THE EFFECTS OF THREE DIFFERENT EXERCISE MODALITIES UPON BALANCE AND PERCEPTION OF QUALITY OF LIFE IN INDIVIDUALS SEVENTY YEARS OF AGE AND OLDER.

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Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
In partial fulfillment of the
Requirements for the
Degree of
DOCTOR OF EDUCATION
May, 2003

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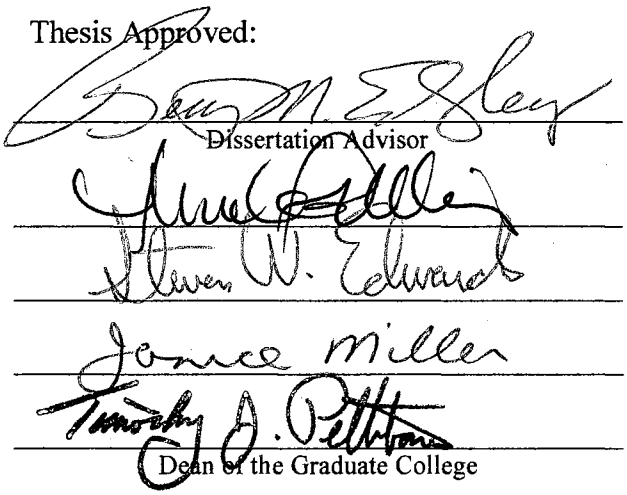
Thesis Approved:



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PREFACE

Success: To laugh often and much,
to win the respect of intelligent
people and the affection of children,
to earn the appreciation of honest
critics and endure the betrayal of
false friends, to appreciate the beauty,
to find the best in others, to leave
the world a bit better, . . . to know
even one life has breathed easier
because you have lived.
This is to have succeeded!

Ralph Waldo Emerson

ACKNOWLEDGEMENTS

Good research usually evolves from an individual's passion for knowledge and understanding. For this researcher the quest for better appreciation about the challenges faced by senior adults stems for the love and respect of one person, my grandmother Reba Crowder. Since I am unable to change the here and now, the hope of this research study was to make an impact on the future.

As with every major quest in life, there are people along the way that make the road worth traveling. These individual's are instrumental in the accomplishment of any type of success and essential during the times of failure. It would be impossible to mention all the people who have made such an impact on me throughout my life, because I have been truly blessed with phenomenal family, friends, colleagues, and mentors. Thank you for being there and pushing me to be all that I can.

Thank you to James Story, his wonderful staff (Lindsey, Anika, Amber, Melissa, Jason, and Butch), Jefferson Gardens, Dr. Patricia Querry, Jane Bowler and Fred Dolan without these dedicated professionals this research would have never taken place. A special

thank you to Steve Howard, Leslie Maas, Brady Redus, Donna Cobb and Karen Dowd; it is nice to have friends you can count on.

Thank you to my committee whose knowledge and expertise help keep me moving forward, even during the times I would have chosen to remain still: Dr. Steve Edwards, Dr. Janice Miller, Dr. Frank Kulling, and the amazing Dr. Betty Edgley (Chair). I could not have asked for a better advisor or committee of individuals who work together to help me succeed; you are all a blessing.

Thank you to the 55 individuals who participated as subjects for the study. You so willingly and graciously let me into your lives; without your generosity, patience, and passion for living this would have never become a reality. I can only hope to do you justice and make you proud, you taught me so much that can never be measured or recorded. God bless you all.

To my family – what can be said? Your patience, love, understanding, unwavering support, gentle pushes, and special hugs are the only reason that I am writing this today. You are my life and my reason for being. Thank you for giving me this time of selfishness. I love you all, Gary, Maddison, Mallory, Mason, and Ginger.

And finally, to my parents Bill and Peggy Ausmus, whose firm belief in "why can't you", has gotten me so far in life. What do you say to two people who have given you the freedom to live and succeed? I can only hope I have the ability to install in my own children the values and knowledge that you gave me. Dad, this may have my name on the title page but it is yours from the first word. This is dedicated to you with respect and thanks; I know that you had to give up finishing your dissertation for us - it is done now, with all my love.

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CHAPTER 1

INTRODUCTION

Overview

The demographics of aging continue to rise each year at an alarming rate. The number of elderly 70 years of age and older has been rising in America and it is projected that the percentage of elderly in the total population will double from 13 percent in the year 2000 to 26 percent in the year 2030 (Federal Interagency Forum, 2000). Life expectancy has also been increasing every year and in the U.S. the average expectancy has reached 75.5 years. The fastest growing segment of the U.S. population is adults over the age of 85 and it is anticipated that by the year 2030 this group will number over nine million (Smolowe & Allis, 1996).

The health care costs associated with the growing elderly population will have an alarming effect on our society. In 1996, the average annual health care expenditures for individuals 65 years to 69 years were $5,864 and for those over 85 years of age expenditures

averaged $16,465 (Federal Interagency Forum, 2000). The cumulative impact of these health care expenditures total over $50 billion annually. These costs alone account for over 30% of the total U.S. healthcare bill (Smolowe & Allis, 1996). With the projected growth in the 85 and older demographic group, the cost of taking care of the elderly population will present a huge burden to the nation unless new knowledge can be employed to ensure that this population will not only live longer but also enjoy better health.

One area of special consideration for elderly adults is the increased risk for falls. The frequency, severity, and health cost implications have been well documented in the literature (Arfken, Lach, Birge, & Miller, 1994; Brown, 1999; Tinetti & Williams, 1998). Approximately 340,000 elderly adults fall each year and one third of that number die as a result of complications related to the falls. There are a variety of factors that are associated with the increased number of falls among the elderly but many researchers agree that loss of balance and poor gait are two key problems (Robertson, Devlin, Gardner, & Campbell, 2001; Tinetti & Williams, 1998).

According to the National Institute of Health, falling is the second leading cause of death in seniors and the number one reason for admittance to the emergency room (Perkin-Carpenter, 2001). Research has begun to focus on how to predict the risk of falls, ways to reduce the probability of falls, and the role of aging and its effects on balance and

mobility in senior adults. As of yet, no one has found a definitive answer on how to address these increasingly costly problems.

Falls occur when an individual engages in activities that result in a loss of balance because the mechanisms that regulate the body fail to compensate for change (Bonder & Wagner, 2001). Senior adults tend to fall more frequently than their younger counterparts and usually while they are completing normal daily living activities such as walking or climbing stairs. Because of this increased likelihood of falls, many senior adults become fearful of falling and up to 45% begin altering or limiting their lifestyles to avoid situations where they could fall (Lachman et al., 1998; Powell & Myers, 1995; Shumway-Cook & Woollacott, 2001). As a result of their inhibitions, the elderly move less and their muscles atrophy, decreasing the motor activity required to stay engaged in society.

The exact reason for the increased likelihood of falls is hard to pinpoint with senior adults because falls may be associated with a combination of many factors. The increased number of falls may indicate underlying problems of both intrinsic and extrinsic factors. Tinetti and Williams (1998) noted that injuries caused by falls are determinants of a decline in functional mobility. Whether this decline in mobility is an inherent effect of aging or a preventable effect, is yet to be determined.

Tinetti and Williams (1998) emphasized the need for more research into reducing the risk of falls in independent dwelling elderly adults. Research needs to address the problems of how to increase balance in senior adults and what preventative measures must be taken to ensure that motor control in the elderly is maintained at a level that decreases their probability of falling. Further investigation is also needed in defining the relationship between perceived quality of life and balance in the elderly population.

Justification

This study attempted to determine the effects of three different exercise modalities upon balance and quality of life in senior adults 70 years old and over. As the numbers of senior adults rise in the United States the results of this study could be useful for understanding and linking both health care cost and the general well-being of this population.

Statement of Problem

The problem of this study is to determine the effects of three different exercise modalities upon balance and perception of quality of life in individuals 70 years of age and older. There were four groups: one group received a 16-week strength intervention program, one group

received a 16-week flexibility intervention program, one group received a 16-week strength/flexibility combination intervention program, and one group served as the control group.

Hypotheses

The following null hypothesis was tested at the .05 level of significance. Investigation of each hypothesis was made on comparison of the strength, flexibility, strength and flexibility and no intervention groups at the pre, mid, and post time periods.

Ho_1: There will be no significant difference in balance scores among the four groups (EG1, EG2, EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period.

Ho_2: There will be no significant difference in the scores of the Medical Outcomes Study's SF-36® (short form) among the four groups (EG1, EG2, EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period.

Ho_3: There will be no significant difference in the scores of the Life Satisfaction Index (LSIZ) among the four groups (EG1, EG2, EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period.

Delimitation

The following delimitations were applied:

1. The subjects were limited to community-dwelling (independent) individuals who were 70 years and older.
2. The subjects were responsible for transportation to and from the facility.
3. The subjects were asked to adhere to an exercise protocol every Monday, Wednesday, and Friday at a senior adult fitness facility.
4. The study intervention program ran for 16 weeks including pre, mid, and post testing.
5. Exercise parameters were determined on an individual basis by an exercise physiologist.
6. Subject's perceptions of quality of life were measured by the SF-36® and the LSIZ instruments.
7. Subject's measure of balance was measured by the Berg Balance Test (BBT).

Limitations

The following limitations were applied:

1. Subjects were volunteers.

2. Pre-existing conditions, medications, and other neurological factors may affect mobility and balance and it is possible that some of these conditions existed even after having physician medical clearance.
3. Daily activities outside the scope of the experimental design were not controlled.
4. The control group was asked not to participate in any activities beyond their normal routine.

Assumptions

The following assumptions were made:

1. Subjects participating in the study understood the questions and instructions of the three assessment tools.
2. All subjects participated to the best of their ability and made every effort to be compliant to the study.
3. All control subjects refrained from activities outside their normal routine.
4. Physical, mental, and environmental factors were unique to each subject.

Definitions

Aerobic utilization of oxygen while exercising

Anaerobic without the immediate utilization of oxygen while exercising

Balance is the ability to maintain the body's center of gravity within the limits of stability as determined by the base of support (Yim-Chiplis & Talbot, 2000 p. 321)

Balance Testing performance-orientation assessment of simple mobility task (Steffen, Hacker, & Mollinger, 2002)

Dynamic Balance automatic postural responses to the disruption of the center of mass position (Blackburn & Voight, 2001, p 30)

Flexibility ability to move a joint through its complete range of motion (ACSM, 2000)

Flexibility Training program devised to increase ability to move joints fluidly through a complete range of motion without injury (Heyward, 2002)

Mobility the ability to successfully manipulate task of daily living

Rated Perceived Exertion a scale used to measure subjective rating of exercise intensity (Heyward, 2002)

Repetitions number of times a specific exercise movement is performed (Heyward, 2002)

Sets number of times a specific number of repetitions of an exercise are repeated (Heyward, 2002)

Senior Adult individual 70 years and older

Strength Training program devised to increase force or tension produced by a muscle or group of muscles (Heyward, 2002)

Trained Fitness Instructors individuals that have a degree in Exercise/Fitness Management or a related area and currently have or are working towards a fitness certification by a nationally recognized organization.

Quality of Life Renwick and Brown's (1996) definition of QOL will be used. QOL is defined as the degree to which a person enjoys the important possibilities of his or her life.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The following sections will review current research in various areas that may affect the rate or frequency of falls in senior adults. The review will focus on a general overview of balance and stability; assessment tools that predict an individual's chances of falling; assessment tools that quantify an individual's perception of their quality of life; and research that has addressed programs developed to decrease an individual's risk of falling. The following will clearly identify the justification for the study.

Balance and stability are commonly taken for granted throughout the human life span with the exception of infancy and the senior years. Because of the decline in ability to maintain balance with aging, researchers are looking more deeply into the definition of the term and the multiple factors that contribute to balance (Yim-Chiplis & Talbot, 2000). Balance is used in association with stability and postural control

and is frequently used to assess individuals with neurological, orthopedic or vestibular deficits (Pollock, Durward, Rowe & Paul, 2000).

Newton's First Law defines balance as the state of an object when the sum of the forces acting on it is zero (Pollock et al., 2000). This definition of balance is commonly used but when used in reference to humans, it becomes ambiguous and unclear. According to Yim-Chiplis and Talbot (2000), human balance is the ability to maintain the body's center of gravity within the limits of stability as determined by the base of support. This ability to remain balanced is largely dependent upon the feedback that the body receives from the vestibular, visual, and proprioceptive systems (Bonder & Wagner, 2001).

In humans, the center of gravity is located in the pelvis and the biomechanical limitations occur when the center of gravity (CoG) moves outside the base of support (BoS). These limitations are called limits of stability or sway angles (Yim-Chiplis & Talbot, 2000). The normal range of motion (ROM) for the sway angle according to Yim-Chiplis and Talbot (2000) is approximately "12.5 degrees of body sway in the anterior-posterior plane and 16 degrees in the lateral plane (p322). Moving outside of these parameters will greatly increase an individual's chance of falling.

