# EFFECTS OF EXERCISE ON THE FUNCTIONAL STATUS OF OLDER ADULTS

By

MARY KATHRYN NOLE

Bachelor of Science
University of Tulsa
Tulsa, Oklahoma
1978

Master of Science
University of South Carolina
Columbia, South Carolina
1984

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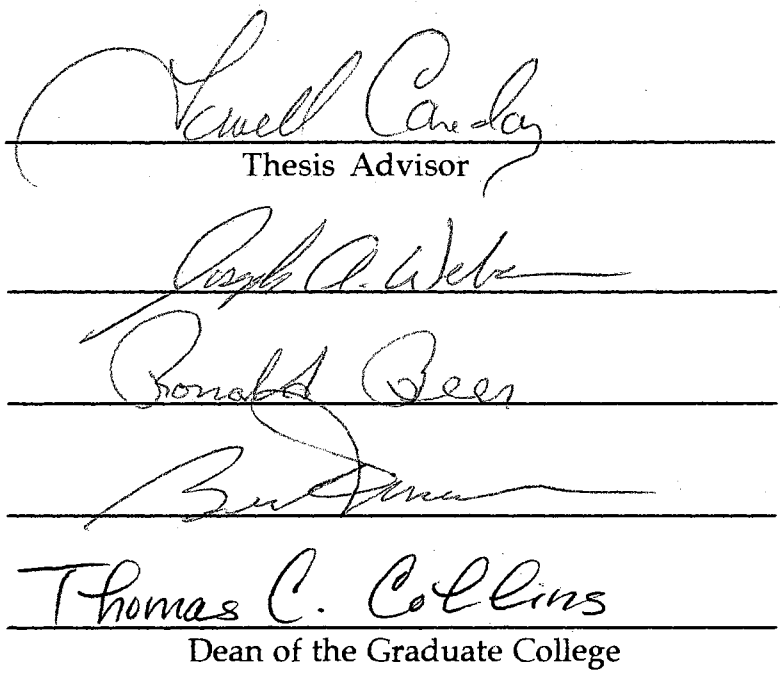

Thesis Advisor

Dean of the Graduate College

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# CHAPTER I

## INTRODUCTION

The "graying of America" will result in a society made up of more old people than at any other time in history by the year 2010. Concurrently, there is a growing awareness that even though great advances have been made in terms of providing longer life spans, relatively little has been done to ensure that those lives are productive and healthy. The means by which older persons' lives are enhanced, i.e. their "quality of life" is improved, will no doubt become increasingly important in the future. In order to understand and respond to the needs of the elderly population, greater knowledge of the aging process itself, and dissemination of this knowledge to a larger segment of society, will be necessary.

Gerontology is relatively young when compared with most sciences. This is at least partially due to the fact that developmental theory has traditionally concentrated on child and adolescent development and psychology. There was very little study of the continued development of humans through late adulthood until Eric Erickson's work, The Life Cycle Completed. Erickson presents eight stages in his theory, each containing a core conflict. The outcome of this conflict results in a "strength" which is used within that stage and also as a dynamic agent in moving to the next stage. The novelty of Erickson's work was his consideration of the entire life cycle, including: middle adulthood (centering around the conflict of

Generativity vs. Stagnation, resulting in "Care"), and late adulthood (Integrity vs. Despair, resulting in "Wisdom") (Weiland, 1993).

Another unique feature of gerontological study is that the aging process is an extremely personalized endeavor. There is a great deal of heterogeneity within the older population. In fact, some feel that "elderly persons are the most heterogeneous of any age stratum with regard to many characteristics" (Dannefer, 1988, p. 360). The complexity of the aging process contributes to the creation of this diversity. Theorists no longer categorize aging as either a biomaturational or psychosocial phenomenon. Current gerontological theories include the interactive nature of human functioning. They consider the biological realm, wherein physical aging occurs, psychological factors and cognitive abilities, and sociological influences, such as "where and how" elders live (Birren, 1988; Blazer, 1990; Rybash, Roodin & Hoyer, 1995).

Continuity Theory, as developed by Robert Atchley (1989), considers the influence of the aging process on different human attributes. He proposes that a person's "continuity" involves the maintenance of a stable and coherent sense of self, even in the face of change, decline, or illness. According to this model, as people grow older they will attempt to "preserve and maintain internal and external structures" as they always have. The first preference of older persons is to maintain past behaviors and experiences through the use of their established, familiar patterns. However, if they are unable to do so and realize customary outcomes, they will often adapt their behaviors/coping strategies (Atchley, 1989; Rubinstein, Kilbride & Nagy, 1992). The principal manifestation of this theory is that as people age, their general behavior does not change dramatically. For the most part, they will think and act as they have previously.

Conversely, change, whether environmentally induced or personally initiated, takes place in every stage of life. Therefore, dealing with change is a recurrent theme, and the process of adaptation itself can provide continuity. Often the ability to adapt becomes more important during late life. Typically, elders are faced with changes in their familial and societal roles, the loss of friends and loved ones, a gradual decline in physical or mental competencies, and/or the onset of illness and disability. In many instances, older adults are forced to adjust their behaviors and coping strategies if they are to maintain a semblance of their past. Age-related changes, and the corresponding attempts to preserve continuity, occur in psychological, social and/or biological realms (Atchley).

The physical manifestations of aging are generally attributed to one of two causes: primary aging (senescence), or secondary aging (senility). Primary aging is a biological process which produces time-related changes in the human organism. These changes are heavily rooted in heredity, are inevitably detrimental, and occur independently of acquired disease, stress or trauma. Primary aging has traditionally been called "normal aging." Secondary aging refers to defects or disabilities which are the result of environmental factors. The human organism is subjected to forces from the general environment (such as those within a certain geographic location or workplace), as well as those personally inflicted by individual choices relative to behavior and lifestyle. Examples of environmental stressors which contribute to secondary aging are cigarette smoking, poor diet and air pollution. Often, conditions which are labeled as "age-related," (i.e. coronary artery disease, osteoporosis), result from a combination of primary and secondary factors (Blazer, 1990; Leslie, 1989).

As pointed out, normal aging occurs in the absence of chronic physical or mental disease. However, just because aging is "normal" does not mean it is "successful." Recently there has been more and more emphasis placed on successful aging as both a goal and an evaluation process for older persons. While the definition of successful aging continues to be developed, there is general consensus on two points. First, and foremost, the inevitable results of aging must be separated from age-related, yet modifiable, risk factors for disease. Since secondary aging is largely a result of the environment, it stands to reason that these effects can be manipulated, or at least managed. The second point is that individual differences within the aging process must figure prominently into any research, theory or policy formation. If only two categories of the aging population are provided - either diseased or normal - researchers run the risk of overlooking and/or negating the vast heterogeneity within the non-diseased group. Perhaps even more disabling, is the implication inherent in this methodology that normal is "natural," and anything normal cannot, or should not, be modified (Blazer, 1990; Rowe & Kahn, 1987).

## Justification for the Study

Until recently, the study of aging has concentrated on losses and negative outcomes. This would be appropriate if the definition of aging is to remain, "the transformation of the human organism... so that the probability of survival constantly decreases and there are regular transformations in appearance, behavior, experience and social roles" (Birren, 1988, p. 159). However, there is mounting evidence to suggest that many of the decrements

experienced in late life are age-related, not age-dependent. Current research indicates that older persons have the ability to postpone, or even reverse, age-associated losses through lifestyle adjustments such as diet, exercise or other personal habits. Exercise has been identified as a primary means of increasing life expectancy as well as functional capacity in older adults (Foret & Clemons, 1996; Liebman, 1995; Rikli & Edwards, 1991; Rooney, 1995).

## Problem Statement

The purpose of this study was to examine the physiological and/or psychological effects of participation in moderate-intensity exercise activities by older adults. The exercise benefits were measured and evaluated relative to the subjects' functional capacities. Additionally, two distinct modes of exercise were employed and compared in order to determine their relative benefits.

## Assumptions

The following assumptions were made:

1. Participants will understand the purpose of the program for which they are volunteering (a research study) and the nature of the activities involved.
2. The volunteers will be physically capable of performing the activities of the program.
3. The participants will attach positive value to good health and feeling well (physically and emotionally).

4. Subjects will participate according to the established criterion, i.e. exercise at the prescribed intensity level.

## Limitations

The following limitations were anticipated at the beginning of this study:

1. Evaluation of functional abilities within this age group may be somewhat subjective as older adults' daily health status and energy levels may fluctuate noticeably.
2. Exercise intensity and correct performance could not be completely standardized between participants in the program.
3. Attendance and adherence were uncontrolled factors which could potentially influence the results of the study.
4. Subjects' self-assignment into groups might pose a threat to internal validity.
5. The relatively small sample size (36 subjects) could limit the generalizability of results.

## Design of the Study

This study was quasi-experimental, utilizing a pretest-posttest control group design. An intervening program of exercise was conducted for 12 weeks. The dependent variables of interest were the subjects' functional abilities, as reflected in physical skills and emotional well-being. The subjects were community-dwelling adults, aged 60 and older. Subjects' physical

abilities were assessed through the use the Functional Fitness Assessment for Adults Over 60 Years, developed by a committee within the American Alliance for Health, Physical Education, Recreation and Dance (Osness, 1990). Overall emotional well-being and perceived self-efficacy were evaluated through the use of the General Well-Being Schedule, developed by the National Center for Health Statistics (Dupuy, 1970). Subjects were divided into three groups: the Aerobic Group, Weight Training Group, and the Control Group. Since subjects were not paid and motivation directly influenced their enrollment and adherence to the program, subjects were allowed to self-select their participatory group.

## Research Questions

The following research questions were investigated as part of this study:

1. Will regular participation in physical activities by older adults yield physiological benefits which result in improved functional abilities?
2. Do different modes of exercise (i.e. aerobics or strength training) result in different functional benefits?
3. Do participants realize an improved sense of general well-being due to participation in regular physical activity?
4. Do different modes of exercise result in different self-perceptions?
5. Are affective improvements dependent upon measurable physiological changes?

## Hypotheses

The following hypotheses relative to the Functional Fitness Assessment for Adults Over 60 Years were tested at the .05 level of significance:

1. There is no significant difference between the three groups' pretest scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.
2. After 12 weeks of exercise, there is no significant difference between the Aerobic Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.
3. After 12 weeks of exercise, there is no significant difference between the Weight Training Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Test for Adults Over 60 Years.
4. After 12 weeks of exercise, there is no significant difference between Control Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.
5. There is no significant difference between the two exercising groups' scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.

Hypotheses tested relative to the General Well-Being Schedule were:

6. There is no significant difference between the three groups' pretest scores on the General Well-Being Schedule.

7. After 12 weeks of exercise, there is no significant difference between the Aerobic Group subjects' pre- and posttest scores on the General Well-Being Schedule.
8. After 12 weeks of exercise, there is no significant difference between the Weight Training Group subjects' pre- and posttest scores on the General Well-Being Schedule.
9. After 12 weeks of exercise, there is no significant difference between Control Group subjects' pre- and posttest scores on the General Well-Being Schedule.
10. There is no significant difference between the two exercising groups' scores on the General Well-Being Schedule.

**Procedures**

Subjects self-assigned into three groups: the Aerobics Group (participated in low-impact, dance-based aerobics classes), Weight Training Group (participated in a supervised weight training program), or the Control Group (took the pre- and posttests). The Aerobics group had 12 participants, the Weight Training group had 15, and there were 9 subjects in the Control group. Both of the exercising groups met twice weekly, for approximately one hour. Members of the Control Group were encouraged to continue in their regular daily routines, trying not to modify them in terms of activity level. As previously stated, the subjects were allowed to choose the group they joined.

This selection was generally based upon whether or not they would be available to participate for the entire twelve weeks, the time and days the

classes met, and their personal interest in certain modes of activity.

Prior to their participation, all subjects received verbal and written information concerning the program. Verbal orientation was provided through speaking engagements at scheduled group meetings, and/or individual conversations. At this time, participants received an information sheet containing an explanation of the study, the time frames involved, and a description of the types of activity to be undertaken. When subjects committed to entering the study they were mailed an additional "Logistics and Details" sheet to facilitate their participation. These forms are included in Appendices E and F, respectively.

The Aerobics Group met 7:00-8:00am, on Tuesdays and Thursdays. The Weight Training class was held 10:30-11:30am, on Mondays and Wednesdays. In addition, a standing "make-up" session met from 7:00-8:00am on Friday of each week. Members of either group were allowed to attend the make-up session, but were not required to do so. Attendance records were kept for all classes.

The first two sessions for each of the exercising groups were dedicated to testing and orientation. The first session included all aspects of the Functional Fitness Assessment for Adults Over 60 Years, except for the Endurance test (one half mile walk). The second session began with the Endurance test, and the completion of the General Well-Being Schedule, followed by a brief overview of what each group's typical class sessions would entail. Following these introductory class periods regular exercise sessions were held for the next 24 class periods (12 weeks). Class content for the Aerobic Group included:

- Warm-up (10-15 minutes of easy movements and stretching)

- Aerobic phase (15-20 minutes of rhythmic activity sufficient to elevate participants' heart rates to a target zone of 40% - 60% of their maximum predicted heart rate)
- Cool down (approximately 5-10 minutes of slower movement to gradually lower heart rates)
- Toning and strengthening (15 minutes of exercises isolating muscle groups for the purpose of building strength and endurance)
- Flexibility and relaxation (5 minutes of gradual, static stretching)

The Weight Training sessions included:

- Warm-up (10-15 minute sequence of stretching, range of motion exercises and sit-ups)
- Weight lifting (8 exercise stations)
- Cool Down (5-10 minutes of stretching, walking)

The weight training protocol was established according to current American College of Sports Medicine guidelines (Kenney, Humphrey, & Bryant, 1995). Participants began with two sets of eight repetitions for each exercise and the weight lifted was sub-maximal. Participants were instructed to lift at a resistance which allowed them to breathe freely and rhythmically (no breath holding). After sufficient strength and endurance were gained, repetitions could be increased, followed by the addition of a third set. Repetitions and sets were always increased before weight was increased.

