	
	n	96	54	42	0.01*
A49	Do you cook the meals you eat?				
	Yes	81.3	85.2	76.2	
	No	18.8	14.8	23.8	
	n	96	54	42	0.26
A50	Do you use a microwave at home?				
	Yes	75.0	77.8	71.4	
	No	25.0	22.2	28.6	
	n	96	54	42	0.48
A51	Do you use a stove at home?				
	Yes	88.5	90.7	85.7	
	No	11.5	9.3	14.3	
	n	96	54	42	0.44

Variable Name and Description		Total (%)	By Age Group (%)		P-value
			59-79 (<80)	≥80	
	Do you have or have you ever had any of the following?				
A52	Diabetes?				
	Yes	37.2	50.0	21.4	
	No	62.8	50.0	78.6	
	n	94	52	42	0.004*
A53	Cancer?				
	Yes	12.8	13.5	11.9	
	No	87.2	86.5	88.1	
	n	94	52	42	0.82
A54	Heart disease or heart attack?				
	Yes	21.1	22.6	19.1	
	No	79.0	77.4	81.0	
	n	95	53	42	0.67
A55	High blood cholesterol?				
	Yes	43.6	48.1	38.1	
	No	56.4	51.9	61.9	
	n	94	52	42	0.33
A56	High blood pressure or hypertension?				
	Yes	58.5	55.8	61.9	
	No	41.5	44.2	38.1	
	n	94	52	42	0.55

*P-values < 0.05 were considered significant

† P-values 0.05-0.15 were considered trends

Table 3. Participant Characteristics at Time 1 (n=73)

Age	**n**	**%**
59-69	21	29
70's	23	32
80's	23	32
90+	6	8
Gender	**n**	**%**
Male	8	11
Female	65	89
Ethnicity	**n**	**%**
Caucasian*	31	42
African American	42	58
A52-A56 Do you have or have you had any of the following diseases or conditions? (% yes)	**n**	**%**
Cancer	10	14.1
Heart disease/Heart attack	16	22.2
Diabetes	29	40.9
High cholesterol	35	49.3
Hypertension	42	59.2

*Caucasian includes Hispanic

Table 4. Participant Responses on Pre-test Questionnaires (n=73)

Variable Name and Description		**Total (%)**
A7	100% orange juice	
	0-1 serving/week	40.9
	2-3 servings/week	15.5
	4 or more servings/week	43.7
	Mean ± S.E.	3.5 ± 0.4
	n	71
A8	100% cranberry, apple, or purple grape juice	
	0-1 serving/week	61.1
	2-3 servings/week	22.2
	4 or more servings/week	16.7
	Mean ± S.E.	1.7 ± 0.3
	n	72
A9	Berries such as strawberries, blueberries, or blackberries	
	0-1 serving/week	75.0
	2-3 servings/week	16.7
	4 or more servings/week	8.3
	Mean ± S.E.	1.1 ± 0.2
	n	72
A10	Nectarines, peaches, or apricots	
	0-1 serving/week	59.7
	2-3 servings/week	31.9
	4 or more servings/week	8.3
	Mean ± S.E.	1.4 ± 0.2
	n	72
A11	Broccoli, cabbage, or cauliflower	
	0-1 serving/week	48.0
	2-3 servings/week	39.7
	4 or more servings/week	12.3
	Mean ± S.E.	2.0 ± 0.2

Variable Name and Description		Total (%)
	n	73
A12	Cantaloupe or honeydew	
	0-1 serving/week	83.3
	2-3 servings/week	9.7
	4 or more servings/week	6.9
	Mean ± S.E.	0.9 ± 0.2
	n	72
A13	Leafy greens such as mustard, turnip, collard greens	
	0-1 serving/week	39.7
	2-3 servings/week	45.2
	4 or more servings/week	15.1
	Mean ± S.E.	2.1 ± 0.2
	n	73
A14	Corn	
	0-1 serving/week	63.8
	2-3 servings/week	36.2
	4 or more servings/week	0.0
	Mean ± S.E.	1.2 ± 0.1
	n	69
A15	Cooked or stewed tomatoes	
	0-1 serving/week	63.0
	2-3 servings/week	31.5
	4 or more servings/week	5.5
	Mean ± S.E.	1.4 ± 0.2
	n	73
A16	Spaghetti or lasagna	
	0-1 serving/week	86.1
	2-3 servings/week	12.5
	4 or more servings/week	1.4
	Mean ± S.E.	0.6 ± 0.1
	n	72

Variable Name and Description		Total (%)
A17	Onions	
	0-1 serving/week	43.8
	2-3 servings/week	31.5
	4 or more servings/week	24.7
	Mean ± S.E.	2.6 ± 0.3
	n	73
A18	Squash or zucchini	
	0-1 serving/week	77.8
	2-3 servings/week	18.1
	4 or more servings/week	4.2
	Mean ± S.E.	0.9 ± 0.2
	n	72
A19	Spinach	
	0-1 serving/week	76.4
	2-3 servings/week	19.4
	4 or more servings/week	4.2
	Mean ± S.E.	0.9 ± 0.2
	n	72
A20	Sweet potatoes or yams	
	0-1 serving/week	63.9
	2-3 servings/week	36.1
	4 or more servings/week	0.0
	Mean ± S.E.	1.2 ± 0.1
	n	72
A21	Carrots	
	0-1 serving/week	53.4
	2-3 servings/week	37.0
	4 or more servings/week	9.6
	Mean ± S.E.	1.8 ± 0.2
	n	73
A22	Baked beans, pintos, black-eyed peas, other beans	

Variable Name and Description		Total (%)
	0-1 serving/week	65.8
	2-3 servings/week	32.9
	4 or more servings/week	1.4
	Mean ± S.E.	1.2 ± 0.1
	n	73
A23	How often do you eat fruit as a snack?	
	0-1 serving/week	19.4
	2-3 servings/week	30.6
	4 or more servings/week	50.0
	Mean ± S.E.	4.6 ± 0.4
	n	72
A24	How often do you eat fruit as dessert?	
	0-1 serving/week	52.1
	2-3 servings/week	29.6
	4 or more servings/week	18.3
	Mean ± S.E.	2.2 ± 0.3
	n	71
A25	How often do you eat vegetables as a snack?	
	0-1 serving/week	78.1
	2-3 servings/week	15.1
	4 or more servings/week	6.9
	Mean ± S.E.	1.1 ± 0.3
	n	73
A26	When you are at home, how often do you eat fresh fruit?	
	0-1 serving/week	18.1
	2-3 servings/week	31.9
	4 or more servings/week	50.0
	Mean ± S.E.	4.4 ± 0.4
	n	72
A27	When you are at home, how often do you eat frozen fruit?	
	0-1 serving/week	84.9

Variable Name and Description		Total (%)
	2-3 servings/week	11.0
	4 or more servings/week	4.1
	Mean ± S.E.	0.6 ± 0.2
	n	73
A28	When you at home, how often do you eat canned fruit?	
	0-1 serving/week	50.0
	2-3 servings/week	38.9
	4 or more servings/week	11.1
	Mean ± S.E.	1.7 ± 0.2
	n	72
A29	When you are at home, how often do you eat fresh vegetables?	
	0-1 serving/week	26.0
	2-3 servings/week	30.1
	4 or more servings/week	43.8
	Mean ± S.E.	4.1 ± 0.4
	n	73
A30	When you are at home, how often do you eat frozen vegetables?	
	0-1 serving/week	62.5
	2-3 servings/week	26.4
	4 or more servings/week	11.1
	Mean ± S.E.	1.6 ± 0.3
	n	72
A31	When you are at home, how often do you eat canned vegetables?	
	0-1 serving/week	53.4
	2-3 servings/week	30.1
	4 or more servings/week	16.4
	Mean ± S.E.	2.3 ± 0.4
	n	73
All FV	Summary score for total fruit and vegetable items, excluding A16 (spaghetti or lasagna) and A22 (beans)	
	0-13 servings/week	22.1

