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EFFECTS OF EXERCISE ON LIPID LEVELS AND MUSCLE STRENGTH IN ELDERLY WOMEN

by

LISA D. FOLEY

A Thesis
Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Nursing in the Division of Nursing Mississippi University for Women

COLUMBUS, MISSISSIPPI

August 1999
Effects of Exercise on Lipid Levels and Muscle Strength in Elderly Women

by

Lisa D. Foley

Lynn Chilton
Associate Professor of Nursing
Director of Thesis

Dr. Melinda E. Bush
Assistant Professor of Nursing
Member of Committee

Mary O'Keeffe
Assistant Professor of Nursing
Member of Committee

Barbara Thompson
Director of the Graduate School
Abstract

The purpose of this comparative, descriptive study was to ascertain the effects of exercise on serum lipid levels and muscle strength in elderly women. The theoretical framework utilized was Pender’s Health Promotion Model. The null hypotheses were there will be no difference in lipid levels among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program; and there will be no difference in muscle strength among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program. A convenience sample of 101 women, ages 65 and over, was divided into three groups based on the amount of exercise reported. This sample was taken from established senior groups located in Northeast Mississippi. Measures used in this study included a self-report questionnaire, muscle strength testing per a dynamometer, and serum lipid levels. Instrumentation
utilized was the researcher-designed demographic survey, lipid analysis from the DADE RXL Dimension, and the Chatillon dynamometer. Data analyses utilized were descriptive statistics and ANOVA testing. Results revealed no significant differences in lipid levels between the groups. There was a significant difference in upper and lower body muscle strength. Recommendations for further study are to replicate the study excluding women on lipid-lowering drugs and replicating the study with a more culturally diverse group.
Acknowledgments

I owe a world of gratitude to many people who have helped me survive this year in graduate school. If it were not for the advice, home-cooked meals, encouragement, and prayers of my friends and family, this year would not be possible.

I would like to thank the Zeta Rho Chapter of Sigma Theta Tau Nursing Honor Society for the scholarship. This assisted me with the actual implementation of my research. I hope that my research was worthy of this award by such a prestigious group.

I would also like to acknowledge Baptist Memorial Hospital-Union County for the use of the dynamometer and for the assistance with analyzing the laboratory work.

To Amy, Angel, and Jodie, I say thanks for all the car rides, studying, laughs, encouragement, and fun that you allowed me to share with you this year. May God bless each one of you in your endeavors.

To Dr. Lynn Chilton, whom no graduate program needs to do without, it is impossible to express my gratitude.
You kept us in line and on target this year. I know that God was in the selection of students for the advisors. I could not have had a better one. You faced many challenges this year with your family and still you were willing to meet on weekends, keep papers graded, and chapters read to keep us on target for our completion in this program. You are truly a gifted teacher and have the student at heart.

To my family who cooked meals, cleaned house, cared for my children, and gave encouragement, I will never be able to repay you for the love you have shown me this year.

To my special friend, Diane. Even from the first day when I worried if I could still learn after 12 years, you had faith in me. You have encouraged, laughed, cried, proofread, and prayed for me. Thanks for your unending faith in me and your encouragement.

To my husband, David, I say I love you more than ever. You have always said I could do anything I set my mind to and your faith in me has been unshakable. You have had to raise the children almost single-handedly this year and for this I love you more. I am so glad that God gave you to me.
To Luke and Lindsey, I owe you many picnics, bike rides, and stories. You two have been so understanding to me. Lindsey, you have kept me organized this year and you reminded me of things I had forgotten. You have played mother and housekeeper for me and I love you. Luke, you have given me many laughs this year just when I needed them. Thanks for always being so easygoing. I love you.

Finally, and most important, I say thank you to my Lord and give Him all the glory for this year and for my new career. So many miracles have happened this year in my life. From acceptance into the program, my good grades, my husband’s job, to the dynamometer. God, I know that those were miracles happening in my life. I found, this year, reaffirmation of your never-ending, awesome, power, protection, and love for me. My faith has been renewed and I am at peace with whatever you may have for me.
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Chapter I
The Research Problem

Recently, there has been an increasing emphasis on preventive medicine and health maintenance, partly as a result of inflating healthcare costs and partly due to a greater awareness of the effects of lifestyle on health and longevity. While public interest in exercise and fitness has increased in the past 20 years, health habits have not changed significantly (Myers, 1998). In 1990, only 41% of adults 18 to 64 years reported they exercised regularly, and only 32% of those older than 65 years reported regular exercise or participation in physical sports. People who maintain sedentary lifestyles make up about one half of the population (Rantanen, 1998). Additionally, one fourth to three fourths of Americans are overweight and at risk for health problems (Myers, 1998).

One aspect of preventive medicine and health maintenance that has not been adequately explored is exercise in elderly women. Older adults have received less scientific attention than younger adults with regard to
exercise, and this lack of attention has led to a paucity of information about their activity patterns later in life. Researchers are uncertain of the type of exercise, the intensity, the frequency, or the duration of exercise that work best in elders and specifically in elderly women (O’Brien-Cousins, 1996).

Establishment of the Problem

Experts seem to be in agreement regarding the benefits of general exercise in elders, and some studies have been completed that researched different aspects of beneficence when elders exercise. Exercise has lowered blood pressure and clotting mechanisms and has shown to be a factor in decreased risks of death due to heart disease and stroke (Rantanen, 1998). Exercise has aided in decreasing weight, preventing diabetes, strengthening bones, and enhancing the immune system’s function (Myers, 1998). Other studies have concluded that engaging in exercise has a positive impact on blood lipid levels and lipoproteins (Kennedy & DeVoe, 1996). Cognitive and mental health, mental function, and social adjustment are also areas which were improved by regular exercise (Fontane, 1996). Exercise participants have reported increased self-confidence and a positive attitude toward life as well as
an increase in self-concept and perceived internal locus of control (Fontane, 1996).

Yet these benefits of exercise, which have been released to the public, have not influenced the majority of elderly Americans who still do not exercise regularly. Studies have concluded that elders believe that exercise is important and provides benefit; however, the National Health Survey completed in 1985 found that, overall, 70% of elderly women live sedentary lives (Fiatarone, O’Neill, & Ryan, 1994).

One benefit of exercise is improved muscle strength. Muscle strength has been shown to play a major role in the prevention of falls which occur frequently among elders. Dinsmoor (1993) found that one third of seniors living in one community have fallen in the last year and that falls were responsible for one half of the injuries inflicted on elders. The risk of hip fractures increased for patients with weak ankles and quadriceps; therefore, the need for strength in the elder has been established. However, studies disagree on how to obtain needed strength. Dinsmoor (1993) and Fiatarone et al. (1994) concluded that muscle strengthening should be carried out a specific number of times per week using a set of weights. Fiatarone
et al. (1994) suggest that elders be urged to walk or ride bicycles for exercise; however, new studies have found that elders who perform household activities or work in gardens are more likely to maintain a regular routine that leads to adequate muscle strength needed to maintain independence than those who do not (Rantanen, 1997).

Another beneficial aspect of exercise among elderly women is its effects on lipid levels. Although some research has been conducted with only females as subjects, the studies revealed few conclusive findings. Stefanick (1998) concluded that the serum low-density lipoprotein cholesterol levels in women decreased by 14.5 mg per deciliter in one group that used a combination of a diet and exercise program. On the other hand, the results were inconclusive in the group that exercised only and the group that dieted only. These findings, however, highlight the importance of physical activity in the treatment of elevated low-density cholesterol rather than diet alone (Stefanick, 1998). Indeed, few studies have been completed that showed regular physical activity reduces the levels of total cholesterol and of low density lipoprotein levels; however, many studies remain inconclusive
regarding the impact of exercise alone on blood lipid levels (Kennedy & DeVoe, 1996).

Most of the studies found in the literature included younger women, men, or a combination of men and women. Few studies have been conducted to examine the health benefits of exercise in older women. Data show that exercise seems to decrease risk factors in women; however, these research data are not as conclusive as research data in men (Thompson, 1994). Fitzgerald and Singleton (1994) state that preliminary data suggest that exercise may improve the health of women. Several studies suggested that exercise exhibited a protective effect in women. Although the evidence that exercise benefits women is suggestive, it is far from conclusive (Fitzgerald & Singleton, 1994).

Thus, the purpose of this study was to compare the effects of exercise on both lipid levels and muscle strength among elderly women who participated in either structured or unstructured exercise programs, or those who did not exercise at all.

Significance to Nursing

Research concerning exercise and elders has very important implications for nurses in practice. As this generation ages, promotion of health is an important
educative process that must be undertaken by the nurse practitioner in order to make the difference between aging and aging well. Elders have the greatest need for health care. They use the most medications, have more clinic visits, and consume greater amounts of the health care dollars than any other age group in the United States. It is vital that the nurse practitioner encourage preventive health and promote healthy lifestyle behaviors in patients at a young age to retard some of the chronic problems in elders.

Physical activity is an important aspect of health promotion. One way nurse practitioners could utilize this concept in practice would be to adopt and then educate the patient on the Healthy People 2000 year agenda which encompasses health promotion, prevention, and protection services. This agenda included specific age-related objectives for elders. Physical activity and fitness were items included in the health promotion strategies. Environmental health and unintentional injuries were items listed in the health protection segment of the Healthy People 2000 agenda. By educating the patient regarding physical activity, some of the unintentional injuries, such as an injury sustained through a fall, and

While the benefits of exercise are well documented in the literature, the benefits of various intensities of exercise among certain groups have not. Research is lacking in the area of elderly women and the benefits to this age group. The amount, type, and intensity of exercise for this age group is unclear in the literature.

Nurse practitioners have the opportunity to utilize prior nursing skills, advanced skills of assessment and management, and also teaching skills to provide optimal care for the patients. As America ages, prevention of illness and promotion of a healthy lifestyle have become the most important aspects of health care. Encouraging elders to maintain an active lifestyle can, in fact, reduce morbidity and mortality. Through education, exercise, and routine evaluations of health, the elderly population can increase their quality and quantity of life.