All participants maintained a personal record of daily information as to the weight lifted, number of repetitions, and sets performed for each machine. The machines used/exercises conducted were: Latissimus Pulldown ("Lat Pulldown"), Seated Row, Bench Press, Military Press, Leg

Press, Leg Extension, and Leg Curl. In addition, there was an "abdominal station" at which participants performed abdominal crunches or adapted abdominal exercises if necessitated by weakness or injury.

Because it would be impossible for the instructor to supervise all of the participants at all times, weightlifting was done in pairs. Partners helped maintain records, talked to each other throughout the exercises as a means of avoiding breath holding, and "spotted" for each other if the lifter was straining to finish a set. The partner format provided a means of maintaining the proper range of motion throughout the set, and also socialization opportunities. The social aspect of the class structure was perceived by the instructor to have important enjoyment and safety ramifications.

The posttesting was again conducted in two sessions. During the second session participants given the option of completing a voluntary program evaluation. Two weeks after the conclusion of the study, subjects were mailed their individual scores with a summary of their changes.

## Definition of Terms

The following definitions were utilized :

1. Exercise - Physical exertion of sufficient intensity, duration and frequency to achieve or maintain fitness, or other health or athletic, objectives (Nieman, 1990).
2. Health - An individual's capacity to respond to various stressors: physiological, emotional, social (Wallace, 1994).
3. Functional ability - The physical capacity to meet the demands of

daily life safely and effectively (Hopkins, Murrah & Hoeger, 1990).

4. Motivation - Factors which prompt action, such as: education, personal goal setting, fear or concern, social considerations (Foderaro, 1988).

# CHAPTER II

## REVIEW OF THE LITERATURE

If the health of elderly individuals is crucial to their ability to maintain familiar patterns of behavior ("continuity") and full function ("successful aging"), what are the determinants of good health? The concept of health is continually evolving. The World Health Organization's 1974 definition of health emphasized that "health is a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity" (Pender, 1982, p. 25). Health is therefore defined, at least partially, by social norms. Social standards of role fulfillment have further dictated that functional norms be considered as a major component of health. Sociological models propose that health is defined by "those functional levels that man considers adequate or desirable" (Pender, p. 31).

The components of function have been further examined. David Leslie states that a person's functional status includes: physical health, quality of self-maintenance, quality of role activity, intellectual status, social activity, attitudes towards the world and self, and emotional status (Leslie, 1989, p. 38). Other theorists postulated that health becomes more functional with age and includes older persons' abilities to maintain their lifestyle through "the performance of those everyday activities appropriate for their age and gender" (DiCicco & Apple, 1968; Patrick, Bush & Chen, 1973; Duffy & MacDonald, 1990). Believing that the health of older individuals includes the capacity

to perform activities of daily living (ADL's), as well as the environmental, social and economic resources to maintain independent lifestyles, Duffy and MacDonald conducted a study to investigate the relationship between functional health and health promotion practices among the elderly. They attempted to determine what specific health promotion practices influence functional health in older persons, and also whether various age groups differed in their behaviors relative to these practices. Not, surprisingly, their findings indicated significant relationships between certain demographic variables, self-esteem, control of health, health promotion activities, and health status. Specifically, exercise and nutrition were cited as, "critical factors in maintaining productive, independent and fulfilling lives" (Duffy & MacDonald).

The U.S. Department of Health and Human Services issued the "Healthy People 2000" report in 1990, which included a set of public health goals. Among these were to increase the span of healthy life, with a greater emphasis on the quality of life. Targeted outcomes included preventing morbidity and disability, and preserving functional capacity. In order to do this, increased physical activity and appropriate use of leisure time were recommended. The outlined benefits of physical activity for the older population included: maintaining and improving cardiovascular fitness; cultivating muscular strength, flexibility and balance; preventing falls and fractures; promoting self-care capabilities and independence; preventing or modifying chronic diseases such as hypertension, osteoporosis and coronary artery disease; providing social contact; relieving anxiety, insomnia and depression (Rooney, 1993).

From the preceding discussion, it is easy to see the relationship

between age-related adaptations, maintaining functional abilities, and quality of life. Older persons' daily activities, experiences and efficacy have a direct bearing on their ability to preserve an independent lifestyle. Independence has been acknowledged as one of the major governing principles affecting "quality of life." In order to remain independent, the elderly must remain functional. This leads back to the determinants of functional status, which include the ability to perform daily activities safely and successfully (Barry, Rich & Carlson, 1993; Clark, 1991; Pirkl, 1995; Rowe & Kahn, 1987; Strawbridge, Kaplan, Camacho & Cohen, 1992).

In terms of strictly physical capabilities, functional capacity has been defined as "the ability to generate energy for work and play" (Sherman, 1992). Assuming that everyone would like to remain independent and function at the highest possible level, it is important to determine the factors which influence their potential to do so. Commonly observed age-related physical changes include: loss of muscular strength and endurance, decreased flexibility, diminished balance and coordination (Blocker, 1992; Bray, 1991; Judge, Whipple & Wolfson, 1994). These changes can diminish physical skills and aptitude, which leads to a reduction of task accomplishment and efficacy, i.e. functional performance (Schultz, 1992). Wallace (1994) stated that an individual's "capacity to respond to physiologic, psychic or social stressors," has a direct effect on their health and the emergent effects of aging. This again points to the need for adaptation to offset the stress of declining physical status and maintain "physical continuity." Many geriatric specialists, exercise and fitness experts, and gerontologists believe that exercise is a primary means of counteracting physical aging (Lord, Ward, Williams & Strudwick, 1995; Kligman, 1992; McGrath, 1991; McAuley, Courneya & Lettunich, 1991;

Rooney, 1993). There is also research evidence which supports the concept of exercise as an intervention specifically aimed at functional incapacity (Blocker, 1992; Emery & Blumenthal, 1990; Hunter, Treuth, Weinsier, Kekes-Szabo, Kell, Roth & Nicholson, 1995; Nichols, Omizo, Peterson & Nelson, 1993; Noreau, Martineau, Roy & Belzile, 1995; Ruuskanen & Parkatti, 1991).

Muscular losses seem to be particularly detrimental to the functional status of the elderly, since a minimal level of muscular fitness is required to perform many daily activities. Decreases in muscular strength due to normal aging have been estimated to be as great as 20-40% between the third and eighth decade of life. This decrease in strength is generally attributed to a reduction in muscle mass, as well as the loss of speed and force during muscle contraction. A direct relationship has been proven between muscular strength and the performance of certain activities. For example, leg extensor power has been correlated with walking (gait velocity and stride length), stair climbing and the ability to rise from a chair (Bassey, Fiatarone, O'Neill, Evans & Lipsitz, 1992; Hunter et al., 1995; Judge et al., 1994; Shephard, Anderson, Eichner, George & Sutton, 1993). In addition, decreases in muscle mass have been cited as a "peripheral factor" in reduced maximal oxygen uptake (the amount of oxygen effectively delivered and utilized throughout the body during work) in elderly persons. Less muscle mass means less oxygen absorption (Rooney, 1993).

The consequences of muscular losses on the daily function of older adults range from the obvious to the obscure; from drastic to merely annoying in their impact. Being able to dress unaided, lift the body weight from a chair/bed, and utilize bathroom facilities are fundamental to individuals who intend to remain in their homes. Mobility decrements

which result in the inability to perform normal self-maintenance activities are directly related to nursing home placement and mortality (Blocker, 1992; Lipsitz, Nakajima & Gagnon, 1994). Further, statistics show that the loss of functional mobility results in a 50% mortality rate within the first 6-12 months of nursing home placement (Blocker). Even if muscular losses do not lead to disability or death, they often interrupt a person's ability to carry out the common tasks associated with independent living.

Hunter et al. (1995) conducted a study to investigate the effects of a strength training program on not only strength and walking speed, but also on the subjects' ability to carry a box of groceries and stand from a chair. Their findings indicated significant strength gains in the biceps brachii and rectus femoris muscles, and increased walking velocity. Perhaps more importantly, the practical applications of these gains were seen in greater ease of carrying the groceries (as reflected in a 36% reduction in integrated electromyographic activity in the biceps), and greater ease in rising from a seated position (40% reduction in electromyographic activity in the rectus femoris).

One of the more serious by-products of decreased mobility among older adults is falling, or the fear of falling. Falls are the leading cause of injury-related morbidity and mortality among the elderly. For community-dwelling persons aged 65 and older, the risk of falling is 20% per year (Nevitt et al., 1991). Lipsitz reports the risk to be even greater, suggesting that nearly one third of elders in the community and 50% of nursing home residents fall each year (Lipsitz et al.,1994). The result of a fall, or the fear of a fall, is often a vicious cycle of disuse and loss of function: elders reduce their level of physical activity, thereby hastening the effects of muscular atrophy. This leads to even greater impairments in mobility. Lord et al. (1995) investigated

the effects of exercise on several of the physical skills associated with falls, as well as fall rates among women aged 60-85. While the exercise program was not solely composed of strength training, muscular strength was one of the measures of interest, as was: postural sway, balance, reaction time, neuromuscular control and accidental falls. After 12 months of exercise consisting of warm-up, conditioning, stretching and relaxation periods, subjects showed improvements on most of the measures. Specifically, strength in each of the five muscle groups tested in the dominant leg improved; reaction time improved; body sway with eyes open and closed decreased. The proportion of fallers did not differ significantly between the exercising subjects and the control group, but the frequency of falls was lower in the exercising group.

It is interesting to note that while it has been suggested that increased muscular strength and size achieved through weight training do not necessarily translate into improved athletic performance (Jones, 1992), resistance training research among the elderly has shown a direct relationship between strength gains and functional performance. A study conducted at Harvard Medical School utilizing frail nursing home residents aged 86-96, netted significant gains in strength, muscle mass and walking speed from an eight-week strength training program (Fiatarone, Marks & Ryan, 1990). Likewise, Sauvage et al. (1992) utilized strength training and aerobic cycling in a study involving male nursing home residents. Their results indicated that improvements in quadriceps muscle strength and lower extremity muscular endurance led to improved stride length, gait velocity and mobility. Results from Bassey et al. (1992) were similar: when leg extensor power was increased through exercise in subjects of mean age 87.5 years, their performance in

chair rises, stair climbing and walking speed improved.

These types of positive results are not confined to the frail elderly. Since muscular losses occur even in the absence of chronic disease, and begin at a fairly early age, it can be assumed that normally active persons can benefit from some form of strength training. A study conducted utilizing healthy women over the age of 75, who participated in resistance training for 12 weeks, verified this supposition. The exercises performed emphasized muscles used in the performance of functional tasks. Isokinetic knee extensor strength, isokinetic elbow flexor strength, and hand grip strength improved significantly with the training program (Skelton, Young, Grieg & Malbut, 1995).

Another skill commonly linked to functional status among active elders is stair climbing. Stair climbing is generally seen as a prominent and challenging activity by older persons. Their willingness to remain active can be inhibited by their fear of encountering stairs in the process of moving about. Performing competently and with some degree of confidence on stairs can directly influence the ability to go shopping, visit relatives or go for a walk. Whether it be for lack of strength, fear of falling or other perceived efficacy reasons, stairs can be a significant deterrent to mobility among the elderly (Gill, Kelley, Williams & Martin, 1994). This highlights the importance of building not only muscular strength, endurance, and coordination, but also self-confidence in this population.

The lack of previous experience and/or proficiency combine to make the threat of decreased function in old age especially great for women. For most of the current generation of older women, an "exercise habit" was not developed at earlier stages of their lives. Many times, the importance of

exercise was not learned during adolescence due to either inadequate emphasis on, or opportunity for, girls' participation. This lack of physical activity was often perpetuated through adulthood, when societal expectations included child-rearing and familial obligations, not self-interest in fitness. The widespread result has been women entering old age in relatively poorer physical condition than their male counterparts. This provides another application of Continuity Theory: in old age people tend to participate in the activities they enjoyed, and experienced success in, during their earlier years. Those who have exercised infrequently, or have no level of competence (whether real or perceived), are more likely not to exercise in late adulthood. Compounding the fact that women usually enter late life with less muscular strength and aerobic capacity than men, they are also more prone to chronic ailments such as migraine headaches, varicose veins, spinal degeneration and deformity, and osteoporosis, which further limit their motivation to be active (O'Brien & Vertinsky, 1991). These are significant indicators that older women are more predisposed to functional disability than old men.

The impact of the aforementioned predisposition is compounded by the gender content of the older population which is overwhelmingly female. Women outlive men by an average of seven to eight years, and the ratio of women to men in the old-old category (where chronic illness and disability are most likely) increases sharply. Greater acquired risks and poorer health habits, and the fact that women aged 65-plus are three-and-a-half times as likely to be widowed as men, will likely result in record numbers of elderly women living alone, struggling to remain independent (Hess, 1990). It is apparent that there is a growing need for older women to begin regularly participating in physical activities and exercise (Bassey et al., 1992; O'Brien &

Vertinsky; Fiatarone et al., 1990; Shephard et al., 1993).

Despite the wealth of evidence demonstrating that proper exercise habits help counteract the physical declines and the concomitant losses in functional status associated with aging, the 1985 National Health Interview Survey yielded startling results. Conducted with 27,000 seniors aged 65 and older, findings revealed: only 7.5% participated in regular vigorous physical activity; two-thirds of those interviewed were irregularly active or completely sedentary; a mere 5% knew the necessary intensity, frequency and duration of exercise for fitness gains; and of those who were sedentary, only 30% were counseled by their physicians as to the benefits of exercise (Rooney, 1993).

There is a documented lack of encouragement for the adoption of health-promoting behaviors among the elderly from members of the medical community. Overall, the attitudes of health care professionals towards older people are alarmingly negative, and these attitudes affect the quality of care they receive. Many times, physicians are frustrated by the chronic nature of older patients' health problems; they can treat them, but not cure them. In addition, physicians are often uninformed as to the total life situation of their elderly patients, and are reluctant to "pry" into areas other than the somatic complaints presented to them (Duerson, Thomas, Chang & Stevens, 1992; Greene, Hoffman, Charon & Adelman, 1987). Because there is a general lack of knowledge among medical students regarding the special needs of the elderly, and a relatively small number of physicians choose to specialize in geriatric medicine, the interrelationship of physical, mental, and emotional realms continues to be overlooked. Factors such as sociological and psychological problems sometimes influence physical health directly, as in

the onset of stress-related illnesses. However, there are many less obvious outcomes, such as a reduction in a patient's desire to ambulate and stay active as a result of depression. Left untreated, there is the potential for a loss of mobility and vitality which impairs the patient's quality of life.

