GROWING MINDS: EVALUATING THE EFFECT OF GARDENING ON QUALITY OF LIFE AND OBESITY IN OLDER ADULTS

A Thesis

by

AIME JO SOMMERFELD LILLARD

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2008

Major Subject: Horticulture

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Approved by:

Chair of Committee,	Jayne M. Zajicek
Committee Members,	Tina M. Waliczek Cade
	Gary E. Briers
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ABSTRACT

Growing Minds: Evaluating the Effect of Gardening on Quality of Life and Obesity in Older Adults. (December 2008)

Aime Jo Sommerfeld Lillard, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Jayne M. Zajicek

Older adults represent a growing part of the population of the United States. Due to decreased physical activity, dietary changes, and alterations in metabolic rate this population is susceptible to an increased rate of diseases. The generation entering older adulthood is one which welcomed fast food and meal replacement foods allowing them to adapt to a more sedentary lifestyle and to need programs of preventative health.

The Nutrition and Life Satisfaction Survey was used to investigate gardening as a preventative health intervention for older adults. This instrument was used to compare older (age 50+) gardeners and nongardeners on their perceptions of personal life satisfaction, nutrition, health, and gardening habits. The instrument was posted online at the Aggie Horticulture website in spring 2005. Respondents differentiated themselves as gardeners or nongardeners by responding positively or negatively to the question “Do you garden?” Then, they completed the questionnaire about their quality of life and health status and, for gardeners, their gardening habits.

Results indicated that gardeners had more desirable responses: Overall quality of life scores were higher for gardeners compared to nongardeners, and four individual

quality of life statements yielded more positive answers by gardeners. Additionally, gardeners reported a higher consumption of total fruits and vegetables, including herbs, and of vegetables only including herbs. Personal reports of physical activity and of perceived health were higher among gardeners. Females were more likely than males to garden and spend a higher percentage of their budget on fruits and vegetables. Higher consumption of fruits and vegetables and higher levels of physical activity result in healthier lifestyles and, in turn, can increase quality of life.

DEDICATION

This thesis is dedicated to all of those who ever told me I could do it. Most of all it is dedicated to my loving family who stood by me when I got frustrated and as things were changing in my life. For the times it seemed like I would never finish I can look at my daughter and smile: thank you Rori, you were truly the drive behind these data, (although you weren't much help when I was trying to write)!

I also dedicate this work to the ladies of the Belsterling Foundation. Your support has been a key component in my ability to complete this study and to further my education while spending quality time with my family. You have truly given me a gift and I appreciate it more than I know how to express.

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Again, I want to thank my parents; they are my inspiration and the reason I am who I am today. They did an amazing job with my upbringing and I hope that I can be the leader for others as they have been for me. Thank you to Nonna, Papa, and Grandma KK for instilling my love for gardens from the very beginning and Grandma and Grandpa for always being there. Words cannot express how very much you mean to me and how proud I am to be a part of your lives.

To Patrick, I appreciate your patience, your love, your encouragement, and your help when I wanted to throw the computer out of the window or beat it up with a hammer!

Last but not least, I want to thank God; may I go on to do work that shares joy, excitement, and understanding of nature with others.

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CHAPTER I

INTRODUCTION

Older adults represent a growing part of the population of the United States. Along with this steadily growing population, the older population itself is getting older. By 2004, life expectancy had increased to 77.8 years of age (Arias, 2007), and by 2010 older adults (65+) are expected to increase to 40 million (U.S. Department of Health and Human Services [USDHHS], 2005). Chronic diseases affecting older adults are often associated with disability, diminished quality of life, and increased costs of health care (Centers for Disease Control and Prevention [CDC], 2007a). Increased diseases can be noted in the older adult population due to a decrease in physical activity, dietary changes, and alterations in metabolic rate (Arterburn et al., 2004). More than one-third of U.S. deaths in 2000 were attributed to three behaviors that increased personal risk for developing chronic diseases: smoking, poor diet, and physical inactivity. The generation entering older adulthood is one which welcomed fast food and meal replacement foods, allowing them to adapt to a more sedentary lifestyle and leading them to need public health programs that promote preventative health measures (Chappa et al., 2004).

Physical activity is an important factor for healthy lifestyles (Andersen et al., 2001; Bertera, 2003, Rossner, 2001; Yusuf et al., 1996); however, it is reported that 30% of adults over the age of 60 report no leisure time physical activity (Andersen, 2001).

This thesis follows the style of HortTechnology.

Unfortunately, adults in the United States tend to become less active as they age (CDC, 2007a).

Moderate levels of physical activity are sufficient to produce significant barriers to coronary heart disease, stroke, and overall cardiovascular risk (Wannamethee and Sharper, 2001). Light to moderate physical activity in middle or older age appears to significantly reduce cardiovascular and all cause mortality (Wannamethee and Sharper, 2001). In addition, higher levels of physical activity have also been linked to higher consumption of fruits and vegetables in adults over the age of 60 (Mummery et al., 2007; Sahyoun et al., 2005). Chronic diseases have consistently demonstrated health benefits of diets rich in fruits and vegetables (Nestle, 2007). Although older adults tend to report a higher intake of fruits and vegetables than other age groups, these amounts indicate that over one-half of the United States older population still does not meet the 5-A-Day recommendation (Sahyoun et al., 2007). The combination of moderate physical activity and increased consumption of fruits and vegetables resulting in healthier lifestyles, have been reported to dramatically reduce an adult's risk for many chronic diseases and in turn improve health-related quality of life (HRQL) (Blanchard et al., 2004; CDC, 2007a).

Studies have shown that gardening is a favorite leisure time physical activity among older adults (Bertera, 2003; Yusuf, 1996), providing an opportunity for exercise and increased consumption of fruits and/or vegetables. Gardeners have been reported to spend an average of 11.7 hours a week in the garden and an average of 5.6 of these hours in "heavier" work (Blair et al., 1991). A longitudinal study comparing older adults

revealed that those engaged in gardening, mowing, and/or planting activities reported a significant decrease in body mass index compared to adults who were not physically active (Kahn, 1997). Gardening not only affects physical activity of individuals but also can influence dietary habits, including fruit and vegetable consumption (Blair et al., 1991; Mummery et al., 2007; Sahyoun et al., 2005). Studies examining fruit and vegetable consumption of older adults report that factors such as ownership of a garden at some point, experiences with foods eaten from a garden (past or present), early exposure to the taste of fresh fruits and vegetables, the availability of fresh produce, and eating with others can enhance fruit and vegetable consumption of this population (Devine et al., 1999).

Interventions, such as gardening, that include physical activity and an increase in fruit and vegetable consumption, can result in healthier diets and can have dramatic effects on reducing a persons risk for many chronic diseases improving health-related quality of life (HRQL) (Blanchard et al., 2004; CDC, 2007a; Lancaster, 2004). The primary focus of this study was to examine the effect of gardening on quality of life, nutrition, and obesity in older adults.

Statement of Problem

As older adults represent a growing part of the population of the United States, it becomes increasingly important to focus research on the arena of their health. Nutrition and health issues along with quality of life are areas where slight positive changes can lead to long lasting effects (Chappa et al., 2004). Life expectancy has increased from 47.3 in 1900, to 77.8 in 2004 (CDC, 2007a) which shows a dramatic increase in the

population of older adults, especially as the generation of baby boomers has entered this category. Unfortunately, adults tend to become less active as they age (CDC, 2007a), and they fall short of dietary recommendations of fruit and vegetable consumption (Sahyoun et al., 2007). These factors along with alterations in metabolic rate can be directly or indirectly attributed to excess weight issues in older adults. Today 64.5% of adult Americans are categorized as being overweight or obese (American Obesity Association, 2005), and the prevalence of obesity in the elderly is expected to increase by 5.4% between 2000 and 2010 (Arterburn et al., 2004). Because chronic diseases such as obesity disproportionately affect older adults (CDC, 2007a), actions that improve health and quality of life of this population become more important.

Statement of Purpose and Objectives

The purpose of this study was to evaluate relationships between gardening and quality of life, nutrition, and obesity by comparing a population of gardeners to non-gardeners over the age of 50.

The objectives for this study were to determine if gardening is related to:

1) an increased quality of life in older adults.
2) a higher fruit and vegetable consumption in older adults.
3) reduced obesity in older adults.

The research hypotheses were:

H1) Older adults who garden have an increased quality of life.

H2) Older adults who garden have a higher fruit and vegetable consumption.

H3) Older adults who garden have a healthier Body Mass Index.

Definition of Terms

For the purpose of this study, the following terms were operationally defined:

BMI: Body Mass Index, a formula used to expresses body weight in relation to height; BMI= (weight in pounds/(height in inches*height in inches))*703, (CDC, 2008)

Cole Crops: cabbage, broccoli, brussel sprouts, kale, cauliflower, pak choi, and a variety of Chinese vegetables

HRQL: Health Related Quality of Life, an individual's satisfaction or happiness with domains of life that affect or are affected by their health

Ischemic heart disease: inadequate circulation of blood flow to the heart tissue

LTPA: Leisure Time Physical Activity, one or more activities three or more times per week for at least thirty minutes each

Mortality: term used to refer to death

Morbidity: term used to refer to illness

Obesity: a BMI of 30 or above, roughly 20% above recommended weight for height

Older adults: for the purpose of this study older adults are adults over the age of 50

Overnutrition: eating too much food or eating too much of certain kinds of food

QOL: Quality of Life, the overall enjoyment of life

Basic Assumptions

This study relied on four basic assumptions. It was assumed that participants understood the questions and answered them to the best of their ability. It was also assumed that the participants were familiar with, and capable of correctly using, a computer. Another assumption was that each participant submitted only one completed

instrument. A final assumption was that the computer and Internet access remained online and functional while the participant was actively filling out the instrument.

Limitations

This study was composed of a sample of volunteers. It was limited by the fact that the sample was not chosen randomly from the target population of older adults.

Delimitations

The participants of this study were delimited to individuals who had access to a computer with the Internet. This sample was further delimited to individuals who self-selected themselves to participate in the study when visiting the website where the instrument was hosted.

CHAPTER II

REVIEW OF LITERATURE

The following review of literature outlines the increase of the older adult population in the United States followed by health related issues that this population faces. It focuses on obesity in older adults and how their food choices, including fruit and vegetable consumption, affect their overall health. Research is presented on the importance of fruits and vegetables in diets and how gardening provides opportunities to increase consumption of fruits and vegetables and increase physical activity.