Variable Name and Description		Total (%)
	14-20 servings/week	19.1
	21-28 servings/week	32.4
	29-34 servings/week	14.7
	≥ 35 servings/week	11.8
	Mean ± S.E.	22.3 ± 1.2
	n	68
All Fr	Summary score for total fruit items: A7-A10, A12	
	0-6 servings/week	35.7
	7-13 servings/week	48.6
	≥14 servings/week	15.7
	Mean ± S.E.	8.4 ± 0.6
	n	70
All Veg	Summary score for total vegetable items: A11, A13-15, A17-21	
	0-6 servings/week	10.0
	7-13 servings/week	38.6
	14-20 servings/week	34.3
	≥21 servings/week	17.1
	Mean ± S.E.	14.2 ± 0.8
	n	70
Hi VitACar	Summary score for total items high in vitamin A and/or carotenoids: A13, A19, A20, A21	
	0-6 servings/week	64.8
	≥7 servings/week	35.2
	Mean ± S.E.	6.0 ± 0.5
	n	71
Hi CarCru	Summary score for total items high in vitamin A/carotenoids and cruciferous vegetables: A13, A19, A20, A21, A11	
	0-6 servings/week	50.7
	≥7 servings/week	49.3
	Mean ± S.E.	8.0 ± 0.6
	n	71

Variable Name and Description		Total (%)
Hi VitC	Summary score for total fruit and vegetable items high in vitamin C: A7, A9, A11-A13, A15, A20	
	0-6 servings/week	22.9
	≥7 servings/week	77.1
	Mean ± S.E.	12.0 ± 0.7
	n	70
Hi LutZea	Summary score for total items high in lutein and zeaxanthin: A13, A19	
	≤ 2 servings/week	51.4
	≥ 3 servings/week	48.6
	Mean ± S.E.	3.0 ± 0.3
	n	72
Hi Lycop	Summary score for total items high in lycopene: A15, A16	
	≤ 2 servings/week	66.7
	≥ 3 servings/week	33.3
	Mean ± S.E.	2.0 ± 0.2
	n	72
A32	Do you think that eating more fruits and vegetables will help reduce your risk of cancer?	
	Yes	67.1
	No	13.7
	Don't know	19.2
	n	73
A33	Do you think that eating more fruits and vegetables will help reduce your risk of heart disease?	
	Yes	68.5
	No	6.9
	Don't know	24.7
	n	73
A34	Do you think if you improved the way you eat, that you would be a much healthier person?	

Variable Name and Description		Total (%)
	Yes	83.6
	No	12.3
	Don't know	4.1
	n	73
A35	Do you think that your grocery store has a wide selection of fruits and vegetables?	
	Yes	94.4
	No	5.6
	Don't know	0.0
	n	71
A36	How many fruits and vegetables should people eat each day?	
	1 per day	6.9
	2 per day	16.7
	3 per day	26.4
	4 per day	12.5
	5 or more per day	20.8
	Don't know	16.7
	n	72
A37	Do you like the way most vegetables taste?	
	Yes	84.9
	No	15.1
	n	73
A38	Do you have tooth or mouth problems that make you usually eat easy-to-chew fruits and vegetables?	
	Yes	21.9
	No	78.1
	n	73
A39	Do you have enough money to spend on fruits and vegetables?	
	Yes	58.8
	No	41.2
	n	68

Variable Name and Description		Total (%)
A40	Would you like to know more about which fruits and vegetables are good for your health?	
	Yes	87.7
	No	12.3
	n	73
A41	Would you like to know more about different ways to cook vegetables?	
	Yes	75.3
	No	24.7
	n	73
A42	Would you like a handout with healthy menus to take home?	
	Yes	87.5
	No	12.5
	n	72
	Which of these kitchen tools can you easily use to cook vegetables at home?	
A43	Sharp knife?	
	Yes	84.9
	No	15.1
	n	73
A44	Can opener?	
	Yes	86.3
	No	13.7
	n	73
A45	Pot of hot water?	
	Yes	84.9
	No	15.1
	n	73
A46	Do you shop for your own groceries?	
	Yes	77.8
	No	22.2

Variable Name and Description		Total (%)
	n	72
A47	If you answered no, then who shops for you?	
	Spouse	1.4
	Other family	19.4
	Friend	0.0
	Other	1.4
	N/A	77.8
	n	72
A48	Do you plan the meals you eat?	
	Yes	83.6
	No	16.4
	n	73
A49	Do you cook the meals you eat?	
	Yes	86.3
	No	13.7
	n	73
A50	Do you use a microwave at home?	
	Yes	75.3
	No	24.7
	n	73
A51	Do you use a stove at home?	
	Yes	90.4
	No	9.6
	n	73
	Do you have or have you ever had any of the following?	
A52	Diabetes?	
	Yes	40.9
	No	59.2
	n	71
A53	Cancer?	
	Yes	14.1

Variable Name and Description		Total (%)
	No	85.9
	n	71
A54	Heart disease or heart attack?	
	Yes	22.2
	No	77.8
	n	72
A55	High blood cholesterol?	
	Yes	49.3
	No	50.7
	n	71
A56	High blood pressure or hypertension?	
	Yes	59.2
	No	40.9
	n	71

Table 5. Participant Responses on Post-test Questionnaires (n=73)

Variable Name and Description		**Total (%)**
B7	100% orange juice	
	0-1 serving/week	32.9
	2-3 servings/week	25.7
	4 or more servings/week	41.4
	Mean ± S.E.	3.6 ± 0.4
	n	70
B8	100% cranberry, apple, or purple grape juice	
	0-1 serving/week	52.8
	2-3 servings/week	27.8
	4 or more servings/week	19.4
	Mean ± S.E.	2.5 ± 0.4
	n	72
B9	Berries such as strawberries, blueberries, or blackberries	
	0-1 serving/week	76.1
	2-3 servings/week	18.3
	4 or more servings/week	5.6
	Mean ± S.E.	1.0 ± 0.2
	n	71
B10	Nectarines, peaches, or apricots	
	0-1 serving/week	43.7
	2-3 servings/week	42.3
	4 or more servings/week	18.1
	Mean ± S.E.	2.0 ± 0.2
	n	71
B11	Broccoli, cabbage, or cauliflower	
	0-1 serving/week	50.7
	2-3 servings/week	36.6
	4 or more servings/week	12.7
	Mean ± S.E.	1.9 ± 0.3

Variable Name and Description		Total (%)
	n	71
B12	Cantaloupe or honeydew	
	0-1 serving/week	55.6
	2-3 servings/week	33.3
	4 or more servings/week	11.1
	Mean ± S.E.	1.8 ± 0.2
	n	72
B13	Leafy greens such as mustard, turnip, collard greens	
	0-1 serving/week	51.4
	2-3 servings/week	43.1
	4 or more servings/week	5.6
	Mean ± S.E.	1.6 ± 0.2
	n	72
B14	Corn	
	0-1 serving/week	65.2
	2-3 servings/week	34.8
	4 or more servings/week	0.0
	Mean ± S.E.	1.4± 0.2
	n	69
B15	Cooked or stewed tomatoes	
	0-1 serving/week	56.3
	2-3 servings/week	32.4
	4 or more servings/week	11.3
	Mean ± S.E.	1.6 ± 0.2
	n	71
B16	Spaghetti or lasagna	
	0-1 serving/week	72.9
	2-3 servings/week	27.1
	4 or more servings/week	0.0
	Mean ± S.E.	0.7 ± 0.1
	n	70