There is ample research to support the fact that patient satisfaction as well as health status are linked to the inclusion of psychosocial issues in the doctor-patient encounter (Greene, Hoffman, Charon & Adelman, 1987; Mishler, 1984; Thomas, 1996). Especially with older patients, doctors need to consider more than biological factors in order to effectively treat disease. However, a study comparing the interaction of physicians with their older patients and with their younger ones, showed that the opposite often occurs. There were significant differences between the two groups' experiences during tape-recorded office visits. The older patients were less likely to bring up psychosocial concerns within the context of doctor's visits, and the doctors themselves raised fewer of these issues. Further, when psychosocial issues **were** raised, the physicians were less responsive to older patients than younger ones (Greene et al., 1987).

The general well-being and functional status of the elderly are greatly influenced by forces other than those of a physical nature, and yet doctors appear reluctant to become involved in their patients' "total lifeworld." This widespread apathy has undoubtedly contributed to the current population of elders being sedentary, inexperienced in training principles and practice, and already undergoing some level of decreased efficiency in movement. Physicians have the opportunity to break the cycle of inactivity and decreasing health often present among the elderly, but they must choose to become actively involved as motivators and educators in order to do so (Barry et al.,

1993; Rooney, 1993).

Additionally, two programming problems have historically existed in the realm of senior exercise: 1) programs for the general population often involve activity levels which are too strenuous for the older participant, 2) instructors avoid moderate-to-vigorous exercise for the elderly due to doubts about their physical abilities. The first of these obstacles is being addressed for all populations. Due to the small percentage of the general population which regularly exercises, many fitness experts and researchers are now advocating moderate levels of physical activity sufficient to provide healthful, quality of life improvements, rather than attempting to "elevate everyone to an arbitrary fitness or activity level" (Kenney, Humphrey & Bryant, 1995). The American College of Sports Medicine has stated that, "the threshold necessary for the health benefits of exercise, such as significantly lowering chronic disease risk, is lower than previously thought." This is promising news for the elderly since their tolerance is better for slightly lower intensity levels. If health benefits can be achieved at 60-70% of maximal heart rate, rather than going up to 85% as traditionally advocated, enjoyment and participation may increase, with a corresponding improvement in seniors' health. (Bray, 1991; Higdon, 1992; McGrath, 1991; National Dance-Exercise Instructor's Training Association, 1994; Rocca, 1991; Van Camp & Boyer, 1989). In fact, it is hoped that this more moderate and flexible approach to exercising will encourage greater levels of participation and adherence among all age groups (Kenney et al., 1995).

The second concern often results in programs for older adults not being rigorous enough. It is true that the elderly require more care in planning and individualization of their exercise programs because of their

variant physical conditions, experience levels, and interests. However, physical training for the older adult utilizes the same underlying principles as other exercise regimens. In order to realize general health gains the program should be progressive, with the frequency, intensity and duration established to "overload" the various physical systems of the participants, without over-exerting or endangering them. It is generally accepted that in order to achieve maximum fitness benefits, exercise activities should be well-rounded; including training for endurance, strength and flexibility (Barry et al., 1993; Bray, 1991; Higdon, 1992; Kligman & Pepin, 1992). Since achieving an appropriate intensity level is a primary concern, various methods of measuring the exercise intensity level should be implemented. In addition to monitoring heart rates, ratings of perceived exertion are often used. The participants self-evaluate how hard they are working based on how they feel. This could benefit older exercisers who might be sedentary or obese, as it reduces the social and/or psychological pressure to workout at a rate which might be uncomfortable or unrealistic (National Dance-Exercise Instructor's Training Association, 1994; Van Camp & Boyer, 1989).

As mentioned, there should be enough variation in activities to provide health benefits to several of the body's physical systems. There has been speculation that among the elderly resistance training may provide functional benefits equal to, or even greater than, those of aerobic conditioning. An investigation by Taaffe et al. (1995) attempted to show that resistance training in older women would positively effect basal metabolic rate (BMR) as well as muscular strength and endurance. Basal metabolic rate is related to total energy expenditure, food intake and nutrient use, and eventually body composition. Through strength training they were hoping to

offset the increases in central fat mass, decreases in lean muscle and bone mass, and declining energy use which often accompany aging. While there were no significant changes in BMR at the end of the program, the women did demonstrate substantial strength gains in both the upper and lower body. This led the researchers to conclude that while body composition and metabolic rate were relatively unaffected, strength training "may prove an effective strategy for preventing frailty and maintaining functional independence in older adults."

If aerobic exercise yields improvements in cardiovascular function, body composition and metabolic function, and weight training is the most effective means of inducing changes in muscle mass and increasing total body strength, it might be reasonable to surmise that older adults would realize their greatest gains from some combination of weight training and aerobic exercise. Morey, Cowper and Feussner (1989) conducted a study utilizing an exercise program of stretching, strength training, and aerobic activities. The subjects were in excess of age 64, some of whom were chronically ill. After four months, improvements were seen in cardiovascular measures (sub-maximal and resting heart rates), abdominal strength, and flexibility (as measured in hamstring length). Since 19% of older adults suffer some limitation of activity from spine, back, hip and lower extremity ailments, the improved hamstring flexibility and abdominal strength were viewed as particularly meaningful in preventing functional declines.

A 1993 study investigated the impact of adding resistance training to the activities of previously exercising older women. The subjects, all over age 60, had each been exercising for at least six months (participating in physical activity at least three days per week, for a minimum of 30 minutes, at an

intensity sufficient to induce sweating and noticeable increase in breathing). None of the subjects had any previous weight training experience. After 24 weeks, significant strength gains were seen in seven exercises, with the greatest differences seen in the shoulder and trunk muscles. In addition, percent body fat decreased and lean body mass increased significantly by the end of the program (Nichols et al., 1993).

The need to maintain general health, as reflected in functional status, has been shown to be a fundamental need among the elderly. Also, the components of exercise aimed at the improvement of "health and function" are unique from those traditionally associated with "physical fitness." Therefore, a device which measures the functional status of older adults is necessarily different from methods of exercise testing strictly for fitness characteristics. However, certain attributes of fitness obviously contribute to functional abilities; i.e. cardiorespiratory endurance influences stair climbing ability. Currently, there is a relative paucity of both evaluation tools and data to discern the functional benefits of exercise participation by this age group.

The Functional Fitness Assessment for Adults Over 60 Years, was developed by a committee of the American Alliance of Health, Physical Education and Dance (AAHPERD) that was appointed by the Council on Aging and Adult Development. "Functional fitness" was defined by the committee as, "the physical capacity of the individual to meet ordinary and unexpected demands of daily life safely and effectively" (Osness et al., 1996). The AAHPERD instrument was chosen for use in the current study due to its focus on "functional abilities." The instrument contained tasks which are practical, and typical of those encountered by the chosen population. It was consistent with the investigator's desire to measure functional status relative

to the quality of life and performance of daily activities.

Reliability

The reliability of the test items was studied in multiple laboratories by members of the committee. The test re-test method was utilized, and each of the test items were found to meet an acceptable level of reliability. The reliability studies differed in their comparisons of scores; some were single sex tests, others combined male and female scores. On the Flexibility test, the reliability ranged from 0.988-0.991 for men, and 0.978-0.99 for women. The Agility test showed reliability scores of 0.947 (women only) to 0.99 (men and women combined). The Coordination test reliability ranged from 0.853 (women) to 0.993 (men). The Strength scores reflected reliability of 0.807 (women) to 0.947 (men). The Endurance test had a reliability of 0.82 for men in its only study.

Because these tests were "functional" rather than "maximal," there was a concern regarding their reliability. Typically, maximal tests yield more reliable results. The committee felt that there was very little variation in the day to day performance of these functional tests.

Validity

Because two of the tests did not have a clinical equivalent (the Flexibility and Agility tests), the committee used its "best judgment" regarding their validity. The Coordination test was validated using laboratory procedures testing hand-eye coordination, reaction time, and hand steadiness. The coefficients for these were: 0.59 with Reaction Time, 0.399 with Hand Steadiness, and 0.349 with Eye-Hand Coordination. While these correlations may be considered relatively low, the values for this particular test (the soda pop can test) were better than other alternatives investigated by the

committee. The correlation for the Strength measure - validated against an elbow curl on a Cybex machine - was much higher (0.82). The Endurance walk was validated against a treadmill test and yielded a correlation of 0.82. Notes of interest in the committee's reporting of validity for the various tests on the Functional Fitness Assessment for Adults Over 60 Years, include: the Strength validation test utilized a "much lower" number of subjects than the Coordination test (90 subjects). The validity of the Endurance test was established at a length of 880 yards because shorter distances yielded levels of validity which the committee deemed unacceptable (lower than 0.615) (Osness et al., 1996).

Data relative to the test items included in the Functional Fitness Assessment for Adults Over 60 Years has been collected since 1990. Age and gender norms are being established utilizing the over 2,000 subjects who have taken the evaluation. Despite its weaknesses and relatively small number of applications, it is the only documented measure of functional capacity which attempts to measure older adults' abilities within the context of "normal" older adults encountering "normal" activities (i.e. no prescribed level of health or fitness was required by participants before testing, and tasks were neither stressful nor difficult enough to prevent participation by the vast majority of the specified age group).

Since it was previously established that functional status is comprised of an individual's psychological, as well as physical, attributes, a means of measuring the effect of exercise on the mental state of older adults was needed. The General Well-Being Schedule (GWB) was developed by Harold Dupuy for the National Center for Health Statistics in 1970 (McDowell, 1987). The GWB is a self-report instrument. This was desirable because self-

perceptions are often a component of function, as they represent feelings of self-efficacy. Self-efficacy is regarded as an indicator of psychological well-being (Hopkins, Murrah, Hoeger & Rhodes, 1990). In a study conducted by Fazio, (1977) the GWB was compared with other self-report scales in order to determine its usefulness and accuracy in assessing psychological states. Specifically, it is designed to measure the respondent's sense of well-being and distress. It was deemed appropriate for the current study because it did not assume a high level of disease, or attempt to diagnose psychiatric disorders, which was the case with most of instruments dealing with the mental health of elders.

Reliability

The reliability of the GWB has been tested repeatedly on different populations and has consistently been found to have extremely high internal consistency (McDowell, 1987). In his study, Fazio reported a test-retest coefficient of 0.851 for the total scale. Fazio found the internal consistency to be extremely high: 0.91 for the college males in his study, and 0.95 for the females.

Validity

The correlational validity also appears high for the GWB. Fazio found it correlated well with other measurements, including the Zung Depression Scale, (0.66 correlation), the Personal Feelings Inventory (0.78), and interviewer ratings of depression (0.47 correlation).

The only weakness pointed out in the GWB was the division of the total assessment into six subscales. While the rationale for this type of differentiation is supported, it was felt that there were too few elements included in each subscale to provide for a meaningful measurement.

Therefore, any assessments of these individual aspects of well-being or distress may not be entirely reliable. Of the subscale measures, the Depression subscale was found to be particularly strong in its relationship to other independent tests of depression. It demonstrated a strong correlation for both sexes and was consistent with interviewer rating systems of assessment (Fazio, 1977).

Overall, the GWB has been praised for being well designed, easy to comprehend, and comprehensive in its content coverage (Fazio, 1977; McDowell, 1987).

## Summary

The very root of the word gerontology is the Greek word "geron," which can mean growing older, and/or awakening (Leslie, 1989). The extension of the human lifespan now provides extra years. How these years are to be spent by the majority of older adults is yet to be determined. To this point, longer life has not necessarily meant better health.

It has been suggested that "mental and physical inactivity are the greatest obstacles to successful aging; the atrophy of disuse, the greatest thief of capacity" (Cosky, 1989). Indeed, there are many theorists and practitioners who support the notion that while certain decrements in performance abilities are unavoidable, many losses experienced by the elderly are actually the result of lifestyle rather than aging per se. Health promotion and disease prevention, on both physical and psychosocial levels, will positively impact the "health span" of elderly individuals, as well as their serial lifespan (Blazer, 1990; Hopkins et al., 1990; Leslie, 1989; Rowe & Kahn, 1987). As a

result of research investigation, exercise has been cited as one of the lifestyle changes which is helpful in maintaining health among the elderly (Bray, 1991; Brown, McCartney & Sale, 1990; Kligman & Pepin, 1992; McAuley, Courney & Lettunich, 1990; McGrath, 1991; O'Brien & Vertinsky, 1991; Sauvage et al., 1992).

# CHAPTER III

# METHOD AND DESIGN

The purpose of this study was to examine the physiological and/or psychological effects of participation in moderate-intensity exercise activities by older adults. This chapter provides a description of the methods utilized.

The design of this study, use of the research instruments, and participation of the subjects were approved by the Institutional Review Board (IRB), January 25, 1996. A copy of the IRB approval is included in Appendix N.

## Design of the Study

This study was quasi-experimental, utilizing a pretest-posttest control group design. An intervening program of exercise was conducted for 12 weeks. The dependent variables of interest were the subjects' functional abilities, as reflected in physical skills and emotional well-being. The subjects were community-dwelling adults, aged 60 and older. Subjects' physical abilities were assessed through the use the Functional Fitness Assessment for Adults Over 60 Years, developed by the American Alliance for Health, Physical Education, Recreation and Dance (1990). Overall emotional well-being and perceived self-efficacy were evaluated through the use of the General Well-Being Schedule, developed by the National Center for Health

Statistics in 1970. Subjects were divided into three groups: the Aerobics Group, Weight Training Group, and the Control Group. Since subjects were not paid, and motivation directly influenced their enrollment and adherence to the program, subjects were allowed to self-select their participatory group.

## Description of the Subjects

The sample for this study was comprised of individuals aged 60 and older, all living independently in the community. Subjects were volunteers, solicited through the Stillwater Senior Citizens Center, the emeritus faculty group at Oklahoma State University, and a local non-profit organization (Judith Karmen Hospice). A total of 36 subjects participated in the study: 26 women and 10 men. Of those original participants, 34 were available at the time of the posttest. The age range was 60-80 years, with a mean age of 68.3 years. The number of participants in each group was: 12 in Aerobics, 15 in Weight Training, and 9 in the Control group.