Increase of the Older Adult Population in the United States

Older adults represent a growing part of the population of the United States. As stated in *A Profile of Older Americans: 2007,* one in every eight Americans is an older adult (65+). It is projected that this population will increase to 40 million by 2010, with an estimated increase of 36% in the decade leading up to 2020 (USDHHS, 2007). In addition to this steadily growing population, the older population itself is getting older (USDHHS, 2007).

Life expectancy of individuals has increased from 47.3 in 1900, to 77.8 in 2004 (Arias, 2007), which shows a dramatic increase in the population of older adults, especially as the generation of baby boomers, ages 44 to 62 in 2008, has entered this category. Baby boomers are important to consider due to their different lifestyle management practices. This group has a “change the world” attitude, and wants control over every aspect of their personal life (Sullivan, 2004). Boomers have a more diverse

family structure, more formal education, and a quest for knowledge that was absent in previous generations (Chappa et al., 2004).

With this increase in population of older adults there is the likelihood of a significant effect on health, quality of life, and cost of health care (Arterburn et al., 2004). This up-and-coming generation shift of older adults (baby boomers), has the potential to demand a comprehensive health care package that shifts away from the traditional, western healthcare of their predecessors to a more integrative, holistic model (Chappa et al., 2004). Boomers are already the most economically powerful cohort in the United States and intend to work longer while slowly transitioning into retirement (Miller, 2007). As they transition into this next stage in life, they are expected to shift spending practices to focus more on themselves (Miller, 2007). Some of the most widely observed traits of the baby boomers are their desire to stay active and appear young, and their willingness to exercise in order to maintain these goals (Chappa et al., 2004; Miller, 2007; Sullivan, 2004). However, this generation is also the generation that welcomed fast food and meal replacement foods allowing them to adapt to a more sedentary lifestyle and the need for public health programs that promote preventative health measures (Chappa et al., 2004). Because of these later traits, it is becoming increasingly important to focus research on the arena of health in this older population. Nutrition and health issues, along with quality of life, are areas where slight positive changes can lead to significant long term effects (Chappa et al., 2004).

Health Related Issues of Older Adults in the United States

According to the Centers for Disease Control and Prevention (2007a), “chronic diseases disproportionately affect older adults and are associated with disability, diminished quality of life, and increased costs for health care and long-term care” (p. 1). Increased diseases can be noted in the elderly population due to a decrease in physical activity, dietary changes, and alterations in metabolic rate (Arterburn et al., 2004). In the United States people ages 65 and older currently require health care that is 3-5 times greater than the cost for younger adults. This increase accounts for almost one-third of health-care expenditures, and is projected to increase 25% by 2030 (CDC, 2007a). According to data collected in 2004-2005, the most frequently reported health issues among the elderly were hypertension, diagnosed arthritis, all types of heart disease, any cancer, diabetes, and sinusitis (USDHHS, 2007). Hypertension overtook the number one spot in the 2003 U.S. Department of Health and Human Services report which was the first time obesity was addressed as a health issue (USDHHS, 2003). These data indicated an average increase of 57% in out-of-pocket health care expenditures through the previous decade (USDHHS, 2007), compared to a 46% increase in the 2005 report (USDHHS, 2005). William F. Benson, a consultant to CDC (2007a), stated that, “Primary and secondary prevention are necessary to slow the growth in health care spending” (CDC, 2007a, p .4). Primary prevention refers to the preemptive behavior that seeks to avert disease while secondary prevention is the early detection with the aim of preventing or curing a disease (Encyclopedia Britannica, 2008).

Several of the aforementioned health complications can directly or indirectly attribute to excessive weight issues in older adults. Adults in the United States tend to become less active as they age and in turn the prevalence of obesity in older adults has increased (CDC, 2007a). Obesity can lead to fractures, hypertension, diabetes mellitus, osteoporosis, impaired mobility, sleep apnea, and decreased self esteem (Rossner, 2001).

Obesity

Obesity is one of the largest growing problems in the United States among adults as well as children. Obesity is a disease that affects nearly one-third of the adult American population and has continued to increase since 1960, a trend that is not slowing down (American Obesity Association, 2005). Today, 64.5% of adult Americans are categorized as being overweight or obese (American Obesity Association, 2005). According to Arterburn et al. (2004), the prevalence of obesity in the elderly is expected to increase by 5.4 percent between 2000 and 2010, becoming approximately 20.9 million by 2010. This increase in obesity has been attributed to the interaction between sedentary life styles, dietary changes, and age-associated alterations in metabolic rate (Arterburn et al., 2004).

The leading causes of deaths among adults in the year 2000 were heart disease, cancer, and stroke (CDC, 2007a; Nestle, 2007). Some of these deaths may be attributed to obesity due to the fact that obesity is a risk factor for four of the 10 leading causes of death in the United States: coronary heart diseases, type 2 diabetes, stroke, and several forms of cancer (CDC, 2007a). According to Thorpe and Ferraro (2004), “Obesity has become a substantial public health problem in the United States…” (p. 109) and

"…accelerates the risk of hypertension, diabetes, and ischemic heart disease…" (p. 110). A twenty year longitudinal study by Thorpe and Ferraro (2004) concluded that obese elderly are more likely to develop serious illnesses which accelerate mortality risk, highlighting the indirect effect of obesity on mortality through disease. In Thorpe and Ferraro's (2004) study, obesity was linked to an increase in risk of heart disease for younger and older adults, and was consistently related to ischemic heart disease deaths. Other researchers have reported that conditions such as obesity increase the risk of coronary heart disease, cancer, stroke, and diabetes later in life (Nestle, 2007).

One way to measure obesity is Body Mass Index (BMI). BMI is a measure of body fatness; it is calculated using a person's weight and height to assess and place that person into a category (Fig.1, CDC, 2008).

BMI*	Weight Status
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and Above	Obese

Fig.1. Body Mass Index (BMI) Measurement table and categories (CDC, 2008)
*The formula for calculating BMI is: BMI=(weight in pounds/(height in inches*height in inches))*703 (CDC, 2008).

As reported by the United States Department of Health and Human Services publication, *A Profile of Older Americans*, obesity has increased since its appearance on this report in 2003 (USDHHS, 2003, 2004, 2005, 2007). In 2007, roughly 25% of

persons over the age of 60 reported body mass index's categorized as obese (USDHHS, 2007). Past reports are as follows: 24% in 2005, 24% in 2004, and 22% during its introduction year, 2003 (USDHHS). Rossner (2001) warns that the costs of medical treatment for obesity will be substantial in relation to the increasing prevalence of overweight and obese elderly, and treatment will need to be addressed for future economic reasons. This increase in obesity contributes to increased healthcare costs, transcending those affected by the condition and encompassing the nation (Arterburn, 2004; Nestle, 2007; Rossner, 2001). In a high, middle, and lower case scenario, Arterburn et al. (2004), used the middle case scenario to project that the number of obese Americans aged 65 and older, will account for an average of 400,000 new Medicare-eligible elders per year from 2000 to 2010. Arterburn et al. (2004) go on to say that "as the prevalence of obesity rises, a greater proportion of elderly Americans may require long-term care, home health assistance, and personal medical equipment…" (p. 1911).

Data collected by the American Public Health Association (AHPA) (n.d.) regarding the U.S. estimated annual cost of obesity in 2000 for all age groups was $117 billion. According to the Centers for Disease Control (CDC, 2007a), more than one-third of U.S. deaths in 2000 were attributed to three behaviors that increased a person's risk for developing chronic diseases. Two of these behaviors were directly linked to obesity, poor diet and physical inactivity, while the third behavior was smoking. These behaviors will need to be addressed if there is to be an improvement in elderly health, in turn reducing costs for the elders. According to Arterburn et al. (2004), "a systematic review

of the association between body weight and cardiovascular and all-cause mortality suggests that mortality risk may be higher in obese elderly individuals" (p. 1910).

Healthy Food Choices/Diet

According to Schlettwein-Gsell (1992), "Eating is one of the greatest pleasures in old age and one of the most important ties to life" (p. 1265S). However, nutrition is one of several factors responsible for mortality and morbidity in the elderly (Schlettwein-Gsell, 1992). Research by Nestle (2007) revealed that the effect of diet on chronic diseases is comparable to cigarette smoking in the United States; each contributes to about one-fifth of annual deaths. Sahyoun et al. (2007) reported that "obese individuals reported less frequent consumption of fruits and vegetables compared with individuals in the healthy weight category" (p. 18). Diet in the elderly is influenced by ease of preparation, proportion size and price (Donkin et al., 1998). Fast food, take out, and pre-prepared meals offer convenience and value which is appealing to an aging and/or busy population but lacks in nutritional value (Chappa et al., 2004; Souter and Keller, 2002).

According to Nestle (2007), overnutrition (eating too much or too much of certain kinds of food) is the principal nutrition problem among all Americans today, including the elderly. "Overeating causes its own set of health problems; it deranges metabolism, makes people overweight, and increase the likelihood of 'chronic' diseases – coronary heart disease, certain cancers, diabetes, hypertension, stroke, and others…" (p. 3). In addition, changes in food sources over time can be a contributing factor to poor dietary choices (Souter and Keller, 2002). A study of older rural adults showed that the food they were eating now did not taste like the food they remembered from their

gardens and these changes in food sources affected food choices in a negative manner (Souter and Keller, 2002). A change in food source was just one of several changing circumstances related to how food was obtained and prepared (Souter and Keller, 2002). They also reported other circumstances such as ease of preparation, diminishing resources (monetary), limited choices (monetary, leftovers), changing eating patterns (illness, loss of teeth), health related dietary changes (physician recommendations), and diminishing desire (eating alone) as components affecting food choices. Since fast food and snacks have replaced home cooked meals, Americans are able to eat whatever they want, whenever they want it, leading to an increase in caloric intake (Chappa et al., 2004).

Information collected by the APHA (n.d.) states that "Access to healthy food plays a major role in the ability of individuals to follow a healthful diet" (p. 2). "Unfortunately, income, or lack of it, can decrease the ability to access healthy food and increase access to fast food restaurants, convenience stores, and liquor stores where there is poor selection and quality of fresh foods" (p. 2). One-third of Americans over the age of 65 receive 90% of their income from Social Security benefits, and 9.8% were below the poverty level in 2004, while another 6.7% were classified as "near-poor" (USDHHS, 2005). This information offers cause or effect support to Nestle's (2007) statement that "In the United States, low-income groups seem to have about the same nutrient intake as people who are better off, but they choose diets higher in calories, fat, meat, and sugar, and they display higher rates of obesity and chronic diseases" (p. 27).