During upright stance, the human body's BoS is in the area contained within a perimeter where the feet and the support surface are

in contact. In this instance, the CoG is relatively high and the BoS is relatively small. This combination increases the person's chances for body sway and thus instability (Pollock et al., 2000). Humans by nature are very adaptable to change and the body has an inherent ability to sense any threat to stability and counter the problem with a solution. Humans use muscular activity to counter the force of gravity and prevent themselves from falling. Therefore, people have the ability to control balance and to counter any threats to balance whereas inanimate objects do not (Pollock et al., 2000).

In regards to controlling balance, people are usually challenged the most during three primary events. These events include maintenance of posture while stationary (static balance control), movement between postures (dynamic, functional, or anticipatory balance control), and reaction to an external disturbance (reactive balance control) (Pollock et al., 2000; Yim-Chiplis & Talbot, 2000). To control balance and remain stable without falling, individuals must rely upon a combination of neurological, sensory, and motor reactions to restore the line of gravity within the BoS. Human stability is the 'inherent ability' to remain in or return to homeostasis (balance) (Bonder & Wagner, 2001; Hobeika, 1999; Pollock et al., 2000).

When balance is disturbed, the body falls back on learned strategies, muscle strength, BoS, and other factors to determine exactly what must be done to compensate and return stability to the body (Yim-

Chiplis & Talbot, 2000). Optimal balance throughout an individual's life span depends upon the person's ability to maintain adequate muscle strength and nerve functionality. In the past, it was generally accepted that aging caused these factors to deteriorate and that senior adults were doomed to instability. More recently, investigators have begun looking more deeply into the age-related physiological changes that contribute to poor balance in senior adults and how to prevent their increased risk for falls (Cho & Kamen, 1998; Dayhoff, Suhrheinrich, Wigglesworth, Topp, & Moore, 1998; Gustafson, Noaksson, Kronhed, Moller, & Moller, 2000; Tinetti & Speechley, 1989; Shumway-Cook & Woollacott, 2001; Woollacott, Shumway-Cook, & Nashner, 1986).

Falls happen when the body fails to compensate for the changes that occur either intrinsically or extrinsically and/or when the postural information given is incorrect (Hobeika, 1999). In senior adults, these falls are seen to increase at an alarming rate and it is recognized that the loss of stability may affect the seniors' actual way of life (Arfken, Lach, Birge, & Miller, 1994; Brown, 1999; Shumway-Cook & Woollacott, 2001; Tinetti & Williams, 1998). As the risk for falls increase, the elderly tend to adjust their lifestyles to compensate for the fear of falling and this fear leads to a decrease in their overall quality of life. As the fear of falling increases individuals begin to restrict their activities and social contacts (Lachman et al., 1998; Powell & Myers, 1995). As a result of these restrictions, the elderly move less and the muscles atrophy decreasing

the ability to stay engaged in society. Even though most elderly hope to remain independent until death, inactivity, poor nutrition, and disease work against the aging population and eventually contribute to decreased ability to function (Grove & Spier, 1999).

Arfken et al. (1994) found that among community dwelling senior adults, the fear of falling increases with age. If the women and men are of equal age, the women will express a greater fear towards falling than the men. The study linked an increased fear of falling to a decreased satisfaction of life and increased rates of depression and perception of frailty. The study concluded that more research needs to be conducted in this area and that the need to look at the intervention process is imperative to preventing falls and associated decline in life satisfaction. Tinetti and Williams (1998) supported Arfken et al. (1994) findings; noting that falls and injuries caused by falls are determinants of a decline in functional mobility. Tinetti and Williams (1998) also emphasized the need for further research into reducing the risk of falls in community dwelling elderly adults.

Assessments for Predicting Falls

As aging occurs, people experience a decline in their mobility. This decline has a significant relationship with falling (Edelstein, 1996; Raiche, Hebert, Prince and Corriveau, 2000). Mobility is defined by

O'Sullivan and Schmitz (2001) as an initial movement in a functional pattern where "range of motion is available for movement to occur and there is sufficient motor unit activity to initiate muscle contraction," (p. 207). As the ability to stimulate these motor units declines, the ability of an individual to move is limited and the prevalence of falls increases. Falls are usually defined as unintentional acts of coming to rest on the ground or floor (Agostini, Baker, & Bogardus, 2002 & Robertson & Devlin, 2001). Falls are associated with high health care costs (Robertson & Devlin) and have a profound effect upon physical and psychological health of the elderly. Falls are one of the leading causes of death from injury in the elderly over 65 (Leslie & Pierre, 1999).

Among community-dwelling elderly 30-50% have reported falling at least once in a one-year period of time (Leslie & Pierre, 1999). In the nursing home setting, approximately 50% of the adults have fallen at least once in a year's time and about 10% of those falls resulted in serious injury. The total cost of falls in 1994 for individuals over 65 was approximately $20.2 billion (Agostini et al., 2002). Concern with the rising portion of the total national health care costs incurred by the elderly, researchers have been investigating ways to reduce falls. To accomplish this feat, it first must be determined how to predict the likelihood that a given individual might fall.

Traditional fall prediction tests have concentrated on static and dynamic balance. The focus of static balance is on the maintenance of

posture whereas; dynamic balance focuses on balance during actual movement or shifting of weight. Standardized tests and measures of balance are readily available and must be objectively examined for reliability and validity. There are many functional balance tests, however very few of these tests have been validated as tools to predict falls. Tinetti and Speechley (1988) found that falling is associated with many factors, and of these factors balance and gait are easiest to assess and have good predictability for falls (Protas, Harris, Moch & Ruck, 2000; Raiche et al., 2000).

In 1989, Tinetti and Speechley looked at minimizing the risk of falls in the elderly and found that the goal for preventive strategies should be multifaceted. The strategies should include both assessment and modification. The assessment should have two components: medical evaluation and functional testing. Medical evaluations are used to rule out risk factors that increase the chance of falling such as: proprioceptive dysfunction, musculoskeletal disorders, postural hypotension, effects of medications, and vestibular dysfunction. Functional testing is used to observe and assess the person while they conduct a series of movements.

One functional test that has been validated as a predictor of falls is the Tinetti's *Performance-Oriented Mobility Assessment (POMA IA)* (Lombardi et al., 2001; Protas et al., 2000; Raiche et al., 2000). According to O'Sullivan and Schmitz (2001) the *POMA IA* is a simple,

brief, and reliable (.85 internal reliability) assessment of balance and gait during daily activity. The test scores some items on a 0-2 scale and other items by time. The scale was developed as a predictor of falls among community dwelling elderly and includes both static and dynamic balance components (O'Sullivan & Schmitz, 2001).

Berg Balance Test (BBT) is another static/dynamic test that is easy to administer, simple, and brief. It consists of 14 functional tasks of daily living measured on a 5 point Likert scale (0-4 each for a maximum total score of 56 points). *BBT* was originally developed for elderly who have suffered strokes and has been a very useful tool in predicting falls (Edelstein, 1996; Shumway-Cook et al., 1997). Internal reliability for the *BBT* has been reported as high as .95 (O'Sullivan & Schmitz, 2001). Shumway-Cook et al. reported that when a single cutoff point of 45 was used to differentiate those at risk for falls (≤45) and those not at risk for falls (>45), sensitivity was 55% and specificity were 95% (1997). Sensitivity is used to estimate the number of individuals who were correctly identified for falling and specificity indicates how well the test correctly identifies the absence of disease. Using the same cut-off point, Bogle, Thorbanhn, and Newton (1992) reported 82% and 87% respectively for sensitivity and specificity. If these two studies are combined the overall sensitivity is 64% and specificity is 90% (Riddle & Stratford, 1999)

POMA IA and BBT scales are good tests of mobility because they assess balance activities common to daily living and both are valid predictors of falls within the elderly population (Raiche et al., 2000: Shumway-Cook et al., 1997). Recent information indicates that the *BBT* scale might be slightly easier to administer because it is shorter and has a more sensitive scale (5-point verses 3 point). The BBT has also been shown to have high intrarater and interrater reliability scores (O'Sullivan & Schmitz, 2001). Furthermore, evidence exists to support construct validity and criterion-related validity of test scores for predicting risk of falls for the elderly in a variety of settings (Berg, Wood-Dauphinee, Williams, & Maki, 1992).

Assessment Tools for Measuring Quality of Life

Tools to assess mobility and balance can have a variety of scales that evaluate essentially the same components but in different manners. Measurements to assess quality of life in individuals are no exception to this definitive search for the optimum assessment tool. If anything, the search is made even harder by the fact that researchers disagree on the definition of quality of life (QOL) and also the definitions are value laden through an individual's perception and current "mood".

QOL is typically seen as "how good life is" but it can be conceptualized in many different ways (Renwick & Brown, 1996). To

measure QOL a researcher must first define what area or focus of quality is being investigated. Renwick and Brown's definition of QOL is "the degree to which a person enjoys the important possibilities of his or her life" (p. 17). It is also accepted that QOL is not a single dimension within an individual but rather a collection of dimensions (Lawton, 1997). Finally, the control of QOL has moderating conditions and that it may be judged either outside "('objective', social-normative) or inside ('subjective,' intrapersonal) and that QOL is an attribute neither of the person nor the environment but of the person-environment" (Lawton, p. 45).

There are many areas into which QOL can be divided and thus measured. The scope of this review prohibits addressing all of them so the following concentration will be on QOL aspects of psychological well-being and health-related QOL. Lawton (1997) reviewed quality of life psychological well-being measurement scales and found that Life Satisfaction Index (LSI) (Neugarten, Havighurst, & Tobin, 1961) measures a mix of items addressing both cognitive-based and emotional-based judgments and that the results remain stable over time. Lawton also reviewed health-related QOL and found that Medical Outcomes Study's SF-36® (a short-form QOL measuring 36 physical and mental health items, (Stewart & Ware, 1992; Stewart, Hays, & Ware, 1988) is among the most thorough measurement tools of health-related QOL (Lawton, p. 47).

The original Life Satisfaction Index (LSIA) was developed by Newgarten, Havighurst, and Tobin in 1969 and has been used to measure QOL in older adults. It is a 20 question self-rated instrument that claims to measure life satisfaction in five domains. The domains are: zest for life (optimism); resolution and fortitude (personal responsibility for life); congruence (feels goals have been achieved); self-concept (physical, social, and psychological attributes); and mood tone (happiness) (Hoyt & Creech, 1983; Neugarten et al., 1969). Since 1969 many versions of the LSIA have been designed and been repetitively tested, analyzed, and validated (Adams, 1969; Hoyt & Creech, 1983; Liang, 1984; Lohmann, 1977; Neugarten et al., 1969; Sidney & Shephard, 1976; Stock & Okum, 1982). The following will be a brief descriptive review of the versions of the LSIA and researchers' findings and suggestions.

Adams (1969) found that the LSIA provided a fair estimate of life satisfaction for small town and rural elderly but recommended that two items be omitted from the test and questioned whether the scale actually assessed all five domains of QOL, as stated. Adams' study was the first of many that questioned the ability of the scale to measure in all five domains and suggested that certain questions should be omitted. Wood, Wylie, and Sheafor (1969) recommended a revision of the LSIA called Life Satisfaction Index Z (LSIZ). This scale took the original 20 items down to 13 and dropped from five domains to four. It had a reliability score of .79

to .80 and had good correlation with the original scale (Stock et al., 1982; Wood et al., 1969).

In 1983, Hoyt and Creech upheld the strength of the LSIZ that had been previously found but recommended that only three domains be recognized (congruence, mood tone, and zest for life). They even suggested that the test could be further condensed into possibly eleven or even as few as eight questions. Liang (1984) concurred with the findings of Hoyt and Creech and strengthened the assertion that eleven questions represented the three domains based upon face validity, reliability, and pattern of correlated measurement errors. The data from this study came from the 1974 national survey of 2,797 residents 65 and over and it was found that the correlation ranges of mood tone, zest, and congruence ranged from .669 to .998 and all were significant at the .05 level (Hoyt & Creech, 1983). The shortened 11-question version of the LSI still needs to be validated with a variety of cultures and with different genders and age categories.

As with all measurements used to assess an individual's quality of life the LSIA, the LSIZ, and the newest 11-question version need further investigation and validation. The different versions have all been widely used and correlated with many other scales (Fritz, Farver, Kass, & Hart, 1997) and have the definite advantage of years of data. Lohmann (1977) has investigated construct validity of several standard measures of psychological well-being and concluded that LSIA correlates with almost

all other scales (.6 to.8) and indicated that it contributes to both dimensions of the Lohmann scale for life satisfaction.