Variable Name and Description		Total (%)
B17	Onions	
	0-1 serving/week	32.9
	2-3 servings/week	38.4
	4 or more servings/week	28.8
	Mean ± S.E.	2.9 ± 0.3
	n	73
B18	Squash or zucchini	
	0-1 serving/week	69.4
	2-3 servings/week	25.0
	4 or more servings/week	5.6
	Mean ± S.E.	1.2 ± 0.2
	n	72
B19	Spinach	
	0-1 serving/week	77.6
	2-3 servings/week	20.9
	4 or more servings/week	1.5
	Mean ± S.E.	0.7 ± 0.1
	n	67
B20	Sweet potatoes or yams	
	0-1 serving/week	63.9
	2-3 servings/week	33.3
	4 or more servings/week	2.8
	Mean ± S.E.	1.3 ± 0.2
	n	72
B21	Carrots	
	0-1 serving/week	51.4
	2-3 servings/week	37.5
	4 or more servings/week	11.1
	Mean ± S.E.	1.8 ±0.2
	n	72
B22	Baked beans, pintos, black-eyed peas, other beans	

Variable Name and Description		Total (%)
	0-1 serving/week	56.2
	2-3 servings/week	41.1
	4 or more servings/week	2.7
	Mean ± S.E.	1.5 ± 0.1
	n	73
B23	How often do you eat fruit as a snack?	
	0-1 serving/week	26.0
	2-3 servings/week	26.0
	4 or more servings/week	48.0
	Mean ± S.E.	4.3 ± 0.4
	n	73
B24	How often do you eat fruit as dessert?	
	0-1 serving/week	53.5
	2-3 servings/week	29.6
	4 or more servings/week	16.9
	Mean ± S.E.	2.0 ± 0.3
	n	71
B25	How often do you eat vegetables as a snack?	
	0-1 serving/week	69.6
	2-3 servings/week	18.8
	4 or more servings/week	11.6
	Mean ± S.E.	1.3 ± 0.2
	n	69
B26	When you are at home, how often do you eat fresh fruit?	
	0-1 serving/week	15.1
	2-3 servings/week	34.3
	4 or more servings/week	50.7
	Mean ± S.E.	4.4 ± 0.3
	n	73
B27	When you are at home, how often do you eat frozen fruit?	
	0-1 serving/week	82.4

Variable Name and Description		Total (%)
	2-3 servings/week	14.7
	4 or more servings/week	2.9
	Mean ± S.E.	0.7 ± 0.2
	n	68
B28	When you at home, how often do you eat canned fruit?	
	0-1 serving/week	45.8
	2-3 servings/week	44.4
	4 or more servings/week	9.7
	Mean ± S.E.	1.8 ± 0.3
	n	72
B29	When you are at home, how often do you eat fresh vegetables?	
	0-1 serving/week	27.8
	2-3 servings/week	38.9
	4 or more servings/week	33.3
	Mean ± S.E.	3.6 ± 0.4
	n	72
B30	When you are at home, how often do you eat frozen vegetables?	
	0-1 serving/week	57.1
	2-3 servings/week	30.0
	4 or more servings/week	12.9
	Mean ± S.E.	1.8 ± 0.3
	n	70
B31	When you are at home, how often do you eat canned vegetables?	
	0-1 serving/week	44.3
	2-3 servings/week	35.7
	4 or more servings/week	20.0
	Mean ± S.E.	2.2 ± 0.2
	n	70
All FV	Summary score for total fruit and vegetable items, excluding A16 (spaghetti or lasagna) and A22 (beans)	
	0-13 servings/week	19.4

Variable Name and Description		Total (%)
	14-20 servings/week	24.2
	21-28 servings/week	24.2
	29-34 servings/week	11.3
	≥ 35 servings/week	21.0
	Mean ± S.E.	24.8 ± 1.7
	n	62
All Fr	Summary score for total fruit items: A7-A10, A12	
	0-6 servings/week	32.8
	7-13 servings/week	40.3
	≥ 14 servings/week	26.9
	Mean ± S.E.	10.5 ± 0.9
	n	67
All Veg	Summary score for total vegetable items: A11, A13-15, A17-21	
	0-6 servings/week	12.5
	7-13 servings/week	35.9
	14-20 servings/week	32.8
	≥ 21 servings/week	18.8
	Mean ± S.E.	14.3 ± 1.0
	n	64
Hi VitACar	Summary score for total items high in vitamin A and/or carotenoids: A13, A19, A20, A21	
	0-6 servings/week	68.2
	≥ 7 servings/week	31.8
	Mean ± S.E.	5.5 ± 0.5
	n	66
Hi CarCru	Summary score for total items high in vitamin A/carotenoids and cruciferous vegetables: A13, A19, A20, A21, A11	
	0-6 servings/week	49.2
	≥ 7 servings/week	50.8
	Mean ± S.E.	1.9 ± 0.7
	n	65

Variable Name and Description		Total (%)
Hi VitC	Summary score for total fruit and vegetable items high in vitamin C: A7, A9, A11-A13, A15, A20	
	0-6 servings/week	25.4
	≥ 7 servings/week	74.6
	Mean ± S.E.	12.5 ± 1.1
	n	63
Hi LutZea	Summary score for total items high in lutein and zeaxanthin: A13, A19	
	≤ 2 servings/week	57.6
	≥ 3 servings/week	42.4
	Mean ± S.E.	2.3 ± 0.2
	n	66
Hi Lycop	Summary score for total items high in lycopene: A15, A16	
	≤ 2 servings/week	63.2
	≥ 3 servings/week	36.8
	Mean ± S.E.	2.2 ± 0.2
	n	68
B32	Do you think that eating more fruits and vegetables will help reduce your risk of cancer?	
	Yes	82.2
	No	2.5
	Don't know	15.1
	n	73
B33	Do you think that eating more fruits and vegetables will help reduce your risk of heart disease?	
	Yes	82.2
	No	4.1
	Don't know	13.7
	n	73
B34	Do you think if you improved the way you eat, that you would be a much healthier person?	

Variable Name and Description		Total (%)
	Yes	74.0
	No	20.6
	Don't know	5.5
	n	73
B35	Do you think that your grocery store has a wide selection of fruits and vegetables?	
	Yes	89.0
	No	5.5
	Don't know	5.5
	n	73
B36	How many fruits and vegetables should people eat each day?	
	1 per day	4.1
	2 per day	16.4
	3 per day	24.7
	4 per day	6.9
	5 or more per day	35.6
	Don't know	12.3
	n	73
B57	Have you increased your overall consumption of fruit or fruit juice (fresh, frozen, and canned)?	
	Yes	56.9
	No	43.1
	n	72
B58	Have you increased your overall consumption of vegetables (fresh, frozen, and canned)?	
	Yes	44.4
	No	55.6
	n	72
B59	Can you think of some diseases or conditions that might be decreased by a diet high in fruits and vegetables?	
	Yes	59.7

Variable Name and Description		Total (%)
	No	40.3
	n	72
	Because of the information that you learned in the lessons, have you or do you:	
B60	Tried different ways of preparing fruits and vegetables?	
	Yes	49.3
	No	50.7
	n	69
B61	Tried a fruit or vegetable that you didn't like before, but like now?	
	Yes	28.2
	No	71.8
	n	71
B62	Eat more fruits and vegetables because you think they are good for you?	
	Yes	80.0
	No	20.0
	n	70
B63	Feel more strongly than before that eating fruits and vegetables will reduce the risk of disease?	
	Yes	80.3
	No	19.7
	n	71
B64	Feel that canned and frozen fruits and vegetables are just as good for you as fresh fruits and vegetables?	
	Yes	30.6
	No	69.4
	n	72
B65	Tried to follow a healthier diet?	
	Yes	69.0
	No	31.0
	n	71