In March 2007, the National 5-A-Day fruit and vegetable program led by the Centers for Disease Control, became the National Fruit and Vegetable Program (CDC, 2007b). This program launched a new public health initiative, *Fruits & Veggies--More Matters,* in order to reflect the new dietary guidelines, which recommends more than 5 servings of fruits and vegetables for some Americans (CDC, 2007b). Previous guidelines recommended 5 to 9 servings of fruits and vegetables a day, while the new recommendations include 2 to 6 1/2 *cups* of fruits and vegetables, or the equivalent of 4 to 13 servings a day (CDC, 2007b). Even though older adults tend to report a higher intake of fruits and vegetables than other age groups, over one-half of the U.S. older population does not meet the old recommendation of 5 daily servings of fruits and vegetables (Sahyoun et al., 2007). Another study of adults over the age of 60 reported an even larger percentage, 72.5%, of participants did not meet the recommended minimum of five servings of fruit and vegetables per day (Prochaska et al., 2005).

Positive health effects in older adults have been reported due to the increase in fruit and vegetable consumption in addition to a sensible diet (Jane Higdon Linus Pauling Institute, 2005). These effects include lower blood pressure and a lower risk of developing type 2 diabetes mellitus (DM) (Jane Higdon Linus Pauling Institute, 2005), and a decrease in coronary heart disease and stroke (Ness and Powles, 1997). “The scientific evidence supporting a role for fruits and vegetables in prevention of chronic diseases (in any population) is expanding beyond that of a role in cancer and heart disease prevention” (Van Duyn and Pivonka, 2000, p. 1520). It is important to continue to emphasize the necessity of fruit and vegetable consumption as a practical and

important means for optimizing nutrition to reduce disease risk and maximize good health (Van Duyn and Pivonka, 2000).

Physical Activity

In addition to healthy diets, a review of literature by Wannamethee and Sharper (2001) concluded that moderate levels of physical activity are sufficient to produce significant benefits for coronary heart disease, stroke, and overall cardiovascular risk. Unfortunately, adults in the United States tend to become less active as they age (CDC, 2007a). Adults, aged 60 years or older, reported a higher prevalence (30%) of *no* leisure time physical activity (LTPA), compared to younger adults, attributing to a higher rate of obesity (Anderson et al., 2001).

Light to moderate physical activity in middle or older age appears to have significant benefits for cardiovascular and all cause mortality (Wannamethee and Sharper, 2001). Moderate levels of physical activity do not need to be strenuous or prolonged and can include daily leisure activities such as gardening, swimming, brisk walking, long walks, and “do-it-yourself” (DIY) recreational work (Wannamethee and Sharper, 2001).

In addition, higher levels of physical activity have also been linked to higher consumption of fruits and vegetables in adults over the age of 60 (Mummery et al., 2007; Sahyoun et al., 2005). It has been suggested that those who are aware of the benefits of a healthier lifestyle may display linked characteristics such as these (Mummery et al., 2007; Sahyoun et al., 2005). The combination of moderate physical activity and increased consumption of fruits and vegetables resulting in healthier lifestyles, have

been reported to dramatically reduce an adult's risk for many chronic diseases in turn improving health related quality of life (HRQL) (Blanchard et al., 2004; CDC, 2007). One leisure time activity that has the potential to aid in both increasing physical activity and improving nutritional habits of older adults is gardening.

Gardening

Gardening is one of the United States' most popular home-based leisure activities (Ashton-Shaeffer and Constant, 2005) and has been reported as the second most common leisure activity, after walking, of adults over the age of 65 (Yusuf et al., 1996). Adults garden for many reasons including physical health and exercise, mental health, recreation, creativity, intellectual expansion, friendship, produce quality and nutrition, spiritual reasons (including contact with nature), self expression/self-fulfillment, and cost and convenience (Ashton-Shaeffer and Constant, 2005; Blair et al., 1991). Recreation, being the number one reason for gardening in Blair et al.'s (1991) study, can be linked positively to physical activity. Blair et al. (1991) reported that older adults that gardened spent an average of 11.7 hours a week in the garden and an average of 5.6 of these hours in "heavier" work like hoeing, digging, planting or pulling weeds. In a ten year longitudinal study comparing adults ages 50-75, those engaged in gardening, mowing, and/or planting activities reported a significant decrease in body mass index (BMI), compared to adults who were not physically active (Kahn, 1997). Another study evaluating the effects of lifetime leisure gardening on women aged 67-75, who considered themselves to be in good to excellent health, felt that gardening kept them mentally and physically active (Infantino, 2004/2005). Researchers reported that

gardening had a significant influence on positive lifetime traits including successful and healthy aging, resiliency, hardiness, adaptability, creativity, self-transcendence, and a positive outlook on life (Infantino, 2004/2005). Similar results were reported on research conducted with Master Gardeners and the effect gardening has had on their quality of life (Boyer et al., 2002; Waliczek et al., 2005). Boyer et al. (2002), reported that statistically significant improvements were found in all 4 quality of life categories including improvements in perception of physical and social activity, self-esteem, and nutrition.

Gardening does not only affect physical activity of individuals, but can also influence dietary habits, including fruit and vegetable consumption (Blair et al., 1991; Mummery et al., 2007; Sahyoun et al., 2005). Studies examining fruit and vegetable consumption of older adults report factors such as ownership of a garden at some point throughout participants' lifetime, experiences with foods eaten from a garden (past or present), early exposure to the taste of fresh fruits and vegetables, the availability of fresh produce, and eating with others, can enhance fruit and vegetable consumption of this population (Devine et al., 1999)

Interventions, such as gardening, that include physical activity and an increase in fruit and vegetable consumption, can result in healthier diets and can have dramatic effects on reducing a persons risk for many chronic diseases improving health related quality of life (HRQL) (Blanchard et al., 2004; CDC, 2007a; Lancaster, 2004).

Summary

It is projected that the population of older adults (age 65+) will increase to 40 million by 2010, with an estimated increase of 36% in the decade leading up to 2020 (USDHHS, 2007). With this increase in population of older adults there is the likelihood that there will be a significant effect on health, quality of life, and cost of health care (Arterburn et al., 2004). Because of these trends, it is becoming increasingly important to focus research on the arena of health in this older population. Nutrition and health issues, along with quality of life, are areas where slight positive changes can lead to significant long term effects (Chappa et al., 2004).

Chronic diseases disproportionately affect older adults and can be linked to a decrease in physical activity, dietary changes, and alterations in metabolic rate (Arterburn et al., 2004; CDC, 2007a). All of these factors can be directly or indirectly attributed to excess weight issues in older adults. In 2007, roughly 25% of persons over the age of 60 reported body mass index's categorized as obese (USDHHS, 2007). In 2000 (CDC, 2007a), more than one-third of U.S. deaths were attributed to three behaviors that increase a person's risk for developing chronic diseases. Two of these behaviors were directly linked to obesity; poor diet, and physical activity (CDC, 2007a). It is becoming more and more critical to address these health issues to help improve quality of life of older adults and in turn reduce costs for medical expenses.

Unhealthy diets can have deadly effects on adults with chronic diseases contributing to about one-fifth of annual deaths (Nestle, 2007). Again, this fact is linked to obesity where research indicates that obese individuals report less frequent

consumption of fruits and vegetables compared with individuals that are a healthy weight (Nestle, 2007; Sahyoun et al., 2007). However, positive health effects in older adults have been reported to be due to the increase in fruit and vegetable consumption in addition to a sensible diet (Jane Higdon Linus Pauling Institute, 2005). It is important to continue to emphasize the necessity of fruit and vegetable consumption as a practical and important means for optimizing nutrition to reduce disease risk and maximize good health (Van Duyn and Pivonka, 2000).

In addition to healthy diets, moderate levels of physical activity are sufficient to produce significant benefits for many types of chronic and other diseases. Unfortunately, adults tend to become less active as they age (CDC, 2007a). Higher levels of physical activity have also been linked to elevated consumption of fruits and vegetables in older adults (Mummery et al., 2007; Sahyoun et al., 2005). This combination of physical activity and increased fruit and vegetable consumption can result in healthier lifestyles and in turn reduce older adults risk for chronic and other forms of diseases (Blanchard et al., 2004; CDC, 2007a).

Gardening is one of the most popular home-based leisure activities in the United States and has been reported to positively affect physical activity of older adults (Ashton-Shaeffer and Constant, 2005; Blair et al., 1991) and additionally influence dietary habits of this population including fruit and vegetable consumption (Blair et al., 1991; Mummery et al., 2007; Sahyoun et al., 2005). As many older adults start to search for alternative forms of life satisfaction to improve their quality of life through living healthier lifestyles, they may begin searching for a more holistic approach. This

approach would include healthy diets and physical activity using an activity that brings them enjoyment. Gardening is an example of an activity that may be able to satisfy these needs. As reported by Kaplan (1973), gardening offers a fascinating experience as an activity with a degree of universality that transcends differing backgrounds through contact with nature and a first hand viewing of the cycle of life.

CHAPTER III

METHODOLOGY

This chapter begins with an overview of study objectives and hypotheses, and discusses methodology used in this study. The population is defined and procedures and instrumentation used are explained. Data collection is addressed, and design of the study and statistics are included. Reliability and validity are also addressed. The Institutional Review Board approved this study prior to its start in 2005.

Statement of Objectives and Hypotheses

The goal of this study was to evaluate the relationship between gardening and quality of life, nutritional habits, and obesity of older adults by comparing a population of gardeners to non-gardeners. In order to achieve this goal, 3 main objectives and hypotheses were developed:

1) To determine if older adults who garden have an increased positive quality of life when compared to nongardeners' quality of life, with the null hypothesis that there is no difference between gardener quality of live and nongardener quality of life.

2) To determine if older adults who garden have an increased consumption of fruits and vegetables when compared to nongardeners' fruit and vegetable consumption, with the null hypothesis that there is no difference between gardener fruit and vegetable consumption and nongardener fruit and vegetable consumption.

3) To determine if older adults who garden have a healthier Body Mass Index when compared to nongardeners' Body Mass Index, with the null hypothesis that there is no difference between gardener Body Mass Index and nongardener Body Mass Index.

Population

The target population in this study was adults over the age of 50. The sample was drawn from an online survey. The survey was designed to be answered by older adults (50+) and respondents self-selected themselves for inclusion in the study by visiting the webpage and choosing to answer the survey. The survey was not advertised in any other manner than the link to it on the webpage. A total of 298 participant responses were gathered from adults ages 50+. This initial sample was reduced to 261 responses for the final data analysis eliminating duplicate and incomplete surveys. Respondents differentiated themselves as gardeners or nongardeners by responding positively or negatively to the survey question, "Do you garden?"