The second scale to be reviewed is the Medical Outcomes Study (MOS), 36-item short form (SF-36®). It is much less controversial than the LSI and has been tested in at least 260 clinical settings and translated into 10 foreign languages (Larson, 1997). It is a practical and valid test and has been used in a variety of population settings (Andresen, Gravitt, Aydelotte & Podgorski, 1999; Wiesendanger, Werthmuller, Reuter, & Walach, 2001; Wokenstein, Zeller, Revuz, Ecosse & Leplege, 2001).

The SF-36® measures eight concepts related to health status: physical functioning, role limitations due to physical and emotional problems, social functioning, bodily pain, general mental health, vitality, and general health perceptions. The MOS was originally a 149-item test that was shortened to an 18 to 20-item test. The MOS SF-36® combined the best aspects of both tests and used items that were adapted from instruments that have been in use for 20-40 years (Larson, 1997).

The SF-36® was designed to be a brief survey that could be conducted in about 10 minutes. It has been used on a variety of different populations that include but are not limited to spinal cord injuries, neurofibromatosis, nursing home residents, chronically ill patients, veterans, and the elderly (Andresen et al., 1999; Byles, Higginbotham, Goodger, & Taverner, 2000; Wiesendanger et al., 2001).

Of all these different population studies, the SF-36® has been consistently found to have good reliability and validity.

There are many scales that claim to measure some form of QOL. The challenge is to find what aspect of QOL is most important to investigate and then choose the instrument that has been validated in that area. The nature of the measurement of QOL itself is ambiguous and difficult to ascertain due to the fact that it is subjective in nature, affected by state of mind, varies with situations, and is difficult to define. According to Lawton (1997) it is an illusion that a consensus on QOL exists and that it is best suited to giving users a warm, comfy feeling and no more. However, even with the ambiguity on how to define and measure QOL, assessment tools are available and can be used as a starting point.

Studies Conducted on Increasing Balance/Mobility

The review has focused upon survey/assessment type studies that measure different parameters of mobility and QOL. The assumption is that much of the current research has investigated what is happening in the elderly population or even why certain factors are occurring but the review has yet to address the aspect of studies which intervene and try to make changes occur. It has been widely accepted that exercise training for the elderly should be used to emphasize fitness development, but

more investigators are beginning to realize that maintenance of functional capacity and quality of life are equally as important (Drowatzky & Drowatzky, 1999; Pollock & Graves, 1994).

In the most recent stance of American College of Sports Medicine (ACSM, 2000) for exercise guidelines, ACSM recognizes two forms of fitness, cardiovascular and health-related fitness. Health-related fitness is a relatively new concept that uses a lower intensity than what was previously accepted and focuses on longer durations and higher frequency (Pollock & Graves, 1994). According to Pollock and Graves, the American Heart Association agreed with these health-related guidelines and emphasizes a well-rounded exercise program for all ages.

Pollock and Graves (1994) agree that many of the basic guidelines of exercise prescription that have been developed for younger populations are appropriate for the elderly. The researchers emphasize the need to recognize that elderly are more fragile and more susceptible to fatigue, orthopedic injury, and cardiovascular problems. Because of these issues, exercise prescription for the elderly should be performed at a low to moderate intensity, progress slowly to allow for gradual adaptation and include longer warm up and cool down sessions.

More researchers are beginning to investigate the effects that exercise training has on mobility, balance, and reduction of falls. Wolfson, Whipple, Judge, Amerman, Derby & King (1993) hypothesized that strength and balance training would help to improve functionality in

elderly. This has been upheld in a variety of studies that used exercise intervention methods (Judge et al., 1994; Kronhed, Moller, Olsson & Moller, 2001; Skelton & Dinan, 1999; Worm, Vad, Puggaard, Stovring, Lauritsen & Kragstrup, 2001).

Judge et al., (1994) randomized four groups of 110 subjects with the mean age of 80 into control, resistive training, balance training, and combination resistive/balance. The purpose was to determine the safety and efficiency of a three-month intervention program on the isokinetic strength of the elderly population. They found that resistance training significantly increased isokinetic strength ($F = 21.1$, $P<.001$) in the population but balance training alone did not. Judge et al. concluded that long-term intervention training needs to be conducted to determine if resistive exercises can serve as preventative strategies to maintain independent function.

Kronhed et al. (2001) found similar results in their study of 30 community dwelling participant's 70-75 years of age. In this study the researchers were trying to improve coordination, not muscle strength, so they used a nine-week, two times a week exercise intervention program and justified the length of the program by gains in the compliance and adherence of the participants. They concluded that short-term balance training might affect equilibrium in older adults. Further investigation is needed to determine how long the gains found would endure.

There have been a variety of studies conducted that support the above findings that gains can be made in strength, balance, and mobility (Gustafson et al., 2000; Wolfson et al., 1993; Schmidt & Smyers, 1996; Worm et al., 2001). According to Brown (1999) in her review of exercise intervention programs that attempt to reduce the risk of falls among the elderly, there is not adequate evidence to support a "single" intervention program. She recommended multiple targeted intervention strategies for individuals at risk for falls. Brown and Skelton and Dinan (1999) agreed that not enough evidence exists to support the role that exercise plays in fall management among the elderly.

Summary

The literature reviewed indicates that more investigation needs to be conducted in the area of understanding of the elderly population and the challenges that they face. There has been very little research that incorporates both the assessments of mobility and QOL with an intervention program to reduce falls. Currently, there is good support for assessment tools that measure mobility and QOL as well as the vital role exercise plays in maintaining mobility and reducing the risk of falls in the aging population. But, how all three relate together has not yet been fully explored.

Tinetti and Berg have designed tools to measure balance through functional assessment. Both use functional daily activities for their assessments and have good reliability and validity for predicting the risk for future falls (Raiche et al., 2000: Shumway-Cook et al.). These tools may be a great asset to researchers and practitioners in helping to determine who is at the highest risk for falling, but how this information may be used to decrease risk needs to still be investigated.

One action that must be taken is to encourage aging adults to stay active and strong into their senior years. Research is currently being conducted to determine what activities should be prescribed and how much is needed to decrease the individuals risk for falls but questions remain unanswered. Skeleton and Dinan (1999) summarized many studies that have been conducted on exercise intervention and conclude the studies have been insufficient in length, intensity, frequency, and/or overload to make a meaningful change in a person's physical abilities. Skeleton and Dinan also stress that many other studies have relied upon an individual's recollection of events rather than on actual data collection. Self-reported surveys are a common weakness often found in research that is constrained by finances or time.

For individuals in the field of health promotion, it is essential to investigate ways to reduce falls and improve QOL in the elderly and reduce the astonishing cost of health care. As evident by the literature, more research needs to focus on how to prevent decrease in balance, if

this pattern of aging is changeable, or determine that the cycle is set. Health promotion by definition is the "process of enabling people to increase control over, and to improve, their health" (Renwick & Brown, 1996 p. 15). It is impossible to achieve control over oneself without a clear understanding of the processes and information needed to accomplish the task. According to Hobeika (1999), caregivers should inform and educate the elderly about the cause and effect of the loss of balance; develop a way to provide seniors with access to care and intervention; educate the public of the negative effects of loss of balance and mobility; and encourage people of all ages to begin working early on prevention.

CHAPTER 3

METHODS AND PROCEDURES

Introduction

The purpose of this study was to determine the effects of three different exercise modalities upon balance and perception of quality of life in individuals 70 years of age and over. In the following sections the methods and procedures of the study will be clearly defined. This section will define the subjects of the study; describe the instrumentation used to measure quality of life and balance; describe the major equipment used during the study; outline the preliminary procedures of the study; describe the methods and procedures throughout the study; and briefly discuss the analysis that was used to report the studies findings and conclusions.

Subjects

Volunteer, independent community dwelling individual's 70 years of age and over were the subjects used for this study. The study started

with a total of 55 subjects (43 women and 12 men) with the average age being 79.98 years (N = 55, sample group average = 14). At the time of the post test 38 subjects (28 women and 10 men) were left in the program. The 17 that were not post tested dropped out during the course of the study due to transportation problems, illness, or relocation. Recruitment of subjects was achieved through a newspaper ad placed in the local paper; flyers posted at various assisted living dwellings and community centers; and through the investigator soliciting subjects from a variety of community dwelling facilities. The subjects were healthy individuals who were free from any physical or health impairments that might hinder their performance either during the testing or intervention period. All subjects were willing participants in the three-day a week program for 16-weeks.

Subjects were matched into one of four groups on a volunteer basis. The matches were based upon age, gender, and self reported health status. Match subject design was used instead of random design because of the transportation needs of the subjects. The four groups were: experimental group 1 (EG1) - flexibility program; experimental group 2 (EG2) – strength program; experimental group 3 (EG3) – strength/flexibility combined; and control group (CG) – no interaction program. CG was contacted by the investigator only for the purpose of conducting the pre, mid, and post assessments. They were asked to refrain from making any changes in their exercise status and EG1, EG2,

and EG3 were asked to refrain from any additional exercise programs outside the study. The study ran for a total of 16-weeks including pre, mid, and post testing sessions.

Instrumentation

All subjects were assessed for mobility using the Berg Balance Test (BBT) for balance. The BBT consists of 14 functional tasks of daily living measured on a 5 point Likert scale (0-4 each for a maximum total score of 56 points). It was originally developed for elderly who have suffered strokes and has been used as a tool to predict falls (Edelstein, 1996; Shumway-Cook, Baldwin, Polissar, & Gruber, 1997). Additional information related to the BBT can be found in the review of literature.

Quality of life was assessed on all subjects by using the Life Satisfaction Index (LSIZ) and the Medical Outcomes Study's SF-36® (short form). The LSIZ is a 13-item questionnaire designed to measure health related quality of life and in older populations found to measure life satisfaction (Clark et al., 1997). The SF-36® measures eight concepts related to health status: physical functioning, role limitations due to physical and emotional problems, social functioning, bodily pain, general mental health, vitality, and general health perceptions (Larson, 1997). Additional information related to the LSIZ and SF-36® can be found in the review of literature.

Equipment

FreeMotion™ freestanding plate loaded strength equipment was used for all testing and exercise protocols. FreeMotion™ Strength equipment was designed by Roy Simonson in 1999 and was originally named Ground Zero (Iconfitness, 2003). The philosophy of FreeMotion™ is based upon simulating the motion of the human movement patterns and focused on building strength, stability, balance, and flexibility through replicating human movements (Iconfitness, 2003). The machines used were plate loaded chest, lat, row, shoulder, seated and standing hamstring and quad.

StretchMate Flexibility System™ was used for all flexibility exercise protocols. StretchMate™ is a unique multipurpose piece of equipment designed by Fred Dolan in 1989. The StretchMate™ is designed to assist the human body in restoring, maintaining, and increasing a person's range of motion by giving the individual stretch in all three planes of motion (StretchMate, 2003). The StretchMate™ uses self-adjusting cords to provide optimal tension while allowing an individual to simulate the real world motions.

Preliminary Procedures

The subjects were thoroughly briefed by the investigator on the components of the study and they agreed to voluntarily read, sign, and

complete all the required paper work. The subjects were given a health screening form that included medical history, previous activity, demographic information, and other pertinent subjective information (Appendix A). Next they were asked to read and sign an agreement to participate form (Appendix B), and a physician's release form (Appendix C). All forms had been approved by the Institutional Review Board (IRB) from Oklahoma State University prior to conducting the study.

Once the paper work was completed, the physician release forms were faxed or mailed to the respective physicians. As the forms were returned from the physicians, the investigator screened the forms for any contraindications for exercise as in accordance with ACSM guidelines. Subjects were not allowed to participate if they did not have a signed physicians release form and/or had absolute contraindications to exercise as outlined by ACSM guidelines (2000). Each subject was assigned a folder and all subjects' records were carefully compiled. All folders were stored in the principal investigator office in a locked file cabinet.

The subjects were asked to comply with the study's proceedings. The control group was asked to refrain from changing their "normal" daily activities and to not enter into a formal exercise program until the completion of the 16 weeks. The experimental groups were asked not to change their "normal" daily activities outside the parameters of the

study. Subjects were asked to inform the investigator of any illnesses or changes in their health (acute or chronic) during the study.

The subjects were scheduled for testing times and dates. All tests (pre, mid, and post) were conducted on two consecutive days with two sessions (morning and afternoon) at the fitness facility. The subjects were randomly assigned a testing time and divided into morning or afternoon groups. Every effort was made to maintain the approximate time and testing order for all testing (pre, mid, and post) and all subjects.

Methods and Procedures

On the first day of testing the subjects reported to the fitness facility at 8:00 am (morning session) or 1:00 pm (afternoon session). The first day of testing consisted of all the paper and pencil tests and flexibility testing. Day two of testing included only the strength testing. On both days of testing the subjects were taken through warm up activities (light walking and flexibility) prior to participating in any physical activity.