As stated, subjects were allowed to self-select their participatory group. Selection was based largely upon convenience of schedule and/or interest in the activities.

## Description of the Instruments

The Functional Fitness Assessment for Adults Over 60 Years, was developed by a committee of the American Alliance of Health, Physical Education and Dance that was appointed by the Council on Aging and Adult Development (Osness et al., 1990). This instrument was chosen due to its

focus on "functional abilities." The instrument contained tasks which are practical, and typical of those encountered by the chosen population. It was consistent with the investigator's desire to measure functional status relative to the quality of life and performance of daily activities.

The General Well-Being Schedule (GWB) was developed by Harold Dupuy for the National Center for Health Statistics (McDowell, 1987). The GWB is designed to measure the repondent's sense of well-being and distress, and compares favorably with other self-report scales in terms of its accuracy in assessing psychological states. It was deemed appropriate for this study because it did not assume a high level of disease, or attempt to diagnose psychiatric disorders, which was the case with most of instruments dealing with the mental health of elders.

## Hypotheses

The following hypotheses were tested relative to the Functional Fitness Assessment for Adults Over 60 Years :

1. There is no significant difference between the three groups' pretest scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.
2. After 12 weeks of exercise, there is no significant difference between the Aerobic Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.
3. After 12 weeks of exercise, there is no significant difference between the Weight Training Group subjects' pre- and posttest

scores on any of the five components of the Functional Fitness Test for Adults Over 60 Years.

4. After 12 weeks of exercise, there is no significant difference between Control Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.
5. There is no significant difference between the two exercising groups' scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.

Hypotheses tested relative to the General Well-Being Schedule were:

6. There is no significant difference between the three groups' pretest scores on the General Well-Being Schedule.
7. After 12 weeks of exercise, there is no significant difference between the Aerobic Group subjects' pre- and posttest scores on the General Well-Being Schedule.
8. After 12 weeks of exercise, there is no significant difference between the Weight Training Group subjects' pre- and posttest scores on the General Well-Being Schedule.
9. After 12 weeks of exercise, there is no significant difference between Control Group subjects' pre- and posttest scores on the General Well-Being Schedule.
10. There is no significant difference between the two exercising groups' scores on the General Well-Being Schedule.

## Statistical Design

As outlined previously, the design used in this study was a quasi-experimental pretest-posttest control group design. All subjects took the same pre- and posttest measures, separated by 12 weeks. Six dependent variables were assessed: the score on each of five physical tasks comprising a functional fitness test (Functional Fitness Assessment for Adults Over 60 Years), and responses to a self-evaluation of physical, social and emotional well-being (the General Well-Being Schedule). Within-group and between-group differences were evaluated for each of the dependent variables. The statistical technique used was the Analysis of Variance. Alpha was established at the .05 level of significance. When significance was indicated, the Student-Newman-Keuls post hoc comparison was used to determine where the differences existed.

Additional information pertaining to personal characteristics of participants, motivational factors, and programmatic preferences was obtained by way of an optional evaluation of the activity programs. A copy of the evaluation is included in Appendix J.

All statistical procedures were conducted on the IBM 3090-200S system, through the Department of Computing and Information Services at Oklahoma State University. Statistical calculations were completed using the Statistical Package for the Social Sciences (SPSS).

## Methods

General procedures for the recruitment and preparation of subjects,

testing protocols, and exercise programs were outlined in Chapter I. The complete testing protocol as developed and prescribed by Osness et al. (1996) is available from the American Alliance of Health, Physical Education, Recreation and Dance.

The first two sessions for both exercising groups were dedicated to testing and orientation. The first session included taking the weight and height of the subjects, and four of the five tests making up the Functional Fitness Assessment for Adults Over 60 Years. Subjects were given a scorecard to carry from test to test. Subjects' scores were recorded and maintained by means of an assigned subject number in order to provide anonymity. The order of testing was:

1) Subjects' Height - measured against the wall, with shoes off, and recorded to the nearest one half inch.
2) Flexibility - a modified sit and reach test. Subjects sat on the floor and reached as far as possible along a yardstick. Each subject was given two warm-up stretches, then two recorded trials, measured to the nearest half inch.
3) Choice of either the Coordination or Agility tasks (after completing one, subjects went to the other). The Coordination test involved moving soda pop cans across a table top by turning them over in succession with one hand. Subjects were given group a demonstration and one practice trial individually, followed by two timed trials. Scores were recorded to the nearest tenth of a second. The Agility task consisted of sitting/rising from a chair, and walking through a course of traffic cones. Each subject was given a demonstration and one practice trial, before

being timed on two trials separated by a rest period of 30 seconds. Trials were recorded to the nearest tenth of a second.

4) Strength test - biceps curls. Subjects were given 30 seconds to complete as many biceps curls as possible, lifting either one half gallon (for the women) or one gallon milk bottles (for the men). Subjects were given an explanation and shown a proper biceps curl before performing one timed trial. The number of completed curls in the allotted time was the recorded score.
5) Subjects' weight - measured to the nearest pound. Subjects removed shoes and bulky clothing, such as coats or sweaters.

The second session began with the Endurance test, followed by completion of the General Well-Being Schedule.

1) Endurance test - one half mile walk. The walk was conducted indoors, around the perimeter of a gymnasium consisting of four basketball courts. One trial was given, and times were recorded to the nearest second.
2) The General Well-Being Schedule was administered, using subjects' numbers rather names to provide anonymity in grading.

This was followed by an overview of what the typical class sessions would entail. For aerobics, participants were led through sample warm-up exercises, basic movements and combinations, and a short set of strengthening exercises. In the weight training class, participants were given a guidebook of the stretches to be done at the beginning of each session and led through them. Participants were then introduced to the machines which would be utilized, and given a demonstration of proper lifting technique. The weight training equipment used was plate-loaded, variable

resistance machines (Universal Gym Equipment, Cedar Rapids, IA).

Following these introductory class periods for each group, regular exercise sessions were held for the next 24 class periods (12 weeks). Class content for the Aerobic Group included:

- Warm-up (10-15 minutes of easy movements and stretching)
- Aerobic phase (15-20 minutes of rhythmic activity sufficient to elevate participants' heart rates to a target zone of 40% - 60% of their maximum predicted heart rate)
- Cool down (approximately 5-10 minutes of slower movement to gradually lower heart rates)
- Toning and strengthening (15 minutes of exercises isolating muscle groups for the purpose of building strength and endurance)
- Flexibility and relaxation (5 minutes of gradual, static stretching)

Subjects were instructed to work at the maximum level they could achieve comfortably. Particularly during the aerobic phase, participants were repeatedly told to "come down" (lower or eliminate arm movements) if they got too tired, felt pain or severe discomfort. Water was readily available in the exercise room, and they were instructed to drink frequently, or as necessary, during the workout. If subjects had conditions which contraindicated certain types of movements the instructor provided alternate moves to the individual(s) affected. Subjects were taught how to take their pulse and educated as to the relationship between heart rate and exercise intensity. They were taught how to calculate their age-predicted maximum heart rate, and also their measured maximum heart rate using the Karvonen

method. In addition, they were given a copy of Borg's Rating of Perceived Exertion scale and instructed as to its significance. Subjects' perceived exertion and heart rates were monitored during class sessions. These methods were employed as complimentary means of helping the participants develop an accurate and appropriate sense of their exercise intensity levels.

The Weight Training sessions included:

- Warm-up (10-15 minute sequence of stretching, range of motion exercises)
- Weight lifting - Eight exercise stations, including: Latissimus Pulldown, Seated Row (pronated grip), Military Press, Bench Press, Leg Press, Leg Extension, Leg Curl, and abdominal crunches (done on the floor, without machine resistance).
- Cool Down (5-10 minutes of stretching, walking)

The weight lifted on each machine was sub-maximal, with the starting weight for each subject being individually determined. The starting weight was that at which the subject could perform eight repetitions. If eight repetitions were not possible at a given machine's lightest weight, subjects performed as many repetitions as possible. Participants were instructed to lift at a resistance which allowed them to breathe freely and rhythmically. It was repeatedly stressed that there should be no breath holding while lifting. When they were able to do so without straining, participants were allowed to increase the number of repetitions up to 10. After sufficient strength and endurance were gained, a third set was added. Repetitions and sets were increased before weight was increased. Three sets were performed for a minimum of five sessions before an increase in weight was allowed. In addition, there was an "abdominal station" at which participants performed

abdominal crunches. If necessitated by weakness or injury, adapted abdominal exercises were provided.

Because it would be impossible for the instructor to supervise all of the participants at all times, weightlifting was done in pairs. Partners helped maintain records, talked to each other throughout the exercises as a means of avoiding breath holding, and "spotted" for each other if the lifter was straining to finish a set. The beneficial effects of spotting were emphasized as a means of maintaining the proper range of motion throughout the set, and also to avoid straining. On some machines spotting was necessary from the first repetition because even the lightest weight was difficult for the subjects to lift. This was typically the case with the Military Press and the Leg Curl.

The posttesting was again conducted in two sessions, following the same order and format as the first testing session.

# CHAPTER IV

## RESULTS

The primary purpose of this study was to determine whether regular participation in moderate intensity exercise would yield physiological and/or psychological benefits for older adults. Of specific concern was the subjects' functional capacities: both real and perceived. For that reason, their physical abilities were evaluated by their performance on the Functional Fitness Assessment For Adults Over 60, developed by a committee of the American Alliance for Health, Physical Education, Recreation and Dance (Osness et al., 1996). The Functional Fitness Assessment For Adults Over 60 consists of six parameters: body composition, flexibility, agility, coordination, strength, and endurance. Body composition was represented as a "Pondural Index," which was computed for each subject using their height and weight. This measure was considered to be a relatively indirect indicator of function and therefore was not addressed in the stated research hypotheses or questions. The remaining five parameters (those involving the performance of a physical task) were utilized in the formation of hypotheses and research questions. Performance scores from all three groups' pre- and posttest trials were analyzed. It should be noted that positive changes in function can be reflected by either increases or decreases in subjects' scores. Increased scores in the Flexibility and Strength tests reflect improvement (a greater number of inches reached or repetitions performed). The Agility, Coordination and Endurance

tests were timed, therefore lowered scores indicate less time needed to perform these tasks.

A related area of inquiry was whether different modes of exercise would produce different physical outcomes, i.e. was one type of exercise "better" than the other. In order to investigate this question, a direct comparison of the two exercising groups was conducted.

The psychological status of each of the subjects, both before and after the 12 week exercise period, was evaluated by their responses to the General Well-Being Schedule. The General Well-Being Schedule is a self-report instrument developed by the National Center for Health Statistics (McDowell, 1987). It is intended to assess selected aspects of well-being and distress. A cumulative score is calculated which reflects the overall state of perceived well-being. Additional information can be obtained from six subscales within the instrument: freedom from health concerns, energy level, satisfying/ interesting life, cheerful versus depressed mood, relaxed versus tense, and emotional control. The higher the cumulative total and/or scores on the six subscales, the greater the subjects' sense of well-being. Due to the weakness in the subscales mentioned in Chapter II (that there were too few criteria), only the cumulative scores will be analyzed in this section. A complete set of subscale scores is included in Appendix D.

Physical Measure

This section will examine the findings concerning the Functional Fitness Assessment For Adults Over 60 Years. The study began with a sample size of 36 persons. Pre- and Posttest comparisons were computed based on the scores of 34 subjects (Aerobics group=12, Weight Training group=13, Control group=9). All statistical comparisons were conducted using the Statistical

Package for the Social Sciences (SPSS), through the Oklahoma State University Department of Computing and Information Services.

Research Hypotheses to be tested were:

1. There is no significant difference between the three groups' pretest scores on any of the five components of the Functional Fitness Assessment For Adults Over 60 Years.

A oneway Analysis of Variance (ANOVA) was completed on the scores from each of the five tasks. The results revealed that at the .05 significance level there were differences between the groups at the time of the pretest. The Student-Newman-Keuls (SNK) post hoc procedure was utilized to determine where these differences existed. Table 1 summarizes the findings regarding pretest differences. The ANOVA and SNK results for all five functional tasks' pretests can be found in Appendix B, Tables B1-B9.

**TABLE 1**

**SUMMARY OF PRETEST DIFFERENCES: FUNCTIONAL FITNESS ASSESSMENT FOR ADULTS OVER 60 YEARS**

| Measure | Significant Differences | Table(s) |
|---|---|---|
| Flexibility | No | B1 |
| Agility | Yes | B2, B3 |
| Coordination | Yes | B4, B5 |
| Strength | Yes | B6, B7 |
| Endurance | Yes | B8, B9 |

Possible explanations for the existence of pretest differences on four of the five measures include:

a. the fact that subjects were allowed to self-select the group they would join;
b. the wide discrepancy between older subjects' performance abilities as referenced in the discussion of the heterogeneity of the older population;
c. each of the treatment groups contained a relatively small number of subjects, meaning that one or two subjects' scores could excessively influence (skew) the group's scores.

Hypotheses 2 through 4 will be examined together.

2. After 12 weeks of exercise, there is no significant difference between the Aerobics Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Assessment For Adults Over 60 Years.
3. After 12 weeks of exercise, there is no significant difference between the Weight Training Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Assessment For Adults Over 60 Years.
4. After 12 weeks of exercise, there is no significant difference between Control Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Assessment For Adults Over 60 Years.

Table 2 shows the mean scores, and amount of change on each task, for all three groups on the five skill measures of the Functional Fitness Assessment For Adults Over 60 Years.