Variable Name and Description		Total (%)
B66	Eat more dark green vegetables than before?	
	Yes	47.9
	No	52.1
	n	
B67	Made a recipe from one of the lessons?	
	Yes	26.8
	No	73.2
	n	
B68	What was your overall level of satisfaction with this fruit and vegetable nutrition education program?	
	Poor	1.4
	Fair	4.3
	Good	42.9
	Very Good	30.0
	Excellent	21.4
	n	70
B69	How many sessions of the fruit and vegetable nutrition education program did the participant attend?	
	0	5.6
	1	2.8
	2	8.5
	3	9.9
	4	9.9
	5	2.8
	6	11.3
	7	8.5
	8	19.7
	9	12.7
	10	8.5
	n	71

Table 6. Time 1, Time 2, and Change in Fruit and Vegetable Intake (Mean Number of Servings Per Week, n=73)

	Time 1	Time 2	Mean Change	
Variable Name & Description of Variable	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**P value**
Diff 7. 100% orange juice	3.6 ± 0.4	3.4 ± 0.4	-0.18 ±0.4	0.60
n	68	68	68	
Diff 8. Cranberry, apple, or purple grape juice	1.6 ± 0.3	2.6 ± 0.4	0.94 ± 0.4	0.08†
n	71	71	71	
Diff 9. Berries	1.1 ± 0.2	1.0 ± 0.2	-0.09 ± 0.3	0.88
n	70	70	70	
Diff 10. Peaches, nectarines, apricots	1.5 ± 0.2	2.0 ± 0.2	0.56 ± 0.3	0.08†
n	70	70	70	
Diff 11. Broccoli, cabbage, cauliflower	2.1 ± 0.2	1.9 ± 0.3	-0.13 ± 0.3	0.54
n	71	71	71	
Diff 12. Cantaloupe, honeydew	0.9 ± 0.2	1.8 ± 0.2	0.85 ± 0.3	0.003*
n	71	71	71	
Diff 13. Leafy greens	2.1 ± 0.2	1.6 ± 0.2	-0.53 ± 0.2	0.02*
n	72	72	72	
Diff 14. Corn	1.2 ± 0.1	1.4 ± 0.2	0.19 ± 0.2	0.41
n	71	71	71	
Diff 15. Tomato products	1.4 ± 0.2	1.6 ± 0.2	0.20 ± 0.3	0.59
n	71	71	71	
Diff 16. Spaghetti or lasagna	0.6 ± 0.1	0.7 ± 0.1	0.09 ± 0.1	0.32
n	69	69	69	
Diff 17. Onions	2.6 ± 0.3	2.9 ± 0.3	0.33 ± 0.27	0.40
n	73	73	73	
Diff 18. Squash, zucchini	0.9 ± 0.2	1.2 ± 0.2	0.30 ± 0.21	0.20
n	71	71	71	
Diff 19. Spinach	1.0 ± 0.2	0.8 ± 0.1	-0.23 ± 0.2	0.16
n	66	66	66	
Diff 20. Sweet potatoes	1.2 ± 0.1	1.3 ± 0.2	0.11 ± 0.2	0.82
n	71	71	71	
Diff 21. Carrots	1.8 ± 0.2	1.8 ± 0.2	0.03 ± 0.2	0.67

	Time 1	Time 2	Mean Change	
Variable Name & Description of Variable	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**P value**
n	72	72	72	
Diff 22. Beans	1.2 ± 0.1	1.5 ± 0.1	0.23 ± 0.2	0.12†
n	73	73	73	
Diff 23. Fruit as snack	4.6 ± 0.4	4.3 ± 0.4	-0.31 ± 0.5	0.66
n	72	72	72	
Diff 24. Fruit as dessert	2.2 ± 0.3	2.0 ± 0.3	-0.22 ± 0.4	0.32
n	69	69	69	
Diff 25. Vegetables as snack	1.1 ± 0.3	1.3 ± 0.2	0.16 ± 0.3	0.58
n	69	69	69	
Diff 26. Fruit, fresh	4.4 ± 0.4	4.4 ± 0.4	-0.01 ± 0.4	0.90
n	72	72	72	
Diff 27. Fruit, frozen	0.7 ± 0.2	0.7 ± 0.2	0.00 ± 0.2	1.00
n	68	68	68	
Diff 28. Fruit, canned	1.7 ± 0.2	1.9 ± 0.3	0.17 ± 0.3	0.52
n	71	71	71	
Diff 29. Vegetables, fresh	3.9 ± 0.4	3.6 ± 0.4	-0.34 ± 0.5	0.54
n	72	72	72	
Diff 30. Vegetables, frozen	1.6 ± 0.3	1.7 ± 0.3	0.14 ± 0.4	0.34
n	69	69	69	
Diff 31. Vegetables, canned	2.1 ± 0.3	2.2 ± 0.2	0.09 ± 0.4	0.29
n	70	70	70	
Diff All Fruit and Vegetable Measures (excluding diff16 & diff22)	21.8 ± 1.2	24.2 ± 1.6	2.47 ± 1.5	0.12†
n	57	57	57	
Diff All Fruit Measures	8.4 ± 0.7	10.1 ± 0.9	1.70 ± 0.9	0.07†
n	64	64	64	
Diff All Vegetable Measures	14.1 ± 0.9	14.5 ± 1.0	0.34 ± 1.0	0.76
n	61	61	61	
Diff All Vegetable Measures High in Vitamin A & Carotenoids	6.1 ± 0.5	5.5 ± 0.5	-0.59 ± 0.5	0.28

	Time 1	Time 2	Mean Change	
Variable Name & Description of Variable	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**P value**
n	64	64	64	
Diff All Fruit and Vegetable Measures High in Carotenoids and Cruciferous Vegetables	7.9 ± 0.6	7.5 ± 0.7	-0.41 ± 0.66	0.37
n	63	63	63	
Diff All Fruit and Vegetable Measures High in Vitamin C	11.9 ± 0.8	11.8 ± 0.9	-0.15 ± 0.8	1.00
n	60	60	60	
Diff All Fruit and Vegetable Measures High in Lutein and Zeaxanthin	3.0 ± 0.3	2.3 ± 0.2	-0.71 ± 0.3	0.02*
n	65	65	65	
Diff All Fruit and Vegetable Measures High in Lycopene	2.0 ± 0.2	2.2 ± 0.2	0.16 ± 0.3	0.45
n	67	67	67	

*P-values <0.05 were considered significant
†P-values 0.05-0.15 were considered trends

Table 7. Percent Change in Knowledge of Fruits and Vegetables (n=73)

Variable Name and Description	Time 1 (%)	Time 2 (%)	P-value
Diff 32. Do you think that eating more fruits and vegetables will help reduce your risk of cancer?			
Yes	67.1	82.2	
No	13.7	2.5	0.04*
Don't know	19.2	15.1	
n	73	73	
Diff 33. Do you think that eating more fruits and vegetables will help reduce your risk of heart disease?			
Yes	68.5	82.2	
No	6.9	4.1	0.05†
Don't know	24.7	13.7	
n	73	73	
Diff 34. Do you think that if you improved the way that you eat, that you would be a much healthier person?			
Yes	83.6	74.0	
No	12.3	20.6	0.16
Don't know	4.1	5.5	
n	73	73	
Diff 35. Do you think that your grocery store has a wide selection of fruits and vegetables?			
Yes	94.4	89.0	
No	5.6	5.5	0.23
Don't know	0.0	5.5	
n	71	71	
Diff 36. How many fruits and vegetables should people eat each day?			
1 per day	6.9	4.2	0.04*
2 per day	16.7	15.3	
3 per day	26.4	25.0	
4 per day	12.5	6.9	

Variable Name and Description	Time 1 (%)	Time 2 (%)	P-value
5 or more per day	20.8	36.1	
Don't know	16.7	12.5	
n	72	72	

†*P-values 0.05 – 0.15 were considered trends.*

**P values < 0.05 were considered significant.*

Table 8. Stepwise regression models predicting effects of age, intake of targeted fruits and vegetables, fruit and vegetable knowledge, barriers to consumption, and disease states at pre-test on mean change in fruit and vegetable intake and knowledge of fruits and vegetables at post-test