Every effort was made to ensure that all subjects were assessed in the following order on day one: blood pressure, heart rate, Berg Balance Test (*BBT*) (Appendix D), SF-36® (Appendix E), LSIZ (Appendix F), and flexibility. On day one the subjects were assessed for their current level of flexibility using standardized protocol and a calibrated electric goniometer on week one, week eight, and week 16 of the study. Bilateral

measurements were taken using hip flexion, hip extension, and shoulder abduction. The same trained tester and recorder was used for all three measurements and on all subjects.

The second day of testing consisted of the strength testing using the three repetition maximal (3RM) test. All subjects were warmed up using light aerobic activity (walking) and passive stretches for all major body parts. Once the subjects were properly warmed up they were taken into the workout area and given a brief overview about the equipment, what they were to expect and instructed that they were free to stop the test at any point. Each subject was rotated through the machines going from large to smaller muscle groups (chest press, leg extension, seated row, bicep curl, leg curl, triceps press, and upright row). Each machine was supervised by a trained fitness instructor who had gone through training to correctly conduct a 3 RM with senior adults. Each tester recorded the results of the test, circling the final total and placing their initials next to the test. This procedure ensured that the same tester was used for each test (pre, mid, and post) and that the correct maximal score was used for the final recording.

Each experimental group was assigned a time and date to return to the fitness facility to be given instructions about their activity program. On the scheduled day the investigator and the trained fitness instructors greeted the groups and demonstrated proper technique/use of the equipment and exercises (EG1 flexibility, EG2 strength & EG3 strength &

flexibility). The individuals were taken through each exercise by the investigator or fitness supervisor. Based upon the subjects' results on the 3 RM test, their weights/activities were set at levels that the individual could comfortably complete in one set of 10-15 repetitions. All daily activities were recorded by the investigator or the trained fitness instructors with additional comments about progression or problems. The record of what the subjects lifted, along with the fitness instructors comments were used weekly to determine how to correctly progress the subjects in their exercise program.

Each experimental group was treated the same except for the instruction of exercises/equipment. The subjects were reminded that they were free to quit the exercises or the study at anytime and to report any changes in their health status to the investigator or fitness instructor. If the subject reported changes in their health status, the trained fitness instructors were asked not to allow them to participate in the exercises. The subject was then reevaluated for their programs by the investigator or doctor (whichever was appropriate) before they could resume their exercise program. The subjects were given their activity schedule and encouraged to adhere to the three times a week activity program.

During the 16-week study there were no changes in the scheduled times and dates except to allow for the mid (eight) and post (16) week

assessments. Heart rate and blood pressure were assessed at the beginning of each exercise session for EG1, EG2, and EG3.

During the 16-week intervention period EG1 was taken through a series of full body flexibility exercises using the StretchMate Flexibility System™. Three fitness instructors were personally trained by the designer of the StretchMate to conduct the individualized stretches on the subjects during the study. The stretches were individualized and in accordance with ACSM flexibility guidelines. Progression was slow and gradual and based upon the subjects daily results and their verbal input.

During the 16-week intervention period the EG2 group was conditioned with FreeMotion™ plated loaded machines for all major body parts. The exercises were individualized for each person based upon their 3 RM test conducted on week one, week eight, and week 16. The tests were conducted by the same testers for each of the testing periods (pre, mid, and post). The 3 RM tests and daily exercises included but were not limited to chest press, leg extension, leg flexion, lat pull-down, bicep curl, upright row and triceps extension.

The investigator or fitness instructor took each subject through all the exercises to ensure that proper technique was used and that the program was individualize to accommodate the subjects' present level of strength and needs. Each exercise session lasted between 10-50 minutes and was progressive in nature throughout the 16-week period of

time. Careful consideration was given not to overload the individuals or progress them too quickly.

During the 16-week intervention period the EG3 group was conditioned with FreeMotion™™™ plate loaded machines for all major body parts similar to EG2 and taken through a series of full body flexibility exercises using the StretchMate Flexibility System™ similar to EG1. Every session the group went through strength training first then flexibility training. Slow progressive overload was used with the subjects and they received the same instruction and monitoring as the other two groups (EG1 & EG2).

Each program for EG1, EG2, & EG3 consisted of three segments – warm-up, activity, and cool-down. Warm-up included a combination of slow progressive aerobic activity and range of motion exercises. The exercises were used to enhance blood flow and prepare the subjects for the activity portion of the workout. Cool-down consisted of progressively decrease activity, range of motion exercises, and deep breathing. Heart rate and blood pressure were checked prior to exercise.

Analysis

A 4 X 3 mixed ANOVA design was used to identify whether significant differences occurred in each measurement (LSIZ, SF-36®, & Berg). Statistical significance was set at an alpha level of $p < .05$ level. Data were analyzed with SPSS 11.5, among pre, mid, and post

measurements and between four groups (EG1, EG2, EG3 and CG) on all three measurements (LSIZ, SF-36®, and Berg). Significance F values were obtained so appropriate post hoc procedures were used to explore the significant results.

CHAPTER 4

RESULTS AND DISCUSSION

Introduction and Descriptive Data

This chapter reports on the data analysis of the study at pre, mid, and post test and then discusses the results that were significant to the stated hypothesis. The intended purpose of the study was to determine the effects of three different exercise modalities upon balance and quality of life in senior adults 70 years old and over. The four groups were experimental group one (EG1) who received a 16-week strength intervention program, experimental group two (EG2) who received a 16-week flexibility intervention program, experimental group three (EG3) who received a 16-week strength/flexibility combination intervention program, and control group (CG) who received no intervention.

Pre, mid, and post data was collected on the four groups during the 16-week study. Participants were administered two tests that assessed the subjects' perception of quality of life (SF-36® and LSIZ) and one physical test of balance (Berg Balance Test [BBT]). The study began

with a total of 55 (N = 55, n group mean = 14) subjects (43 women and 12 men) with the mean ± standard deviation of age being 79.98 (±7.641) years (Table I & II and Figures 1 & 2).

TABLE I

Total subjects (N) and group (n) Descriptive Statistics

Group	Mean Age	N	Std. Deviation	Percent
Control	79.33	12	8.721	21.8
Strength	81.73	15	8.903	27.3
Flexibility	81.87	15	6.833	27.3
Combination	76.38	13	6.279	23.6
Total	79.98	55	7.641	100.0

TABLE II

GENDER FREQUENCY

	Frequency	Percent
Male	12	21.8
Female	43	78.2

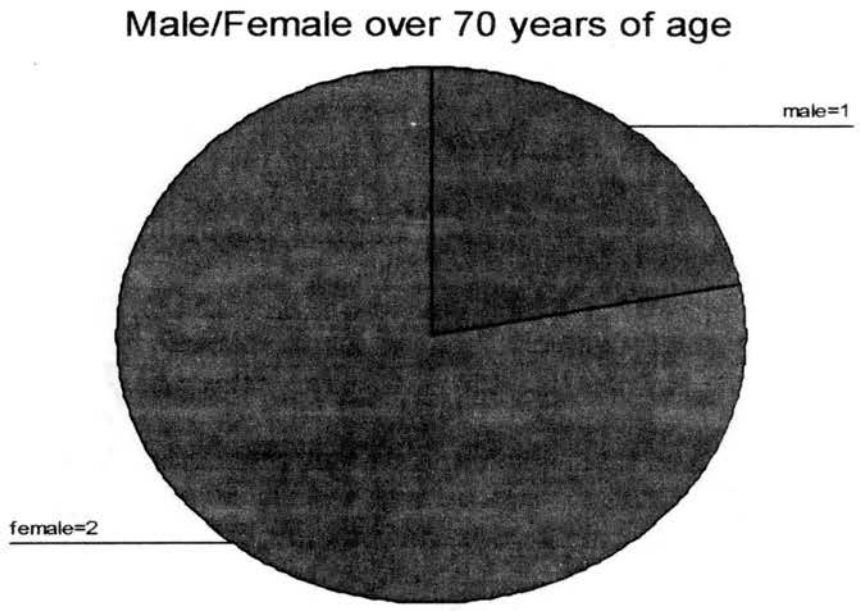


Figure 1: Pie graph of gender frequency

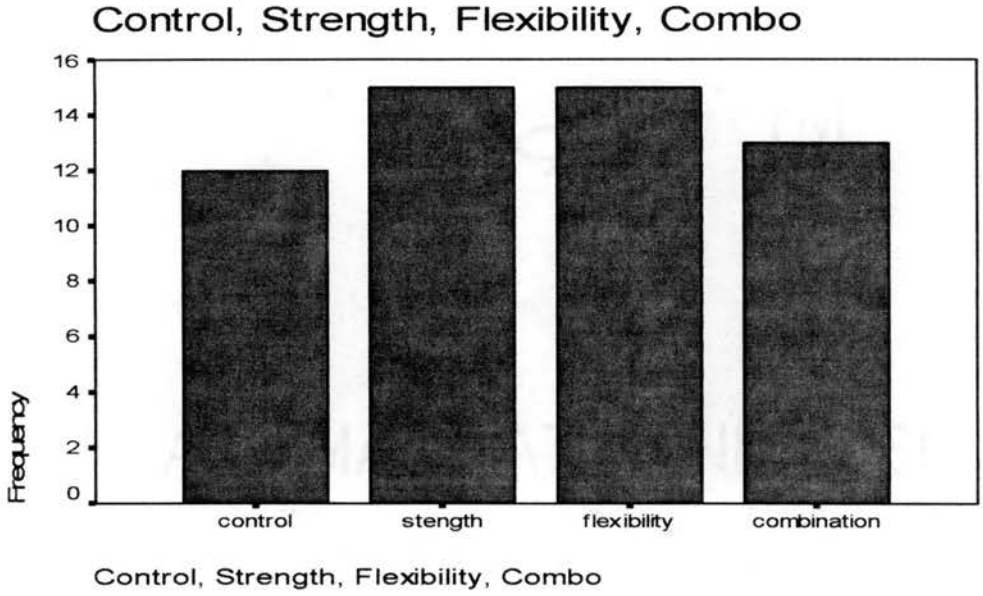


Figure 2: Bar graph of group frequency

The hypothesis in this study focused upon the pre, mid and post test data of the instrumentation used (BBT, LSIZ & SF-36®). However,

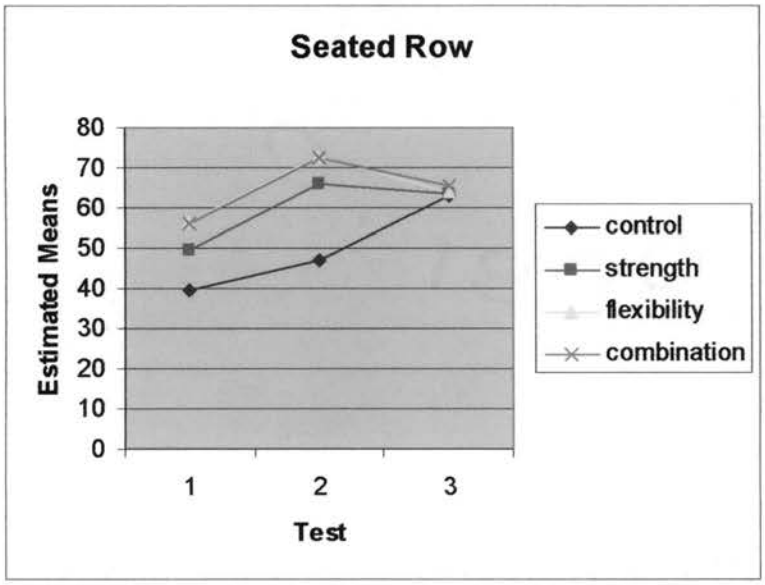
before the findings of the hypotheses are summarized it is important to note the participant changes that occurred among the exercise protocols of strength (EG1), flexibility (EG2), and combining both strength training and flexibility (EG3) training. All subjects were pre, mid and post tested for strength and flexibility. Repeated measure ANOVA's were conducted on each test for flexibility (six total) and for strength (eight total). Tukey post hoc tests were run if statistical significance was found at the .05 level.

The flexibility results revealed very few overall changes in the participant's flexibility either over time or between the groups. Left shoulder abduction indicated that there was statistical significance between the groups ($p = .013$) and the Tukey post hoc test showed that EG1 had significant changes in their left shoulder abduction when compared to the CG and EG3.

With right hip extension ($p = .002$) and right hip flexion ($p = .000$) there was a main effect within the parameters of time. However, the Tukey post hoc test revealed no further significance. There was no significant changes within the pre, mid and post test times or between the groups with right shoulder abduction, left hip extension, or left hip flexion.