**Theoretical Framework**

The theoretical framework utilized for this study was Pender’s Health Promotion Model (Pender, 1987). Pender sought to explain certain factors that could influence the
person's motivation to seek a healthy lifestyle and the likelihood that the person would engage in health-promoting activities. The model includes certain perceptual factors in the individual that are modified by situational, personal, and interpersonal characteristics, resulting in one's participation in health-promoting behaviors. The person's belief that he or she can change his or her own health can, in itself, motivate the desire for a healthy lifestyle.

Pender (1987) proposed that there were interrelationships between cognitive/perceptual factors and modifying factors that may influence the occurrence of health-promoting behaviors. Cognitive/perceptual factors or primary motivational mechanisms are factors that directly motivate or predispose individuals to behaviors or to respond in a certain way. Pender (1987) included seven factors that may influence the occurrence of health-promoting behaviors: importance of health, perceived control of health, perceived self-efficacy, perceived health status, perceived benefits of behaviors, and perceived barriers to health-promoting behaviors.

Modifying factors, such as age, gender, education, income level, weight, family patterns of health care and
behaviors and expectations of significant others, also play a role in health care behaviors. These factors are seen as having an indirect effect on influencing behaviors, whereas cognitive/perceptual factors play a more direct role.

Pender revised the model by adding four new variables that may influence health promotion behaviors. One variable added was prior related behavior, which occurs when future behavior is influenced by the success or failure of previous attempts with this behavior. The second variable addition is the activity-related affect, which may evoke positive or negative feelings of the individual and that may influence the performance of that behavior. The next variable is formalizing a commitment to oneself or another, such as entering into a contract for a certain wellness behavior. The last is immediate competing demands and preferences, which refer to conflicts over which the person has decreased control. Competing preferences are alternate behaviors with increased personal control (Pender, 1987). Pender proposed that these factors, to some degree, affect people's choice to participate or not participate in health-promoting activities. These factors may cause one to develop a
positive health state and health promotion will assist people and their quest for health and wellness.

This study was designed to discover how a health promotion activity, such as exercise, could impact the health and wellness of elderly women. Utilizing Pender’s Primary Motivational Mechanisms provided a framework in understanding why the individual reacts in a certain way to certain stimuli. If the participant sees exercise as having an impact on cholesterol and muscle strength, they may perceive this as an important aspect of controlling their health and may change their view of how they view their health status. Elderly women may also realize that there are added benefits to this behavior and go on with exercise participation. However, if the participant has exercised in the past and no benefits were noted, this could influence any new attempt. Research has been lacking in the area of exercise benefits of elderly women. By providing more research in this area, women would be able to make an informed decision as to whether to incorporate exercise as a health-promoting behavior activity into a daily routine in order to reap the identified benefits (Pender, 1987).
Assumptions

The assumptions underpinning this study were as follows:

1. Exercise affects the physical well-being of a person.

2. Engaging in exercise is a health-promoting activity.

Statement of the Problem

Maintaining health in older adults becomes more important as this segment of the population increases. Health professionals must be aware of the health needs of elders and preventative measures to take in maintaining their health. Many studies have been conducted regarding effects of exercise on lipid levels and strength; however, minimal empirical knowledge exists regarding the effects of different levels of exercise on lipid levels and muscle strength in elderly women. The purpose of this proposed study was to compare the effects of participation in either a structured and unstructured exercise program or no exercise program at all on lipid levels and muscle strength in women 65 and over.
Research Hypotheses

The null hypotheses were as follows:

1. There will be no difference in lipid levels among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program.

2. There will be no difference in muscle strength among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program.

Definition of Terms

There were many different terms utilized in this study; thus, to better explain the problem statement, the following definitions are given:

**Elderly women:** Theoretical: older females; advanced beyond middle age and bordering on old age. Operational: Elderly women were defined as females aged 65 and over who may or may not participate in an exercise program.

**Lipid levels:** Theoretical: the measurement of the total cholesterol level in the body. This can be divided into the high-density lipoproteins (HDL) and low-density lipoproteins (LDL). Operational: Lipid levels were
defined as the measurement of a fasting, high-density and low-density lipoprotein level, triglycerides and total cholesterol level in the body as measured by the Smith-Kline Laboratories. For the purposes of this study, normal lipid levels were defined as having normal levels in three out of four of the tests to be measured.

**Muscle strength:** Theoretical: the isometric measurement of maximum voluntary force obtained with the tested body segments in gravity-neutralized positions. Maximum voluntary force subjects are able to exert on the environment under specific testing conditions (Bohannon, 1996). Operational: the measurement of the voluntary force, using a dynamometer, obtained with wrist extension, elbow flexion, shoulder abduction, as an indication of upper body strength, and ankle dorsiflexion, knee extension, and hip flexion as an indication of lower body strength. For the purposes of this study, a difference in muscle strength was defined as a change in either the upper body or lower body muscle strength.

**Structured exercise program:** Theoretical: a regular, patterned leisure time activity pursued to achieve desirable outcomes, such as improved level of health. Operational: A structured exercise program was defined as
a chair aerobics exercise program that occurs in a class setting and involves aerobic activity and/or muscle strengthening. The activity occurred at least two to three times per week, and the duration for each time was at least 20 minutes.

**Unstructured exercise program:** Theoretical: a leisure time activity that does not occur in a class-like setting. **Operational:** An unstructured exercise program was defined as any leisure time activity that did not occur in a class setting, involved the use of aerobic exercise and/or muscle strength, and occurred in the participant’s home. This activity included gardening, walking, or housework and must have occurred at least two to three times per week with the duration for each activity at least 20 minutes.

**No exercise program:** Theoretical: The patient fails to routinely participate in any type of physical exercise or activity. **Operational:** For the purpose of this study, no exercise program meant the subject failed to participate in any type of physical exercise or activity at least two times per week that lasted for at least 20 minutes in duration.
Chapter II

Review of the Literature

A review of the literature revealed a scarcity of information regarding effects of exercise on muscle strength and lipid levels in elder women. Many studies were found regarding exercise, muscle strength, and lipid levels; however, the relationship of these variables to elder women was not noted. In the following review, five studies were reviewed regarding effects of exercise on muscle strength, and five studies were reviewed regarding the effects of exercise on lipid levels. The identified research is presented in two sections.

In the first section, it should be noted that few studies have been conducted that were specific to muscle strength in the elderly. Even fewer studies have evaluated muscle strength through the use of a dynamometer. Most studies have quantified increases in muscle strength through either an increase in weightlifting capacity or through a decrease in the number of documented falls in a certain population. The following reviews will discuss
muscle strength with regard to exercise. Different age groups were utilized, and different mechanisms of muscle strength testing were employed.

In the second section, some research was identified that investigated lipid levels. However, in three of the studies the subjects were men and women ranging from middle age to old age. In the two studies that researched women, all age groups were included. No studies were identified that investigated older women and lipid levels in relation to exercise.

**Exercise and Muscle Strength**

The decline in muscle strength with aging has been established with great certainty. This tendency has been demonstrated for many different muscle groups among both men and women. Bohannon (1996) analyzed a subset of data to determine muscle strength that had been previously analyzed for a different purpose. This research focused on 123 women, aged 20 to 79 years, without known neuromuscular, musculoskeletal, or cardiovascular pathology. The mean weight was 615 Newtons (62.7 kg) and height was 162 cm. The strength of six muscle actions was measured using a calibrated Enforce II handheld dynamometer. Three upper extremity actions (wrist
extension, elbow flexion, and shoulder abduction) and three lower extremity actions (ankle dorsiflexion, knee extension, and hip flexion) were tested on both the dominant and the nondominant side.

The nature of age-related changes in strength was summarized descriptively. Thereafter a 6 (decade) x 2 (side) x 6 (action) analysis of variance and both linear and quadratic regression analysis procedures were performed to examine the effect of age on muscle strength.

Data indicated that the strengths of all actions declined, but the onset and extent varied between actions. For example, the mean force of wrist extension did not decline below that demonstrated by subjects of 20 to 79 years until subjects were 60 to 69 years. Mean forces of hip flexion and knee extension, on the other hand, were both over 11% less in subjects aged 30 to 39 years than they were subjects of 20 to 29 years of age. The mean force of elbow flexion for subjects 70 to 79 years of age was just over 83% of subjects aged 20 to 29 years, whereas the mean force of knee extension for subjects of 70 to 79 years did not exceed 45% of subjects of 20 to 29 years.

The analysis of variance confirmed that age had a significant effect on strength. Linear regression results
showed a greater effect of age on the strength of some muscle actions, e.g., knee extension, $r > .71$, $b > 4.91$, than on others, e.g., elbow flexion, $r > .34$, $b > .53$). Quadratic regression provided a slightly better explanation than linear regression of the relationship between age and muscle strength. Linear regression results indicated that the declines in strength that occur across age tend to be steeper on the dominant side than on the nondominant side.

Bohannon (1996) concluded that there was, overall, a decline in muscle strength with age. The Bohannon study supports the current research in that it dealt with muscle strength of all ages, while the current study looked at women aged 65 and over. The Bohannon study differed from the current study in that it only measured muscle strength and did not assess any type of physical activity in relation to the muscle strength. Additionally, women in the Bohannon study were aged 20 to 79, while the current study only included women aged 65 and above.

Goldbeck-Wood (1997) sought to assess the effectiveness of a home-based exercise program of strength and balance on falls and injuries in elderly women. A randomized controlled trial of an individually tailored
program of physical therapy in the home was administered to the exercise group (n = 116). An equal number of social visits was provided to the control group (n = 117) to account for the placebo effect or benefit from a visit with a health professional.

The main outcome measures included number of falls, injuries related to falls, and time between falls during one year of follow-up. Changes in muscle strength and balance were also measured after a 6-month time period. The sample consisted of 233 women 80 years and older living in the community. To participate in this study, the women had to be able to move around within their own homes and could not be receiving physical therapy. The subjects completed baseline assessments and were then randomized to a control or an exercise group.