TABLE 2

MEAN SCORES ON FUNCTIONAL FITNESS ASSESSMENT FOR ADULTS OVER 60

| Group | Pretest Mean | Pretest SD | Posttest Mean | Posttest SD | Change |
|---|---|---|---|---|---|
| | | **Flexibility** (inches) | | | |
| Aerobics | 18.83 | 4.53 | 21.38 | 4.39 | +2.55 |
| Weight Training | 20.50 | 3.11 | 22.31 | 2.74 | +1.81 |
| Control | 16.67 | 5.73 | 17.61 | 6.10 | +0.94 |
| | | **Agility** (seconds) | | | |
| Aerobics | 29.34 | 3.28 | 29.48 | 3.15 | +0.14 |
| Weight Training | 25.61 | 3.58 | 24.32 | 4.65 | - 1.29 |
| Control | 31.12 | 2.43 | 27.68 | 4.55 | - 3.44 |
| | | **Coordination** (seconds) | | | |
| Aerobics | 15.56 | 3.11 | 10.53 | 1.07 | - 5.03 |
| Weight Training | 13.03 | 2.31 | 10.50 | 1.26 | - 2.53 |
| Control | 17.24 | 4.90 | 15.18 | 6.71 | - 2.06 |
| | | **Strength** (repetitions) | | | |
| Aerobics | 17.83 | 2.48 | 21.75 | 5.12 | +3.92 |
| Weight Training | 24.80 | 2.98 | 25.31 | 2.80 | +0.51 |
| Control | 17.56 | 2.88 | 20.00 | 4.12 | +2.44 |
| | | **Endurance** (minutes) | | | |
| Aerobics | 7.94 | .74 | 7.68 | .58 | - 0.26 |
| Weight Training | 7.66 | .66 | 7.67 | 1.20 | - 0.01 |
| Control | 9.12 | .93 | 7.98 | .78 | - 1.14 |

A Multiple Analysis of Variance (MANOVA) was performed to compare all three groups' scores on each of the five functional tasks at the .05 alpha level. A summary of the results of the pretest-posttest comparisons is shown in Table 3. Examination of the results indicated significant changes on the Agility and Endurance tasks. However, these results are confounded by the fact that the Control group scores changed on all of the tasks. Therefore, in order to reduce the effects of Control group changes, a oneway ANOVA was run on the Gain Scores, with a post hoc comparison (Student-Newman-Keuls) conducted to determine where any real differences existed. Significant changes were found on the Agility and Endurance tasks. For these tasks, results of the the original ANOVA's as well as the gain score analysis and post hoc comparisons are shown (Tables 4-9). The ANOVA results for the other three functional tasks are included in Appendix C (Tables C1-C3).

**TABLE 3**
**SUMMARY OF PRE- TO POSTTEST CHANGES: FUNCTIONAL FITNESS ASSESSMENT FOR ADULTS OVER 60 YEARS**

| Measure | Group | Pre-Posttest Difference | Table(s) |
|---|---|---|---|
| Flexibility | Aerobics | No | C1 |
| | Weight Training | No | |
| | Control | No | |
| Agility | Aerobics | Yes | 4, 5, 6 |
| | Weight Training | No | |
| | Control | No | |
| Coordination | Aerobics | No | C2 |
| | Weight Training | No | |
| | Control | No | |
| Strength | Aerobics | No | C3 |
| | Weight Training | No | |
| | Control | No | |
| Endurance | Aerobics | No | 7, 8, 9 |
| | Weight Training | No | |
| | Control | Yes | |

TABLE 4

ANALYSIS OF VARIANCE: PRETEST - POSTTEST AGILITY, ALL GROUPS

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 330.35 | 2 | 165.17 | 6.94 | .003 |
| Error | 738.27 | 31 | 23.82 | | |
| Within Subjects | | | | | |
| Time | 35.73 | 1 | 35.73 | 8.08 | .008 |
| Group x Time | 33.30 | 2 | 16.65 | 3.77* | .034 |
| Error | 137.05 | 31 | 4.42 | | |

*p<.05

The Aerobics group displayed a significant pre- to posttest change on the Agility task. Gain Score means are represented in Table 5. The post hoc results shown in Table 6 confirmed that the Aerobics group differed significantly from the Control group. (Even though it appears there were also significant main effects due to Group and Time, neither Group nor Time alone were effects of interest in this investigation.)

TABLE 5

GAIN SCORE MEANS: PRETEST - POSTTEST AGILITY

| Group | n | Mean |
|---|---|---|
| Aerobics | 12 | .1333 |
| Weight Training | 13 | - 1.0923 |
| Control | 9 | - 3.4444 |

TABLE 6

SNK: PRETEST - POSTTEST AGILITY

| Comparison | q | Significant Difference |
|---|---|---|
| Aerobics vs. Wt Training | 1.4563 | No |
| Wt Training vs. Control | 2.5799 | No |
| Aerobics vs. Control | 3.8590* | Yes |

*p<.05

TABLE 7

ANALYSIS OF VARIANCE: PRETEST - POSTTEST ENDURANCE, ALL GROUPS

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 7.49 | 2 | 3.75 | 4.46 | .021 |
| Error | 23.51 | 28 | .84 | | |
| Within Subjects | | | | | |
| Time | 3.67 | 1 | 3.67 | 22.14 | <.001 |
| Group x Time | 1.46 | 2 | .73 | 4.41* | .022 |
| Error | 4.65 | 28 | .17 | | |

*p<.05

The Control group displayed a significant pre- to posttest change on the Endurance task. Gain Score means are represented in Table 8. The post hoc results shown in Table 9 confirmed that the Control group differed significantly from both the Aerobics and Weight Training groups.

(Even though it appears there were also significant main effects due to Group and Time, neither Group nor Time alone were effects of interest in this investigation.)

TABLE 8

GAIN SCORE MEANS: PRETEST - POSTTEST ENDURANCE

| Group | n | Mean |
|---|---|---|
| Aerobics | 12 | - .2597 |
| Weight Training | 13 | - .2556 |
| Control | 9 | - .9929 |

TABLE 9

SNK: PRETEST - POSTTEST ENDURANCE

| Comparison | q | Significant Difference |
|---|---|---|
| Aerobics vs. Wt Training | .0247 | No |
| Wt Training vs. Control | 3.8064* | Yes |
| Aerobics vs. Control | 3.7852* | Yes |

*p<.05

Research Hypothesis 5: There is no significant difference between the two exercising groups' scores on any of the five components of the Functional Fitness Assessment for Adults Over 60 Years.

A Multiple Analysis of Variance (MANOVA) was conducted using only the Aerobics and Weight Training groups to determine whether these two groups' pre-/posttest behavior differed significantly. Since it was

determined that the treatment groups displayed pretest differences, a modification of the originally planned data analysis was again necessary. On tasks where there appeared to be significant differences, the Student-Newman-Keuls post hoc was used to determine where the differences occurred. A t-test of the Gain Scores was then used to determine the extent to which each group's scores changed relative to their pretest starting point. This provided an accurate appraisal of which group actually "changed most." All tests were conducted at the .05 level of significance.

The ANOVA indicated that there were between-group differences present on the Coordination and Strength tasks. These differences were verified with the post hoc analyses. Tables 10-13 show the ANOVA and t-test results for the Coordination and Strength tasks.

**TABLE 10**

**ANALYSIS OF VARIANCE: PRETEST - POSTTEST COORDINATION, EXERCISING GROUPS ONLY**

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 22.86 | 1 | 22.86 | 4.11 | .054 |
| Error | 127.95 | 23 | 5.56 | | |
| Within Subjects | | | | | |
| Time | 171.30 | 1 | 171.30 | 54.33 | <.001 |
| Group x Time | 21.75 | 1 | 21.75 | 6.90* | .015 |
| Error | 72.52 | 23 | 3.15 | | |

*p<.05

The Aerobics group differed from the Weight Training group on the Coordination task. (Even though it appears there was also a significant main

effect due to Time, Time alone was not an effect of interest in this investigation.)

**TABLE 11**

**T-TEST: PRETEST - POSTTEST COORDINATION, EXERCISING GROUPS ONLY**

| Source | Mean | SD | df | t | Prob. |
|---|---|---|---|---|---|
| Aerobics Group (n=12) | -5.0250 | 3.234 | 23 | -2.63* | .015 |
| Weight Training Group (n=13) | -2.3846 | 1.581 | | | |

*p<.05

The Aerobics group had a greater decrease in pre-to posttest scores on the Coordination task than the Strength Training group.

**TABLE 12**

**ANALYSIS OF VARIANCE: PRETEST - POSTTEST STRENGTH, EXERCISING GROUPS ONLY**

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 343.56 | 1 | 343.56 | 21.08 | <.001 |
| Error | 374.92 | 23 | 16.30 | | |
| Within Subjects | | | | | |
| Time | 61.93 | 1 | 61.93 | 8.47 | .008 |
| Group x Time | 35.61 | 1 | 35.61 | 4.87* | .038 |
| Error | 168.07 | 23 | 7.31 | | |

*p<.05

The Aerobics group differed from the Weight Training group on the Strength task. (Even though it appears there were also significant main effects due to Group and Time, neither Group nor Time alone were effects of

interest in this investigation.)

TABLE 13

T-TEST: PRETEST - POSTTEST STRENGTH, EXERCISING GROUPS ONLY

| Source | Mean | SD | df | t | Prob. |
|---|---|---|---|---|---|
| Aerobics Group (n=12) | 3.9167 | 3.528 | 23 | 2.21* | .038 |
| Weight Training Group (n=13) | .5385 | 4.075 | | | |

*p<.05

The Aerobics group had a greater increase in pre-to posttest scores on the Strength task than the Strength Training group.

Affective Measure

This section will examine the findings concerning the General Well-Being Schedule. Research Hypotheses are:

6. There is no significant difference between the three groups' pretest scores on the General Well-Being Schedule.

The results of a oneway Analysis of Variance (ANOVA) revealed that at the .05 level of significance there were no differences between the groups at the time of the pretest. Table 14 represents the results of this analysis.

TABLE 14

ANALYSIS OF VARIANCE: PRETEST DIFFERENCES, GENERAL WELL-BEING SCHEDULE

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Group | 104.6000 | 2 | 52.3000 | .41 | .667 |
| Error | 4216.4000 | 33 | 127.7697 | | |
| Total | 4321.0000 | 35 | | | |

Hypotheses 7 through 9 will be examined together.

7. After 12 weeks of exercise, there is no significant difference between the Aerobics Group subjects' pre- and posttest scores on the General Well-Being Schedule.
8. After 12 weeks of exercise, there is no significant difference between the Weight Training Group subjects' pre- and posttest scores on the General Well-Being Schedule.
9. After 12 weeks of exercise, there is no significant difference between Control Group subjects' pre- and posttest scores on the General Well-Being Schedule.

Table 15 shows the means for the cumulative scores, and the pre- to posttest changes in them, for all three groups on the General Well-Being Schedule. A table of the subscale score means and their changes by group is included in Appendix D.

**TABLE 15**

**MEAN SCORES ON GENERAL WELL-BEING SCHEDULE**

| Group | Pretest | | Posttest | | Change |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Aerobics | 85.67 | 12.24 | 87.83 | 13.37 | +2.16 |
| Weight Training | 89.47 | 11.69 | 96.23 | 9.73 | +6.76 |
| Control | 86.67 | 9.04 | 85.78 | 7.69 | - 0.89 |

A Multiple Analysis of Variance (MANOVA) was performed to compare all three groups' scores on the General Well-Being Schedule at the .05 alpha level. The results are shown in Table 16. No group displayed significant pre- to posttest changes.

**TABLE 16**

**ANALYSIS OF VARIANCE: PRETEST - POSTTEST, GENERAL WELL-BEING SCHEDULE ALL GROUPS**

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 758.76 | 2 | 379.38 | 1.76 | .189 |
| Error | 6686.76 | 31 | 215.70 | | |
| Within Subjects | | | | | |
| Time | 89.51 | 1 | 89.51 | 4.08 | .052 |
| Group x Time | 117.87 | 2 | 58.93 | 2.68 | .084 |
| Error | 680.66 | 31 | 21.96 | | |

Research Hypothesis 10: There is no significant difference between the two exercising groups' scores on the General Well-Being Schedule.

A Multiple Analysis of Variance (MANOVA) was conducted using only the Aerobics and Weight Training groups' scores to determine whether significant between-group differences existed. Table 17 reflects the results of this analysis, run on the two exercising groups' cumulative scores on the General Well-Being Schedule.

TABLE 17

ANALYSIS OF VARIANCE: PRETEST - POSTTEST,
GENERAL WELL-BEING SCHEDULE
EXERCISING GROUPS ONLY

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 549.35 | 1 | 549.35 | 2.20 | 1.51 |
| Error | 5733.65 | 23 | 249.29 | | |
| Within Subjects | | | | | |
| Time | 192.70 | 1 | 192.70 | 8.76 | .007 |
| Group x Time | 38.78 | 1 | 38.78 | 1.76 | .197 |
| Error | 506.22 | 23 | 22.01 | | |

There was no significant difference between the Aerobics and Weight Training groups' scores at the .05 level of significance. (Even though it appears there was a significant main effect due to Time, Time alone was not an effect of interest in this investigation.)

## Discussion

The hypotheses tested, and the decisions indicated by the results of this study are summarized as follows:

Hypothesis #1: There would be no pretest differences among the three groups of participants on the Functional Fitness Assessment for Adults Over 60 Years.

Rejected: This hypothesis was rejected due to the existence of Pretest differences between the groups.

Some of the possible reasons for these differences' existence have already been presented. It appears to this investigator that the greatest influence was probably the relatively small number of subjects. As noted earlier, differences among older adults' abilities are often more pronounced than those observed in other populations. Therefore, the need for an adequately large sample size seems particularly important to offset the effects of this highly heterogeneous population.

Within the area of physical abilities, as measured by the Functional Fitness Assessment for Adults Over 60 Years, evidence did not consistently support the stated hypotheses concerning exercise effects. Although the scores on most of the tasks differed from pre- to posttest for all three groups, only two of these differences reached statistical significance.

Hypothesis #2: There would be no differences between the Aerobics group's pre- and posttest scores on the Functional Fitness Assessment for Adults Over 60 Years.

Rejected: This hypothesis was rejected due to significant changes in the Agility scores.

The decrement in the Aerobics group's Agility test scores does not reinforce the notion of exercise to improve balance and overall walking abilities. The change was very minimal, but due to the improvement in the Control group's scores, it is statistically significant. The influence of conversation during the posttesting session may have contributed to the change in score.

Hypothesis #3: There would be no differences between the Weight Training group's pre- and posttest scores on the Functional Fitness Assessment for Adults Over 60 Years.

Failed to Reject: This hypothesis was not rejected due to the lack of statistically significant change on any measure.

Hypothesis #4: There would be no differences between the Control group's pre- and posttest scores on the Functional Fitness Assessment for Adults Over 60 Years.