Three-rep maximum strength tests were conducted for the nine measures of strength at pre, mid and post assessment times. Repeated measure 4 x 3 ANOVA's were run for each and based on the results,

Tukey post hoc test were conducted when appropriate. Seated row (p = .000), chest press (p = 000), left leg extension (p = .000), right leg extension (p = .000), bicep curl (p = .000), right leg curl (p = .000), left leg curl (p = .000) tricep extension (p = .000), and upright row (p = .000) all evidenced main effects of changes over time of the test. Figure 3 below shows a typical example of the strength test changes over the pre, mid and post testing time. As indicated above flexibility and strength altered somewhat over the length of the study but the changes could not necessarily be directed towards a specific exercise protocol.



* 1 = pre, 2 = mid and 3 = post test

Figure 3: Seated row estimated means graph of groups over time

Hypothesis

Three hypotheses were tested to determine if there were significant differences between the four groups and within each group over time. Repeated measures of analysis (ANOVA) were used to analyze the treatment effects and Tukey HSD was used for post hoc test assessment.

The following null hypotheses were tested at the .05 level of significance. Investigation of each hypothesis was made on comparison of the strength, flexibility, strength and flexibility (combination) and no intervention groups at the pre, mid, and post time periods.

Results of Hypothesis 1

Ho_1: There will be no significant difference in balance scores among the four groups (EG1, EG2, EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period.

The BBT is a functional balance test with 14 subtest performed in a standard order (Bogle Thorbahn & Newton, 1996). Each task is scored on a zero to four scale according to the quality of performance by the subject. The maximum score for the BBT is 56 and individuals who score below 45 points have a higher probability of being impaired and are at an increase risk for falls (Berg, Wood-Dauphinee, Williams, & Maki,

1992; Bogle Thorbahn & Newton, 1996). The means and standard deviations for the BBT can be seen in Appendix G, Table X.

A 4 x 3 measures ANOVA was conducted using the Berg Balance Test (BBT). The ANOVA tested for any main effects found during the 16 week study on the parameters of testing times (pre, mid, and post) and groups (EG1, EG2, EG3, and CG). The ANOVA was also used to analyze if there was an interaction between testing times and group. The results are shown in Table III.

This ANOVA revealed that significance was found for the main effect of time at ($F = 14.152$, $df = 2$, $p = .000$). There was no significant difference at the $p < .05$ between the groups ($F = 1.558$, $df = 3$, $p = .220$) or between the groups over time ($F = 1.190$, $df = 6$, $p = .324$). A Tukey HSD post hoc test was run for the time main effect and Bonferroni was used to adjust for the multiple comparisons. The results revealed that there was a significant difference between the pre test when compared to the mid test ($p = .004$); pre test when compared to the post test ($p = .001$); and the mid test when compared to the post test ($p = .005$). Consequently, the BBT was statistically significant across pre, mid and post test (see Table IV for post hoc results), so the overall null hypothesis was rejected.

TABLE III

BBT 4 X 3 REPEATED MEASURES ANOVA TABLE

Source	SS	df	MS	F
Group	1373.724	3	457.908	1.558
S/G	8816.590	30	293.886	
Time	855.568	2	786.079	14.152*
Group X Time	215.768	6	35.961	1.190
Time x S/G	1813.624	60	30.227	

*significant at p < .05 level

TABLE IV

BBT TUKEY HSD POST HOC RESULT TABLE

TIME	TIME	Mean Difference [a]
PRE	MID	*-5.310
	POST	*-7.046
MID	PRE	*5.310
	POST	*-1.736
POST	PRE	*7.046
	MID	*1.736

* The mean difference is significant at the .05 level.
[a] Adjustment for multiple comparison: Bonferroni

Results of Hypothesis 2

Ho_1: There will be no significant difference in the scores of the Medical Outcomes Study SF-36® (short form) among the four groups (EG1, EG2,

EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period.

The SF-36® form is a health status survey that measures a range of physical and mental health related items. It specifically addresses eight specific areas health which include: bodily pain, physical function, role limitations due to health or emotional issues, general health, vitality, social functioning, and general mental health (Clark et al., 1997). The means and standard deviations for the SF-36® can be seen in Appendix H, Table XI.

A 4 x 3 measures ANOVA was conducted using the SF-36®. The ANOVA tested for any main effects found during the 16 week study on the parameters of testing times (pre, mid, and post) and groups (EG1, EG2, EG3, and CG). The ANOVA was also used to analyze if there was any interaction between the testing times and the groups. The results are seen in Table V.

This ANOVA revealed that significance was found for the main effect of time at ($F = 362.918$, $df = 2$, $p = .000$). There was no significant difference at $p < .05$ between the groups ($F = .349$, $df = 3$, $p = .790$) or between the groups over time ($F = 4.883$, $df = 6$, $p = .909$). A Tukey HSD post hoc test was run for the time main effect which revealed that there was a significant difference between the pre test health scores when compared to the post test scores ($p = .001$) and between mid test when compared to the post test ($p = .001$); but not between pre test scores

when compared to the mid test scores (p = 1.00). Consequently, the significant differences between pre, mid and post test were restricted to difference between the pre and post test times, and between the mid and post test times (see Table VI below for post hoc results). The overall null hypothesis was rejected.

TABLE V

SF-36® *4 X 3 REPEATED MEASURES ANOVA TABLE*

Source	SS	df	MS	F
Group	2074.369	3	691.456	.349
S/G	98941.657	50	1976.833	
Time	10142.716	2	5071.358	*362.918
Group X Time	29.297	6	4.883	.349
Time x S/G	1397.382	100	13.974	

*significant at p < .05 level

TABLE VI

SF-36® *TUKEY HSD POST HOC RESULT TABLE*

TIME	TIME	Mean Difference
PRE	MID	.0000
	POST	*-16.8450
MID	PRE	.0000
	POST	*-16.8450
POST	PRE	*16.8450
	MID	*16.8450

* The mean difference is significant at the .05 level.
1 = pre test, 2 = mid test and 3 = post test

Results of Hypothesis 3

Ho_1: There will be no significant difference in the scores of the Life Satisfaction Index (LSIZ) among the four groups (EG1, EG2, EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period.

The LSIZ is a 13 item health related questionnaire designed to measure life satisfaction in older adults (Clark et al., 1997). The participants rate their perception of each question based on a scale that ranges from zero (low satisfaction) to four (high satisfaction). The total scores were used for the following statistical analysis and the means and standard deviations for the LSIZ can be seen in Appendix I, Table XII.

A 4 x 3 mixed model ANOVA was conducted using the LSIZ as the dependent variable. The ANOVA tested for main effects found during the 16 week study on the parameters of testing times (pre, mid, and post) and groups (EG1, EG2, EG3, and CG). The ANOVA was also used to determine if there was any interaction between testing time and group. The results are shown in Table VII.

This ANOVA revealed statistical significance for both main effects; time ($F = 7.825$, $df = 2$, $p = .001$) and group ($F = 7.265$, $df = 3$, $p = .000$). There was no significant interactions between group over time ($F = 1504.548$, $df = 6$, $p = 1.900$). A Tukey HSD post hoc test was run for each of the main effects of time and group. The post hoc test for time

indicated that there were significant differences between pre test and post test (p = .001) and mid test and post test (p = .035). There was no statistical significance between pre test and mid test, therefore the significant differences over time were attributed to the differences between pre and post testing times and mid and post testing times.

Post-hoc analysis for the LSIZ revealed that among the groups, there were significant differences between the combination group (EG3) when compared to the other three groups of control (CG; p = .029), strength (EG1; p = .016), and flexibility (EG2; p = .000). Consequently, the significant differences were attributed to the difference between group EG3 and all the other groups (see Table VIII and Table IX for post hoc results). The overall null hypothesis was rejected.

TABLE VII

LSIZ 4 X 3 REPEATED MEASURES ANOVA TABLE

Source	SS	df	MS	F
Group	20373.326	3	6791.109	*7.265
S/G	47672.947	51	934.764	
Time	12393.374	2	6196.687	*7.825
Group X Time	9027.288	6	1504.548	1.900
Time x S/G	80774.394	102	791.906	

*significant at p < .05 level

TABLE VIII

LSIZ TUKEY HSD POST HOC TIME RESULT TABLE

GROUP	GROUP	Mean Difference [a]
Pre	Mid	-9.018
	Post	*-21.246
Mid	Pre	9.018
	Post	*-12.228
Post	Pre	*21.246
	Mid	*12.228

* The mean difference is significant at the .05 level.

[a] Adjustment for multiple comparison: Bonferroni

TABLE IX

LSIZ TUKEY HSD POST HOC GROUP RESULT TABLE

GROUP	GROUP	Mean Difference [a]
Control	Strength	-.3300
	Flexibility	-9.7611
	Combined	*20.7868
Strength	Control	.3300
	Flexibility	-9.4311
	Combined	*21.1168
Flexibility	Control	9.7611
	Strength	9.4311
	Combined	*30.5479
Combined	Control	*-20.7868
	Strength	*-21.1168
	Flexibility	*-30.5479

* The mean difference is significant at the .05 level.

[a] Adjustment for multiple comparison: Bonferroni

Discussion

This study compared the effect of three different exercise modalities upon senior adults' functional balance (as measured by BBT) and their perception of their quality of life (as measured by LSIZ and SF-36®). This section will further expound on the above findings from the study and compare the studies findings to prior research conducted on senior adults. The purpose will be to identify what exists in the area of balance and perception of quality of life with senior adults and help to formulate areas of investigation for future studies.

Repeated measures ANOVA's were used on all three hypotheses and when appropriate Tukey post hoc tests were used to further investigate any statistical significance. All three hypotheses were significant over time and the LSIZ revealed significance between the groups. The study was conducted to see if any of the exercise protocols used could enhance an individual's balance and/or enhance their perception of quality of life. The results indicate that changes did occur but there was not enough support to attribute the changes to a particular exercise protocol.

Functional balance was measured using the assessment tool of BBT. The statistical analysis revealed that there were no significant changes between the groups but within the testing times of pre test to mid and post test and mid test to post test, the subjects were able to

improve their ability to balance. This might indicate that there was a learning affect with the instrumentation since all groups, including the control group, improved over the 16 week period of time. It might also indicate that the instrument was not sensitive enough to measure the differences in "healthy active" senior adults. The majority of subjects in this study were mobile and active before beginning (only four to five subjects began the study with walking aids), so there was little room for improvement, even within the CG.

Another factor the BBT can not account for is motivation of the subjects. These individuals were very competitive in nature and even though they were asked not to practice the test or ask other participants how they did, it would be hard to not consider motivation and competitiveness as a factor which might have aided in their balance assessment over time. The BBT is a good functional tool for balance and has the ability to give some baseline information.

The subjects felt that their balance increased and all three exercise groups attributed the improvement they saw in their ability to meet their daily activities to their individual exercise programs. What this probably implies is that it is imperative for senior adults' to stay engaged in activity to maintain or improve their balance; but it is unclear if the improvements can be attributed to exercises, motivation or social engagement.

In previous studies (Bogle Thorbahn & Newton, 1996; Shumway-Cook et al., 1997; Yardley & Smith, 2002) the BBT has been used to predict future falls in the senior adults however, in this study it was used as an assessment tool to measure functional balance. The significance of the results may be more important not in the fact that one group did not perform better than another group; but that there were changes that occurred over time. Rubenstein, Robbins, Josephson, Schulman and Osterweil (1990), found that intervention programs decreased the probability of falls in senior adults by 9.3% when compared to a control group. More importantly however, their study indicated that the intervention programs reduced the participants overall time spent hospitalized.

As with this study, other studies which have tried to link improvements in physical strength to improvements in balance, have not revealed significant changes (Judge et al., 1994; Ringsberg, Gerdhem, Johansson, & Obrant, 1999). Based upon these results it is hard to determine if there is no vital link between strength and balance or if the assessment tools are not sensitive enough to detect changes. Previous studies have used very simplistic assessment tools (a simple chair rise test, Judge et al., 1994; a one-leg standing test, Ringsberg et al., 1999) to test for functional balance.

The findings of this study are in accordance with Piotrowski Brown (1999) summarization of studies conducted on exercise intervention

programs. She summarized that there is inadequate evidence to support a precise intervention program to reduce falls and improve balance but that balance exercises, aerobics and strength training may help. She also concluded that general exercises may lack enough specificity for fall prevention and perhaps programs need to include specific balance training exercises. Silverman (1998) concluded that Tai Chi might be one of those specific programs needed to improve dynamic balance control. In his study there were significant changes in overall time on maintaining balance and slight decreases in the frequency of losing balance.