Several scales were utilized for data collection: ADI scale, Physical Activity Scale, Self-Maintenance Scale, Fear of Falling Scale and Physical Activity Scale for the Elderly. Balance, strength, gait, and endurance tests also were completed on each participant. The mean score on the Physical Activity scale for this group was only 51.5 out of a possible 400 points. The physical therapist visited the exercise group four times in a 2-month period. During
these visits, exercises were prescribed and taught and a walking plan was developed for the participants. Subjects were instructed to complete this regimen three times weekly. The control group received social visits by the health professional, but received no exercise instruction.

Goldbeck-Wood (1997) calculated the sample size based on the proportion of elderly women who had fallen one or more times in the last 12 months. The number of women needed in the group was based on the expectation that the exercise program would reduce the proportion of women by 20% who fell during the year. The event rate was calculated as the mean of the number of falls divided by the time over which falls were monitored for each participant and the 95% confidence interval of the difference was calculated, assessing a negative binomial distribution.

Goldbeck-Wood (1997) found that after 6 months balance had improved in the exercise group compared with the control group. Changes in the 4-test balance score were 0.42 (0.86) and -0.01 (0.80). A higher proportion of those in the exercise group improved in the chair stand test (1.07 to 1.87). After one year the control group experienced 152 falls while the exercise group only had 88
falls. The mean rate of falls per year was lower in the exercise group than in the control group 0.87 (1.29) and 1.34 (1.93) falls per year, respectively. The hazard ratio for a first fall in the exercise group compared with the control group was 0.81. To compare the exercise group and the control group for hazard ratio, the Anderson-Gill extension of the Cox model was utilized. This ratio for the first four falls was 0.68. For the total number of falls, 85 resulted in moderate injury while there were 25 severe injuries. After 12 months of monitoring, the participants from the exercise group had fewer injuries from falls than the control group (26.2% vs. 39.1%).

Goldbeck-Wood (1997) found that the exercise group in a walking program at home had a reduced number of falls and injuries from falls than the control group. The researcher also determined that balance increased, although not as significantly as the fall reduction, in women ages 80 years and older. Another important finding is that, after one year, 42% of the exercise group were still completing the exercise program three or more times per week. The control group became less active with a mean change in the physical activity scale for the elderly score: -11.0 (22.3) vs. -4.6 (22.9). The control group
also had an increase in their fear of falling with a mean (SD) change in falls self-efficacy score -6.1 (12.2) vs. -2.5 (11.1).

Many older adults are unable to travel to participate in a structured exercise program. Being able to exercise in the comfort of one’s own home and exercise three times per week to increase one’s strength and balance is germane to this current research. Comparing muscle strength by unstructured home exercise programs to structured exercise programs is also a part of the Goldbeck-Wood study as well as the current study under investigation. In the Goldbeck-Wood (1997) study, muscle strength was quantified by a reduced number of falls; however, the current research-based muscle strength through the use of objective dynamometer readings.

In a related study, Mikesky and Topp (1996) sought to examine the effects of a 14-week resistance training program on the ankle strength, training intensity, postural control, and gait velocity of older adults. Four hypotheses were tested in this study. First, older adults who participate in a 14-week home-based resistance training program will significantly improve their isokinetic ankle strength. Second, older adults who
participate in a 14-week home-based resistance training program will significantly improve intensities in their resistance training. Third, older adults who participate in a 14-week home-based exercise resistance training program will significantly improve their postural control. Finally, older adults who participate in a 14-week home-based resistance training program will significantly increase their gait velocity. Even though four different hypotheses were tested, only the ankle strength will be discussed in this review since it is germane to this present researcher’s study.

The sample consisted of community dwelling older adults recruited by word-of-mouth referrals and also through a single newspaper ad. Histories of coronary artery disease, greater than one coronary risk factor, or major signs and symptoms of cardiopulmonary or metabolic disease evident during a medically-supervised history and physical excluded potential participants from this study. If the applicants were already participating in a program of resistance or if they were unable to make a 14-week commitment, they were also excluded. A total of 61 older adults completed baseline testing, including isokinetic assessment of ankle dorsi-plantar flexion.
The 61 subjects were randomized into a resistance training group or a control group. Twenty-one (70%) subjects from the control group completed the posttest, and 21 subjects from the resistance-training group completed at least 70% of the prescribed exercise training sessions and the posttesting.

The ankle dorsiflexion was assessed by using a KinCom 500H dynamometer. To maintain consistency, only the right side of subjects was tested. Subjects then performed three to six dorsiflexion and plantar flexion concentric and eccentric contractions. Subjects were allowed to rest for 30 seconds following each contraction. The strength curve demonstrating the greatest peak force output was used for subsequent data analysis. Resistance training intensity was measured by the estimated resistance of the theraband the subject was using during their training. Subjects were instructed in the use of a theraband of sufficient resistance to produce moderate fatigue after 10 repetitions while maintaining proper form. The intensity measurements for each of the 10 exercises were collected during the third and 14th weeks of training.

Subjects who completed the study in the resistance training group and the control group were statistically
similar on all measures except peak concentric and eccentric ankle dorsiflexion and plantar flexion. There was a higher percentage of males in the control group, which may have led to the difference in ankle strength between the two groups. Using .05 as the minimum level of significance, the resistance-training group improved both their peak eccentric and concentric dorsiflexion strength at posttest from their baseline measures. The control group also significantly improved their concentric dorsiflexion, but, upon closer examination of the data, the absolute gains in the control group's dorsiflexion strength was only about one half the gains demonstrated by the resistance training group. It was felt that this might have been the result of practice/familiarization with the testing protocol. The resistance training group did increase the isokinetic ankle strength. Subjects in the resistance training group improved dorsiflexion strength by approximately 12% and 16% for the eccentric and concentric peak torque, respectively. One possible explanation the exercise intervention did not result in significant increase in plantar flexion was that the sample was relatively healthy and physically active prior to entering the study. The exercises designed to increase
strength of plantar flexion may have not been of sufficient intensity beyond the daily demands to increase strength.

These findings by Mikesky and Topp (1996) indicated that older adults who participate in strength training could improve their strength and gait. These findings regarding muscle strength correlate with this present author’s research since the current study is also testing muscle strength of exercising and nonexercising elders. Mikesky and Topp tested muscle strength through the use of a dynamometer; however, only the muscle strength in the ankle was checked, whereas the current study muscle strength was checked in 12 different muscle groups using the dynamometer. Mikesky and Topp utilized older adults, as did the current study; however, Mikesky and Topp’s (1996) study was not specific to women.

Fiatarone, O’Neill and Ryan (1994) hypothesized that physical frailty was partially mediated by skeletal-muscle disuse and marginal nutritional intake and should, therefore, be reduced by interventions designed to reverse these deficits. Volunteers were recruited from the residents of a 125-bed facility providing long-term care of the elderly. The criteria for inclusion were
residential status, age of greater than 70 years, and the ability to walk 6 meters. Subjects were excluded if they had severe cognitive impairment, rapidly progressive or terminal illness, acute illness or unstable chronic disease, myocardial infarction, fracture of the lower extremity in the last 6 months, insulin-dependant diabetes mellitus, or if tests of muscle strength revealed a musculoskeletal or cardiovascular abnormality.

Subjects assigned to exercise training underwent a regimen of high-intensity progressive resistance training of the hip and knee extensors 3 days per week for 10 weeks. For each muscle group, resistance was set at 80% of the one repetition maximum (the maximum load that could be lifted fully one time only). This load was increased at each training session as tolerated by the subject. Strength testing was completed every 2 weeks to establish a new baseline value.

Training sessions lasted 45 minutes and were separated by one day of rest. Each repetition lasted 6 to 9 seconds, with a one- to 2-second rest between repetitions and a 2-minute rest between the three sets of eight lifts. A certified therapeutic recreation specialist supervised all exercise sessions.
Knee extensors were trained with the use of the UNEX II chair. The first 53 subjects were trained with the use of a wall-mounted cable pulley system, and 47 were trained with a double-leg press to exercise hip extensors. There were no differences at baseline or in treatment outcomes between subjects trained on these two machines.

All subjects not randomly assigned to resistance training engaged in three activities of their choice. No resistance training was allowed. Typical activities were walking, calisthenics, crafts, concerts, and board games.

The maximal weight that could be lifted correctly for one repetition only was used as the measure of dynamic concentric muscle strength in hip and knee extensors. Strength measurements in this population are highly reliable, \( r = 0.85, \ p < .001 \). The final test of muscle strength was performed during the week after the intervention.

Muscle strength values for the four muscle groups (right and left hip and knee extensors) were summed in order to derive a unitary variable representing decreased body strength. For the entire sample, lower body strength was 29.9 ± 1.2 kg (range 7.7 to 61.8). There was a difference in strength at baseline (\( F = 2.71, \ p = .05 \)),
with the subjects assigned to exercise training and nutritional supplementation weaker than those assigned to exercise training alone (24.8 ± 1.8 vs. 34.3 ± 2.9 kg, respectively).

Muscle strength significantly improved in all muscle strength tests and increased the cross-sectional area. The change in muscle strength was unrelated to age, sex, medical diagnosis, or functional level. A forward multiple regression model of the variables that showed significant univariate associations with the relative changes in strength after exercise training included assignment to the exercise group, baseline strength, and whole body potassium (all \( p < .001 \)); this model explained 66.3% of the variance in increased muscle strength.

Fiatarone et al. (1994) concluded that there was an increase in muscle strength with exercise. They demonstrated that a high-intensity progressive regimen of resistance training increased muscle strength in frail elderly people. Fiatarone et al. tested muscle strength by recording the maximal weight that could be lifted for one repetition only, whereas the current study used the dynamometer. Fiatarone et al. also concluded that there was an increase in muscle strength with exercise, whereas
the current study sought to reveal any differences in muscle strength related to different exercise intensities.

One study published by the USDA Human Nutrition Research Center on Aging (1996) sought to determine effects of resistance training on strength, balance, and ability of spontaneous activity. This study utilized 39 volunteers who participated on pneumatic equipment for 40 minutes twice a week. The resistance was set at 80% of the maximum load each could handle at a given session. Meanwhile, a control group of 19 women continued their normal lifestyle.