Independent Variable Tested in Model (post-test)	Independent Variable Entered in Model (pre-test)	P-value
Change in Mean Intake of Targeted Fruits and Vegetables (n=51; F=4.19; p=0.001)	Targeted fruit and vegetable intake	0.02*
	Knowledge of fruits and vegetables on heart disease risk	0.003
	Adequate income	0.01*
	Ability to use a can opener	0.002
	Ability to shop for own groceries	0.002*
	Interest in benefits of fruits and vegetables on health	0.002*
	Prevalence of cancer	0.001
Knowledge of Fruits and Vegetables on Cancer Risk (Item B32; n=51; F=6.63; p=0.0001)	Age	0.002*
	Adequate income	0.0002
	Prevalence of hypertension	0.0002
	Prevalence of heart disease	0.0001*
	Prevalence of high cholesterol	0.0001
Knowledge of Fruits and Vegetables on Heart Disease Risk (Item B33; n=51; F=4.69; p=0.002)	Age	0.001*
	Targeted fruit and vegetable intake	0.001
	Adequate income	0.002
	Prevalence of high cholesterol	0.001
	Prevalence of heart disease	0.01*
Knowledge of 5 A Day Recommendation (Item B36; n=51; F=4.40; p=0.002)	Age	0.002*

Independent Variable Tested in Model (post-test)	Independent Variable Entered in Model (pre-test)	P-value
	Targeted fruit and vegetable intake	0.001
	Knowledge of 5 A Day recommendation	0.001
	Knowledge of fruit and vegetable intake on cancer risk	0.001
	Ability to shop for own groceries	0.001*
	Prevalence of high cholesterol	0.002*

*Indicates negative direction of change

Table 9. Logistic regression models predicting effects of age, intake of targeted fruits and vegetables, fruit and vegetable knowledge, barriers to consumption, and disease states at pre-test on change in mean intake of targeted fruits and vegetables and knowledge of fruits and vegetables at post-test

Dependent Variable Tested in Model (post-test)	Independent Variable Entered in Model (pre-test)	P-value
Change in Mean Intake of Targeted Fruits and Vegetables Intake	Targeted fruit and vegetable intake	<0.02*
	Ability to use a can opener	0.02
Knowledge of Fruits and Vegetables on Cancer Risk (Item B32; n=63)	Age	0.002
	Adequate income	0.001
Knowledge of Fruits and Vegetables on Heart Disease Risk (Item B33; n=63)	Age	0.002
	Prevalence of heart disease	0.0003
	Prevalence of high cholesterol	0.0004
Knowledge of 5 A Day Recommendation (Item B36; n=63)	Knowledge of 5 A Day recommendation	0.0001
	Knowledge of fruits and vegetables on cancer risk	0.0002

*Targeted fruit and vegetable intake at pre-test as a predictor of change in mean intake of targeted fruits and vegetables was tested in two models. Intake at pre-test was significant in both models: 1) Change in mean intake of targeted fruits and vegetables predicted by targeted fruit and vegetable intake at pre-test, reported disease states, and knowledge of fruits and vegetables at pre-test (n=55, p=0.014); 2) Change in mean intake of targeted fruits and vegetables predicted by targeted fruit and vegetable intake at pre-test and barriers to consumption (n=51; p=0.013)

CHAPTER IV

CONCLUSIONS

The main goals of this study were to: determine baseline consumption patterns of selected fruits and vegetables; identify perceived and actual barriers to fruit and vegetable consumption, and to improve behaviors, attitudes, and knowledge related to fruit and vegetable intake; and to determine the effectiveness of a nutrition education intervention program designed for a low income, low literacy older adult population by assessing change in intakes of selected fruits and vegetables (Wade, 2003).

Major Findings

Baseline data indicated that the study population had low intakes of several fruit and vegetable groupings. Eighteen of 25 targeted fruit and vegetable groups were reported as being consumed less than once a week by 50 percent or more of the population. Only 23 percent of the population was aware of the recommendation to consume five or more servings of fruits and vegetables each day. Additionally, just 12 percent of participants reported consuming at least five servings each day of targeted fruits and vegetables, and participants reported a mean intake of 3.1 servings of targeted fruits and vegetables each day.

Several barriers to consumption of fruits and vegetables were recognized among the population. Those participants 80 years old and over reported experiencing more barriers compared to younger participants. The two most prominent barriers to consumption among total study participants (n=73) were lack of knowledge of the Five A Day recommendation (79%) and lack of income (41%).

This nutrition education intervention program resulted in several positive outcomes. A significant increase in consumption was seen for melons, and there was a trend toward increased consumption of three other fruit and vegetable groupings, total fruit intake, and total fruit and vegetable intake (change from 22.3 ± 1.2 servings per week to 24.8 ± 1.7 servings per week, p=0.12). Therefore, my first hypothesis, stating participants will increase mean intakes of at least three fruit and vegetable items assessed in the intervention, was supported by this study. Participants also increased knowledge of fruits and vegetables. Significantly more participants at post-test reported knowing that fruit and vegetable consumption could help reduce their risk of cancer and were knowledgeable of the 5 A Day recommendation. More participants also reported understanding that fruit and vegetable consumption could help reduce their risk of heart disease (p=0.05). Therefore, the second hypothesis, which states that after completion of the curriculum, knowledge and self-efficacy related to fruit and vegetable consumption will increase, was also supported.

Implications

This study shows that participants of Georgia OANP are concerned about their health and do benefit from nutrition education. Since OANP participants are at high risk for disease development (Ponza et al., 1996), educating this population is especially important. The older adult population receives much of their nutrition information from the media, which easily leaves many misguided and confused (Higgins and Barkley, 2004_a). Nutrition education interventions among older adults can help individuals to sort out information and understand the health benefits of a proper diet.

Inadequate income to purchase fruits and vegetables was a barrier to consumption among a large majority of the population (41%). Interventions where fruits and vegetables are

distributed to the population may produce greater outcomes. Smith et al. (2004) reported an increase in fruit and vegetable servings per day when baskets of produce were given to home-bound seniors. Participants self-reported feeling better, having better control of diabetes, enjoying the variety of fruits and vegetables provided, and admitted they would not consume that many servings per day of fruits and vegetables if they had to pay for it themselves. Interventions providing fresh produce to participants would also overcome the barrier of individuals' inability to shop for their own groceries.

Future research should take into account taste changes that can occur with medication use. Many elderly avoid fruits and vegetables because of alterations in taste and taste thresholds that can occur with use of some medications (Schiffman & Graham, 2000). The non-medicated elderly may also have alterations in taste thresholds and could benefit from information on overcoming the problem. Advice on ways to help reduce altered taste may help to increase fruit and vegetable consumption. Wade (2003) reported that 56 percent OANP participants in Northeast Georgia self-reported taking at least 4 medications each day, and the number medications taken daily had a significant impact on the intake of several fruits and vegetables, especially those high in vitamin C.

Decreases in cognitive ability often occur with increasing age, therefore, assessment of cognitive ability prior to inclusion in the intervention program should be considered. Participants with low cognitive functioning may not fully understand the information presented and could answer questions by guessing, leading to skewed results. This idea could also apply to participants who attended only a few sessions. Future interventions including only participants who attended most, if not all, of the education sessions may result in larger increases in behavior, attitude and knowledge change.

Using a control group could be beneficial in evaluating outcomes of interventions. Differences among control and intervention groups would provide a better idea of the effectiveness of education interventions. Also, maintenance of behavior and attitude changes and gains in knowledge over time should be examined. This could be achieved by longer follow-up evaluations after intervention (Higgins & Barkley, 2004_b). The effectiveness of the intervention could also be assessed by taking into account short-term changes in health, such as measuring blood lipid levels, blood pressure, and blood glucose.