The SF-36® indicated that all groups had significant increases in their perception of quality of life (mental and physical) over the 16 week period of time. Once again, external factors must be investigated for the cause of change, not just the exercise protocols because CG also improved. The CG in this study consisted of highly engaged individuals who were very inquisitive into the entire research project. They were educated, socially active and extremely independent as a group. These factors could attribute to the changes in their perception of quality of life. Even though the investigator only had physical contact with the CG on the three occasions of testing, they tended to be highly motivated to show improvements upon their test results.

The LSIZ revealed significance in the subjects' perception of quality of life satisfaction over the 16 week period and also a significant interaction

between the groups was found. What was surprising in the interaction between the groups is that the combination group had by far the lowest scores on the LSIZ test. This would seem remarkable and unlikely however, this group had special considerations which could not be accounted for by the test scores. Six out of the final 11 individual's who took the post test had major life changing events occur between mid and post testing times. Three experienced deaths of significant family members, one experienced life-threatening pulmonary embolisms, and the remaining two had acute flare ups of their chronic diseases (rheumatoid arthritis and Meniere's disease).

It is difficult to compare the findings in this study to current research findings on how exercise programs affect an individual's perception of their quality of life because there have been very few if any studies that directly correlate with this study. This study revealed that both the SF-36® and the LSIZ indicated that the subjects' perception of their quality of life had altered significantly over the 16 week period of time. The LSIZ also revealed that there were significant differences between the groups when comparing EG3 to all other groups (CG, EG1 & EG2).

Most studies using indexes for measuring quality of life have focused upon the validity and reliability of the index verses looking for programs to induce changes in the subjects' perception of quality of life (Hawkin, Kim & Eklund, 1995; Schroeder, Nau, Osness, & Potteiger,

1998; Stock & Okun, 1982; Wood et al., 1969). In a study conducted on men and women 60 years of age and older, Sidney and Shepherd (1976) found that even though there were significant physical performance changes in the individuals their perception of quality of life remained unchanged.

In a similar study conducted by Clark et al. (1997) they found that senior adults 60 years and older did increase their LSIZ score ($p = .03$) and their SF-36® score ($p = .05$) after receiving occupational therapy (OT) for nine months. They concluded that OT had significant benefits for the seniors and that preventative health programs might help reduce the health risk of older adults. The findings in this study supported the evidence that changes occur over time however; in Clark et al.'s study the control groups score declined while in this study CG increased their perception of quality of life. (See Appendix J graph of group over time)

As indicated above there were significant findings and changes that were measured by the above instrumentation in the subjects during the 16 week intervention programs. However, there are many changes that individual's in the study reported to the investigator throughout the 16 week sessions that were not measured. Many subjects reported factors like increase time and quality of sleep patterns, better agility and ability to get up out of chairs and out of cars, able to perform daily living activities faster without getting as tired, ability to dress oneself while standing, improved self confidence, better strength and flexibility and

increase satisfaction with their physical ability. One subject was able to do away with her walker after about eight weeks of strength training. Another subject was able to stand unaided for a longer period of time from her wheel chair upon completion of the program.

These findings are difficult to measure and even more difficult to report in a quantitative result however, their importance to the subjects is very significant. Future studies could help find more sensitive instruments to record changes that are important to the individuals' quality of life yet difficult to ascertain. More investigation also needs to be conducted with longer training programs and more subjects. It would help to focus in on exact procedures or regiments that make specific improvement in this senior adult population. Finally, this study's purpose was to add more information to the current findings, knowing that the results are limited to this specific group of individual's and their training routines.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS AND FUTURE DIRECTIONS

Introduction

The purpose of this chapter was to summarize the findings outlined in the previous chapter; discuss the conclusions that were drawn from the study; and make recommendations for future research with senior adults. The findings and conclusions were based upon data gathered in a 16-week research study. The purpose of the study was to determine the effects of three different exercise modalities upon balance and quality of life in senior adults 70 years old and over. The four groups were experimental group one (EG1) who received a 16-week strength intervention program, experimental group two (EG2) who received a 16-week flexibility intervention program, experimental group three (EG3) who received a 16-week strength/flexibility combination intervention program, and control group (CG) who received no intervention.

Pre, mid, and post data was collected on the four groups during the 16-week study. Participants were administered two tests that

assessed the subjects' perception of quality of life (SF-36® and LSIZ) and one functional test of balance (Berg Balance Test [BBT]). The study began with a total of 55 (N = 55, n group mean = 14) subjects (43 women and 12 men) with the mean ± standard deviation of age being 79.98 (±7.641) years.

Summary of Findings

Three hypotheses were tested to determine if there were significant differences between the four groups and within each group over time. Repeated measures of analysis (ANOVA) were used to analyze the treatment effects and Tukey HSD was used for post hoc test assessment.

The following null hypotheses were tested at the .05 level of significance. Investigation of each hypothesis was made on comparison of the strength, flexibility, strength and flexibility and no intervention groups at the pre, mid, and post time periods.

Ho_1: There will be no significant difference in balance scores among the four groups (EG1, EG2, EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period. The null hypothesis was rejected.

Ho_2: There will be no significant difference in the scores of the Medical Outcomes Study's SF-36® (short form) among the four groups (EG1, EG2, EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period. The null hypothesis was rejected.

Ho_3: There will be no significant difference in the scores of the Life Satisfaction Index (LSIZ) among the four groups (EG1, EG2, EG3, & CG) at pre, mid, and post time assessments during the 16-week intervention time period. The null hypothesis was rejected.

Conclusions

Based upon the findings in this study it is very probable that the subjects' perception of quality of life and their functional balance altered through out the course of the 16 week period of time. An assumption that might be made based upon these results is that because the subjects improved their perception of quality of life and their functional balance, their overall health care cost may be reduced. However, it is also very probable that the subjects in the study altered in various areas of their lives (e.g., activities of daily living, body image, socialization, etc.) that were not being assessed or are unable to be assessed with the current measuring tools available.

The ultimate goal of anyone working with the senior adult population would be to improve their quality of life by restoring confidence in their ability to be mobile. Too many of these people are currently receiving inappropriate or ineffective care because there is so little knowledge available. The nature, cause and treatment of balance and mobility problems are unclear but the ability to make a difference in

the lives of the elderly either on short-term or long-term bases is a reality.

These findings should be beneficial to remind all researchers that instrumentations are excellent devices of quantifying individual's data for comparisons however, when working with human subjects a researcher must never look only at the numbers. It is imperative to listen to the individuals and when working with senior adults never underestimate the power of competition and social engagement. It becomes clear that senior adults need to remain actively engaged in life both physically and mentally so to maintain or counter the natural progression of ageing.

Recommendations for Future Studies

Even though this study did not reveal any interactions between the groups over time, it is evident that more research needs to be conducted with the senior adult population. There is very little conclusion data using the senior adult population in regards to accurate measures of quality of life and how perceptions can affect health and well-being. With the senior adult population growing and health care cost escalating; any light that can be shed upon the detrimental side of aging and how it can be prevented would be beneficial to science, as well as, mankind.

1. A similar study needs to be conducted using a larger sampling of males so that gender differences may be addressed.

2. Further investigation into the connection between quality of life and balance with senior adults using a larger sampling size.
3. Continue investigation into instrumentations that are sensitive and accurate for measuring quality of life in senior adults.
4. A more randomized sample of the population and more randomized among the groups.
5. A study that further investigates the probability of falls during and after long term intervention programs.
6. Studies which address cardiovascular training and its effect upon quality of life and balance in senior adults.
7. A longitudinal study using the same intervention programs.
8. Comparisons on the used intervention programs and how they affect activities of daily living in the senior adults.
9. A qualitative study looking at the parameters of improvements that were self-reported by the subjects but were not measured by any instrumentation.
10. A research study that narrows down the exact factors or exercise regiments that can be associated with increase functional balance in the senior adults.
11. How health care cost are affected or altered in various levels of physically active senior adults.

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APPENDIXES

APPENDIX A

HEALTH SCREENING FORM

SUBJECT INFORMATION/ PAR-Q

Personal Information:

Name: _____ Date of Birth:_____ Age:_____
Date:_____

Address: _____ City:_____ Zip:_____

Family Member Contact:_____Phone:_____

Emergency Contact: _____Phone:_____

Physicians Name: _____Phone: _____

1. Are you?
Married_____ Widowed _____ Single_____
Other_____

2. What is your overall self-reported health status?
Excellent____
Very-good_____
Good_____
Fair_____
Poor_____

3. What is your present health compared with your health a year ago?
Much better_____
Better_____
Same_____
Worse_____
Much worse_____

4. Past and Present Personal History (check if applicable)

[] Disease of the heart and arteries
[] Abnormal Electrocardiogram
[] High Blood Pressure
[] Angina Pectoris (chest pain)
[] Epilepsy
[] Stroke
[] Anemia
[] Abnormal Chest x-ray
[] Cancer
[] Asthma
[] Other Lung Disease
[] Orthopedic or muscular problems
[] Diabetes

If any of the above is checked, please explain further and indicate any recommendations your doctor has made regarding exercise.

_____

_____

Reasons to Begin Exercise Program:

[] Cardiovascular Fitness
[] Improve Muscular Strength
[] Improve Muscular Endurance
[] Weight Control
[] Improve Balance
[] Improve Posture
[] Improve Bone Density
[] Improve Diabetes Level
[] Nutritional Awareness
[] Improve Flexibility
[] Stress Release
[] Rehabilitation
[] Increase Energy Level
[] Improve Gait
[] Control Blood Pressure

5. Is there a family history of heart disease, hypertension, stroke, diabetes, heart failure, lung disease, or epilepsy? Yes_____ No_____

If **YES**, Please provide information regarding who the relative is, the medical problem, and the age at onset or death.

_____

_____

6. Physical Parameters

Height_____

Present Weight_____

Desired Weight_____

Most ever Weighed_____ When _____

Least ever Weighed_____ When _____

Weight loss methods tried?

_____

_____

7. Do you currently smoke cigarettes Yes_____ No_____

If **YES**, how many cigarettes per day? _____

If you smoked in the past, when did you quit? _____

8. Are you currently taking medication prescribed by a physician?
Yes_____ No_____

If **YES**, indicate **name** of medication, **dosage**, and **reason why you are taking it**:

_____

_____

9. Please indicate below any additional medical information that you think is important for us to know prior to fitness testing or exercise.

_____

_____

10. Has your doctor ever said that you have a heart condition and recommend only medical approved physical activity?
Yes___ No___

11. Do you have chest pain brought on by physical activity?
Yes____ No____

12. Have you developed chest pain in the past month?
Yes____ No_____

13. Do you lose consciousness or lose your balance as a result of dizziness?
Yes_____ No_____

14. Do you have a bone or joint problem that could be aggravated by the proposed physical activity? Yes____ No____

15. Is your doctor currently prescribing medication for your blood pressure or heart condition (diuretics or water pills)? Yes____ No_____

16. Are you aware, through your own experience or a doctor's advice, of any other reason against your exercising without medical approval?
Yes_____ No_____

Exercise Habits:

Do you exercise on a regular basis? [] Yes [] No

What activities do you engage in on a regular basis?

_____
_____
_____
_____

How many days a week do you exercise or engage in one of the above activities? _____

How many exercises or activities each day do you participate in?

_____

How long (minutes) do you spend during each exercise or activity?

_____

What would you like to achieve from an exercise program?

_____

_____

_____

_____

_____

17. Do you have a bone or joint problem that could be made worse by a change in your normal physical activity?
Yes_____ No_____

18. Have you fallen in the last 6 months?

Yes_____ No_____ If yes, how many times? _____

19. Have you fallen in the last year?

Yes_____ No_____ If yes, how many times? _____

20. Have you been treated by a doctor or take to the hospital as a result of a fall in the last year?

Yes_____ No_____

21. Have you ever fallen and could not get up without assistance?

Yes_____ No_____

22. Do you feel comfortable going out shopping or walking outside without help?

Yes_____ No_____

23. Are you afraid of falling?

Yes_____ No_____

24. Do your fears of falling cause you to change the way you live or cause you to limit your activities?

Yes_____ No_____

25. If you answered yes to the above question please explain how you change your life or limit your activities.

_____

_____

_____

Note:

1. This questionnaire applies only to those 15 years of age and older.
2. If you have a temporary illness, such as fever, or are not feeling well at this time, you may wish to postpone the proposed activity.
3. If you are pregnant, you are advised to consult with your physician before exercising.
4. If there are any changes in your status relative to the above questions, please bring this information to the immediate attention of your fitness professional

I have read, understood and completed this questionnaire.
Any questions that I had were answered to my full satisfaction.

Name:_____

Signature:_____

Date: _____ Witness: _____

APPENDIX B

AGREEMENT TO PARTICIPATE

Agreement to Participate in Research
Balance and Perceived Quality of Life in Women 70 Years of Age and Older

I, _____, agree to participate in the research project conducted by Jamie Hooyman. The data collected during this study will be used by Mrs. Hooyman to fulfill the requirements necessary for the completion of a doctoral program of study in the School of Applied Health and Educational Psychology at Oklahoma State University in Stillwater, Oklahoma.