At the end of the first year, the trained group had gained 1% more bone density in the hips and spine, compared to a 2.5% loss in the control group. The trained muscles group had strength increases from 35% to 76% above the control group. Balance improved 14%. Spontaneous physical activity, excluding the training session, increased an average of 27%, whereas it decreased in the control group by the same amount. The USDA study did find an increase in bone density and muscle strength after one year of resistance training. They also found an increase in spontaneous activity in the exercise group rather than in the control group. Once again, this study supports the
use of resistance training to increase muscle strength. The USDA differed from the current study in that it did not discuss different exercise intensities or a specific age group with relation to exercise and muscle strength.

**Exercise and Lipid Levels**

Fitzgerald and Singleton (1996) studied relationships between older adults' exercise habits and lipid levels. This study addressed the gaps in literature by examining the exercise habits and lipid profiles of healthy older adults that included a substantial number of women. There were two research questions addressed in this study: What is the relationship between self-reported exercise patterns and lipid levels in this group and are self-reported exercise patterns, gender, age, and body composition predictive of lipid levels?

For this study, older adults included 117 participants. The term older adult included individuals whose ages ranged from 50 to 80 years. The following self-reported chronic or debilitating medical conditions resulted in exclusion from the study: severe hypertension, history of liver or kidney failure, frequent bleeding, diabetes mellitus requiring medication, severe anemia, sickle cell anemia, angina pectoris, previous myocardial
infarction, or a cancer diagnosis within the past year. The inability to read a newspaper due to poor vision, inability to use the radio or telephone due to inadequate hearing, or chest or leg pain while walking also resulted in exclusion.

Exercise activity was collected using the Paffenbarger's Physical Activity Questionnaire and was used to determine cardiovascular exercise activity for the past 7 days. Participants were given a score, depending on the amount of exercise based on the MET (Metabolic Equivalent) levels. For walking, jogging, or cycling, participants were given scores based on miles per hour. Other exercises were difficult to score. Swimming, for example, was assigned a score depending on the lower end of the MET scores due to the assumption that elders exercise at lower intensities. Based on the above self-reported exercise habits, a dichotomous classification was used to distinguish active and nonactive participants. Individuals who participated in one or more exercise sessions in the previous week were classified as "active," while individuals who had not exercised in the previous week were classified as "not active." In addition, because only a few individuals were involved in informal
cardiovascular activities (e.g., gardening and housework), and because of the difficulty in quantifying the exercise intensity of these activities, informal cardiovascular activities were not included in these analyses.

Lipid measurement was completed in the mornings at least 8 hours after a fast. The total cholesterol and high-density lipoprotein (HDL) were completed using Sigma Diagnostic, as were the low-density lipoprotein (LDL) and triglyceride levels. Based on the ratios of total cholesterol to HDL, participants were also categorized as having either high or low cardiovascular risk. Total cholesterol/HDL ratios greater than 4.5% were considered high risk and ratios that were equal to or less than 4.5% were considered low risk for this study.

Body fat composition was determined using a tetrapolar impedance plethysmograph. Body fat percentages less than 21% for females and less than 32% for men were considered healthy.

Independent t tests were performed to determine differences by gender, ethnicity, and active/nonactive status for total cholesterol, HDL, LDL, and triglyceride levels. Differences in the cholesterol levels of the three
age decades were determined by one-way analysis of variance.

Regression analysis was used to examine the relationships of each lipid value to the measures of the Exercise Index (EI) score, percentage of body fat, age, and gender. The dependant variables for this study were the lipid measures. The independent variables were the EI score, percentage of body fat, age, and gender. A second series of regression analyses were also completed. The literature suggested that relative levels of activity intensity and duration might play a significant role in influencing lipid levels.

The demographic results of this study of 117 participants found that most percentages of the people were active and that more than half had unhealthy body fat percentage. The majority (68%) of the participants were married, more than one half (55%) held baccalaureate or graduate degree, and 75% had an annual household income of $25,000 or greater. The most frequent form of exercise reported was walking. Women were less likely to be active than men and were more likely to have an unhealthy percentage of body fat.
The researchers found that men had, on average, a lower HDL (46.5%), as compared to women, who had 55%. Men were more active than women (75% vs. 48%), and men were more likely to have an acceptable percentage of body fat (67% vs. 30%). Although not statistically significant, 79% of the men and 61% of the women were categorized as low risk for total cholesterol/HDL ratio. The average total cholesterol for the study participants was 188.5.

There were no significant differences between African Americans and Caucasians for total cholesterol and LDL. African Americans had higher HDL levels and lower triglyceride levels than Caucasians. There also was no significant difference found in the lipid levels of the three age decades. No significant difference was found between activity status, body fat percentage category, or cholesterol ratio risk by age decade.

No significant differences were found for the lipid levels and the body fat percentage categories of the active and nonactive participants. Activity status also had no impact on the total cholesterol/HDL ratios. A regression model was built for each of the four lipid values. The EI score, percentage of body fat, age, and gender were used as independent variables to predict each
lipid value. Only one model proved to be significant, the model predicting HDL. Gender was significantly correlated with HDL, the EI score, and the percentage of body fat. Women tended to have higher HDL values, a higher percentage of body fat, and lower EI scores.

When the correlation and regression analyses were repeated using only active individuals, again only the HDL model proved to be significant. Gender, the percentage of body fat, and the EI score were significant to this model.

The evidence suggested that physical activity is an important factor associated with blood lipid levels in active older women. It was not clear, from the data presented, what was the primary causal factor. It was recommended that future studies be conducted to attempt to clarify this relationship.

Significance for the need of a study to further define the relationship of women, lipids, strength, and exercise has been shown by the Fitzgerald and Singleton (1996) study, which supports the need for the current research. The Fitzgerald and Singleton study did not address the relationship between all the variables mentioned above with different degrees of exercise which were addressed in the current study. Differences in
structured exercise (e.g., health club, exercise classes), unstructured exercise (walking or exercising at home) and a nonactive group were not compared as it was in the current study. Similarities between the studies included the use of self-reported physical activity. The Fitzgerald and Singleton (1996) study found that the use of a self-reported questionnaire regarding the physical assessment to be valid with this specific age group; however, they did not single out women in their study as in the current study.

In another study, Kennedy and DeVoe (1996) sought to examine the effect of physical activity on blood concentrations of total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides in sedentary Mexican-American females. The researchers felt that Hispanic-American women might be at a disadvantage as they face many socioeconomic challenges, such as low education, urban poverty, and limited occupation and health insurance coverage.

Announcements for the study were advertised through the local Hispanic church bulletins and church organizations along with personal discussions in the community. For inclusion in this study, participants were
required to be first or second generation Mexican Americans and sedentary in their physical activity patterns prior to the investigation. Sedentary status was determined by subject completion of a health risk appraisal and personal interview. Each subject was required to submit a completed health history and referral from the physician with informed consent.

A total sample of 53 Mexican-American women met the criteria and were randomly assigned to a control group (n = 25) and to an experimental group (n = 28). The control group did not receive any intervention but were told they would rotate into the activity program at the termination of the investigation.

The exercise regimen served as the treatment variable and consisted of a 50-minute, biweekly session implemented throughout a 12-month program. The first 3 weeks of the program consisted of simple range of motion and comfortable walking routines. The participants were slowly increased from 65% to 75% of their maximum heart rate after the eighth week.

Blood samples, for the use of lipid level testing, were taken prior to the initiation of the exercise program. Participants were required to have fasted for at
least 12 to 14 hours prior. This procedure was repeated in 12 months.

A simple 2 x 2 multivariate analysis (MANOVA) with repeated measures was used to analyze data. Simple main effect tests were performed to determine any significant differences between and within the group. The mean age for the experimental and control group was 58.16 (SD = 9.97) and 58.68 (SD = 8.32), respectively. Age range was 37 to 72 years for the experimental and 39 to 72 years for the control group. MANOVA testing revealed a significant difference by group interactions, F(4, 44) = 14.38, p < .001. Univariate analysis revealed HDL cholesterol and triglyceride concentrations to be significantly different between the experimental and control groups. The control group displayed no significant difference between pre- and post-exercise means. HDL pre-exercise means were not found to be significantly different between experimental and control groups. Simple main effects revealed a significant difference, F(91, 47) = 6.60, p < .013, in mean HDL cholesterol values between the experimental group (M = 54.58, SD = 8.95) and the control group (M = 48.40, SD = 7.87) post-exercise. A significant increase in mean HDL concentrations was noted in the treatment group: F(91, 47)
A significance was also noted for triglycerides $F(1, 47) = 6.17$, $p < .017$. Simple main effects tests revealed a significant difference $F(1, 47) = 3.90$, $p < .05$ between the experimental ($M = 154.88$, SD = 55.78) and the control group ($M = 185.36$, SD = 52.26) post-exercise. Triglyceride levels decreased significantly $F(1, 47) = 5.65$, $p < .05$, between pretest ($M = 167.42$, SD = 61.18) and the posttest ($M = 154.88$, SD = 55.78) in the experimental group only. There was no significant difference between the experimental group and the control group prior to exercise with regard to triglycerides.

Kennedy and DeVoe (1996) revealed that regular aerobic exercise was associated with significant increase in blood HDL cholesterol concentrations as well as significant decreases in triglyceride concentration in sedentary Mexican-American women. A further conclusion was that a reduction in sedentary Mexican-American women’s lifestyles contributes to the physical fitness objective set by Healthy People 2000.

Kennedy and DeVoe’s (1996) findings are germane to this author’s research. Kennedy and DeVoe studied
Mexican-American women of all ages, whereas the current study focused only on women 65 and over. Kennedy and DeVoe (1996) researched the effects of aerobic exercise on lipid levels also while the current study investigated differences in lipid levels with regard to varying amounts of physical activity.