Suggested questions to add to pre-test data collection include: 1) Do you eat more fresh fruits and vegetables when they're in season? If yes, which fruits and vegetables? 2) Do you feel that fruits and vegetables are expensive (in place of "Do you have enough money to spend on fruits and vegetables?") 3) How are the fruits and vegetables that you eat usually prepared? ___ fried ___ steamed ___ boiled ___ raw ___ sautéed ___ with fatback or meat ___ in a casserole ___ other (Wade, 2003) 4) Do you feel that canned and frozen fruits and vegetables are just as good for you as fresh fruits and vegetables (corresponds with B64 on post-test) 5) Are you concerned about chronic diseases, such as cancer or heart disease, and 6) Have you ever received education about fruits and vegetables? If yes, where did you receive your information? Suggested questions to be added to the post-test questionnaire are: 1) Because of the information you learned in the lessons, do you think you are more willing to try different fruits and vegetables, 2) Because of the information you learned in the lessons, did you replace foods previously consumed with fruits and vegetables? Items that should be added to the food frequency questionnaire include oranges, grapefruit, and tangerines; and fresh tomatoes (Wade, 2003).

In conclusion, low income, low literacy older adults are at high risk for chronic disease development, and, therefore, would benefit from nutrition education interventions. Although fruits and vegetables have been associated with reduced risk of many chronic diseases, intake among this population falls below recommendations. With proper guidance and encouragement, this population can overcome barriers experienced, and positive changes in behavior, attitudes, and knowledge may ensue. Incorporating suggestions mentioned into future nutrition education interventions may help reduce risk of chronic disease and increase quality of life.

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APPENDIX

Vitamin C content (mg) of selected foods, USDA Nutrient Database 2004

Description	Common Measure	Content per Measure
Apple juice, bottled	1 cup	2.2
Apricots, canned in juice	½ cup	6.0
Apricots, raw	1 medium	3.5
Beans, baked, canned, plain	½ cup	0
Beans, pinto, canned	½ cup	1.1
Blackberries, raw	½ cup	15.1
Blueberries, raw	½ cup	7.0
Broccoli, frozen, cooked	½ cup	36.9
Broccoli, raw	1 cup	78.5
Cabbage, raw	1 cup	15.1
Cabbage, raw, cooked	½ cup	15.1
Cabbage, red, raw	1 cup	50.7
Carrots, canned	½ cup	2.0
Carrots, frozen, cooked	½ cup	1.7
Carrots, raw, chopped	1 cup	7.6
Cauliflower, frozen, cooked	½ cup	28.2
Cauliflower, raw	1 cup	46.4
Collards, frozen, boiled	½ cup	22.4
Collards, raw, boiled	½ cup	17.3
Corn, frozen, cooked	½ cup	3.9
Corn, sweet, yellow, canned	½ cup	7.0
Corn, sweet, yellow, raw	½ cup	5.2
Cranberry juice cocktail, bottled	8 fl oz	89.6
Grape juice, bottled	1 cup	0.3
Melons, cantaloupe, raw, cubed	1 cup	58.7
Melons, honeydew, raw, diced	1 cup	30.6
Mustard greens, frozen, cooked	½ cup	10.3
Mustard greens, raw, boiled	½ cup	17.7
Nectarines	1 medium	7.3
Onions, raw	½ cup	5.1
Orange juice, chilled, includes from concentrate	8 fl oz	81.9
Peaches, canned in light syrup	½ cup	3.0
Peaches, raw	1 medium	6.5
Sauce, spaghetti, ready to serve	½ cup	3.9
Soup, tomato, canned, prepared with water	1 cup	66.4

Spinach, canned	½ cup	15.3
Spinach, frozen, cooked	½ cup	2.1
Spinach, raw	1 cup	8.4
Squash, summer, all varieties, raw	1 cup	19.2
Squash, winter, all varieties, raw	1 cup	14.3
Strawberries, raw, halves	1 cup	89.4
Sweet potato, baked in skin	1 medium	22.3
Tomatoes, canned, stewed	½ cup	10.1
Turnip greens, frozen, boiled	½ cup	17.9
Turnip greens, raw, boiled	½ cup	19.7

*RDA for Vitamin C for males is 90 mg/day; for females, 75 mg/day.
*20% of the RDA for females = 15 mg/day.

Vitamin A content (IU) of selected foods, USDA Nutrient Database 2004

Description	Common Measure	Content per Measure
Apple juice, bottled	1 cup	2
Apricots, canned in juice	½ cup	2063
Apricots, raw	1 medium	674
Beans, baked, canned, plain	½ cup	137
Beans, pinto, canned	½ cup	0
Blackberries, raw	½ cup	154
Blueberries, raw	½ cup	39
Broccoli, frozen, chopped, cooked	½ cup	1029
Broccoli, raw	1 cup	581
Cabbage, raw	1 cup	152
Cabbage, raw, cooked	½ cup	105
Cabbage, red, raw	1 cup	993
Carrots, canned	½ cup	8154
Carrots, frozen, cooked	½ cup	12137
Carrots, raw	1 cup	15406
Cauliflower, frozen, cooked	½ cup	9
Cauliflower, raw	1 cup	13
Collards, frozen, cooked	½ cup	9769
Collards, raw, cooked	½ cup	7708
Corn, frozen, cooked	½ cup	190
Corn, sweet, yellow, canned	½ cup	66
Corn, sweet, yellow, raw	½ cup	160
Cranberry juice cocktail, bottled	1 cup	10
Grape juice, bottled	1 cup	20
Melons, cantaloupe, raw	1 cup	5411
Melons, honeydew, raw, diced	1 cup	85
Mustard greens, frozen, cooked	½ cup	5307
Mustard greens, raw, cooked	½ cup	4426
Nectarines, raw	1 medium	452
Onions, raw	½ cup	2
Orange juice, chilled, includes from concentrate	1 cup	194
Peaches, canned in light syrup	½ cup	444
Peaches, raw	1 medium	319
Sauce, spaghetti, ready to serve	½ cup	675
Soup, tomato, canned, prepared with water	1 cup	478
Spinach, canned	½ cup	10487
Spinach, frozen, cooked	½ cup	11458
Spinach, raw	1 cup	2813
Squash, summer, all varieties, raw	1 cup	226
Squash, winter, all varieties, raw	1 cup	1586
Strawberries, raw, halves	1 cup	18

Sweet potato, baked in skin	1 medium	21909
Tomatoes, canned, stewed	½ cup	222
Turnip greens, frozen cooked	½ cup	8827
Turnip greens, raw, cooked	½ cup	5490

*RDA for Vitamin A for men aged 19+ is 3000 IU, and for women aged 19+ is 2330 IU.

* 20% of the RDA for females = 466 IU.

Carotenoid content (µg) of selected foods, USDA Nutrient Database 2004

Description	Common Measure	Beta-carotene	Beta-cryptoxanthin	Lutein + Zeaxanthin	Lycopene
Apple juice, bottled	1 cup	0	0	40	0
Apricots, canned in juice	½ cup	1232	12	32	0
Apricots, raw	1 medium	383	36	31	5
Beans, baked, canned, plain	½ cup	83		20	649
Beans, pinto, canned	½ cup	0	0	0	0
Blackberries, raw	½ cup	92	0	85	0
Blueberries, raw	½ cup	23	0	58	0
Broccoli, frozen, cooked	½ cup	610	1	1378	
Broccoli, raw	1 cup	337	1	1488	0
Cabbage, cooked	½ cup	56	0	190	0
Cabbage, raw	1 cup	80	0	276	0
Cabbage, red, raw	1 cup	596	0	293	18
Carrots, canned	½ cup	3892	0		0
Carrots, frozen, cooked	½ cup	5904		211	1
Carrots, raw	1 cup	7391	100	265	3
Cauliflower, frozen, cooked	½ cup	5	0	22	0
Cauliflower, raw	1 cup	8	0	33	0
Collards, frozen, cooked	½ cup	5795	24	9263	0
Collards, raw, cooked	½ cup	4573	19	7309	
Corn, frozen, cooked	½ cup	48	116	699	0
Corn, sweet, yellow, canned	½ cup	26	5	844	0
Corn, sweet, yellow, raw	½ cup	40	98	588	0
Cranberry juice cocktail, bottled	1 cup	0	0	0	0
Grape juice, bottled	1 cup	13	0	89	0
Melons, cantaloupe	1 cup	3232	2	42	
Melons, honeydew, diced	1 cup	51	0	46	0
Mustard greens, frozen, cooked	½ cup	3184	0	5004	0
Mustard greens, raw, cooked	½ cup	2656	0	4173	0
Nectarines, raw	1 medium	204	133	177	
Onions, raw	½ cup	1	0	4	0