Rejected: This hypothesis was rejected due to significant changes in the Endurance scores.

An unexpected change was seen in the Control group's Endurance scores. As a group they improved markedly, while the two exercising groups demonstrated no changes. This is almost certainly an outcome of the nature of the groups from which subjects were selected and the self-assignment process. Many of the subjects chose the Control group because they were "too busy" to commit to regular attendance at the classes. If being "busy" is assumed to be related to activity level, then this group was probably more active than a randomly selected control group made up of a more diverse set of subjects. Also, the time of year that the test sessions were held may have been an influence. Pretesting was held in January, when most people are less active and indoors. Posttesting occurred in April when many people are enjoying the outdoors and activity levels naturally increase.

Hypothesis #5: There would be no differences between the Aerobics group's and the Weight Training group's scores on the Functional Fitness Assessment for Adults Over 60 Years.

Rejected: This hypothesis was rejected due to significant changes in the Coordination and Strength scores.

A comparison of the two exercising groups showed the Aerobics group to have improved more in the areas of Coordination and Strength than the Weight Training group. This would indicate that the "better" mode of exercise for the improvement of general functional abilities within this sample was Aerobics. However, it is worth noting that the Strength measure used was a movement assimilating a Biceps Curl. While this test was an adequate measure of strength and endurance in the upper arm, it is somewhat questionable how directly it reflects total body strength. The weight training protocol which was used concentrated on strength and flexibility in the larger muscle groups of the upper and lower body. Only two of the exercises incorporated the Biceps: the Lat Pulldown and the Seated Row. Further, the use of a pronated grip during the Seated Row reduced the involvement of the biceps during that exercise. The rationale for the selection of tangential rather than direct exercises for the biceps was twofold. First, the American College of Sports Medicine suggests that multi-joint exercises are preferable to single-joint exercises for older adults (Kenney et al., 1995). Also, it was feared that the inclusion of an exercise specifically targeting the biceps (most likely a Biceps Curl), would potentially skew the results in a positive direction.

Hypothesis #6: There would be no pretest differences among the three groups of participants on the General Well-Being Schedule.

Failed to Reject: This hypothesis was not rejected due to the lack of Pretest differences between the groups.

This would indicate that even though not randomly selected or assigned, the subjects were similar in their psychological states and sense of well-being at the beginning of the study.

Hypothesis #7: There would be no differences between the Aerobics group's pre- and posttest scores on the General Well-Being Schedule

Failed to Reject: This hypothesis was not rejected due to the lack of statistically significant change in the cumulative scores.

Hypothesis #8: There would be no differences between the Weight Training group's pre- and posttest scores on the General Well-Being Schedule

Failed to Reject: This hypothesis was not rejected due to the lack of statistically significant change in the cumulative scores.

Hypothesis #9: There would be no differences between the Control group's pre- and posttest scores on the General Well-Being Schedule

Failed to Reject: This hypothesis was not rejected due to the lack of statistically significant change in the cumulative scores.

No group displayed significant pre- to posttest differences in cumulative scores on the General Well-Being Schedule. It is interesting to note however, that both the Aerobics and Weight Training groups displayed significant pre- to posttest changes in the Depression subscale scores. Both groups demonstrated positive changes in their scores, indicating lower levels of depression. (ANOVA and post hoc results for these scores are included in Appendix E.)

Hypothesis #10: There would be no differences between the Aerobics group's and the Weight Training group's scores on the General Well-Being Schedule.

Failed to Reject: This hypothesis was not rejected due to a lack of differences in a direct comparison of the two exercising groups' cumulative scores.

There were no differences displayed between these two groups' Depression subscale scores. (ANOVA results are included in Appendix F.)

# CHAPTER V

# SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## Summary

This study examined the physiological and/or psychological effects of participation in moderate-intensity exercise activities by older adults. The measurements applied evaluated physical and affective outcomes relative to functional capacities. Additionally, different modes of exercise were compared to determine their relative benefits.

Other studies have suggested that there are significant health benefits to be gained through regular exercise by older adults. These have been documented for community-dwelling as well as institutionalized elders. Even when significant losses have been experienced, muscular strength, cardiovascular endurance, and joint flexibility have been regained at noticeable levels. A direct relationship has been documented between these types of physical skills and individuals' ability to participate in activities of daily living. Since the literature suggested the existence of this relationship, and a means of measuring functional abilities and perceptions of personal well-being were available, this study was deemed viable in its attempts to illustrate the benefits of an exercise intervention.

Subjects in this study were community-dwelling adults, aged 60 years

and older. They were recruited to participate through various organizations in the community, and participated voluntarily. The program consisted of pre- and posttesting sessions, separated by 12 weeks of exercise. The instrument used to evaluate their physical status was the Functional Fitness Assessment for Adults Over 60 Years, developed by the American Alliance for Health, Physical Education, Recreation and Dance. Two exercise groups were formed: one participating in dance-based aerobics, the other utilizing variable resistance machines for weight training. A control group, pre- and posttested only. Subjects also completed a self-report of their psychological well-being at the pre- and posttesting sessions. The instrument used for this evaluation was the General Well-Being Schedule .

The following hypotheses were tested in this study:

1. There is no significant difference between the three groups' pretest scores on any of the five components of the Functional Fitness Test for Adults Over 60 Years.
2. After 12 weeks of exercise, there is no significant difference between the Aerobics Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Test for Adults Over 60 Years.
3. After 12 weeks of exercise, there is no significant difference between the Weight Training Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Test for Adults Over 60 Years.
4. After 12 weeks of exercise, there is no significant difference between Control Group subjects' pre- and posttest scores on any of the five components of the Functional Fitness Test for

Adults Over 60 Years.

5. There is no significant difference between the two exercising groups' scores on any of the five components of the Functional Fitness Test for Adults Over 60 Years.
6. There is no significant difference between the three groups' pretest scores on the General Well-Being Schedule.
7. After 12 weeks of exercise, there is no significant difference between the Aerobics Group subjects' pre- and posttest scores on the General Well-Being Schedule.
8. After 12 weeks of exercise, there is no significant difference between the Weight Training Group subjects' pre- and posttest scores on the General Well-Being Schedule.
9. After 12 weeks of exercise, there is no significant difference between Control Group subjects' pre- and posttest scores on the General Well-Being Schedule.
10. There is no significant difference between the two exercising groups' scores on the General Well-Being Schedule.

## Conclusions

The results of this study indicated:

1. There were few demonstrated differences in physical function due to the twelve week intervention of exercise.
2. A significant difference was apparent in the agility of subjects participating in the Aerobics program.
3. Changes in the Control group, and most appreciably in their

endurance scores, were likely due to the effects of self-assignment into the group, increased activity on their part and/or the reactive effects of the experimental environment, i.e. the Hawthorne Effect (Wiersma, 1980).

4. Physical gains were greatest for the Aerobics participants, as evidenced in greater coordination and strength.
5. The exercise intervention did not change the psychological status of the participants, (reflected in their sense of overall well-being and/or distress), as measured by the General Well-Being Schedule.

Therefore, it may be concluded that:

1. Certain physical skills are positively affected through participation in a moderate-intensity Aerobic ("dance based") exercise program.
2. Psychological well-being is unaffected by participation in a moderate-intensity exercise program.

## Recommendations for Further Study

This study addressed the effects of moderate-intensity exercise on the general health, defined as "functional fitness," of older adults. While the results do not convincingly favor exercise participation, certain trends in the data can be seen by examining the changes in each group's scores (Table 2). The existence of significant pretest differences, and the large changes in the Control group over the course of the study, were due to the unique

characteristics of an older population. Adequate precautions were not taken to guard against their effects. For example, the small sample size was an apparent weakness in this study. In addition to the fact that there were a limited number of willing exercisers found in the initial contacts, prolonging the recruitment process would have risked losing some of the original volunteers. This was a result of their enthusiasm once they became aware of the program (those who were willing to exercise wanted to "get started"), and also due to their need to complete the 12 week program before their trips/ activities of late spring. Additionally, the characteristics of persons who belong to the groups solicited might be very different from the general population. For one thing, a large number of ex-faculty members who are knowledgeable about research methods and goals might behave differently than participants who have no prior knowledge or expectations. Another discrepancy is that the activity level among these particular elders was probably greater among what is commonly encountered in this age group. Given the opportunity to conduct a similar study, the investigator would recruit a larger number of subjects, from less intact groups, and if possible, randomly assign them to participation groups. If random assignment was not possible, then a posttest-only design would be recommended in order to eliminate the effects of a reactive test situation.

The length of the exercise intervention could be examined also. The 12 week course was consistent with the majority of the research cited in this study, and many of the participants noticed improvements based upon their personal conditions. It is possible however, that a longer period of activity would have yielded more statistically significant results. Again, it should be emphasized that there is a difference between fitness goals and general

health/functional goals. The objectives of the latter generally require less time and intensity to realize noticeable gains.

It also bears mentioning that in order to provide a friendly and unintimidating environment, the atmosphere during the test sessions was very casual. Tighter controls might be advisable, specifically as related to subject interaction and conversation during testing. One particular incident (a subject fainting during testing) was a topic of conversation in a later test session and may have had a distracting influence on scores.

The psychological measure used (the General Well-Being Schedule) was described as a good "quality of life measure," and as being in the "right place at the right time to present coherent and useful data about the subjective well-being of large cross-sections of our citizenry" (Fazio, 1977, p.12). However, it may not have been sensitive enough to distinguish the presence of distress among the tested population. The individuals in this study were all retired, basically healthy, secure and happy individuals. By assessing overall well-being, which was relatively high, any specific concerns which may have been evident within the sub-areas was probably overlooked. If the number of criteria present within the subscales was increased, a greater amount of information regarding the specific factors which contribute to individuals' well-being could be assessed more accurately. As previously stated, it was extremely difficult to find a non-diagnostic instrument to administer to an essentially healthy population.

While the statistical significance reported in this study was not overwhelming, the "personal significance" reported by the participants reflected a much more optimistic conclusion. Individual testimonials made during, and after, the course of the program, and comments obtained on an

optional (anonymous) program evaluation, described many physical improvements. The evaluation and a summary of responses are included in Appendices L and M, respectively.

The fact that attendance and adherence were both extremely high for the two exercising groups indicates that there was at least a minimal level of enjoyment and value attached to the activities. The practical results and outcomes of this study are:

1. the creation of an "exercise habit" among several of the participants, many of whom had been sedentary previously, (16 out of the 27 exercising subjects have continued to participate in consistent exercise regimens);
2. many statements of feeling better, stronger, having more "pep" in the course of daily activity, (such as being able to mow the lawn without stopping to rest, and being able to climb flights of stairs which had previously been insurmountable);
3. quantifiable evidence to support feelings of improvement (i.e. lowered cholesterol, ability to finish the half mile endurance test when unable to do so at the beginning of the study).

The issue of motivating persons in this age group to consistently exercise is an overriding question; both how to get them started, as well as what motivates them to continue. These questions were tangential to this investigation, but obviously related, since any benefits which are "real" to the participants would almost certainly contribute to their motivation.

The medical profession's lack of encouragement for older persons' exercise participation is a perplexing dilemma. Perhaps it is due to indifference or ignorance, as suggested in much of the cited literature. Many

times these are the people the elderly contact when in distress and in whom they place their trust relative to their long-term well-being. Physicians have the opportunity to directly disseminate information and motivate older adults to adopt health-promoting behaviors, should they choose to do so. It appears that more time needs to be spent "caring for" the elderly rather than merely "treating" them.

If not for humanitarian reasons, then economic ones, much of society has a vested interest in generating longer health spans for senior citizens. Certainly "health care reform" must begin with keeping the rapidly growing older population as healthy as possible. The major obstacle seems to be a widespread lack of knowledge and understanding of the aging process. Educators in the field of Gerontology must begin to change the stereotypical images of the elderly. The assumption that all old people are frail and decrepit is extremely unsettling and exists even within the professions which directly serve older people. Physicians who pass off health concerns as "just getting older," and administrators of assisted living centers and nursing homes assume that their residents have no more potential to develop, or experience new things. Even researchers are not immune to these debilitating notions, as evidenced by the lack of rigorous evaluation instruments available to assess older subjects. Of the two instruments used in this investigation, probably neither was sensitive enough to be completely accurate in measuring the abilities of basically well elderly individuals.

Whether conscious or unconscious, expectations and attitudes influence behavior. The idea that old people are somehow different - that at some point human beings suddenly lose their will for self-direction, the desire to feel a sense of accomplishment, or the need to remain actively

engaged both mentally and physically - is so thoroughly ingrained in societal mores that it is often not even recognized as offensive. A change is needed not only in younger peoples' attitudes and expectations, but also among older adults themselves. An aggressive course of education and changing of the status quo on all fronts is necessary. The physical realm is but a small piece of the total aging process, but it is the one with which this study was directly concerned. Perhaps future inquiries should concentrate even more heavily on the practical outcomes of exercise participation for older adults. The more obvious the resultant benefits, the more likely it is that a particular action will be seen as valuable and therefore put into practice. At the least, attempts should be made to establish a more direct relationship between clinical investigation and the quality of life issues encountered on a daily basis by the older population. Doing so would generate more information regarding appropriate exercise interventions for health benefits, and also provide an impetus for the development of motivational strategies to secure broad-based exercise participation by older adults.