Stefanick (1998) studied the effects of exercise on the National Cholesterol Education Program Diet (NCEP) in persons with lipoprotein levels that placed them at high risk for coronary artery disease. The hypothesis Stefanick tested was that the HDL levels would be increased by exercise but decreased by the diet. The researcher also hypothesized that the LDL would be decreased by diet and that the ration of HDL to LDL would be most improved by combining the two independent variables of diet and exercise. The sample size was 180 women and 197 men who were randomly assigned to one of four groups: those assigned to follow the NCEP Step II diet (47 women and 49 men), those assigned to aerobic exercise only (44 women and 50 men), those assigned to both the diet and the aerobic exercise group (43 women and 57 men), and a control group (46 women and 47 men). Computer-made assignments with use of a modified Efron Procedure, which
weighted the probability of assignment in order to balance
groups in terms of sample size and average HDL and LDL
cholesterol levels.

Potential subjects were excluded if they reported a
history of heart disease, stroke, diabetes, recent cancer,
and other life-threatening illnesses or any conditions
that limited their ability to engage in moderate intensity
exercise. Individuals were excluded if using medications
for heart problems, blood pressure, or high cholesterol,
if they smoked greater than 9 cigarettes per day or
consumed greater than 4 alcoholic drinks per day. Women on
hormone therapy agreed not to change therapy for the
length of the study.

Dietary recommendations regarding the NCEP Step II
diet (< 30% fat, < 7% saturated fat, and > 200 mg
cholesterol/day) were presented to the subjects by
registered dietitians. The subjects entered a 12-week
adoption phase and received individualized counseling
sessions followed by 8 one-hour mixed sex group sessions
regarding diet. Weight loss was not emphasized. All group
sessions were held separately for the diet alone and the
diet-plus exercise group. A 6- to 8-month maintenance
phase consisted of monthly contacts with dietitians by mail, phone, or in group/private meetings.

The aerobic exercise program began with a private meeting with the exercise staff, followed by a 6-week adoption phase in which participants attended supervised, one hour, mixed-sex exercise sessions three times per week. These were held separately from the diet-plus-exercise group. Subjects were instructed not to discuss diet during these sessions. They then participated in a 7- to 8-month maintenance phase. Participants could attend supervised group meetings three times per week and supplement with home or could do both activities. The goal was to engage in aerobic walking equal to at least 16 kilometers (10 miles) of brisk walking or jogging each week.

The individuals in the control group were asked to maintain their usual diet and exercise habits until the one-year follow-up. After one year, subjects returned to the clinic several times to provide data on physical measures, aerobic fitness, and plasma lipoprotein and glucose levels. The body mass index was measured by the weight on a standard balance beam during two visits and the height with a Haarpendem stadiometer. The means of the
three measures of the following were recorded with participants standing: waist, abdominal girth, and hip circumference. Resting heart rate and blood pressure measurements were determined by two morning visits. Oxygen uptake during a treadmill exercise test was determined every 30 seconds.

Lipoprotein values at baseline and at one year were reported as the means of two fasting values. Plasma levels of total cholesterol and triglycerides were measured by enzymatic procedures. HDL cholesterol was measured by dextran sulfate magnesium precipitation followed by enzymatic measurement of the non-precipitated cholesterol. Very low density lipoprotein (VLDL) was calculated as the triglyceride level divided by 5 unless the triglyceride levels exceeded 400 mg per deciliter. LDL cholesterol was calculated as the total cholesterol minus the sum of the HDL cholesterol plus the VLDL cholesterol.

Analysis of variance (ANOVA) was used as a global test for differences in the degree of changed from baseline values among groups, calculated separately for each sex. When the ANOVA indicated significant differences between groups (p < .05), post hoc comparisons were made
using the Bonferroni at the 5% level of significance in two-tailed tests.

The screening procedures excluded 421 of 789 women and 341 of 767 men because they had HDL at or greater than 60. An additional 111 women and 172 men did not meet the criteria for the LDL cholesterol or triglyceride level. Twenty women and 11 men did not meet the criteria for blood pressure or glucose. Finally, 30 men and 35 women chose not to continue. Final participants included 180 women and 197 men who were randomly assigned to a group. Of these, 177 women (98%) and 190 (96%) men returned in one year for lipid measurement.

Dietary intake of fat and cholesterol decreased during the one-year study (p < .001) as did body weight in women and men in either the diet group or the diet-plus exercise group, as compared with the controls (p < .001) and the exercise group, (p < .05), in which dietary intake and body weight were unchanged. Changes in HDL cholesterol and triglyceride levels and the ratio of total to HDL cholesterol did not differ significantly among the treatments groups for subjects of either sex. The serum level of LDL cholesterol was significantly reduced among women (a decrease of 14.5 ± 22.2 mg/dl) and men (a
decrease of 20.0 ± 17.3 mg/dl) in the diet-plus-exercise group, as compared with the control group (women with a decrease of 2.5 ± 16.6 mg/dl, p < .05, and men with a decrease of 4.6 ± 21.1 mg/dl, p < .001). The reduction in LDL cholesterol in men in the diet-plus exercise group was also significant as compared with that among the men in the exercise group (3.6 ± 18.8 mg/dl, p < .001). In contrast, changes in the LDL cholesterol levels were not significant among the women (a decrease of 7.3 ± 18.9 mg/dl) or the men (10.8 ± 18.8 mg/dl) in the diet group, as compared with the controls.

In the Stefanick (1998) study, the NCEP Step II diet alone failed to decrease LDL cholesterol levels in men and women with at-risk lipoprotein levels who did not engage in aerobic exercise. Stefanick also found that exercise alone did not have significant findings. Stefanick found that the combination of diet and exercise were needed to lower LDL cholesterol. No significant changes were found in the exercise-only group, as noted in other studies, which supports the need for further research in this area. These findings highlighted the importance of studying physical activity as a factor in lowering LDL cholesterol.
levels, which is significant to this present author's research.

Maines et al. (1997) studied 591 consecutive patients from two academic institutions before and after completion of a cardiac rehabilitation and exercise training program to determine the effects of this therapy on exercise capacity, indices of obesity, plasma lipid values, behavioral characteristics, and quality of life parameters. Only the findings from the plasma lipid levels will be discussed because of its significance to this present author's research.

Maines et al. (1997) reviewed data at baseline and after outpatient phase II cardiac rehabilitation and exercise programs in 591 consecutive patients (431 from Ochsner Medical Institution and 160 from Massachusetts General Hospital), who completed the 12-week program, with a dropout rate of 10%. With the exception of HDL-C, which was slightly higher in the Massachusetts General Hospital patients \( (p < .05) \), the characteristics of patients from both institutions were statistically similar.

Exclusions from the study were persons taking lipid-lowering medications. All participants either had an acute myocardial infarction \( (45\%) \), coronary artery bypass
grafting (30%), or had percutaneous transluminal coronary angioplasty for an acute ischemic syndrome in 25%.

The subjects completed an outpatient phase II cardiac rehabilitation and exercise program that lasted 12 weeks and consisted of 36 educational and exercise sessions. Each exercise class consisted of 10 minutes of warm-up and stretching and calisthenics followed by 30 to 40 minutes of continuous upright aerobic and dynamic exercise and approximately 10 minutes of cool-down stretching and calisthenics. All patients were encouraged to exercise one to three times per week outside the formal program. Each patient’s exercise prescription was periodically adjusted to encourage a gradual increase in overall exercise performance. At baseline, all patients were instructed to comply with the Phase I diet of the American Heart Association and the National Cholesterol Education Program. Height, weight, basal metabolic index, sex, age, and fasting levels of plasma lipids were assessed at baseline and again at one week after completing the program.

Significant differences were noted in estimated exercise capacity, triglycerides, HDL-C, and LDL-C/HDL-C. The reduction noted in total cholesterol was not
significant. In all, a 5% increase in HDL levels was seen. There was a modest decrease in total cholesterol and LDL-C (-1.3% and -1.5%, respectively). Triglycerides decreased by 9%. These differences in lipids were noted more in obese than nonobese people.

Maines et al. (1997) looked at lipid levels in relation to exercise, but did not look at a specific age population as in the present study. In addition to the exercise program, Maines et al. also investigated the intervention of a Phase I American Heart Association diet. Additionally, Maines et al. looked at only one type of exercise program, whereas the current study examined different types of physical activity.

There have been few studies regarding the validity of self-reported exercise habits. Fitzgerald and Singleton (1994) examined self-reported activity, measured fitness, exercise knowledge, and exercise beliefs of African American and white females. There were three research questions: What are the self-reported exercise habits of healthy African American and white female’s 50-80 years old? What is the relationship between self-reported activity and measured fitness status in this group? And what are the exercise beliefs and knowledge of this group
and how do exercise knowledge and beliefs relate to measured fitness status and exercise behavior?

The sample included 99 women (48 African American and 51 white women) between the ages of 50 and 70 years. The average age was 61 years. Almost half (44%) held a bachelor’s or graduate degree, 69% had an annual income of more than $25,000, and the majority of the women were married (62%). White women had income levels greater than African-American women. However, no differences were found with age, educational attainment, or marital status.

Fitness was determined by a treadmill test using a modified Naughton Protocol. Each participant was asked to continue the test until reaching 70% of her predicted maximum heart rate (220-age). The length of time it took each participant to reach 70% of her predicted maximum heart rate (PMHR) was recorded in seconds.

Activity assessment was recorded using a Seven-Day Activity Recall, modified from the Physical Activity Index Questionnaire by Paffenbarger. Each subject was questioned concerning participation in one or more cardiovascular activities, such as brisk walking or biking during the previous week. Each activity listed on the Seven-Day Activity Recall was assigned an intensity level based on
its metabolic equivalent (MET). An EI Score was determined for each participant using her reported exercise levels and the associated MET levels. This score was calculated by multiplying the number of times during the week the exercise was performed by the duration of each exercise session in minutes by the MET level for the activity.

In this study by Fitzgerald and Singleton (1994), a simple dichotomous activity classification was created. Individuals who participated in at least one session of exercise in the previous week were classified as "active," whereas individuals who had not exercised in the previous week were classified as "not active."