Orange juice, frozen from concentrate, diluted with water	1 cup	42	227	286	0
Peaches, canned in light syrup	½ cup	221	92	77	0
Peaches, raw	1 medium	159	66	89	0
Sauce, spaghetti, ready to serve	½ cup	405	0	0	21499
Soup, tomato, canned	1 cup	288	0	110	13322
Spinach, canned	½ cup	6293	0	11315	
Spinach, frozen, cooked	½ cup	6875	0	14906	0
Spinach, raw	1 cup	1688		3659	
Squash, summer, all varieties, raw	1 cup	136	0	2401	0
Squash, winter, all varieties, raw	1 cup	951	0	44	0
Strawberries, raw, halves	1 cup	11	0	40	0
Sweet potato, cooked with skin	1 medium	13120	0	0	0
Tomatoes, stewed, canned	½ cup	133	0	153	5145
Turnip greens, frozen, cooked	½ cup	5296	0	9770	0
Turnip greens, raw, cooked	½ cup	3294	0	6077	0

Summary Score Categories Defined	Fruit and Vegetable Items Included
Total Fruit Items	A7. 100 % orange juice A8. Cranberry, apple, purple grape juice A9. Berries A10. Peaches, nectarines, apricots A12. Cantaloupe, honeydew
Total Vegetable Items	A11. Broccoli, cabbage, cauliflower A13. Leafy greens A14. Corn A15. Tomato Products A17. Onions A18. Squash, zucchini A19. Spinach A20. Sweet potatoes, yams A21. Carrots
Total Fruit & Vegetable Items	All items except A16. Spaghetti or Lasagna & A22. Beans
Cruciferous Vegetables	A11. Broccoli, cabbage, cauliflower
Total Vegetables High in Carotenoids + Cruciferous Vegetables	A11. Broccoli, cabbage, cauliflower A13. Leafy greens A19. Spinach A20. Sweet potatoes, yams A21. Carrots
Total Vegetable Items High in Carotenoids & Vitamin A	A13. Leafy greens A19. Spinach A20. Sweet potatoes, yams A21. Carrots
Total Items High in Lutein & Zeaxanthin	A13. Leafy greens A19. Spinach
Total Items High in Lycopene	A15. Tomato products A16. Spaghetti, lasagna
Total Fruit & Vegetable Items High in Vitamin C	A7. 100 % orange juice A9. Berries A11. Broccoli, cabbage, cauliflower A12. Cantaloupe, honeydew A13. Leafy greens A15. Tomato Products A20. Sweet potatoes, yams

FORM FV

NUTRITION AND PHYSICAL ACTIVITY CONSENT FORM

I, _____, agree to participate in the study titled "NUTRITION AND PHYSICAL ACTIVITY" conducted by Dr. Mary Ann Johnson in the Department of Foods and Nutrition at the University of Georgia. I understand that I do not have to take part if I do not want to. I can stop taking part without giving any reason and without penalty. I can ask to have all information concerning me removed from the research records, returned to me, or destroyed. My decision to participate will not effect the services that I receive at the Senior Center.

The benefits of this study are to help me improve my eating habits and physical activity habits. This study will also help the investigators learn more about good ways to help older adults improve their eating and increase their physical activity. This study will be conducted at my local Senior Center. If I volunteer to take part in this study, I will be asked to do the following things:

1) Answer questions about my health, food intake, and nutrition status.
2) Attend up to 10 nutrition, health, and fitness programs that will last about 30 to 60 minutes each.
3) Take part in a physical activity program to improve my strength and balance.
4) Attend two sessions for collecting information about my health, fitness, food, and nutrition habits. Each session will last up to 60 minutes.
5) Someone from the study may contact me to clarify my information.

The instructor will provide food to taste. Mild to no risk is expected by tasting food. However, I will not taste foods that I should not eat because of swallowing difficulties, allergic reactions, dietary restrictions, or other food-related problems.

No risk is expected, but I may experience some discomfort or stress when the researchers ask me questions about my food intake, nutrition status, and health. The leaders will advise me to stop exercising if I experience any discomfort or chest pains. No information concerning myself or provided by myself during this study will be shared with others without my written permission, unless law requires it. I may choose not to answer any question or questions that may make

me uncomfortable. I will be assigned an identifying number and this number will be used on all of the questionnaires I fill out. Data will be stored in locked file cabinets under the supervision of Dr. Mary Ann Johnson at the University of Georgia; only the staff involved in the study will have access to these data and only for the purpose of data analyses and interpretation of results. The data will be destroyed by January 1, 2012.

I will allow the staff to take my picture, videotape, or record me on audiotape while participating in the study. I can verbally refuse at anytime, and my wishes will be upheld. My pictures will only be used to promote this nutrition and physical activity program.

I will allow my picture/video/audio recordings to be used for promotional purposes.

Circle one: YES / NO. Initial _____

I will allow the staff to take my picture.

Circle one: YES / NO. Initial _____.

I will allow the staff to videotape me.

Circle one: YES / NO. Initial _____.

I will allow the staff to record me on audiotape.

Circle one: YES / NO. Initial _____.

If I have any further questions about the study, now or during the course of the project I can call Ms. Susan Stone 706-542-4838 or Dr. Mary Ann Johnson 706-542-2292.

I will sign two copies of this form. I understand that I am agreeing by my signature on this form to take part in this project. I will receive a signed copy of this consent form for my records.

_____	_____	_____
Signature of Participant	Participant's Printed Name	Date

_____

Participant Address and Phone

_____	Mary Ann Johnson	_____
Signature of Investigator	Printed Name of Investigator	Date

Questions or problems regarding your rights as a participant should be addressed to Dr. Christina Joseph; Institutional Review Board; Office of V.P. for Research; The University of Georgia; 604A Graduate Studies Research Center; Athens, GA 30602-7411; Telephone 706-542-6514.

UGA project number: H2000-10489-3 DHR project number: 990102 01/15/03 maj

PRE-TEST: Fruit and Vegetable Intake

Administer this questionnaire before doing any nutrition and health education activities

Name (ID): 1-4	**2. County:** 5-7	**3. Date (M/D/Y):** 8-13	***Line 1***
4. Age: 14-16	**5. Male(0) Female(1)** 17	**6. White(1) Black(2) Hispanic(3) Other(4)** 18	

How often do you eat or drink these fruits and vegetables? ***Think about fresh, frozen, and canned fruits and vegetables***	Less than 1 per wk	1 per wk	2 per wk	3 per wk	4 per wk	5 per wk	6 per wk	1 per day	2 per day	Missing/ Don't Know	
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	***Line 2***
7. 100% orange juice	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	7
8. 100% cranberry, apple, or purple grape juice	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	8
9. Berries such as strawberries, blueberries, or blackberries	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	9
10. Nectarines, peaches, or apricots	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	10
11. Broccoli, cabbage, or cauliflower	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	11
12. Cantaloupe or honeydew melon	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	12
13. Leafy greens such as mustard, turnip or collard greens	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	13
14. Corn	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	14
15. Cooked or stewed tomatoes such as in vegetable soup or rice and tomato gravy	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	15
16. Spaghetti or lasagna	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	16
17. Onions	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	17
18. Squash or zucchini	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	18
19. Spinach	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	19
20. Sweet potatoes or yams	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	20
21. Carrots	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	21
22. Baked beans, pintos, black-eyed peas, other beans	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	22
23. How often do you eat fruit as a snack?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	23
24. How often do you eat fruit as dessert?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	24
25. How often do you eat vegetables as a snack?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	25