Instrumentation

The instrument used in this study, "The Nutrition and Life Satisfaction Survey," was an online survey posted within the Aggie Horticulture network (http://aggie-horticulture.tamu.edu) for approximately one month, from April 19 to May 12, 2005. An information sheet was provided at the beginning of the survey and a link marked "Take the Survey," which once clicked indicated informed consent from the respondent. The instrument required respondents to check boxes or fill in radio circles in addition to text boxes for open-ended questions.

The instrument was divided into four sections containing a total of 55 questions. Section one measured the perceptions of life satisfaction of gardeners and nongardeners using the Life Satisfaction Index (LSIA) (Neugarten et al., 1961). The original instrument was developed through an extensive 5-year study of a "relatively healthy, middle-class, urban Kansas City sample" (Adams, 1969). Initial data gathered information on respondents' life patterns, attitudes and values, activity levels, other members of the household, income and work, religion, organization involvement, social interaction, illness, loneliness, boredom, anger, and self-image. From reported information the final instrument was developed that measured psychological well-being and contained representational measures in distinguishable components including zest for life, resolution and fortitude, congruence between desired and achieved goals, physical, psychological and social self-concept, and optimism. The LSIA instrument has been shown to be valid and reliable through its use in other research (Adams, 1969; Sexton and Munro, 1985; Sexton and Munro, 1988; Waliczek et al., 2005; Wood et al., 1969). The reported instrument reliability is 0.78 (Neugarten et al., 1961). This section of the Nutrition and Life Satisfaction survey contained 20 questions with answer options consisting of agree, I don't know, and disagree (Appendix A).

Section 2 of the survey measured dietary habits, shopping preferences, health, and Body Mass Index (BMI) of both gardeners and nongardeners. Questions for this portion of the instrument were compiled from similar instruments; there were 23 questions (Appendix A) (Source Unknown; Koch et al., 2006; Waliczek et al. 1996). Survey questions for this section included those that asked the frequency at which

respondents consumed certain fruits and vegetables, respondent's height and weight (information needed to calculate BMI), and types of health issues.

Section 3 of the survey contained 12 questions in order to gain demographic information on respondents. This information included age, level of physical activity, overall health perception, and gardening experience along with typical demographic information (Appendix A).

Section 4 contained questions that were answered by gardeners only. Questions gathered information on respondents' length, type, and reasons for gardening (Appendix A). The gardening questions were derived from questions used in the Community Garden study performed by Kansas State University, compiled by Waliczek et al, (1996). The Nutrition and Life Satisfaction Survey in entirety was expected to take approximately 12 minutes to completion. Once respondents entered their answers, responses were automatically downloaded onto an electronic spreadsheet.

Scoring and Data Analysis.

This study gathered data from 261 participants over the age of 50. Participant composition was 158 gardeners and 103 nongardeners. The instrument used in this study grouped questions into four segments: quality of life, nutritional information, gardening habits, and demographics. The data were saved into a Microsoft Excel (Seattle, Wash.) document and then transferred and analyzed using the Statistical Package for the Social Sciences (SPSS).

The LSIA section of the instrument (section 1) for each respondent was scored using Microsoft Excel (Seattle, Wash.). Respondents received a score on the test

instrument ranging from 20 to 60 based on their answers. A positive answer to each survey statement resulted in a score of 3 and an overall score of 60 if positive answers were given for all 20 statements. A negative answer to each survey statement received a score of 1 and resulted in an overall score of 20 on the test if negative answers were given for all 20 statements. Answers of "I don't know" were considered neutral and received 2 points each. Individual scores were tabulated and entered into the overall data spreadsheet.

The nutritional section of the instrument (section 2) was scored using Microsoft Excel (Seattle, Wash.). Nutritional questions that requested numbers for specific fruits and vegetables eaten per month were given the option to select an answer from one point increments ranging from 0 to 5+. A 5+ answer indicated that respondents consumed that individual fruit or vegetable more than five times a month and was scored as a 6. Data originally entered separately (by specific fruit or vegetable) was then calculated as total fruits and vegetables, vegetables alone including herbs, and fruits alone. A range of scores on the vegetable section alone including herbs was 0 to 66, while the fruit section alone had a possible score range from 0 to 30. Based on these ranges, total fruit and vegetable consumption range per month was 0 to 96, with the higher the number the more times per month fruits and/or vegetables were consumed.

Questions gathering information for Body Mass Index (BMI) measurements asked participants to input number amounts into text boxes. These questions consisted of participant height and weight. Microsoft Excel (Seattle, Wash.) was used to convert answers to height in inches and weight in pounds and then BMI was calculated using the

formula BMI= (weight in pounds/(height in inches*height in inches))*703 (CDC, 2008). Once a respondent's BMI was calculated it was coded into categories: 1=Underweight, 2=Normal, 3=Overweight, 4=Obese, based on ranges provided by the Centers for Disease Control and Prevention (Atlanta, GA). The question asking participants to check all that apply regarding illnesses suffered (Appendix A) was coded using Microsoft Excel (Seattle, Wash.) to assign a 1 to each illness selected and then totaled to provide an illness count, with a range of 0 for no illnesses and a score of 10 being the maximum.

Questions regarding shopping preferences of respondents (Appendix A) included shopping location, frequency, fruit and vegetable purchasing habits (fresh, frozen, canned), and percentage of grocery budget spent on fruits and vegetables. Each answer was assigned a number value and then analyzed for significant differences.

If participants answered yes to the question, "Do you garden," they were directed to the fourth section of the survey where specific information was gathered regarding their gardening practices. Questions in this section included number of years gardened with a text box for self-entered answers, and radio buttons for kind of garden, and hours spent in garden per week during growing season. Types of plants grown (ornamental, fruits and vegetables, or herbs), and reasons for gardening (recreation, cost/convenience, produce quality/nutrition, physical health and exercise, mental health (reduce stress/pride), self expression/self fulfillment, and spiritual reasons/contact with nature), allowed respondents to check all that applied. Answers were downloaded into Microsoft Excel (Seattle, Wash.) and assigned number values before importing into Statistical

Package for the Social Sciences (SPSS). All information in this section was analyzed using frequencies.

Data collected were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows Release 11.5 (Chicago, IL). Statistical procedures included frequencies and multiple one-way ANOVAs to determine differences between scores or individual statements responses based on differences in gardening and any differences in demographics.

CHAPTER IV

RESULTS AND CONCLUSIONS

This chapter will present, analyze, and interpret the data collected in order to fulfill the study's purpose of examining the relationships between gardening versus nongardening, and quality of life, nutritional habits, and obesity of the older adults in the United States. Information and conclusions regarding the study objectives beyond the testing of the hypotheses will also be discussed. These objectives were to determine whether older adults who garden have a more positive quality of life, a higher consumption of fruits and vegetables, and/or a healthier Body Mass Index when compared to nongardeners. Demographic variables were also examined to determine if they influenced quality of life, nutritional habits, and obesity in older gardeners and nongardeners.

Hypotheses

In accordance with the study objectives, the following hypotheses were tested:

H1) Gardeners have an increased positive quality of life when compared to nongardeners, with the null hypothesis that there is no difference between gardener quality of life and nongardener quality of life.

H2) Gardeners have a higher consumption of fruit and vegetables than nongardeners, with the null hypothesis that there is no difference between gardener fruit and vegetable consumption and nongardener fruit and vegetable consumption.

H3) Gardeners have a healthier Body Mass Index when compared to nongardeners, with the null hypothesis that there is no difference between gardener Body Mass Index and nongardener Body Mass Index.

Test reliability of a scale means that a test or questionnaire taken multiple times would reveal consistent measurements (Tuckman, 1999). Reliability scores range from 0.0 to 1.0 and the closer the reliability score is 1.0, the less error variance is present within the test, and the more likely the differences observed during measurement by the test are those that are due to respondents' answers (Borg and Gall, 1989). The Nutrition and Life Satisfaction Survey reported a reliability of 0.83.

Sample Description

The target population for this study was adult gardeners and nongardeners age 50 or older. Due to inconsistencies in reports and previous studies on "older adults," the age of 50 was chosen as the cut off point for the Nutrition and Life Satisfaction Survey. This age break allows for 10 year age groupings when gathering demographic information, includes a large number of the baby boomers, and is perceived as an understandable age break by participants. Responses were gathered from a total of 298 participants--adults ages 50+. This initial sample was reduced to 261 valid responses; excluding multiple submissions, unfinished responses, and those who did not answer the question, "Do you garden?". These 261 responses were used for the final data analysis. One hundred fifty-eight were gardeners and 103 were nongardeners. Frequency and analysis of variance tests were run in SPSS (Chicago, IL) to compare gardeners and nongardeners based on

demographic information on the variables of age, gender, ethnicity, income, and education (Table 1). No significant differences were found in any of the demographic variables between the two groups.

Table 1. Demographic information for the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

	DO YOU GARDEN?			
	YES		NO	
	Frequency (no.)	Frequency (%)	Frequency (no.)	Frequency (%)
GENDER				
Male	53	34	51	49.5
Female	103	66	52	50.5
ETHNICITY				
African American	2	1.3	3	2.9
Asian/Pacific Islander	0	0.0	1	1.0
Hispanic	0	0.0	2	2.0
Native American	1	0.6	3	2.9
Caucasian	153	96.8	93	91.2
Other	2	1.3	0	0.0
AGE GROUP				
50-59	98	62.4	61	60.4
60-69	52	33.1	31	30.7
70-79	7	4.5	7	6.9
80-89	0	0.0	1	1.0
90 or older	0	0.0	1	1.0
EDUCATION				
Grade School	0	0.0	2	1.9
High School Degree/GED	11	7.0	5	4.9
Professional/Trade School	9	5.7	9	8.7
Some College	28	17.7	16	15.5
College Degree	42	26.6	38	36.9
Post Graduate School/Degree	68	43.0	33	32.0
ANNUAL INCOME				
< $15,000	9	5.9	3	3.1
$15,000-$29,000	14	9.2	11	11.3
$30,000-$44,000	28	18.3	15	15.5
$45,000-$59,000	32	20.9	23	23.7
$60,000-$74,000	18	11.8	11	11.3
$75,000-$84,000	12	7.8	11	11.3
$85,000-$94,000	12	7.8	7	7.2
>$95,000	28	18.3	16	16.5

Results

Gardeners' vs. nongardeners' quality of life comparisons. An analysis of variance was used to compare gardeners' and nongardeners' responses. Statistically significant results were reported in comparisons of the overall LSIA scores. Gardeners had higher mean scores (36.06) compared to nongardeners (34.40) on overall LSIA scores (p=0.01) (Table 2). Significant differences were also reported by Waliczek et al. (2005) on mean scores on the LSIA for both gardeners (45.88) and nongardeners (43.69).