By agreeing to participate in this study, I agree to the following:

1. To participate in a pre, mid, and post test assessment which includes two questionnaires about my perception of quality of life and one physical assessment for balance.
2. To participate in a three day a week/16 week intervention program that may include muscular strength exercises, flexibility exercises, balance exercises, or no exercises at all (control group).
3. To provide other sources of information that are appropriate and needed (physician release form, health history, medical conditions, etc).
4. To not withhold any information pertinent to symptoms and to inform the researcher/staff immediately if your health conditions changes in any way.
5. Not to exercise when I do not feel well or immediately after eating.
6. To report any unusual symptoms that are experienced before, during, or after exercise to the researcher/staff.

I further understand:

1. Any identifying information collected will remain confidential and that access will be limited to the researcher and the dissertation advisor.
2. All identifying material will be stored separately from data and destroyed by the researcher following the satisfactory completion of the doctoral degree.
3. Prior to presentation in final form, all names will be removed from the data.
4. This research project is being conducted with the intent of contributing to existing research and knowledge regarding balance and quality of life in senior adults.
5. I may ask questions at any time about my program, concerns, or the research study.

General Statement of Research/Program Objectives and Procedures:

I understand that the physical fitness programs include exercises to build the strength, flexibility, and balance. The exercises may include weight training, stretching, range of motion exercises, and balance exercises.

Description of Potential Risks:

I understand that there exists the possibility of certain changes occurring during exercise. These may include blood pressure changes, irregular heart rhythm, fainting, dizziness, muscular injuries, and in rare instances, heart attack, stroke, or death. Every effort will be made to minimize the risk by provisions of careful screening, proper programming, emergency equipment, and trained personal.

Description of Potential Benefits:

I understand that a program of regular exercise for the body can have many benefits associated with it. There is no assurance that the program will increase your muscle strength and endurance or increase your flexibility, mobility, and balance; however, much of the current research indicates these improvements and others may occur.

Understanding:

In understand that participation in this project is voluntary and that at any time during the data collection process I am free to withdraw my consent and participation by notifying Jamie Hooyman.

There will be no cost for my participation in this research. Transportation and travel however will be my responsibility. If any health problems develop during the study, I understand that I am solely responsible for my medical care. This includes but is not limited to medical checkups, medications, hospital visits, surgery, or medical supplies. I understand that the financial burden that may occur during the conduct of this research will rest on my insurance company or myself. If health problems develop during the study, I understand that I will be removed from the remainder of the research.

Should I wish for further information about the research project, I may contact Jamie Hooyman at 405-974-5239 or via email at jhooyman@ucok.edu. I may also contact the dissertation advisor, Dr. Betty Edgley at 405-744-7680 or via email at bedgley@okstate.edu. Questions, concerns, or complaints about the research or subjects' rights should be directed to IRB Executive Secretary, Oklahoma State University Office of Research Compliance, 405-744-5700.

I have read the foregoing information and have complete understanding of it. Any questions that may have occurred to me have been answered to my satisfaction. I also understand that I a free to withdraw consent or discontinue participation in any or all procedures. I have also been informed that the information gathered about me will be keep confidential and not disclosed to anyone other than my physician or others who are involved in my care or exercise prescription without my permission. I agree that the information from the study may be used for research purposes as long as my information is not identifiable to me.

I sign freely and voluntarily. A copy has been given to me as well.

Signature of Participant

_____ _____

Date Time (AM / PM)

I certify that I have personally explained all the element of this form to the participant before asking the participant to sign it.

Signature of Investigator

_____ _____

Date Time (AM / PM)

APPENDIX C

PHYSICIAN'S RELEASE FORM

Medical Release Form

Effects of two different exercise modalities on balance and perceived quality of life in individual's seventy years of age and older

Medical Release Form
for:_____

Jamie Hooyman is conducting a research study about the effect of three exercise modalities on balance and perceived quality of life in women seventy years of age and older. To participate in the study the above individual needs to have a medical release form signed by his/her personal physician. The release would allow participation in a fitness program at Jefferson's Garden Fitness Center. The programs may include strength training on equipment with a weight the participant can comfortably move 10-15 repetitions, flexibility exercises, range of motion exercises and floor/chair exercises that work on increasing balance. The individual will be pre/mid/post tested with two questionnaires about perception of quality of life and one physical assessment for balance (Berg Balance Scale).

The fitness program will be designed for each individual using their medical records and any medical and/or physical restrictions that they may have. Under direction of the researcher and Fitness Coordinator, the fitness programs will be designed and written in accordance with ACSM guidelines. A personal trainer will be assisting and guiding each individual through his or her workout at all times while he or she is in the fitness center.

It would be greatly appreciated if you would please take a few moments to make any recommendations or comments regarding the exercise and fitness program on the attached sheet.

Thank you for your time and assistance and if you have any questions or concerns, please feel free to contact me.

Respectfully,

Jamie Hooyman, Researcher
MS Ed. / Exercise Physiology

Physician Approval Form
Medical Release

Name:_____

Date:_____

Special considerations, limitations,
restrictions:_____

_____

_____

_____

_____

_____

_____

Additional
Comments:_____

_____

_____

_____

_____

_____

Physician's Printed
Name:_____

Physician's
Signature:_____

_____

Physician's Phone Number:_____
Date:_____

Physician's Fax Number:_____

RELEASED FOR ACTIVITY: YES NO

APPENDIX D

BERG BALANCE TEST

BALANCE SCALE*

Name _____ **Date**

Location _____ **Rater** _____

ITEM	DESCRIPTION	SCORE (0-4)
1.	Sitting to standing	_____
2.	Standing unsupported	_____
3.	Sitting unsupported	_____
4.	Standing to sitting	_____
5.	Transfers	_____
6.	Standing with eyes closed	_____
7.	Standing with feet together	_____
8.	Reaching forward with outstretched arm	_____
9.	Retrieving object from floor	_____
10.	Turning to look behind	_____
11.	Turning 360 degrees	_____
12.	Placing alternate foot on stool	_____
13.	Standing with one foot in front	_____
14.	Standing on one foot	_____
	TOTAL	_____

GENERAL INSTRUCTIONS

Please demonstrate each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for specific time. Progressively more points are deducted if the time or distance requirements are not met, if the subject's performance warrants supervision, or if the subject touches an external support or receives assistance from the examiner. Subjects should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing are a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5 and 10 inches (5, 12.5 and 25 cm). Chairs used during testing should be of reasonable height. Either a step or a stool (of average step height) may be used for item #12.

1. **SITTING TO STANDING**

INSTRUCTIONS: Please stand up. Try not to use your hands for support.

( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal aid to stand or to stabilize
( ) 0 needs moderate or maximal assist to stand

2. **STANDING UNSUPPORTED**

INSTRUCTIONS: Please stand for two minutes without holding.

( ) 4 able to stand safely 2 minutes
( ) 3 able to stand 2 minutes with supervision
( ) 2 able to stand 30 seconds unsupported
( ) 1 needs several tries to stand 30 seconds unsupported
( ) 0 unable to stand 30 seconds unassisted

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

3. **SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL**

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

( ) 4 able to sit safely and securely 2 minutes
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support 10 seconds

4. **STANDING TO SITTING**

INSTRUCTIONS: Please sit down.

( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently but has uncontrolled descent
( ) 0 needs assistance to sit

5. **TRANSFERS**

INSTRUCTIONS: Arrange chairs(s) for a pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

( ) 4 able to transfer safely with minor use of hands
( ) 3 able to transfer safely definite need of hands
( ) 2 able to transfer with verbal cueing and/or supervision
( ) 1 needs one person to assist
( ) 0 needs two people to assist or supervise to be safe

6. **STANDING UNSUPPORTED WITH EYES CLOSED**

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays steady
( ) 0 needs help to keep from falling

7. **STANDING UNSUPPORTED WITH FEET TOGETHER**

INSTRUCTIONS: Place your feet together and stand without holding.

( ) 4 able to place feet together independently and stand 1 minute safely
( ) 3 able to place feet together independently and stand for 1 minute with supervision
( ) 2 able to place feet together independently and to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 15 seconds feet together
( ) 0 needs help to attain position and unable to hold for 15 seconds

8. **REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING**

INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that of the finger while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

( ) 4 can reach forward confidently >25 cm (10 inches)
( ) 3 can reach forward >12.5 cm safely (5 inches)
( ) 2 can reach forward >5 cm safely (2 inches)
( ) 1 reaches forward but needs supervision
( ) 0 loses balance while trying/ requires external support

9. **PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION**

INSTRUCTIONS: Pick up the shoe/slipper which is placed in front of your feet.

( ) 4 able to pick up slipper safely and easily
( ) 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5cm (1-2 inches) from slipper and keeps balance independently
( ) 1 unable to pick up and needs supervision while trying
( ) 0 unable to try/needs assist to keep from losing balance or falling

10. **TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING**

INSTRUCTIONS: Turn to look **directly** behind you over toward left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.

( ) 4 looks behind from both sides and weight shifts well
( ) 3 looks behind one side only other side shows less weight shift
( ) 2 turns sideways only but maintains balance
( ) 1 needs supervision when turning
( ) 0 needs assist to keep from losing balance or falling

11. **TURN 360 DEGREES**

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

( ) 4 able to turn 360 degrees safely in 4 seconds or less
( ) 3 able to turn 360 degrees safely one side only in 4 seconds or less
( ) 2 able to turn 360 degrees safely but slowly
( ) 1 needs close supervision or verbal cueing
( ) 0 needs assistance while turning

12. **PLACING ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED**

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.

( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds
( ) 3 able to stand independently and complete 8 steps >20 seconds
( ) 2 able to complete 4 steps without aid with supervision
( ) 1 able to complete >2 steps needs minimal assist
( ) 0 needs assistance to keep from falling/unable to try

13. **STANDING UNSUPPORTED ONE FOOT IN FRONT**

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT)
Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width)

( ) 4 able to place foot tandem independently and hold 30 seconds
( ) 3 able to place foot ahead of other independently and hold 30 seconds
( ) 2 able to take small step independently and hold 30 seconds
( ) 1 needs help to step but can hold 15 seconds
( ) 0 loses balance while stepping or standing

14. **STANDING ON ONE LEG**

INSTRUCTIONS: Stand on one leg as long as you can without holding.

( ) 4 able to lift leg independently and hold >10 seconds
( ) 3 able to lift leg independently and hold 5-10 seconds
( ) 2 able to lift leg independently and hold = or >3 seconds
( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently
( ) 0 unable to try or needs assist to prevent fall

( ) **TOTAL SCORE (Maximum = 56)**

***References**

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APPENDIX E

SF-36®

The SF-36 Health Survey

Instructions for Completing the Questionnaire

Please answer every question. Some questions may look like others, but each one is different. Please take the time to read and answer each question carefully by circling the answer that best represents your response.

YOUR HEALTH IN GENERAL

1. In general, would you say your health is:
Excellent Very Good Good Fair Poor

2. Compared to one year ago, how would you rate your health in general <u>now</u>? (circle a, b, c, d, or e)

a.) Much better than one year ago
b.) Somewhat better than one year ago
c.) About the same as a year ago
d.) Somewhat worse than one year ago
e.) Much worse than one year ago

3. The following items are about activities that you might do during a typical day. Does your health now limit you in these activities? If so how much?

a.) Vigorous activities, such as running, lifting heavy objects, or strenuous sports:
Yes, Limited a lot Yes, Limited a little No, not limited at all

b.) Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf:
Yes, Limited a lot Yes, Limited a little No, not limited at all

c.) Lifting or carrying groceries:
Yes, Limited a lot Yes, Limited a little No, not limited at all

d.) Climbing several flights of stairs:
Yes, Limited a lot Yes, Limited a little No, not limited at all

e.) Climbing one flight of stairs:
Yes, Limited a lot Yes, Limited a little No, not limited at all

f.) Bending, kneeling, or stopping:
Yes, Limited a lot Yes, Limited a little No, not limited at all

g.) Walking more than a mile:
Yes, Limited a lot Yes, Limited a little No, not limited at all

h.) Walking several blocks:
Yes, Limited a lot Yes, Limited a little No, not limited at all

i.) Walking one block:
Yes, Limited a lot Yes, Limited a little No, not limited at all

j.) Bathing or dressing yourself
Yes, Limited a lot Yes, Limited a little No, not limited at all

4. During the past four weeks, have you had any of the following problems with your work or other regular daily activities <u>as a result of your physical health</u>?

a.) Cut down on the amount of time you spent on work or activities
Yes No

b.) Accomplished less than you would like:

Yes No

c.) Were limited in any kind of work or other activities:

Yes No

d.) Had difficulty performing the work or other activities: (for example it took extra time)

Yes No

5. During the past four weeks, have you had any of the following problems with your work or regular daily activities <u>as a result of any emotional problems</u> (such as feeling depressed or anxious).

a.) Cut down on the amount of time you spent on work or activities.