26. When you are at home, how often do you eat <u>fresh fruit</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	26
27. When you are at home, how often do you eat <u>frozen fruit</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	27
28. When you are at home, how often do you eat <u>canned fruit</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	28
29. When you are at home, how often do you eat <u>fresh vegetables</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	29
30. When you are at home, how often do you eat <u>frozen vegetables</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	30
31. When you are at home, how often do you eat <u>canned vegetables</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	31

Please answer "yes" or "no" to these next questions.	**0**	**1**	**8**	**9**	
32. Do you think that eating more fruits and vegetables will help reduce your risk of <u>cancer</u>?	No	Yes	Don't know	Missing	32
33. Do you think that eating more fruits and vegetables will help reduce your risk of <u>heart disease</u>?	No	Yes	Don't know	Missing	33
34. Do you think if you improved the way you eat, that you would be a much healthier person?	No	Yes	Don't know	Missing	34
35. Do you think that your grocery store has a wide selection of fruits and vegetables?	No	Yes	Don't know	Missing	35
36. How many fruits and vegetables should people eat each day? ***Circle one: 1 2 3 4 5 or more***			Don't know	Missing	36

PRE-TEST ONLY			
	0	**1**	
37. Do you like the way most vegetables taste?	No	Yes	37
38. Do you have tooth or mouth problems that make you usually eat easy-to-chew fruits and vegetables?	No	Yes	38
39. Do you have enough money to spend on fruits and vegetables?	No	Yes	39
40. Would you like to know more about which fruits and vegetables are good for your health?	No	Yes	40
41. Would you like to know more about different ways to cook vegetables?	No	Yes	41
42. Would you like a handout with healthy menus to take home?	No	Yes	42
Which of these kitchen tools can you easily use to cook vegetables at home?			
43. Sharp knife?	No	Yes	43
44. Can opener?	No	Yes	44
45. Pot of hot water?	No	Yes	45
46. Do you shop for your own groceries?	No	Yes	46
<u>47. If you answered no, then who shops for you?</u> **8=not applicable; 1=spouse, 2=other family, 3=friend, 4=other, describe: _____**			47
48. Do you plan the meals you eat?	No	Yes	48
49. Do you cook the meals you eat?	No	Yes	49
50. Do you use a microwave at home?	No	Yes	50
51. Do you use a stove at home?	No	Yes	51

Do you have or have you ever had any of the following?			
52. Diabetes	No	Yes	52
53. Cancer	No	Yes	53
54. Heart disease or heart attack	No	Yes	54
55. High blood cholesterol	No	Yes	55
56. High blood pressure or hypertension	No	Yes	56

POST-TEST: Fruit and Vegetable Intake

Administer this questionnaire after doing all nutrition and health education activities

Name (ID): 1-4	**2. County:** 5-7	**3. Date (M/D/Y):** 8-13	***Line 1***
4. Age: 14-16	**5. Male(0) Female(1)** 17	**6. White(1) Black(2) Hispanic(3) Other(4)** 18	

How often do you eat or drink these fruits and vegetables? Think about fresh, frozen, and canned fruits and vegetables	Less than 1 per wk	1 per wk	2 per wk	3 per wk	4 per wk	5 per wk	6 per wk	1 per day	2 per day	Missing/ Don't Know	
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	***Line 2***
7. 100% orange juice	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	7
8. 100% cranberry, apple, or purple grape juice	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	8
9. Berries such as strawberries, blueberries, or blackberries	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	9
10. Nectarines, peaches, or apricots	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	10
11. Broccoli, cabbage, or cauliflower	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	11
12. Cantaloupe or honeydew melon	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	12
13. Leafy greens such as mustard, turnip or collard greens	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	13
14. Corn	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	14
15. Cooked or stewed tomatoes such as in vegetable soup or rice and tomato gravy	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	15
16. Spaghetti or lasagna	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	16
17. Onions	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	17
18. Squash or zucchini	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	18
19. Spinach	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	19
20. Sweet potatoes or yams	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	20
21. Carrots	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	21
22. Baked beans, pintos, black-eyed peas, other beans	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	22
23. How often do you eat fruit as a snack?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	23
24. How often do you eat fruit as dessert?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	24
25. How often do you eat vegetables as a snack?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	25

26. When you are at home, how often do you eat <u>fresh fruit</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	26
27. When you are at home, how often do you eat <u>frozen fruit</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	27
28. When you are at home, how often do you eat <u>canned fruit</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	28
29. When you are at home, how often do you eat <u>fresh vegetables</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	29
30. When you are at home, how often do you eat <u>frozen vegetables</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	30
31. When you are at home, how often do you eat <u>canned vegetables</u>?	<1/wk	1/wk	2/wk	3/wk	4/wk	5/wk	6/wk	1/dy	2/dy	M/DK	31

Please answer "yes" or "no" to these next questions.	**0**	**1**	**8**	**9**	
32. Do you think that eating more fruits and vegetables will help reduce your risk of <u>cancer</u>?	No	Yes	Don't know	Missing	32
33. Do you think that eating more fruits and vegetables will help reduce your risk of <u>heart disease</u>?	No	Yes	Don't know	Missing	33
34. Do you think if you improved the way you eat, that you would be a much healthier person?	No	Yes	Don't know	Missing	34
35. Do you think that your grocery store has a wide selection of fruits and vegetables?	No	Yes	Don't know	Missing	35
36. How many fruits and vegetables should people eat each day? ***Circle one: 1 2 3 4 5 or more***			Don't know	Missing	36
OPEN-ENDED BEHAVIOR AND KNOWLEDGE QUESTIONS RELATED TO FRUIT AND VEGETABLE INTAKE					*Line 3*
37. Have you increased your overall consumption of fruit or fruit juice (fresh, frozen, and canned)? **Please list fruits: Total # per week:___**	No	Yes	Don't know	Missing	57
38. Have you increased your overall consumption of vegetables (fresh, frozen, and canned)? **Please list vegetables: Total # per week:___**	No	Yes	Don't know	Missing	58
39. Can you think of some diseases or conditions that might be decreased by a diet high in fruits and vegetables? List:	No	Yes	Don't know	Missing	59
(Questions 40-47) Because of the information that you learned in the lessons, have you or do you: ***(Record additional responses below.)***					
40. Tried different ways of preparing fruits and vegetables?	No	Yes	Don't know	Missing	60
41. Tried a fruit or vegetable that you didn't like before, but now like?	No	Yes	Don't know	Missing	61
42. Eat more fruits and vegetables because you think they are good for you?	No	Yes	Don't know	Missing	62

43. Feel more strongly than before that eating fruits and vegetables will reduce the risk of disease?	No	Yes	Don't know	Missing	63
44. Feel that canned and frozen fruits and vegetables are just as good for you as fresh fruits and vegetables?	No	Yes	Don't know	Missing	64
45. Tried to follow a healthier diet?	No	Yes	Don't know	Missing	65
46. Eat more dark green vegetables than before?	No	Yes	Don't know	Missing	66
47. Made a recipe from one of the lessons?	No	Yes	Don't know	Missing	67
POST-TEST ONLY *Line 4*					
48. What was your overall level of satisfaction with this fruit and vegetable nutrition education program? Circle one: *1-Poor, 2-Fair, 3-Good, 4-Very Good, 5-Excellent*					68
49. How many sessions of the fruit and vegetable nutrition education program did the participant attend? *Staff should document with attendance records.*					69