Table 2. Analysis of variance comparisons of gardeners' and nongardeners' overall response scores on the Life Satisfaction Index A[y] in the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Category	n	Mean Score[z]	SD	df	F	*P*
Gardeners	158	36.06	4.698	1	6.710	0.010*
Nongardeners	103	34.40	5.565			

[z] Scores range from 20 to 60 with 20 being the lowest possible score and 60 being the highest possible score. These scores are based on a rating where 1=a negative response and 3=a positive response to each of the 20 survey statements.
[y] Neugarten et al., 1961
* Statistically significant at p=0.05

These differences in scores indicated that gardeners had more positive perceptions regarding their life satisfaction than their nongardening counterparts. Boyer et al.'s (2002) study supports this finding by reporting that statistically significant improvements were found in all 4 quality of life categories indicating improvements in perceptions of physical and social activity, self-esteem, and nutrition of those who were actively involved in a Master Gardener program. Blair et al. (1991) also reported that life

satisfaction questions showed gardeners to have a significantly increased positive response to each question compared to nongardeners, leading to the conclusion that "those who are involved in gardening find life more satisfying and feel they have more positive things happening in their lives than those who are not" (p. 165).

Due to the differences between gardeners and nongardeners in overall scores regarding life satisfaction, individual statements were analyzed to see if there were any trends in the different categories within the LSIA between the two groups. Statistically significant differences were found on 20%, or 4 of the 20 life satisfaction questions. Each of these 4 statements was answered more positively by respondents who identified themselves as gardeners.

Related to optimism, more than 84% of gardeners agreed with the statement "I have made plans for things I'll be doing a month or a year from now," compared to only 68% of nongardeners (p=0.000) (Fig. 2).

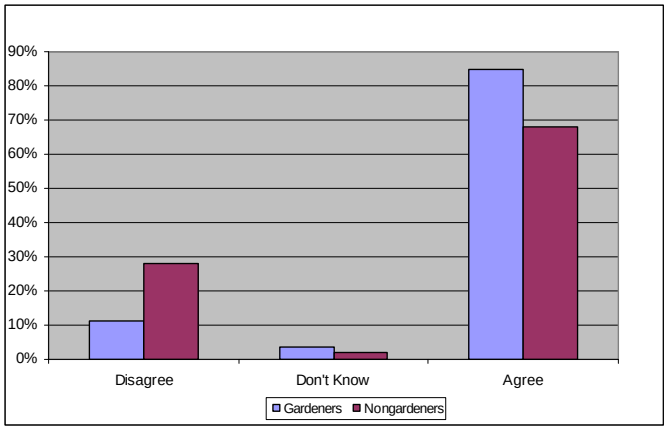

Fig. 2. Statistically significant comparisons (statistically significant at p=0.05) of gardeners' and nongardeners' responses (disagree, don't know, agree) to the statement "I have made plans for things I will be doing a month or a year from now" in the study evaluating the effects of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Differences were observed in that 28.2% of nongardeners disagreed to the statement while only 11.4% of gardeners disagreed, showing optimism by those who garden. These findings are supported by Waliczek et al.'s (2005) study that found 67% of gardeners agreed with the same statement, while only 52% of nongardeners agreed. Horticultural Therapy, including gardening, has been demonstrated to promote positive attitudes in participants in part due to offering participants a sense of accomplishment and a form of control over a small part of his/her life, along with hope for what is yet to come (Shapiro and Kaplan, 1997). Gardening is an ongoing recreation that is available 12 months a year whether planning, planting, picking, or preserving; allowing a gardener to maintain active body and mind while preparing for the next step. According to Lewis (1996), gardening requires patience and planning, a vision for the future, as well as a belief in what some still see as a miracle in the germination of seeds.

Statistical significance was also found in the zest for life statement "Most of the things I do are boring and monotonous." Almost 97% of gardeners disagreed with this statement while 84.5% of nongardeners disagreed ($p=0.002$) (Fig. 3). However, 11.7% of nongardeners compared to 3.2% of gardeners agreed with this statement.

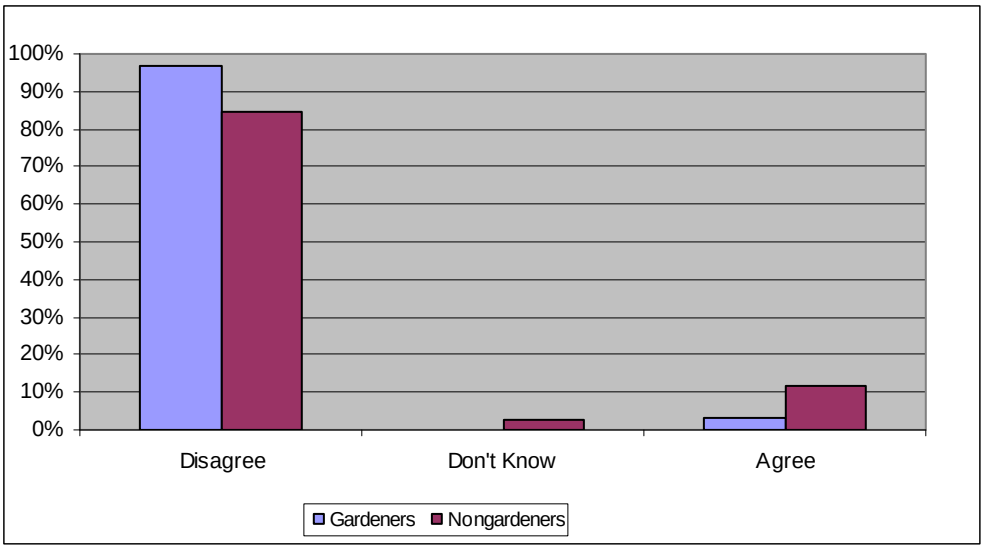

Fig. 3. Statistically significant comparisons (statistically significant at p=0.05) of gardeners' and nongardeners' responses (disagree, don't know, agree) to the statement "Most of the things I do are boring and monotonous" in the study evaluating the effects of gardening on life satisfaction, nutritional habits, and obesity of older adults.

A quality of life study by Waliczek et al. (2005) also found a larger percentage of gardeners disagreed with this statement, leading to the conclusion that gardeners may find more happiness from slowing down to observe the little things. Results of a study looking at motivation for gardening suggests that appreciation for nature was significant motivation and nature uses along with social uses of the yard were associated with satisfaction (Clayton, 2007).

Additional statistically significant differences between gardeners and nongardeners were noted in the energy level statement, "I feel old and somewhat tired" (p=0.004) (Fig. 4). Gardeners disagreed with the statement at a rate of 70.9%, while nongardeners disagreed at a rate of 57.3%.

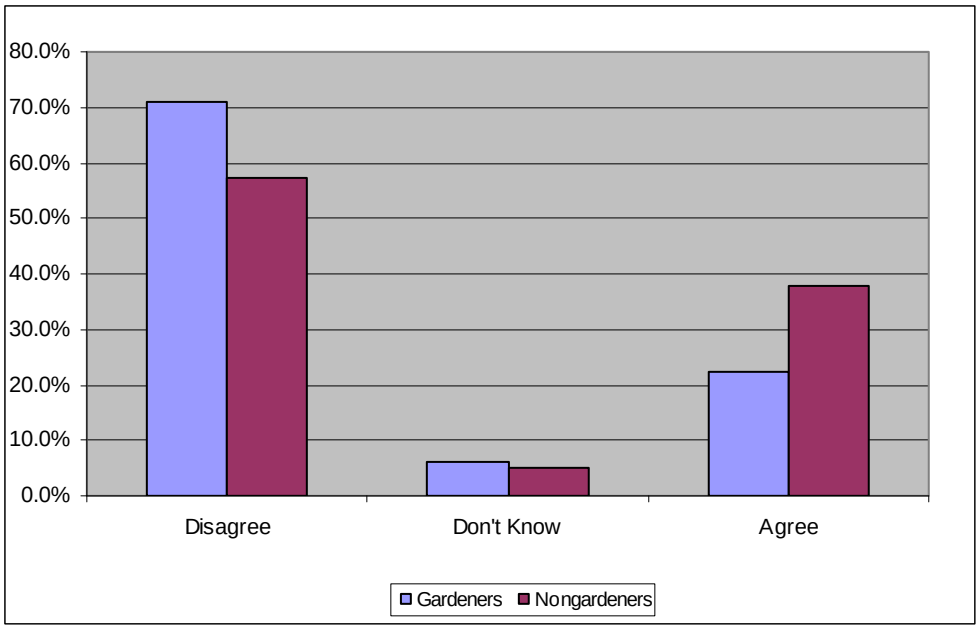

Fig. 4. Statistically significant comparisons (statistically significant at p=0.05) of gardeners' and nongardeners' responses (disagree, don't know, agree) to the statement "I feel old and somewhat tired" in the study evaluating the effects of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Statistically significant differences between gardeners and nongardeners were noted on responses to how participants rated their normal daily physical activity (p=0.000) (Fig. 5). Over three times as many nongardeners considered themselves to be quite inactive (14.71%), compared to gardeners (4.43%). In turn, 38% of gardeners considered themselves to be very active compared to only 19.6% of nongardeners. These data are similar to Waliczek et al.'s (2005) study where almost twice as many nongardeners considered themselves to be quite inactive when compared to gardeners, and 25% of gardeners considered themselves to be quite active compared to only 18.5% of nongardeners.