To assess exercise beliefs and knowledge, participants were asked to respond to six statements taken partially from the Stanford Five City Questionnaire and partially from the project health educator. Exercise knowledge was assessed from three questions from the American College of Sport Medicine guidelines for cardiovascular fitness.

Comparisons between African American and white women in age, income, education, fitness status, activity status, and percent correct for the knowledge questions were made with chi-square analyses. Student t tests were
used to determine differences in EI scores. A multivariate analysis of variance was used to determine if the two ethnic groups differed on the six exercise belief statements. Student t tests were performed post hoc to determine the specific exercise beliefs where the two groups differed. The accepted level of significance was $p < .05$.

Fitzgerald and Singleton (1994) used a logistic regression to examine the relationship of EI scores, ethnicity, income level, education, exercise beliefs, and exercise knowledge to fitness status. Multiple regression was performed to examine the relationship of ethnicity, age, income level, education, exercise beliefs, and exercise knowledge to the EI scores.

After examining fitness status in relation to ethnicity and income level, the researchers revealed that generally women in the lower income levels were less fit ($p = .03$). A chi-square analysis of income level and fitness status while controlling for ethnicity indicated no differences in the fitness status by income level ($p = .36$). However, a chi-square analysis of ethnicity and fitness status while controlling for income found a
difference in fitness status of African-American and white females (p = .02).

The correlation between the EI score and the response to the question "How many days per week do you usually engage in planned exercise?" was .78 (p = < .001) which suggested that previous week’s exercise activities were representative of usual exercise patterns. White women had higher average EI score than African-American women (86 vs. 223, t = -2.44, p = .02), indicating greater activity levels. However, the difference between the EI scores of active African-American (M = 559) and active white (M = 854) women was marginal, t = -1.089, p = .06.

White females were less likely to agree with the statement, "Older people should avoid vigorous exercise," and less likely to find it difficult to adhere to a regular schedule of physical activity. The ethnic groups differed on two of three knowledge questions. White females were more likely to answer correctly the question concerning the number of minutes per session a person needs to exercise to achieve fitness, 67% vs. 385, p = < .01, and also the question concerning how fast the heart must beat over the normal rate during exercise, 18% vs. 2%, p = < .01.
A logistic regression analysis was used to examine how EI scores, ethnicity, income level, education exercise beliefs, and exercise knowledge related to fitness status. In this study, the independent variables did not explain fitness status (likelihood chi-square $p = .38$).

The Fitzgerald and Singleton (1994) study found that white women exercised more and had greater levels of measured fitness than African-American women. All women understood the importance of regular exercise, but both real and perceived obstacles hindered participation in exercise.

It was also found in the Fitzgerald and Singleton (1994) study that the Seven Day Physical Activity recall was representative of the participants’ usual exercise patterns, which is germane to this author’s research. Fitzgerald and Singleton’s study utilized the elderly population and found self-reported results valid in relation to the physical attributes of the individual. This study supports the current research that also was a self-reported questionnaire.

In summary, the decline in muscle strength with aging is evident in the literature. Bohannon (1996) found significant declines in muscle strength while studying
women aged 20 to 79 years. Just as this study found a
decline in muscle strength and helped to establish
parameters for muscle strength with the use of a
dynamometer, other studies have found that through
increasing physical activity, some of this loss could be
regained (Fiatarone et al., 1994; Goldbeck-Wood, 1997;
Mikesky & Topp, 1996; USDA Human Nutritional Research
Center, 1996).

Two authors found that, through home exercise
programs completed on the participant’s time and in the
comfort of their own home, strength could indeed be
increased (Goldbeck-Wood, 1997; Mikesky & Topp, 1996). 
Goldbeck-Wood found that with participation in a home-
based exercise program, a decreased number of falls were
noted. Mikesky and Topp (1996) found similarly that with a
14-week home-based home exercise program, there was an
increase in the strength in ankle dorsiflexion in both men
and women. In both of these studies, exercise was
prescribed and taught to the participants, but were
performed in an informal home environment.

Fiatarone et al. (1994), on the other hand, studied
institutionalized elders in a long-term care facility.
Subjects participated in group exercises lasting for 10
weeks. It was found that muscle strength improved significantly with high-intensity, formal exercise training. Similarly, the study by the USDA found increased muscle strength in volunteers who participated in a formal exercise program.

All literature reviews found increased muscle strength, but no study looked at muscle strength specifically to elderly women and women who exercised at either a formal or informal exercise level as well as no exercise level. This review supports the need for more research in the area of elderly women and muscle strength and the need for more information on exactly how much exercise is needed to make a difference in muscle strength. Elderly women need to know if a simple walking program at home is as beneficial as a formal aerobics class.

Further studies found that research regarding exercise benefits in relation to lipid levels is inconsistent. More research is needed in this area specific to elderly women post-menopause and at different exercise intensities.

Fitzgerald and Singleton (1996) found that activity status had no impact on the total cholesterol and HDL
ratios. No significant differences were found in relation to the three decades of age in this study, neither did they find a significant difference with regard to activity status.

Unlike Fitzgerald and Singleton (1996), Kennedy and DeVoe (1996) found a significant difference in the HDL levels as well as a lowering of triglycerides. Stefanick (1998) also found a difference in lipid levels, but only in a diet-plus exercise group. No other group’s lipid levels were significantly changed.

Like Stefanick (1998), Maines et al. (1997) found a significant difference in triglyceride, HDL, and HDL/LDL ratio. Maines et al. also studied the effects of diet along with the exercise program, so these two studies had other variables involved than exercise alone.

In conclusion, results from the review of literature revealed conflicting information. Studies involved all ages of men and women, different mechanisms of testing muscle strength, and utilized different variables when testing for lipid levels. No other study was identified in the literature specifically regarding benefits of various levels of exercise in elderly women related to muscle
strength and lipid levels similar to the current study under investigation.
Minimal empirical knowledge exists regarding the effects that exercise has on lipid levels and muscle strength in elderly women, and an even smaller amount of research is available regarding the effects of different intensities and frequencies of self-reported exercise in elders. The purpose of this study was to determine effects of exercise on both lipid levels and muscle strength in elderly women who participate in either a structured exercise program, an unstructured exercise program, or no exercise program at all.

**Design of the Study**

A comparative/descriptive design was employed for this study because it is unclear whether exercise of different intensities affects lipid levels and muscle strength in elderly women. This researcher has attempted to identify differences among types of exercise groups and has compared the different exercise intensities as they related to lipid levels and muscle strength. Several
variables were utilized for this study. The independent variable was exercise, and the dependant variables were lipid levels and muscle strength.

Limitations

Limitations to this study included the fact that this information was self-reported. However, many research studies have utilized this particular reporting mechanism and found reliability to be very good. Another limitation may have been the assumption that elders did not want to report inactivity since it could be interpreted as a sign of weakness. Size and homogeneity of the study limited generalization to other populations in different locations.

Setting, Population, and Sample

The setting for this study was a rural Northeast Mississippi town. The population of the town was approximately 12,000. The target population consisted of women aged 65 and over who had various levels of physical activity. A convenience sample (N = 101) of women was placed in one of three groups: the structured exercise group, the unstructured exercise group, and the group that did not exercise. The target sample was taken from an
established chair aerobics program at a local church, a local meal site, and a local Sunday school class. Selection criteria for participation in this study were based on meeting the age requirement, a negative history for a heart attack, and giving informed consent for the study. Subjects were assigned to a group based on amount of exercise reported on the demographic survey.

Procedure or Data Collection

Before data collection proceeded, permission to conduct the study was obtained from Mississippi University for Women’s Committee on Use of Human Subjects in Experimentation (IRB) (see Appendix A). Verbal and written consent was obtained from the selected three sites mentioned to complete testing in the facility (see Appendix B). In addition, consent for participation in the study and for venipunctures and muscle testing was obtained from each participant (see Appendix C). The consent form contained a number for coding purposes and the number appeared on the survey, in the lab results, and on muscle strength tests. In order to protect the confidentiality of the participants, only the researcher had access to the participants’ names. This code and the participant’s name were recorded with all information so
that the participants could be contacted to share results of the tests.

Instrumentation

A researcher-developed instrument was utilized for demographic information. The first six questions dealt with demographic, educational and insurance information. Questions 7 through 14, dealt with the participant's medical history and personal health ratings such as current type of diet and a list of current medications. The survey also questioned the subject regarding cardiac risk factors for themselves and immediate family (see Appendix D).

The instrument utilized to test muscle strength in six different muscle groups was the Chatillon dynamometer. One female tester was utilized to increase reliability of the testing to obtain all strength measurements. The participant's dominant side was measured to determine muscle strength, and three measurements were taken at each of the six muscle sites. The highest score out of the three was the recorded value for the participant.

The total cholesterol, triglycerides, and high density lipoproteins were scored by the Dade RXL Dimension. The low-density lipoprotein values were
tabulated utilizing the values of the other components of the lipid panel (see Appendix E).

Methods of Data Collection

After obtaining permission from the subjects, the researcher gave the demographic survey to the participant for completion. The survey was explained individually to ensure understanding of the proper completion of the survey. Next, the researcher completed a venipuncture and the blood was labeled with the participant’s code and the date. After venipuncture, the muscle strength was recorded using the Jaymar dynamometer. These results were recorded on a flow sheet with the participant’s code only. The local hospital laboratory completed testing at no charge to the participants or the researcher. All blood was labeled with the code from the demographic data, and this code followed the participant through the study so that information from testing could be sent to them. Data were collected from April to May of 1999.

Data Analysis

Demographic data were obtained from all participants. Descriptive statistics, such as mean and frequency, were utilized to analyze the data. Participants were assigned
to one of three groups based on the levels and types of exercise reported. Data analysis compared the three groups for lipid levels and muscle strength.