Yes No

b.) Accomplish less than you would like

Yes No

c.) Didn't do work or other activities as carefully as usual

Yes No

6. During the <u>past 4 weeks</u>, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

Not at all Slightly Moderately Quite a bit Extremely

7. How much <u>bodily</u> pain have you had in the <u>past 4 weeks</u>?

None Very Mildly Mild Moderate Severe Very severe

8. During the past 4 weeks, how much did <u>pain</u> interfere with your normal work (including both work outside the home and housework)

Not at all A little bit Moderately Quite a bit Extremely

9. These questions are about how you feel and how things have been with you for the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks...

a.) Did you feel full of pep?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

b.) Have you been a very nervous person?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

c.) Have you felt so down in the dumps nothing could cheer you up?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

d.) Have you felt calm and peaceful?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

e.) Did you have a lot of energy?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

f.) Have you ever felt downhearted and blue?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

g.) Did you feel worn out?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

h.) Have you been a happy person?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

i.) Did you feel tired?

All of the time	Most of the time	A good bit of the time	Some of the time	None of the time

10. During the past 4 weeks, how much of the time has your <u>physical health and emotional problems</u> interfered with your social activities (like visiting friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time

11. How TRUE or FALSE is <u>each</u> of the following statements for you?

a.) I seem to get sick a little easier than other people

Definitely True	Mostly true	Don't know	Mostly false	Definitely false

b.) I am as healthy as anybody I know

Definitely True	Mostly true	Don't know	Mostly false	Definitely false

c.) I expect my health to get worse

Definitely True	Mostly true	Don't know	Mostly false	Definitely false

d.) My health is excellent

Definitely True	Mostly true	Don't know	Mostly false	Definitely false

THANK YOU FOR COMPLETING THIS QUESTIONAIRE

APPENDIX F

LSIZ

Life Satisfaction Index Z (LSIZ)

Instructions: Below are some statements about life in general that people feel differently about. Would you read each statement on the list, and if you **strongly agree with it circle 4, if you agree with it circle 3. If you disagree with the statement circle 2 and if you strongly disagree, circle 1. If you are not sure one way or another circle 0.** Please be sure to answer every question on the list.

Question	Strongly Agree 4	Agree 3	Not Sure 2	Disagree 1	Strongly disagree 0
1. As I grow older, things seem better than I thought they would be.	4	3	2	1	0
2. I have gotten more of the breaks in life than most of the people I know.	4	3	2	1	0
3. This is the best time of my life.	4	3	2	1	0
4. I am just as happy as when I was younger.	4	3	2	1	0
5. These are the best years of my life.	4	3	2	1	0
6. Most of the things I do are boring or monotonous.	4	3	2	1	0
7. The things I do are as interesting to me as they ever were.	4	3	2	1	0
8. As I look back on my life, I am fairly well satisfied.	4	3	2	1	0
9. I have made plans for things I'll be doing a month or a year from now.	4	3	2	1	0
10. When I think back over my life, I didn't get most of the important things I wanted.	4	3	2	1	0
11. Compared to other people, I get down in the dumps too often.	4	3	2	1	0
12. I've gotten pretty much what I expected out of life.	4	3	2	1	0
13. In spite of what people say, the lot of the average man/woman is getting worse, not better.	4	3	2	1	0

APPENDIX G

BBT MEANS AND STANDARD DEVIATION

TABLE

TABLE X

BBT MEANS AND STANDARD DEVIATION

	Groups	Mean	Std. Deviation	N
berg pre total	control	47.429	4.8941	7
	strength	33.444	18.3106	9
	flexibility	45.667	5.5737	6
	combination	37.167	17.8775	12
	Total	*39.794*	*15.1333*	*34*
berg mid total	control	49.000	2.6458	7
	strength	41.778	11.5518	9
	flexibility	48.833	3.4303	6
	combination	45.333	10.3602	12
	Total	*45.765*	*8.9173*	*34*
berg post total	control	51.000	1.0000	7
	strength	43.556	10.1009	9
	flexibility	49.667	3.9328	6
	combination	47.667	8.9680	12
	Total	*47.618*	*7.8587*	*34*

APPENDIX H

SF-36® MEANS AND STANDARD DEVIATION TABLE

TABLE XI

SF-36® MEANS AND STANDARD DEVIATION

	Groups	Mean	Std. Deviation	N
SF36 pre total % total	control	58.2134	27.35612	12
	strength	65.0839	18.84458	15
	flexibility	63.7718	19.25381	14
	combination	57.7200	28.35444	13
	Total	61.4442	23.08746	54
SF36 mid total % total	control	58.2134	27.35612	12
	strength	65.0839	18.84458	15
	flexibility	63.7718	19.25381	14
	combination	57.7200	28.35444	13
	Total	61.4442	23.08746	54
SF36 post total % total	control	74.2355	34.88533	12
	strength	82.9969	24.03116	15
	flexibility	81.3237	24.55302	14
	combination	73.6062	36.15842	13
	Total	78.3554	29.44180	54

APPENDIX I

LSIZ MEANS AND STANDARD DEVIATION

TABLE

TABLE XII

LSIZ MEANS AND STANDARD DEVIATION

	Groups	Mean	Std. Deviation	N
LSIZ pre total	control	41.7333	27.43416	12
	strength	32.8600	19.23597	15
	flexibility	40.5800	31.15398	15
	combination	33.2231	20.79055	13
	Total	36.9873	24.77224	55
LSIZ mid total	control	42.4833	26.95116	12
	strength	52.2333	35.09297	15
	flexibility	61.7533	37.07228	15
	combination	28.0000	5.13160	13
	Total	46.9745	31.44711	55
LSIZ post total	control	65.3667	36.10773	12
	strength	65.4800	38.19744	15
	flexibility	76.5333	34.26664	15
	combination	26.0000	4.26224	13
	Total	59.1382	36.33904	55

APPENDIX J

LSIZ INTERACTION GRAPH

Table XIII

Interaction of the four treatment groups and the three assessment periods for the LSIZ.

Group	Assessment periods					
	Pre Test		Mid Test		Post Test	
	Mean	SD	Mean	SD	Mean	SD
Control(n= 12)	41.7333	27.4342	42.4833	26.9512	65.3667	36.1078
Strength (n = 15)	32.8600	19.2360	52.2333	35.0930	65.4800	38.1974
Flexibility (n = 15)	40.5800	31.1540	61.7533	37.0723	76.5333	34.2666
Combination n = 13)	33.2231	20.7906	28.0000	5.1316	26.0000	4.2622

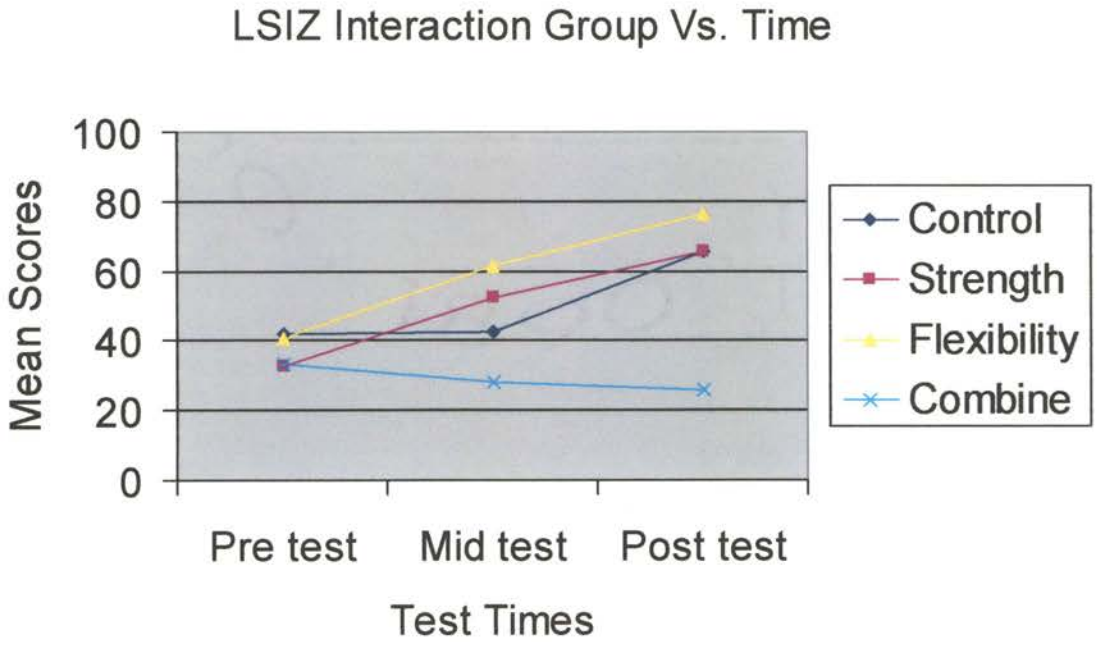

Figure 4: Interaction of treatment groups over testing time for LSIZ.

APPENDIX K

INTERNAL REVIEW BOARD FORM

(IRB)

Oklahoma State University
Institutional Review Board

Protocol Expires: 7/24/2003

Date : Thursday, February 27, 2003 IRB Application No ED034

Proposal Title: THE EFFECTS OF THREE DIFFERENT EXERCISE MODALITIES ON BALANCE AND PERCEIVED QUALITY OF LIFE IN INDIVIDUALS SEVENTY YEARS AND OLDER

Principal Investigator(s) :

Jamie Hooyman
2904 Canton Lane
Edmond, OK 73003

Betty Edgley
110 Colvin Center
Stillwater, OK 74078

Reviewed and Processed as: Expedited **Modification**

Approval Status Recommended by Reviewer(s) : Approved

Signature

Carol Olson, Director of University Research Complian

Thursday, February 27, 2003
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

Oklahoma State University
Institutional Review Board

Protocol Expires: 7/24/2003

Date: Thursday, July 25, 2002 IRB Application No ED034

Proposal Title: THE EFFECTS OF TWO DIFFERENT EXERCISE MODALITIES ON BALANCE AND PERCEIVED QUALITY OF LIFE IN WOMEN SEVENTY YEARS AND OLDER

Principal Investigator(s):

Jamie Hooyman
2904 Canton Lane
Edmond, OK 73003

Betty Edgley
110 Colvin Center
Stillwater, OK 74078

Reviewed and Processed as: Expedited

Approval Status Recommended by Reviewer(s): Approved

Dear PI :

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved projects are subject to monitoring by the IRB. If you have questions about the IRB procedures or need any assistance from the Board, please contact Sharon Bacher, the Executive Secretary to the IRB, in 415 Whitehurst (phone: 405-744-5700, sbacher@okstate.edu).

Sincerely,

Carol Olson, Chair
Institutional Review Board

VITA 2

Jamie Leigh Hooyman

Candidate for the Degree of

DOCTOR OF EDUCATION

Thesis: THE EFFECTS OF THREE DIFFERENT EXERCISE MODALITIES UPON BALANCE AND PERCEPTION OF QUALITY OF LIFE IN INDIVIDUALS SEVENTY YEARS OF AGE AND OLDER

Major Field: Applied Educational Studies

Minor Field: Exercise Science

Biographical:

Personal Data: Born in Milan, Missouri, November 23, 1963, the daughter of Bill and Peggy Ausmus

Education: Graduated from Trenton High School, Trenton, Missouri, May 1982; received Associates of Arts from Trenton Junior College, Trenton, Missouri, August, 1983; received Bachelors of Science degree in Physical Education from Southwest Missouri State University, Springfield, Missouri, August, 1985; received Masters of Science degree in General Physical Education (Exercise Science) from Northern Illinois University, DeKalb, Illinois, December, 1986; completed requirements for the Doctor of Education degree at Oklahoma State University in May 2003.

Professional Experience: Fitness Coordinator, High Plains Baptist Hospital and Amarillo Town Club (1987-1989); Director, Longview Recreation Center, Lee Summit, Missouri (1989-1993); Part time Instructor in the Department of Kinesiology and Health Studies, University of Central Oklahoma, (1995-2000); Temporary Full time Instructor in the Department of Kinesiology and Health Studies, University of Central Oklahoma, (2000-2001); Full time Instructor in the Department of Kinesiology and Health Studies, University of Central Oklahoma, (2001 to present).

Professional Memberships: American College of Sports Medicine (ACSM), American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD), Oklahoma Association for Health, Physical Education, Recreation and Dance (OAHPERD), National Recreation and Parks Association (NRPA).