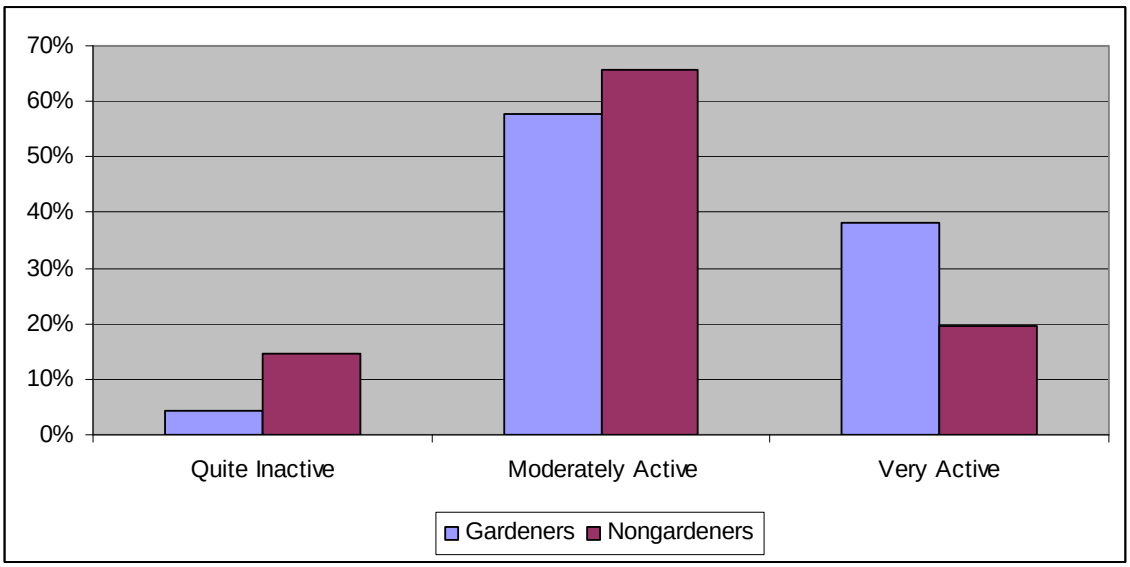

Fig.5. Statistically significant comparisons (statistically significant at p=0.05) of gardeners' and nongardeners' responses (quite inactive, moderately active, very active) to a statement regarding physical activity in a usual day in the study evaluating the effects of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Light to moderate physical activity demonstrates benefits for cardiovascular and all-cause mortality and is linked to a higher consumption of fruits and vegetables in older adults (Mummery et al., 2007; Sahyoun et al., 2005; Wannamethee and Sharper, 2001). Better nutritional habits (including higher consumption of fruit and vegetables) were obvious in the statistical differences reported by gardeners compared to nongardeners when asked to rate their overall health on a scale of "poor" to "excellent" (p=0.005) (Fig. 6). More gardeners rated their health as "very good" (39.1%) or "excellent" (36.5%), when compared to nongardeners (36.9% and 26.2%). Gardeners are inclined to eat more fruits and vegetables because of exposure--past and present (Devine et al., 1999). This in conjunction with higher physical activity results in healthier

lifestyles and increased quality of life (Blanchard et al., 2004; CDC, 2007a; Lancaster, 2004). Gardening as a leisure activity has been linked to a more positive quality of life (Waliczek et al., 2005).

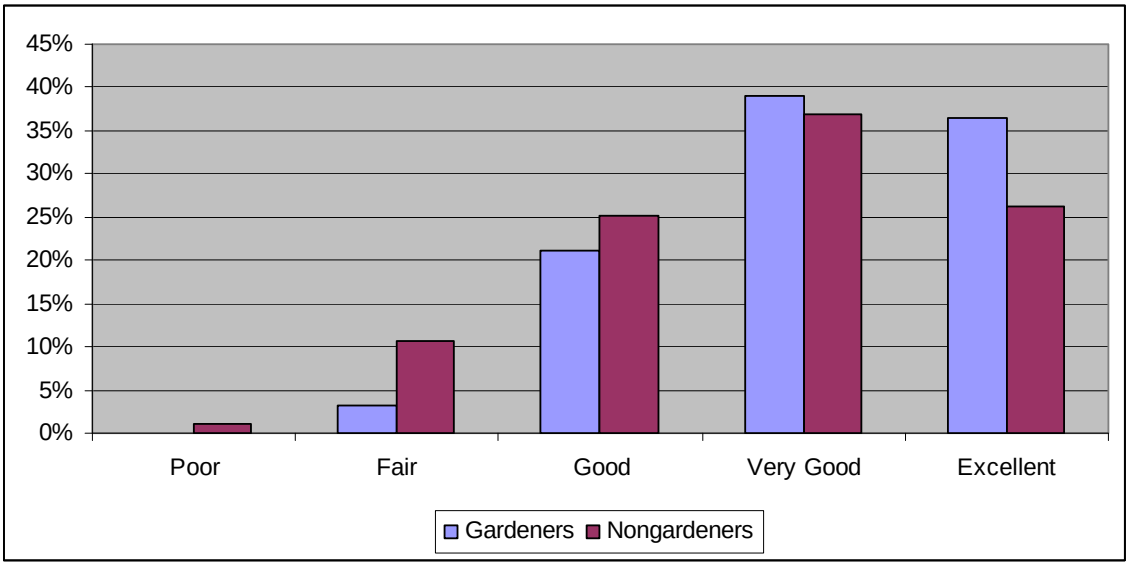

Fig. 6. Statistically significant comparisons (statistically significant at p=0.05) of gardeners' and nongardeners' responses (poor, fair, good, very good, excellent) to the statement "Rate your overall health" in the study evaluating the effects of gardening on life satisfaction, nutritional habits, and obesity of older adults.

The statement "I've gotten pretty much what I expected out of life" also demonstrated statistical significance where gardeners agreed 74.3% of the time compared to 66% of nongardeners (p=0.028) (Fig. 7). Gardens offer a variety of pleasures to growers including exercise, recreation, creativity, friendship, and contact with nature (Ashton-Shaeffer and Constant, 2005; Blair et al., 1991). These reasons for gardening offer a sense of accomplishment when the cycle of life is so visible and rapidly completed during growing seasons or years in the garden (Kaplan, 1973).

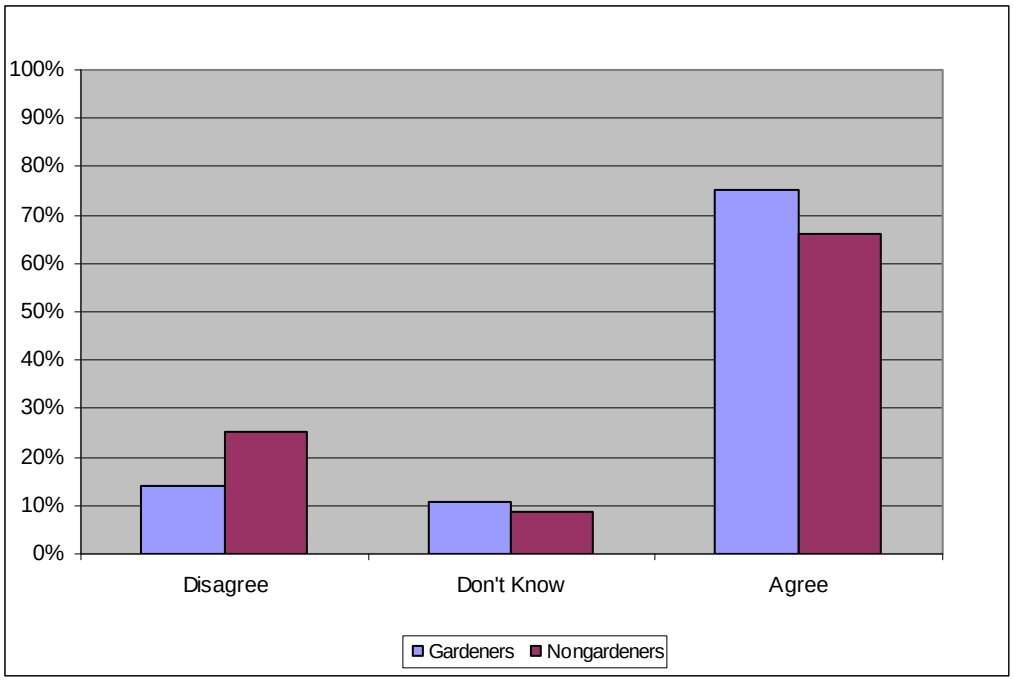

Fig. 7. Statistically significant comparisons (statistically significant at p=0.05) of gardeners' and nongardeners' responses (disagree, don't know, agree) to the statement "I have gotten pretty much what I expected out of life" in the study evaluating the effects of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Gardeners vs. nongardeners nutritional habits comparisons. An analysis of variance indicated significant results in comparisons of nutritional habits of older adult gardeners compared to nongardeners. Monthly consumption of fruits and vegetables was significant (p=0.038) where gardeners consumed approximately 4 more fruits and/or vegetables per month compared to nongardeners (Table 3).

Table 3. Analysis of variance comparisons of gardeners' and nongardeners' overall response scores regarding total monthly fruit and vegetable consumption in the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Category	n	Mean Score [z]	SD	df	F	*P*
Gardeners	145	65.51	15.205	1	4.357	0.038*
Nongardeners	93	61.17	16.308			

[z] Scores range from 0- the lowest possible score to 96-the highest possible score, the greater the score the larger number of fruits and/or vegetables consumed monthly.
* Statistically significant at p=0.05

To help determine if the significant difference in consumption was due to consumption of vegetables, fruits, or a combination of both fruits and vegetables, consumption was analyzed separately. Significant differences (p=0.040) were found in vegetable consumption with gardeners consuming 3 servings of vegetables more per month than nongardeners (Table 4).

Table 4. Analysis of variance comparisons of gardeners' and nongardeners' overall response scores regarding monthly fruit and vegetable[x] consumption when the 2 categories are split into individual headings in the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Category	n	Mean Score	SD	df	F	*P*
Vegetable Consumption [z]						
Gardeners	148	44.07	10.587	1	4.274	0.040*
Nongardeners	97	41.05	12.003			
Fruit Consumption [y]						
Gardeners	155	21.20	6.597	1	1.511	0.220
Nongardeners	99	20.16	6.518			

[z] Scores range from 0 to 66, a higher score indicating a greater number of vegetables consumed per month.
[y] Scores range from 0 to 30, the higher the score the greater the number of fruit consumed per month.
[x] Herbs are considered vegetables for the purpose of this study.
* Statistically significant at p=0.05

Gardening did not show a significant increase in regard to the amounts of fruits only consumption for this study. However, both gardeners and nongardeners reported a

high intake of fruits (21 and 20 servings) when taking into account the upper limit for the study was 30 servings (Table 3). Although this study does show significance regarding an increase of consumption for gardeners, it should be noted that the survey only allowed the respondents to choose from a range of 0 to 5+ times per month. Each 5+ was recoded as a 6 in order to analyze averages, and this may not accurately reflect upper levels of consumption. The importance in sufficient intake of vegetable and fruit consumption in adults over the age of 60 has been reported to significantly increase rates of physical activity, leading to a positive association between lifestyle risk factors and physical activity (Mummery et al., 2007). As this study did not address daily consumption of fruits and vegetables it is difficult to draw any correlations to amount of vegetables consumed and meeting the national recommendations set by the U.S. Department of Health and Human Services of 4 to 13 servings per day (CDC, 2007b). Dietary patterns that include higher intakes of fruits and vegetables are consistently associated with reductions in coronary heart disease, stroke, lower blood pressure, and a lower risk of developing type 2 diabetes (Jane Higdon Linus Pauling Institute, 2005; Ness and Powles, 1997). Fruit and vegetable consumption is a practical and important way to reduce disease risk and maximize good health (Van Duyn and Pivonka, 2000).