The null hypotheses tested were as follows:

1. There will be no difference in lipid levels among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program.

2. There will be no difference in muscle strength among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program.

This study was a level II inquiry, and data were analyzed using a 3 x 2 Analysis of Variance (ANOVA). In order to determine if there was variability resulting from the independent variable or variability between the three groups, ANOVA testing was deemed appropriate (Polit & Hungler, 1995).
The purpose of this study was to compare the effects of participation in either a structured or unstructured exercise program or no-exercise program at all on lipid levels and muscle strength in women 65 years and over. To guide this research, a comparative, descriptive design was employed among patients who attended a local exercise class for senior citizens, a local elderly women’s Sunday school class, or a local meal site. Three tools were utilized in this study for data collection: (a) a demographic tool developed by the researcher, (b) the Chatillon dynamometer, and (c) the Dade RXL lipid tester. Data were analyzed using a 3 x 2 Analysis of Variance (ANOVA) while demographic data were analyzed by descriptive statistics.

The data collected and analyzed for this study are presented in this chapter. Characteristics of the participants are described first, followed by the outcomes of data analysis related to the research hypotheses.
Description of Sample

The convenience sample (N = 101) consisted of women 65 and over and who participated in various levels of physical activity and resided in a rural Northeast Mississippi town. Eligibility criteria included that women had never had a diagnosis of a heart attack. Therefore, none of the participants had a history of a myocardial infarction. The participants were divided into three groups based on the amount of physical activity they reported in the last 2 weeks. The three groups were structured exercise (n = 30), unstructured exercise (n = 43), and a no-exercise group (n = 28).

Distribution of age and ethnicity. Ages ranged from 65 to 88 with a mean age of 73.1 with a standard deviation of 6.36. The mean age of the participants in the structured exercise group was 73.33, in the unstructured exercise group was 73.02, and in the no-exercise group was 75.54. All participants were Caucasian. A summary of the age of subjects is depicted in Table 1.
Table 1

Summary of Sample Characteristics for Age by Frequency and Percentage

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 to 69</td>
<td>33</td>
<td>32.7</td>
</tr>
<tr>
<td>70 to 74</td>
<td>30</td>
<td>29.7</td>
</tr>
<tr>
<td>75 to 79</td>
<td>14</td>
<td>13.9</td>
</tr>
<tr>
<td>80 to 84</td>
<td>15</td>
<td>14.8</td>
</tr>
<tr>
<td>8 to 89</td>
<td>9</td>
<td>8.9</td>
</tr>
</tbody>
</table>

Note: N = 101.

Marital status. The participants were divided into four groups: married, single, widowed, or divorced. Forty-eight percent of the participants were married, 1% was single, 46.5% were widowed, and 4% were divorced.

Living arrangements. A total of 47 participants reported living alone (46.5%), 47 participants reported living with their spouse (46.5%), and 7 participants reported living with a family member or friend (6.9%). The findings concerning living arrangements of participants by exercise group can be found in Table 2.
Table 2

A Comparison of Living Arrangements Among the Structured Exercise Group, Unstructured Exercise Group, and the No-Exercise Group by Frequency and Percentage

<table>
<thead>
<tr>
<th>Living arrangements</th>
<th>Structured exercise</th>
<th>Unstructured exercise</th>
<th>No exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
</tr>
<tr>
<td>With spouse</td>
<td>12</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>With family or friends</td>
<td>3</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Alone</td>
<td>15</td>
<td>50</td>
<td>14</td>
</tr>
</tbody>
</table>

Note. N = 101.

Education. The mean educational level of the combined participants of the three groups was 12.22 years with a standard deviation of 2.64. The average years of education within the structured exercise group were 12.63 (SD = 3.47), the unstructured exercise group was 12.37 (SD = 2.01), and the no-exercise group was 11.54 years (SD = 2.41).

Insurance sources. The frequency distribution for the current type of insurance each participant had was analyzed. Out of the total group of 101 participants, 4 participants (4%) had Medicaid, 39 participants (38.6%)
had Medicare, 55 participants (54.5%) had private insurance, and only 3 participants (3%) stated that they had something other than the choices listed. The structured exercise group had a total of 2 (7.1%) with Medicaid, 9 (30%) with Medicare, 18 (60%) with private insurance and 1 (3.3%) with some other type of payment for health care. The unstructured exercise group had no participants on Medicaid, a total of 17 (39.5%) with Medicare, 24 (55.8%) with private insurance, and 2 (4.7%) with some other type of healthcare payment system. The no-exercise group had 2 (6.7%) with Medicaid, 13 (46.4%) with Medicare, and 13 (46.4%) with private insurance.

**Intake of fat in diet.** The participants were asked on the demographic survey if they monitored the amount of fat intake in their diet. Of the total groups, 77% answered that they did in fact try to monitor the amount of fat intake in their diet. Of the structured exercise group, 24 (80%) stated that they did try to watch the fat intake in their diet and 6 (20%) stated that they did not. The unstructured exercise group had 31 (72.1%) who reported that they monitored the amount of fat intake in their diet, while 12 (27.9%) stated that they did not. The
no-exercise group had 23 (82.1%) who tried to monitor fat intake and 5 (17.9%) who did not.

Cholesterol medication. Seventeen percent of the total number of participants were currently on medication to lower their cholesterol. The structured exercise group had a total of 4 participants (13.3%), the unstructured exercise group had a total of 7 participants (16.3%) presently on cholesterol lowering medication, and the no-exercise group had a total of 6 participants (21.4%) on medication to lower cholesterol.

Family history of heart attack or stroke. A total of 62.4% of the total participants answered that they had a family history of heart disease or stroke. The structured exercise group had a total of 20 participants (66.7%) that had a family history of heart disease or stroke. The unstructured exercise group had a total of 27 (62.8%) that had a family history of heart disease or stroke. The no-exercise group had a total of 16 (57.1%) affirming a history of heart disease or stroke.

Patient history of heart attack or stroke. Each potential subject was queried concerning whether they had a history of heart attack or stroke. This question was asked as a screening mechanism for participation in the
study. If any participant replied that they had a heart attack or stroke in the past, they were excluded from the study. This was done to prevent any unwanted complications from the isometric movements that must be completed in order to evaluate the participant's muscle strength. This information had been explained fully before the demographic survey was given to them, so 100% of the participants answered no to this question.

**Doctor visits.** Eighty-eight percent of the total participants had not been to the doctor in the last year, and about 10% had only had one visit in the last year. The mean number of visits in the last year for the combined groups was 3.29 with an SD of 3.6. The structured exercise group had a mean of 3.03 for the number of visits to the doctor in a year for that group. The range of visits was 0 to 15 with 24 out of 30 participants (80%) visiting the doctor three times or less in the last year. The unstructured exercise group had a mean of 2.84 visits with an SD of 2.35. The range of visits for this group was 0 to 12 with 88% of these participants visiting the doctor four times or less in the last year. The no-exercise group had a mean of 4.25 visits with an SD of 4.98. The range of
visits was 0 to 20 with 78% of these participants visiting the doctor four times or less in the last year.

Hospitalizations. The mean hospitalizations for the total participants in the last year was .15 with a standard deviation of .46. Ninety-eight percent had one or less hospitalizations, and only 2% had 2 or more hospitalizations. The structured exercise group had 25 (83.3%) participants who had not been in the hospital in the last year, 4 (13%) who had been hospitalized one time, and one (3%) who had been hospitalized twice. The unstructured exercise group had 40 (93%) who had not been hospitalized in the last year and 3 (6.9%) participants who had been in the hospitalized once. The no-exercise group had 24 (85.7%) who had no hospitalizations in the last year, 3 (10.7%) who had only one hospitalization in the last year and 1 (3.6%) who had been hospitalized three times in the last year.

Rating of personal health. Participants were asked to rate their personal health with excellent being 4, good being 3, fair being 2, and poor being 1. Eighteen percent of the total participants rated themselves in excellent personal health, and 54% rated themselves in good health. Twenty-six percent rated themselves in fair health, while
3% gave themselves a poor health rating. When combining categories, a total of 29% rated themselves in fair to poor health while 71% rated themselves in excellent to good. It should be noted that no one in the structured exercise group rated themselves in poor health, and 87% rated themselves in excellent to good. In the unstructured exercise group, 2.3% saw themselves in poor health, while 74% of this group saw themselves as either in excellent or good health. In the no-exercise group, 7.1% saw themselves in poor health, while 50% saw themselves in either being in excellent or good health. A comparison of personal health ratings among the groups is better summarized in Table 3.
Table 3

A Comparison of Personal Health Rating Among the Structured Exercise Group, the Unstructured Exercise Group, and the No-Exercise Group by Frequency and Percentage

<table>
<thead>
<tr>
<th>Health rating</th>
<th>Structured exercise</th>
<th>Unstructured exercise</th>
<th>No exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
</tr>
<tr>
<td>Excellent</td>
<td>7</td>
<td>23.3</td>
<td>7</td>
</tr>
<tr>
<td>Good</td>
<td>19</td>
<td>63.3</td>
<td>25</td>
</tr>
<tr>
<td>Fair</td>
<td>4</td>
<td>13.3</td>
<td>10</td>
</tr>
<tr>
<td>Poor</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. N = 101.

Interference with daily activities. Participants were asked to rate how their health interfered with their daily activities with none being 0, hardly any being 1, some being 2, and a great deal being 3. The mean answer for the participants was .83 (SD = .96) which ranks between none and hardly any. Overall, 49% answered that their personal health did not interfere with their daily activities, while 27% answered that their personal health interfered hardly any with their daily activities, 18% answered some, and 7% answered that their personal health interfered with
their daily activities a great deal. The structured exercise group had 18 (60%) who reported that their health did not interfere with daily activities, 7 (23.3%) reported hardly any, 4 (13.3%) reported some, and 1 (3.3%) reported that their health was interfering with daily activities a great deal. The unstructured exercise group had 19 (44.2%) reporting no interference with daily activities, 16 (37.2%) reporting hardly any, 7 (16.3%) reporting some, and 1 (2.3%) reporting a great deal. The no-exercise group had 12 (42.9%) reporting no interference with activities, 4 (14.3%) reporting hardly any, 7 (25%) reported some, and 5 (17.9%) reporting a great deal of interference with activities.