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# APPENDICES

# APPENDIX A

## SUBJECTS' SCORES ON FUNCTIONAL FITNESS ASSESSMENT FOR ADULTS OVER 60 YEARS

## TABLE A1

## AEROBICS SUBJECTS' SCORES

| **Measure:** | **Flexibility** (inches) | | **Agility** (seconds) | | **Coordination** (seconds) | | **Strength** (repetitions) | | **Endurance** (minutes) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Subject 1 | 20.0 | 24.0 | 33.0 | 33.3 | 12.5 | 10.7 | 16 | 20 | 8.08 | 8.20 |
| Subject 2 | 25.0 | 27.5 | 22.7 | 27.9 | 13.2 | 9.6 | 17 | 17 | 7.58 | 7.40 |
| Subject 3 | 26.0 | 27.0 | 29.3 | 29.0 | 15.1 | 12.5 | 22 | 28 | 6.75 | 7.40 |
| Subject 4 | 14.0 | 14.5 | 28.2 | 26.2 | 14.0 | 9.1 | 19 | 22 | 7.87 | 7.38 |
| Subject 5 | 21.0 | 23.0 | 28.3 | 26.5 | 17.1 | 10.1 | 16 | 19 | 8.22 | 7.37 |
| Subject 6 | 20.0 | 21.5 | 29.7 | 29.9 | 17.7 | 11.4 | 19 | 18 | 9.07 | 8.22 |
| Subject 7 | 13.0 | 14.0 | 28.3 | 29.0 | 15.7 | 11.5 | 22 | 35 | 6.75 | 6.42 |
| Subject 8 | 16.5 | 20.0 | 31.9 | 35.4 | 22.6 | 9.6 | 18 | 20 | 8.17 | 7.83 |
| Subject 9 | 21.0 | 22.5 | 34.5 | 34.1 | 18.7 | 11.4 | 14 | 18 | 8.62 | 8.08 |
| Subject 10 | 21.5 | 25.0 | 30.7 | 28.3 | 14.8 | 10.2 | 19 | 23 | 8.95 | 8.70 |
| Subject 11 | 16.0 | 19.5 | 24.8 | 27.9 | 11.1 | 10.7 | 16 | 19 | 7.58 | 7.58 |
| Subject 12 | 12.0 | 18.0 | 30.7 | 26.2 | 14.2 | 9.6 | 16 | 22 | 7.67 | 7.60 |

## TABLE A2

## WEIGHT TRAINING SUBJECTS' SCORES

| **Measure:** | **Flexibility** (inches) | | **Agility** (seconds) | | **Coordination** (seconds) | | **Strength** (repetitions) | | **Endurance** (minutes) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Subject 16 | 24.5 | - | 30.2 | - | 15.9 | - | 24 | - | 7.87 | - |
| Subject 17 | 20.0 | 23.0 | 30.4 | 25.1 | 14.2 | 11.0 | 25 | 28 | 8.67 | 8.00 |
| Subject 18 | 20.0 | 21.0 | 24.1 | 20.4 | 9.6 | 7.9 | 30 | 24 | 7.38 | 7.25 |
| Subject 19 | 20.0 | 22.0 | 26.1 | 29.4 | 10.7 | 11.4 | 25 | 27 | 8.57 | 8.13 |
| Subject 23 | 23.5 | 27.0 | 22.0 | 18.9 | 9.4 | 8.9 | 23 | 25 | 7.03 | 7.37 |
| Subject 25 | 12.5 | 18.0 | 22.8 | 19.9 | 12.8 | 10.3 | 27 | 23 | 6.97 | 6.80 |
| Subject 26 | 16.5 | 18.5 | 33.3 | 35.4 | 16.6 | 11.3 | 24 | 24 | DNF | 10.47 |
| Subject 27 | 20.0 | 19.5 | 21.9 | 22.1 | 11.7 | 9.1 | 26 | 22 | 8.07 | 7.33 |
| Subject 28 | 24.0 | 25.5 | 26.7 | 28.3 | 15.5 | 11.7 | 27 | 27 | 8.12 | 8.33 |
| Subject 29 | 20.0 | - | 23.6 | - | 12.1 | - | 26 | - | 7.05 | - |
| Subject 30 | 23.5 | 25.0 | 26.8 | 26.6 | 10.6 | 10.0 | 25 | 27 | 8.60 | 8.27 |
| Subject 32 | 22.0 | 20.0 | 21.3 | 18.8 | 13.9 | 10.6 | 27 | 23 | 7.15 | 6.80 |
| Subject 33 | 21.5 | 24.5 | 27.5 | 25.7 | 14.8 | 11.6 | 17 | 25 | 7.73 | 7.40 |
| Subject 34 | 21.0 | 24.0 | 25.1 | 24.4 | 14.8 | 11.8 | 25 | 30 | 6.98 | 7.33 |
| Subject 35 | 18.5 | 22.0 | 22.4 | 21.2 | 12.9 | 10.9 | 21 | 24 | 7.00 | 6.18 |

## TABLE A3

## CONTROL SUBJECTS' SCORES

| **Measure:** | **Flexibility** (inches) | | **Agility** (seconds) | | **Coordination** (seconds) | | **Strength** (repetitions) | | **Endurance** (minutes) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Subject 36 | 25.0 | 27.0 | 33.8 | 31.5 | 17.5 | 18.0 | 19 | 26 | 9.88 | 9.53 |
| Subject 37 | 21.5 | 22.0 | 31.6 | 26.5 | 13.1 | 12.1 | 24 | 27 | 7.73 | 7.62 |
| Subject 38 | 6.5 | 7.0 | 29.2 | 18.4 | 23.2 | 31.3 | 16 | 15 | 9.55 | 7.98 |
| Subject 39 | 16.0 | 15.0 | 33.6 | 27.8 | 22.1 | 13.3 | 18 | 20 | 9.33 | 7.62 |
| Subject 40 | 21.5 | 20.0 | 31.3 | 26.9 | 13.6 | 10.4 | 17 | 19 | 8.65 | 8.33 |
| Subject 41 | 14.0 | 15.0 | 27.6 | 23.7 | 17.5 | 10.7 | 15 | 17 | 9.78 | 7.17 |
| Subject 42 | 16.0 | 19.0 | 28.0 | 30.7 | 11.2 | 15.1 | 18 | 16 | 7.87 | 7.60 |
| Subject 43 | 18.5 | 22.0 | 33.9 | 33.2 | 12.9 | 11.3 | 17 | 20 | DNF | DNF |
| Subject 45 | 11.0 | 11.5 | 31.1 | 30.4 | 24.1 | 15.3 | 14 | 20 | 10.15 | DNF |

DNF = Did Not Finish

# APPENDIX B

## ANOVA AND POST HOC RESULTS FOR PRETESTS SCORES: FUNCTIONAL FITNESS ASSESSMENT FOR ADULTS OVER 60 YEARS

## TABLE B1

## ANALYSIS OF VARIANCE ON PRETEST FLEXIBILITY

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Group | 83.0764 | 2 | 41.5382 | 2.20 | .127 |
| Error | 624.1667 | 33 | 18.9141 | | |
| Total | 707.2431 | 35 | | | |

No two groups were significantly different at the .05 level.

## TABLE B2

## ANALYSIS OF VARIANCE ON PRETEST AGILITY

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Group | 192.8179 | 2 | 96.4090 | 9.21* | .001 |
| Error | 345.4221 | 33 | 10.4673 | | |
| Total | 538.2400 | 35 | | | |

*p<.05

Pretest differences existed on the agility task. Conducting the Student-Newman-Keuls procedure revealed that the Aerobics and Control groups were significantly different from the Weight Training group at the beginning of the study.

## TABLE B3

## SNK: PRETEST AGILITY

| Comparison | q | Significant Difference |
|---|---|---|
| Aerobics vs. Wt Training | 4.2081* | Yes |
| Wt Training vs. Control | 5.7123* | Yes |
| Aerobics vs. Control | 1.7651 | No |

*p<.05

**TABLE B4**

**ANALYSIS OF VARIANCE ON PRETEST COORDINATION**

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Group | 106.9075 | 2 | 53.4538 | 4.73* | 0.16 |
| Error | 372.7847 | 33 | 11.2965 | | |
| Total | 479.6922 | 35 | | | |

*p<.05

Significant pretest differences existed on the coordination test. Conducting the Student-Newman-Keuls procedure revealed that the Control group was different from the Weight Training group at the beginning of the study.

**TABLE B5**

**SNK: PRETEST COORDINATION**

| Comparison | q | Significant Difference |
|---|---|---|
| Aerobics vs. Wt Training | 2.7404 | No |
| Wt Training vs. Control | 4.2023* | Yes |
| Aerobics vs. Control | 1.6090 | No |

*p<.05

TABLE B6

ANALYSIS OF VARIANCE ON PRETEST STRENGTH

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Group | 439.7111 | 2 | 219.8556 | 28.09* | <.001 |
| Error | 258.2889 | 33 | 7.8269 | | |
| Total | 698.0000 | 35 | | | |

*p<.05

Pretest differences existed on the strength task. Conducting the Student-Newman-Keuls procedure revealed that the Strength Training group was significantly different from the Aerobics and Control groups at the beginning of the study.

TABLE B7

SNK: PRETEST STRENGTH

| Comparison | q | Significant Difference |
|---|---|---|
| Aerobics vs. Wt Training | 9.0831* | Yes |
| Wt Training vs. Control | 8.6842* | Yes |
| Aerobics vs. Control | .3184 | No |

*p<.05

**TABLE B8**

**ANALYSIS OF VARIANCE ON PRETEST ENDURANCE**

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Group | 11.3641 | 2 | 5.6821 | 9.95* | .001 |
| Error | 17.7075 | 33 | .5712 | | |
| Total | 29.0716 | 35 | | | |

*p<.05

Significant pretest differences existed. Conducting the Student-Newman-Keuls procedure revealed that the Control group was significantly different from the Aerobics and Weight Training groups on the endurance test at the beginning of the study.

**TABLE B9**

**SNK: PRETEST ENDURANCE**

| Comparison | q | Significant Difference |
|---|---|---|
| Aerobics vs. Wt Training | 1.3592 | No |
| Wt Training vs. Control | 6.1769* | Yes |
| Aerobics vs. Control | 4.8257* | Yes |

*p<.05

# APPENDIX C

## ANOVA RESULTS: PRE-POSTTEST CHANGES ON FUNCTIONAL FITNESS ASSESSMENT FOR ADULTS OVER 60 YEARS

## TABLE C1

### ANALYSIS OF VARIANCE: PRETEST - POSTTEST FLEXIBILITY, ALL GROUPS

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 185.73 | 2 | 92.86 | 2.47 | .101 |
| Error | 1165.26 | 31 | 37.59 | | |
| Within Subjects | | | | | |
| Time | 57.02 | 1 | 57.02 | 37.66 | <.001 |
| Group x Time | 6.75 | 2 | 3.38 | 2.23 | .124 |
| Error | 46.94 | 31 | 1.51 | | |

No group changed significantly on the Flexibility task. (Even though it appears there was a significant main effect due to Time, Time alone was not an effect of interest in this investigation.)

## TABLE C2

### ANALYSIS OF VARIANCE: PRETEST - POSTTEST COORDINATION, ALL GROUPS

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 221.00 | 2 | 110.50 | 1.64 | .005 |
| Error | 534.10 | 31 | 17.23 | | |
| Within Subjects | | | | | |
| Time | 165.46 | 1 | 165.46 | 25.88 | <.001 |
| Group x Time | 30.07 | 2 | 15.03 | 2.35 | .112 |
| Error | 198.19 | 31 | | | |

No group changed significantly on the Coordination task. (Even though it appears there were significant main effects due to Group and Time, neither Group nor Time alone were effects of interest in this investigation.)

## TABLE C3

## ANALYSIS OF VARIANCE: PRETEST - POSTTEST STRENGTH, ALL GROUPS

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 528.91 | 2 | 264.46 | 15.07 | <.001 |
| Error | 544.03 | 31 | 17.55 | | |
| Within Subjects | | | | | |
| Time | 87.71 | 1 | 87.71 | 13.52 | .001 |
| Group x Time | 35.87 | 2 | 17.94 | 2.76 | .079 |
| Error 201.18 | 31 | 6.49 | | | |

No group changed significantly on the Strength task. (Even though it appears there were significant main effects due to Group and Time, neither Group nor Time alone were effects of interest in this investigation.)

# APPENDIX D

## SUBSCALE SCORES ON THE GENERAL WELL-BEING SCHEDULE

| Group | Pretest Mean | Pretest SD | Posttest Mean | Posttest SD | Change |
|---|---|---|---|---|---|
| | | **General Health** | | | |
| Aerobics | 11.50 | 3.87 | 12.08 | 2.97 | +0.58 |
| Weight Training | 11.67 | 3.02 | 12.69 | 2.39 | +1.02 |
| Control | 9.78 | 3.03 | 10.33 | 2.69 | +0.55 |
| | | **Vitality** | | | |
| Aerobics | 14.58 | 2.50 | 15.17 | 3.04 | +0.59 |
| Weight Training | 14.60 | 3.40 | 16.77 | 1.96 | +2.17 |
| Control | 13.89 | 3.22 | 14.11 | 2.98 | +0.22 |
| | | **Well-Being** | | | |
| Aerobics | 10.50 | 2.54 | 11.08 | 2.28 | +0.58 |
| Weight Training | 11.80 | 1.42 | 12.85 | 1.73 | +1.05 |
| Control | 11.33 | 2.78 | 11.67 | 1.66 | +0.34 |
| | | **Depression** | | | |
| Aerobics | 15.83 | 2.44 | 16.58 | 3.06 | +0.75 |
| Weight Training | 17.40 | 1.96 | 18.31 | 1.44 | +0.91 |
| Control | 17.56 | 1.01 | 16.33 | 3.61 | -1.23 |
| | | **Anxiety** | | | |
| Aerobics | 20.58 | 3.03 | 19.92 | 3.00 | -0.66 |
| Weight Training | 20.33 | 3.79 | 21.77 | 3.14 | +1.44 |
| Control | 21.33 | 2.12 | 21.11 | 2.47 | -0.22 |
| | | **Self-Control** | | | |
| Aerobics | 12.67 | 2.31 | 13.00 | 1.21 | +0.33 |
| Weight Training | 13.67 | 1.11 | 13.85 | 1.46 | +0.18 |
| Control | 12.78 | 1.39 | 12.22 | 1.72 | -0.56 |

# APPENDIX E

## ANOVA AND POST HOC COMPARISON ON DEPRESSION SUBSCALES: ALL GROUPS

**TABLE E1**
**ANALYSIS OF VARIANCE: PRETEST - POSTTEST DEPRESSION SUBSCALE (ALL GROUPS)**

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 35.31 | 2 | 17.66 | 1.91 | .166 |
| Error | 287.06 | 31 | 9.26 | | |
| Within Subjects | | | | | |
| Time | .26 | 1 | .26 | .15 | .703 |
| Group x Time | 13.56 | 2 | 6.78 | 3.91* | .031 |
| Error | 53.75 | 31 | 1.73 | | |

*p<.05

These results indicate that a significant interaction effect existed at the .05 level of significance. The Student-Neuman-Keuls post hoc showed both the Aerobics and the Weight Training groups to differ significantly from the Control group.