Gardeners vs. nongardeners Body Mass Index (BMI) comparisons. A measure of body mass index (BMI) was used in this study as a measure of obesity. BMI's take a persons height and weight and provide through the calculation, BMI= (weight in pounds/(height in inches*height in inches))*703, determines that persons BMI. This score falls into one of 4 categories: 1=Underweight, 2=Normal, 3=Overweight,

4=Obese. There were no significant differences in BMI scores between gardeners and nongardeners (Table 5).

Table 5. Calculation of BMI scores for both gardeners and nongardeners in the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Category	N	Mean Score [z]	SD	df	F	*P*
Gardeners	157	2.92	.800	1	0.189	0.664
Nongardeners	103	2.96	.791			

[z] Scores are categorized into the following categories 1=Underweight, 2=Normal, 3=Overweight, 4=Obese. (CDC, 2008)

Both gardeners' and nongardeners' average BMIs were in the range closest to "3", or overweight. This supports other literature that indicated 30% of the older adult population is overweight and another 18% to 25% is obese as determined by BMI score (Thorpe and Ferraro, 2004). However, BMI may not be the best measure of obesity in later life. An overview of literature by Rossner (2001) supported the idea that a BMI score indicating overweight in an older adult population may actually be a sign of good health if it does not exceed 3. Rossner (2001) concluded that BMI scores may not be as accurate of a measure for health issues as waist-hip circumference. Other studies suggest that waist-hip ratios give a more accurate measure for older adults (Kahn et al., 1997; Rossner, 2001), as being slightly overweight tends to be considered a healthful advantage. This advantage can be attributed to adequate nutrition levels (Thorpe and Ferraro, 2004), and/or an absence of serious diseases such as cancer (Andersen et al., 2001; Rossner, 2001).

Gardener data collection and frequencies. Questions in this section were answered by those who selected ‘yes’ in response to the question, “Do you garden?” It was possible for participants to submit the survey without completing each question in this section resulting in incomplete collection of all gardening data. Frequencies were used to allow for analysis of this data.

Forty-six gardeners answered the question, “How many years have you been gardening.” Answers ranged from 1 to 45 years. Eight (17.3%), gardeners had been gardening for 10 years or less, while 6 (13%) had been gardening for more than 40 years. The largest number of respondents, 26 or 56.5%, had been gardening between 20 to 35 years.

The most commonly reported type of garden was a home garden (83%), followed by container garden (11.3%), and other (5.7%). Community garden plots were not represented in this sample. When asked to select types of plants grown and given the opportunity to select all that apply, 76.5% of respondents reported growing only one type of plant, while 23.5% reported growing two types. No respondents reported growing all three types of plants. Out of the 53 gardeners who answered these questions 51 grew ornamentals (flowers, shrubs, trees, etc.), while 14 grew herbs. No gardeners reported growing fruits and vegetables.

The highest percentage of gardeners (32.7%) spent less than 2 hours a week gardening during the growing season (Table 6). Since light to moderate physical activity for 30 minutes several days a week has been shown to promote good health (Andersen et al., 2001), two hours per week could translate into four 30 minute activity sessions

positively impacting older adults lifestyles. This benefit increases as the amount of time in the garden increases. The next hour increments were selected by 25% of gardeners, who spent 2-4 hours per week, and 21.2% of gardeners who spent 4-6 hours a week gardening during the growing season. Smaller percentages were present as hours gardening increased: however, a substantial percentage (11.5%) of gardeners spent more than 8 hours per week during the growing season gardening.

Table 6. Percentages of hours spent in the garden during the growing season from the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Category	Frequency (no.)	Frequency (%)
<2 hours/week	17	32.7
2-4 hours/week	13	25.0
4-6 hours/week	11	21.2
6-8 hours/week	5	9.6
>8 hours/week	6	11.5

Fifty-three gardeners answered the question “Please mark all of the reasons for which you choose to garden.” There were 7 answer choices including: recreation, cost/convenience, produce quality/nutrition, physical health and exercise, mental health (reduce stress/pride), self expression/self fulfillment, and spiritual reasons/contact with nature. One respondent chose all seven possibilities and eight of the 53 chose only one (Table 7). Most gardeners chose 2 or 3 reasons (45.2%) for gardening which demonstrates how multifaceted the benefits can be.

Table 7. Frequencies and percentages of the number of reasons for which gardeners choose to garden from the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Number of reasons selected for gardening	Frequency (no.)	Frequency (%)
1	8	15.1
2	12	22.6
3	12	22.6
4	10	18.9
5	9	17.0
6	1	1.9
7	1	1.9

Gardeners were able to select “all that apply” when choosing reasons for gardening. Gardeners who responded selected “self expression/self fulfillment” (79.3%) as the most prevalent reason for gardening (Table 8). Other common reasons for gardening included: “recreation” (64.2%), “mental health (reduce stress/pride)” (56.6%), “physical health and exercise” (49.1%), and “spiritual reasons/contact with nature” (49.1%) (Table 8). These results are consistent with other studies reporting reasons for gardening (Ashton-Shaeffer and Constant, 2005; Austin et al., 2006; Blair et al. 1991; Kaplan, 1973). One study found the following reasons for gardening: recreation (21%), mental health (19%), physical health and exercise (17%), produce quality and nutrition (14%), spiritual reasons (including contact with nature) (10%), self expression/self-fulfillment (7%) and cost and convenience (7%) (Blair et al., 1991).

Table 8. Frequencies and percentages of the number of reasons for which gardeners choose to garden from the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Reasons for Gardening	Frequency (no.)	Frequency (%)
Self Expression/Self Fulfillment	42	79.25
Recreation	34	64.15
Mental Health (Reduce Stress/Pride)	30	56.6
Physical Health and Exercise	26	49.06
Spiritual Reasons/ Contact with Nature	26	49.06
Cost/Convenience	5	9.43
Produce Quality/Nutrition	3	5.66

Demographic Differences. The 2 treatment groups were combined to analyze differences due to demographic variables. The only demographic variable that displayed significant differences was gender.

Females were more likely to spend a larger percentage of their budget on fruits and vegetables than males ($p=0.000$). Due to the fact that women are the primary shoppers in most households, they may be more aware of the breakdown of the budget and spend a larger amount of money during a shopping trip (P.T. Lillard, unpublished data). These data supported the finding that males were more likely to eat fruits and vegetables if there was a female in the household (Donkin et al., 1998), since women were more likely to purchase and prepare these foods.

Table 9. Comparison of males and females regarding the percentage of budget spent on the purchase of fruits and vegetables in the study evaluating the influence of gardening on life satisfaction, nutritional habits, and obesity of older adults.

Percent Budget for Fruits and Vegetables	Male		Female	
	Frequency (no.)	Frequency (%)	Frequency (no.)	Frequency (%)
< 5%	5	4.9	3	1.9
5-10%	38	36.9	29	18.8
11-25%	41	39.8	67	43.5
26-50%	16	15.5	48	31.2
>50%	3	2.9	7	4.5

Gender also indicated differences in shopping locations for fruits and vegetables (p=0.045). Men were more likely than women to shop at a farmers market, while women were more likely than men to shop at a produce stand. However, both males and females overwhelmingly reported that they shopped at the supermarket for their fruit and vegetable purchases (85.4% and 85.8%).

About 67% of the women who took the survey answered “yes” to the question “Do you garden?,” while men were closer to 50% (p=0.012). Females also reported a significantly higher LSIA score (35.91), than males (34.63) (p=0.049). This combination of data from females is consistent with data reported earlier connecting gardening, a higher consumption of fruits and vegetables, and more positive quality of life.

Conclusions

This study looked at adults over the age of 50, comparing responses between gardeners and nongardeners. The purpose of this study was to evaluate the relationship between gardening and quality of life, nutritional habits, and obesity of older adults by comparing a population of gardeners to non-gardeners. Specific objectives included: to

determine if older adults who gardened had an increased positive quality of life, to determine if older adults who garden have an increased consumption of fruits and vegetables, and to determine if older adults who garden have a healthier Body Mass Index when compared to nongardeners.

Significantly higher average scores were reported when comparing quality of life of gardeners (36.06) to nongardeners (34.40). These differences in scores indicated that gardeners appeared to have more positive perceptions regarding life satisfaction compared to their nongardening counterparts. These results were strengthened by several studies which also reported gardening to have a positive impact on quality of life (Blair et al., 1991; Boyer et al., 2002; Waliczek et al., 2005). Individual quality of life statements were analyzed and statistically significant differences were found on 20%, or 4 of the 20 life satisfaction questions. Each of these four statements was answered more positively by respondents who gardened. Significant responses included answers to: “I have made plans for things I’ll be doing a month or a year from now,” “Most of the things I do are boring and monotonous,” “I feel old and somewhat tired,” and “I’ve gotten pretty much what I expected out of life.” Gardening has been known to promote positive attitudes in participants while offering them something to look forward to in the future (Shapiro and Kaplan, 1997). Gardening requires patience and planning, a vision for the future, as well as a belief in what some still see as a miracle in the germination of seeds (Lewis, 1996). Gardens offer a variety of pleasures to growers including: exercise, recreation, creativity, friendship, and contact with nature (Ashton-Shaeffer and Constant, 2005; Blair et al., 1991). These reasons for gardening offer a sense of accomplishment

when the cycle of life is so visible and rapidly completed during growing seasons or years in the garden (Kaplan, 1973).

Gardeners also reported a more positive response compared to nongardeners when asked to rate their overall health on a scale of “poor” to “excellent”. More gardeners rated their health as “very good” (39.1%) or “excellent” (36.5%), than nongardeners (36.9% and 26.2%). This could be due to the fact that gardeners reported a more active lifestyle and a higher monthly consumption of fruit and vegetables. Statistically significant differences between gardeners and nongardeners were noted on responses to how participants rated their normal daily physical activity. Over 3 times as many nongardeners considered themselves to be “quite inactive” compared to gardeners. In turn, almost twice the number of gardeners considered themselves to be “very active” compared nongardeners. These data are supported by Waliczek et al.’s (2005) study where gardeners reported significantly higher levels of physical activity. Increased physical activity is important due to the fact that it provides benefits for cardiovascular and all cause mortality and is linked to a higher consumption of fruits and vegetables in older adults (Mummery et al., 2007; Sahyoun et al., 2005; Wannamethee and Sharper, 2001).

Monthly consumption of fruit and vegetable intake comparing gardeners and nongardeners also demonstrated significance. Gardeners reported consumption levels of approximately 4 more fruits and/or vegetables per month compared to nongardeners. Vegetable consumption including herbs was significantly higher in gardeners; however, gardening did not show a significant increase in regard to the amount of fruit

consumption for this study. Dietary patterns that include higher intakes of fruits and vegetables are consistently associated with reductions in coronary heart disease, stroke, lower blood pressure, and a lower risk of developing type 2 diabetes (Jane Higdon Linus Pauling Institute, 2005; Ness and Powles, 1997). Fruit and vegetable consumption is a practical and important way to reduce disease risk and maximize good health (Van Duyn and Pivonka, 2000). Diets that derive most of their energy from plant foods have been proven beneficial countless times (Nestle, 2007), and people who have had ownership of a garden at some point in their lifetime demonstrate a positive association with fruit and vegetable consumption (Devine, 1999).

No significant differences in BMI scores were reported between gardeners and nongardeners: both groups average BMIs were in the range closest to “3”, or overweight. This supports other literature that indicated 30% of the older adult population is overweight as determined by BMI score (Thorpe and Ferraro, 2004).

Concerning time spent gardening, gardeners reported a range from 1 to 45 years with a majority falling into a range of 20-35 years. The most commonly reported type of garden was a home garden, and three quarters of respondents reported growing only one type of plant, ornamentals (flowers, shrubs, trees, etc.). The highest percentage of gardeners spent less than 2 hours a week gardening during the growing season, while some spent more than 8 hours per week. In either case, gardening provided a type of physical exercise that is extremely beneficial in older age promoting healthy lifestyle choices (Andersen et al., 2001; Austin et al., 2006, Bertera, 2003; Yusuf et al., 1996).

Gardeners were asked to select “all that apply” when choosing reasons for gardening. Gardeners who responded selected self expression/self fulfillment (79.25%) as the most prevalent reason for gardening. Other common reasons for gardening included: recreation, mental health (reduce stress/pride), physical health and exercise, and spiritual reasons/contact with nature. These results are consistent with other studies reporting reasons for gardening (Ashton-Shaeffer and Constant, 2005; Blair et al., 1991). As many older adults search for alternative forms of life satisfaction, Kaplan (1973) offers the gardening experience as a fascinating activity with a degree of universality that transcends differing backgrounds.

Females are more likely to spend a larger percentage of their budget on fruits and vegetables than males, and are more likely to garden. Gender also indicated differences in shopping locations for fruits and vegetables; men were more likely than women to shop at a farmers market, while women were more likely than men to shop at a produce stand. Females reported a significantly higher LSIA score (35.91), than males (34.63), which could be due to the fact that more females gardened and gardening was associated with an increased life satisfaction score.

Higher fruit and vegetable consumption in conjunction with higher physical activity levels results in healthier lifestyles and, in turn, an increased quality of life (Blanchard et al., 2004; CDC, 2007a; Lancaster, 2004). The study investigating the effects of gardening on life satisfaction, nutritional habits, and obesity of older adults provides information to help determine if gardening can be used as an effective tool to reduced obesity and/or increase life satisfaction in older adults. Evaluation of these

results helps indicate that gardening programs can be used to assist older adults in achieving their full potential in health as well as life satisfaction. According to Schlettwein-Gsell (1992), “Eating is one of the greatest pleasures in old age and one of the most important ties to life (p. 1265S).” This statement in conjunction with the findings in the study investigating the effects of gardening on life satisfaction, nutritional habits, and obesity of older adults provide evidence that gardeners eat more fruits and vegetables than nongardeners in turn possibly increasing quality of life and health. Concern for ones’ own health as well as those of others, and interest in social life or leisure activities provides incentives for gardening programs to fill social/leisure gaps in many older adult lives while offering nutritional information and availability of fresh produce to improve health. A study by Ashton-Shaeffer and Constant (2005) provided information that gardening is one of United States’ most popular home-based leisure activities with recent growth and the largest group being adults over the age of 65. Quality of life, nutrition, and physical health can all clearly be connected in the garden. Gardening was a necessity in the past for survival, and again can be a necessity in the future for quality of life.

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APPENDIX A

NUTRITION AND LIFE SATISFACTION QUESTIONNAIRE

NUTRITION AND LIFE SATISFACTION QUESTIONNAIRE

Section 1

Quality of Life

SURVEY

As I grow older, things seem better than I thought they would be.

Agree | Disagree | I Don't Know

I have gotten more of the breaks in life than most of the people I know.

Agree | Disagree | I Don't Know

These are the best years of my life.

Agree | Disagree | I Don't Know

I have made plans for things I'll be doing a month or a year from now.

Agree | Disagree | I Don't Know

This is the dreariest time of my life.

Agree | Disagree | I Don't Know

I am just as happy as when I was younger.

Agree | Disagree | I Don't Know

My life could be happier than it is now.

Agree | Disagree | I Don't Know

Most of the things I do are boring and monotonous.

Agree | Disagree | I Don't Know

I expect some interesting and pleasant things to happen to me in the future.

Agree | Disagree | I Don't Know

The things I do are as interesting to me as they ever were.

Agree | Disagree | I Don't Know

I feel old and somewhat tired.

Agree | Disagree | I Don't Know

I feel my age, but it does not bother me.		
☐ Agree	☐ Disagree	☐ I Don't Know
As I look back on my life, I feel fairly satisfied.		
☐ Agree	☐ Disagree	☐ I Don't Know
I would not change my past even if I could.		
☐ Agree	☐ Disagree	☐ I Don't Know
I have enough energy for everyday life.		
☐ Agree	☐ Disagree	☐ I Don't Know
Compared to other people my age, I make a good appearance.		
☐ Agree	☐ Disagree	☐ I Don't Know
When I think back over my life, I didn't get most of the important things I wanted.		
☐ Agree	☐ Disagree	☐ I Don't Know
Compared to other people, I get down in the dumps too often.		
☐ Agree	☐ Disagree	☐ I Don't Know
I've gotten pretty much what I expected out of life.		
☐ Agree	☐ Disagree	☐ I Don't Know
In spite of what people say, most people in the world are, overall, kindhearted.		
☐ Agree	☐ Disagree	☐ I Don't Know

NUTRITION AND LIFE SATISFACTION QUESTIONNAIRE

Section 2

Nutrition

Survey

What is your height in feet and inches?

What is your weight?

Do you suffer from: (check all that apply).

☐ High Blood Pressure	☐ Heart Disease	☐ Gall Bladder Disease	☐ Diabetes	☐ Depression
☐ Osteoarthirits	☐ Sleep Apnea	☐ Heartburn	☐ Stroke	☐ Cancer

How many times do you eat each fruit/vegetable each month?

Peppers	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Tomatoes	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Iceberg Lettuce	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Peas and Beans	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Cole Crops (broccoli, cabbage, collards, etc.)	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Herbs in Quantity	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Potatoes	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Carrots	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5

Fresh Salad Greens	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Sweet corn	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Sweet Potatoes	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Any Fruit	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Sweet Melons	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Citrus and juices	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Bananas	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5
Apples/Pears	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ More than 5

Where do you shop for fruits and vegetables?

☐ Farmer's Market ☐ Supermarket ☐ Produce Stand ☐ Co-op

How often do you shop for fruits and vegetables?

☐ Daily ☐ Weekly ☐ Every other week ☐ Monthly

Do you buy fruits and vegetables primarily:

☐ Fresh ☐ Frozen ☐ Canned

About what percent of your grocery budget is spent on fruits and vegetables?

☐ <5% ☐ 5 - 10% ☐ 11 - 25% ☐ 26 - 50% ☐ >50%

NUTRITION AND LIFE SATISFACTION QUESTIONNAIRE

Section 3

Demographics

Survey

Are you:				
☐ Female	☐ Male			
What is your ethnicity?				
☐ African American		☐ Asian/Pacific Islander		☐ Hispanic
☐ Native American		☐ Caucasian		☐ Other
What is your age group?				
☐ 50 to 59	☐ 60 to 69	☐ 70 to 79	☐ 80 to 89	☐ 90 or older
What is your highest level of education?				
☐ Grade school	☐ Some high school	☐ High school degree/GED		☐ Professional/trade school
☐ Some college	☐ College degree	☐ Post-graduate school/degree		
What is your current living situation?				
☐ Independent living (house, apartment, retirement community)			☐ Assisted living (nursing home)	
How long have you lived in current situation/at current address?				
☐ <1 year	☐ 2 to 5 years	☐ 6 to 9 years	☐ 10 or more years	
Which of the following best describes you?				
☐ Full-time employee	☐ Retired	☐ Part-time employee	☐ Not currently working	☐ Homemaker
Which of the following best describes you?				
☐ Never married	☐ Married	☐ Widowed	☐ Divorced	☐ Other
Rate your overall health:				

☐ Excellent	☐ Very good	☐ Good	☐ Fair	☐ Poor
In your usual day, are you physically:				
☐ Very active	☐ Moderately active	☐ Quite inactive		
What is your annual income?				
☐ <$15,000	☐ $15,000-$29,000	☐ $30,000-$44,000	☐ $45,000-$59,000	
☐ $60,000-$74,000	☐ $75,000-$84,000	☐ $85,000-$94,000	☐ >$95,000	
Do you garden?				
☐ Yes	☐ No			

NUTRITION AND LIFE SATISFACTION QUESTIONNAIRE

Section 4

Gardening

Survey

How many years have you been gardening?

What kind of garden do you have?

- ☐ Home
- ☐ Community plot
- ☐ Container garden
- ☐ Other

What types of plants do you grow? (Please check ALL that apply)

- ☐ Ornamentals (flowers, shrubs, trees, etc.)
- ☐ Vegetables and fruits
- ☐ Herbs

How many hours per week do you spend gardening during the growing season?

- ☐ <2 hours/week
- ☐ 2-4 hours/week
- ☐ 4-6 hours/week
- ☐ 6-8 hours/week
- ☐ >8 hours/week

Please mark ALL of the following reasons for which you choose to garden:

- ☐ Recreation
- ☐ Physical health and exercise
- ☐ Spiritual reasons/Contact with nature
- ☐ Cost/ Convenience
- ☐ Mental health (reduce stress, pride)
- ☐ Produce quality nutrition
- ☐ Self expression/Self-fulfillment

Thank you for completing this survey.

VITA

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