**TABLE E2**

**GAIN SCORE MEANS: PRETEST - POSTTEST DEPRESSION SUBSCALE**

| Group | Mean |
|---|---|
| Aerobics (n=12) | .7500 |
| Weight Training (n=13) | .8462 |
| Control (n=9) | - 1.2222 |

**TABLE E3**

**SNK: PRETEST - POSTTEST DEPRESSION SUBSCALE**

| Comparison | q | Significant Difference |
|---|---|---|
| Aerobics vs Wt Training | .1825 | No |
| Wt Training vs Control | 3.6231* | Yes |
| Aerobics vs Control | 3.3968* | Yes |

*p<.05

# APPENDIX F

## ANOVA ON DEPRESSION SUBSCALE: EXERCISING GROUPS

**ANALYSIS OF VARIANCE: PRETEST - POSTTEST,**
**GENERAL WELL-BEING SCHEDULE**
**ALL GROUPS**

| Source | SS | df | MS | F | Sig. of F |
|---|---|---|---|---|---|
| Between Subjects | | | | | |
| Group | 35.07 | 1 | 35.07 | 3.85 | .062 |
| Error | 209.61 | 23 | 9.11 | | |
| Within Subjects | | | | | |
| Time | 7.95 | 1 | 7.95 | 9.64 | .005 |
| Group x Time | .03 | 1 | .03 | .03 | .853 |
| Error | 18.97 | 23 | .82 | | |

No significant difference in the Depression subscale existed between the two exercising groups.

# APPENDIX G

## SUBJECT RECRUITMENT AND INFORMATION FORM

# Volunteers Needed for Exercise Study!

Doctoral Dissertation
Conducted by Mary Nole

This investigation is titled: "Practical Implications for Exercise Among Older Adults: Effects of Moderate-Intensity Exercise on Functional Status".
Its purpose is to examine the physical and/or psychological benefits derived from participation in exercise activities by older adults, and whether exercise-related outcomes translate into improved functional abilities.

What you should know prior to signing up:

- The program will last approximately 12 weeks.
- A series of "tests" (not difficult or painful!) will be administered to participants before and after the 12 weeks of physical activity ("exercise").
- Participants may choose one of three groups in which to participate: low impact aerobics, weight training or the control group.
- Participants will need to obtain a Doctor's Release prior to exercising.
- The aerobics will be low impact.
- **Aerobics classes will meet on Tuesday and Thursday mornings from 7:00-8:00am.**
- Weight training will be conducted utilizing variable resistance machines.
- **Weight training classes will meet on Monday and Wednesday mornings from 10:30-11:30am.**
- Participants need to be at as many of the exercise sessions as possible. To that end, a make-up session will be held each Friday morning from 7:00-8:00am which participants from either group can attend.
- The control group will participate in the two testing sessions, but for the 12 weeks in between will not be in an exercise group; "just go about their business as usual."
- All of the exercise classes and testing will take place at the Colvin Center on the Oklahoma State University campus.

The exercise activities will be progressive in nature. They will begin slowly and increase gradually in intensity and duration. The measurements are being done solely to determine the effectiveness of the exercise program, and the scores will kept confidential. The philosophy of the instructor/investigator in this study is that exhaustion, and over-exertion are not necessary to an effective exercise program. Moderate intensity exercise can be fun and beneficial!

If you have any questions, feel free to contact Mary Nole at 744-5577.

***Thank you for your time and consideration.***

# APPENDIX H

# SUBJECTS' LOGISTICS AND DETAILS FORM

**Exercise Program**
**Nole Dissertation**
**Spring 1996**

Logistics and Details!

Philosophy:

1. The intent of this program is FUN as well as FITNESS.
2. In regards to cost: there is none. I appreciate your participation!!

Class Meeting Dates/Times:

1. Weight Training - Mondays & Wednesdays, 10:30-11:30am
   **First class meeting: Wednesday, January 24**
   **Last class meeting: Monday, April 22**
2. Aerobics - Tuesdays & Thursdays, 7:00-8:00am
   **First class meeting: Tuesday, January 23**
   **Last class meeting: Tuesday, April 23**
3. MAKE-UP (either class) - Fridays, 7:00-8:00am
4. Control Group - **Testing on Friday, January 26, 10:00am**
   **Re-Testing on Friday, April 26**

Location:

1. All classes will meet in the Body Mechanics Room (#025) in the Colvin Center.
2. This room is downstairs and not too easily found, so for the first few days I will meet you upstairs in the main hallway.
3. If somehow I miss you, the Campus Recreation Office is Room 119 (in the middle of the main hallway). They can direct you to the Body Mechanics Room.

Clothing:

1. Wear loose, comfortable clothing (shorts, sweats, t-shirts)
2. Athletic shoes which provide good support are advised for all groups. For aerobics, running shoes do not provide much lateral support; "sneakers" without the turned up heel/toe are a bit better.

Parking:

1. The metered lot (South of the Colvin Center, near the greenhouses) is available and costs 25 cents per hour.
2. For the 7:00am classes, the lots on Hall of Fame (next to the Colvin and across the street)are available until 8:00am.

Paperwork:

1. The Physicians' Releases are NOT required at the first class meetings, as these will be the testing periods. We will need them as soon as possible after that.

2. Please bring the Participant Information Form with you if possible.

# APPENDIX I

## SUBJECTS' INFORMED CONSENT FORM

**Moderate Exercise Activities for Persons Over 60**
**INFORMED CONSENT**

I, _____, hereby authorize or direct Mary Nole, or associates/assistants of her choosing, to perform the following treatment.

- A 12 week program of physical activity ("exercise") consisting of either low impact aerobics or weight training.
- Weight training will be conducted utilizing variable resistance machines.
- The program will take place at the Colvin Center on the Oklahoma State University campus.
- Each activity group will meet twice weekly, for one hour per meeting.
- The activities will be progressive in nature. They will begin slowly and increase gradually in intensity and duration.
- A series of evaluations will be administered to each participant before beginning, and at the completion of, the program.
- The measurements will include commonly utilized movements such as walking. The "tests" are not difficult or painful, and are done solely to determine the effectiveness of the exercise program.
- The scores of the evaluations will kept confidential. If, at the end of the Program, participants would like to know their own scores, they will be made available. **At no time will participants' names/scores be made public.**

This will be done as part of an investigation titled: "Practical Implications for Exercise Among Older Adults: Effects of Moderate-Intensity Exercise on Functional Status".

The purpose of this study is to examine the physical and/or psychological benefits derived from participation in exercise activities by older adults, and whether exercise-related outcomes translate into improved functional abilities.

I understand that participation in this study is voluntary. I further understand that I must submit a signed release from my personal physician prior to participating. I am aware that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation at any time, upon notification of the project director.

For additional information, I may contact Mary Nole, at 744-7407 or Dr. Lowell Caneday, at 744-5493. I may also contact Jennifer Moore, Executive Secretary, 305 Whitehurst, Oklahoma State University, Stillwater, OK 74078; Telephone: (405) 744-5700.

I have read, and fully understand the Consent Form. I sign it freely and voluntarily. A copy has been given to me.

Date: _____ Time: _____ (am/pm)

Signed: _____
Subject

I certify that I have personally explained all elements of this form to the subject before requesting the subject to sign it.

Signed: _____
Project Director

# APPENDIX J

# PARTICIPANT INFORMATION FORM

# Exercise for Older Adults
# Participant Information Form

Name _____ Age _____

Address _____ Phone _____

_____

Group (Check one):

| | | |
|---|---|---|
| _____ Weight Training<br>Mon/Wed<br>10:30-11:30am | _____ Aerobics<br>Tues/Thurs<br>7:00-8:00am | _____ Control<br>Pretest &<br>Posttest |

Are you currently under a Doctor's care? ____ Yes _____ No

Doctor's Name: _____

Address _____ Phone _____

_____

To your knowledge, do you have any medical conditions which might inhibit your participation in this program? _____ Yes _____ No

If so, please explain: _____

_____

Are you currently taking medication? _____ Yes _____ No

If so, please list: _____

_____

Do you currently participate in regular physical activity? ____ Yes ____ No

If so, please explain: _____

_____

# APPENDIX K

# PHYSICIAN'S RELEASE FORM

## Exercise for Older Adults
## Physician's Information and Release

The program in which your patient, _____, would like to participate is a physical activity (exercise) program for normally aging persons over the age of 60. The activities will be of two types: low impact aerobics and strength training. The aerobics will include adequate warm-up, cool-down and stretching periods in addition to the aerobic phase. The intensity and duration will be progressive, and participants will be monitored as to their personal comfort levels during exercise. The weight training will utilize selective resistance machines. Warm-up and stretching will precede each session. Participants will lift at a level which allows for normal breathing and conversation throughout.

Pre- and post-testing will be conducted which will entail simple functional tasks such as walking, sitting/standing, seated lifting of an object and manual coordination. Participants will be closely supervised at all times during testing and exercise periods.

If there are any medical conditions or considerations, or contraindications pertaining to this patient's participation that we should be aware of , please list them:

_____

_____

_____

_____

Thank you for your assistance.

_____ _____

Physician's Signature Date

# APPENDIX L

# VOLUNTARY EVALUATION OF PROGRAM

**Voluntary Evaluation**
**Nole Dissertation Exercise Program**
**Spring 1996**

If you would like, you may share your thoughts and experiences in this exercise program. This is intended as an evaluation of the course content itself, the teaching methods employed and the overall effects of participation.This is a purely voluntary evaluation, and you need not sign your name.

Thanks again for your participation.

1. What did you most enjoy about participating in the exercise program?

2. Did the exercise class/program live up to your expectations?

    a. In what way(s) were you disappointed?

    b. In what way(s) did the class/program exceed your expectations?

3. Are there any specific changes you would make to create a more enjoyable class atmosphere?

4. Did you notice any positive physical changes over the course of the program?

5. Did you notice any negative effects which you attribute to your participation in the program?

6. Would you like to continue exercising in this, or some other, format?

7. Any other comments you have concerning your participation in this program:

# APPENDIX M

# VOLUNTARY EVALUATION RESULTS

## Results of Voluntary Evaluation

### Number of Respondents = 25

1. **What participants enjoyed most:**
   Fellowship/social interaction (13)
   Instructor (6)
   Exercise (5)
   Improvements in physical abilities (3)
   Feelings of self-confidence/well-being (2)
   Challenge/new routine (2)
   Stretching exercises
   More energy
   "It was relaxing"

2. **Did the program live up to participants' expectations?**
   Yes - 19
   No - 0
   Did not know what to expect - 3

   **Ways disappointed:**
   None - 14
   Less progress on arm strength
   Could not keep up like wanted
   Equipment
   "Program is ending"

   **Ways expectations exceeded:**
   Improved muscular condition (2)
   Harder than expected
   Effects of Aerobics
   Helped shoulders and hips
   Easier each time
   Remained fun
   Fears of too much regimentation unfounded
   Exceeded expectations of self
   "Instructor did not give up on us"

3. **Any changes participants would make?**
   None - 14
   Spread out class to avoid lines (2)
   Adjustable equipment
   Better music
   Less talking and chit chat
   Cooler room temperature
   More students

4. **Experience any physical changes?**
   Stronger (5): "in arms/upper body" (2); "easier getting up"; "knee improved"
   More energy (4): "in daily activities" (2)

**4. Any physical changes? (cont)**

More flexibility (2)
Tone lower body More flexibility (2)
Tone lower body

**5. Experience any negative effects?**

None - 19
Occasional soreness (2); backache after Military Press muscle
Dizziness on abdominal curl-ups

**6. Plan to continue exercising?**

Yes - 22
No - 1 (not during summer)
Maybe - 1

**7. Other comments?**

"Enjoyed it" (8): instructor (3); fellowship (2); time of day (3); organized opportunity to exercise (3)
"Good experience (3)
"Hope to continue" (3)
"Was surprised at the physical improvements with so little effort"
"This program is better than others participated in: aerobics, walking, stationary cycling"
"Need to lose weight and continue feeling great"
"Looked forward to program each time"
"Excellent program for seniors"

# APPENDIX N

# IRB APPROVAL

**OKLAHOMA STATE UNIVERSITY**
**INSTITUTIONAL REVIEW BOARD**
**HUMAN SUBJECTS REVIEW**

**Date:** 01-04-96 **IRB#:** ED-96-059

**Proposal Title:** PRACTICAL IMPLICATIONS FOR EXERCISE PARTICIPATION AMONG OLDER ADULTS: EFFECTS OF MODERATE INTENSITY EXERCISE ON FUNCTIONAL STATUS

**Principal Investigator(s):** Lowell Caneday, Mary Nole

**Reviewed and Processed as:** Expedited

**Approval Status Recommended by Reviewer(s):** Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL.
ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

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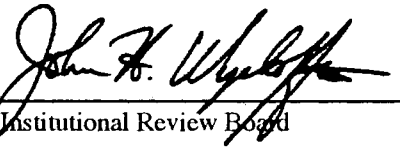
Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature:  Date: January 25, 1996

Chair of Institutional Review Board

# VITA

Mary Kathryn Nole

Candidate for the Degree of

Doctor of Education

Thesis: EFFECTS OF EXERCISE ON THE FUNCTIONAL STATUS OF OLDER ADULTS

Major Field: Applied Educational Studies

Biographical:

Personal Data: Born in Tulsa, Oklahoma, on September 2, 1960, the daughter of William P. and Barbara Nole.

Education: Graduated from Holland Hall, Tulsa, Oklahoma in May 1978; received Bachelor of Science degree in Education from the University of Tulsa in May 1982; received Master of Science degree in Physical Education from the University of South Carolina in August 1984. Completed the requirements for the Doctor of Education degree and Certificate in Gerontology at Oklahoma State University in December 1996.

Experience: Graduate Assistant in the Intramural/Recreational Sports Office, University of South Carolina (1982-84); Assistant Director of Recreational Sports, University of Vermont (1984-85); Director of Recreational Sports, University of Tulsa (1985-88); Director of Recreational Sports, University of Massachusetts-Lowell (1988-92); Coordinator of Intramural Sports, Oklahoma State University (1993-96).

Professional Memberships: National Intramural-Recreational Sports Association, American Society on Aging.