Participation in an exercise program. Participants were asked if they attended formal exercise classes at least two to three times per week for at least 20 minutes in duration. Of the 101 subjects, 30% stated that they participated in a formal exercise program. This group of 30% was assigned to the structured exercise group. Of the 101 participants, 72% replied that they participated in a home exercise program at least two to three times per week and lasting at least 20 minutes in duration. This figure included the 30% of the formal
exercise group also answered yes to this question. Subjects who answered yes to this question, but no to the formal exercise question were assigned to the unstructured exercise group (43%). Those who answered no to participation in both the formal and informal exercise group was then assigned to the no-exercise group, which made up 28% of the total participants. Findings regarding dispersion of participants into the different groups is demonstrated in Table 4.

Table 4

A Comparison of Participants Level of Exercise by Frequency and Percentage

<table>
<thead>
<tr>
<th>Participants</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participated in a formal exercise class</td>
<td>30</td>
<td>29.7</td>
</tr>
<tr>
<td>Participated in an unstructured exercise class</td>
<td>43</td>
<td>42.6</td>
</tr>
<tr>
<td>Did not participate in either a structured or unstructured exercise class</td>
<td>28</td>
<td>27.7</td>
</tr>
</tbody>
</table>

Note. N = 101.
Results of Data Analysis

Two research hypotheses were developed for the current investigation. One-way analysis of variance (ANOVA) testing was performed to give strength to the two hypotheses that were tested.

Research hypothesis 1. The first hypothesis tested was there will be no difference in lipid levels among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program. The DADE RXL Dimension lipid analyzer was utilized to determine the lipid levels, and the ANOVA test was utilized to determine any differences between the groups.

Lipid levels were analyzed in several ways. The total cholesterol, LDL, HDL, and triglycerides determined lipid levels. The mean cholesterol among all three groups was 214.61 with a standard deviation of 35.81. The significance level among groups in relation to the total cholesterol levels was $p = .20$ which was not significant. The structured exercise group had a mean total cholesterol of 217.7 ($SD = 25.64$). The unstructured exercise group had a mean total cholesterol of 219.12 ($SD = 37.72$), and the no-exercise group had a mean of 204.36 ($40.96$).
better depicts the ANOVA of the mean cholesterol levels among participants.

Table 5

One-Way Analysis of Variance Comparing Mean Cholesterol Levels Among Elders in a Structured Exercise Group, an Unstructured Exercise Group, and Those Receiving No Exercise

<table>
<thead>
<tr>
<th>Group</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>4109.227</td>
<td>2054.613</td>
<td>1.623</td>
</tr>
<tr>
<td>Within groups</td>
<td>98</td>
<td>124096.714</td>
<td>1266.293</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>128205.941</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The mean value of LDL (low-density lipoprotein) among all three groups was 129.39 (SD = 31.75). The LDL in the structured exercise group was 132.17 (SD = 19.14). The mean among the unstructured exercise group was 131.80 (SD = 34.27), and the mean among the no-exercise group was 122.29 (SD = 38.09). The significance level in relation to the LDL was $p = .37$, which also was not significant. Table 6 depicts a summary of the LDL values among the groups.
Table 6

One-Way Analysis of Variance Comparing Mean Low-Density Cholesterol Levels Among Elders in a Structured Exercise Group, an Unstructured Exercise Group, and Those Receiving No Exercise

<table>
<thead>
<tr>
<th>Group</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1987.616</td>
<td>993.808</td>
<td>.986</td>
</tr>
<tr>
<td>Within groups</td>
<td>96</td>
<td>96774.020</td>
<td>1008.063</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>98</td>
<td>98761.636</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The mean high-density lippoprotein (HDL) mean among all three groups was 53.20 (SD = 15.15). The mean HDL level among the structured exercise group was 53.93 (SD = 14.68). The HDL mean among the unstructured exercise group was 55.95 (SD = 16.91), and the mean of the no-exercise group was 48.18 (SD = 11.60). The HDL measurements among groups were not significant (p = .10) as noted below in Table 7. Although while not significant at the p = .05 significance level, it should be noted that there was a trend among the HDL measurements between the three groups.
Table 7

One-Way Analysis of Variance Comparing Mean High-Density Cholesterol Levels Among Elders in a Structured Exercise Group, an Unstructured Exercise Group, and Those Receiving No Exercise

<table>
<thead>
<tr>
<th>Group</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1048.159</td>
<td>524.079</td>
<td>2.346</td>
</tr>
<tr>
<td>Within groups</td>
<td>98</td>
<td>21891.881</td>
<td>223.387</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>22940.040</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The mean triglyceride levels among the groups were 166.72 (SD = 119.65). The mean triglyceride level for the structured exercise group was 154.97 (SD = 83.98). The mean of the unstructured exercise group was 173.14 (SD = 154.54), and the mean of the no-exercise group was 169.46 (SD = 89.83). The mean triglyceride levels among the groups were not significant (p = .81). Table 8 below further explains the triglyceride results.
Table 8

One-Way Analysis of Variance Comparing Mean Triglyceride Cholesterol Levels Among Elders in a Structured Exercise Group, an Unstructured Exercise Group, and Those Receiving No Exercise

<table>
<thead>
<tr>
<th>Group</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>6127.144</td>
<td>3063.572</td>
<td>.211</td>
</tr>
<tr>
<td>Within groups</td>
<td>98</td>
<td>1425495.09</td>
<td>14545.868</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>1431622.24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It had been determined by the research definition that at least three of the four lipid parameters had to be significantly different among the groups in order for there to be a difference in lipid levels. Therefore, the researcher failed to reject the null hypothesis.

Research hypothesis 2. The second hypothesis tested was there will be no difference in muscle strength among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program. Using descriptive statistics and the ANOVA test, a total of six muscles were tested with the use of a Chatillon dynamometer. For the purposes of this study, to determine
difference in the muscle strength, the muscles were divided into upper body and lower body muscle groups. The upper body muscle group consisted of wrist extension, elbow flexion, and shoulder abduction. The results of these groups were added together to form a combined sum of upper body muscle strength. The same process was completed for the lower body muscle strength. The lower body muscle strength was comprised of ankle dorsiflexion, knee extension, and hip flexion. These, also, were added together and formed the sum of the lower body muscle strength.

There was a significant difference among the groups with respect to upper body muscle strength, $F(2, 98) = 4.69$, $p = .011$. The mean of the upper body muscle strength for the three combined groups was 65.1 pounds ($SD = 18.74$). Mean values of the structured exercise group was 68.3 ($SD = 16.1$). The mean of the unstructured exercise group was 68.7 ($SD = 18.6$), and the mean of the no-exercise group was 56.2 ($SD = 19.2$). Table 9 presents the results from the upper body muscle strength.
Table 9

One-Way Analysis of Variance Comparing Upper Body Muscle Strength Among Elders in a Structured Exercise Group, an Unstructured Exercise Group, and Those Receiving No Exercise

<table>
<thead>
<tr>
<th>Group</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3071.743</td>
<td>1535.872</td>
<td>4.696</td>
</tr>
<tr>
<td>Within groups</td>
<td>98</td>
<td>32052.197</td>
<td>327.063</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>35123.941</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. p < .05.

There was also a significant difference among the groups in regard to lower body muscle strength, $F(2.98) = 6.82$, $p = .002$. The mean lower body muscle strength of the three groups combined was 91.74 (SD = 22.67). The lower body muscle strength mean for the structured exercise groups was 98.2 (SD = 21.4). The lower body muscle strength mean for the unstructured exercise group was 94.5 (SD = 18.6); and for the no-exercise group the mean was 78.8 (SD = 25.2). This significance is further explained in Table 10.
Table 10

One-Way Analysis of Variance Comparing Lower Body Muscle Strength Among Elders in a Structured Exercise Group, an Unstructured Exercise Group, and Those Receiving No Exercise

<table>
<thead>
<tr>
<th>Group</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>6283.452</td>
<td>3141.726</td>
<td>6.824</td>
</tr>
<tr>
<td>Within groups</td>
<td>98</td>
<td>45121.260</td>
<td>460.422</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>51404.812</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. p < .05.

It had been determined by the research definition that, for this study, a difference in muscle strength would be determined by a significant change in either upper or lower body strength. Since there was a significant difference in both upper and lower body strength, the researcher was able to reject the null hypothesis.

Additional Findings

Additional findings also were noted in this study. In order to help clarify the characteristics of the exercise groups, those significant findings are described in this section.
A significant difference was noted between the groups in relation to the living arrangements, $F(2, 98) = 3.96, p = .022$. The structured exercise group had 50% who lived alone, and the unstructured exercise group had only 33% who lived alone. Sixty-four percent of the no-exercise group were living alone.

A significant difference was noted between the groups in relation to the reported rating of personal health, $F(2, 98) = 4.00, p = .021$. A least significant difference (LSD) post hoc test was completed to look at differences between the different groups. The no-exercise group had a significantly lower health rating than the structured exercise group. There was no significant difference between the unstructured group and the structured exercise group. There was, however, a significant difference between the no-exercise group and the structured exercise group. The LSD post hoc test indicated that the no-exercise group ($M = 2.57$) was significantly lower than the structured exercise group ($M = 3.10$) in the self-rating of health.

**Summary**

The purpose of this study was to compare the effects of participation in either a structured and unstructured
exercise program or no exercise program on lipid levels and muscle strength in women 65 and over. Subjects (N = 101) who participated in this study completed a demographic survey, muscle strength test of six different muscles, and had a venipuncture performed to determine their lipid profile. Descriptive statistics using frequency and percentages, ANOVA, and post hoc tests were used to analyze the data.
Chapter V

The Outcomes

As the population of America ages, it is imperative that health care providers understand the problems that can arise from the normal aging process. Healthcare providers must be aware, however, that some of these changes can be slowed through participation in preventive health and health maintenance. One of the most important preventive health measures that has been presented in the literature is exercise (Fiatarone et al., 1994). Many disease processes can be slowed throughout the use of an exercise program. The effects of physical exercise have been documented well in regard to the circulatory, respiratory, and the musculoskeletal systems (Dinsmoor, 1993).

The purpose of this study was to compare the effects of exercise participation in either a structured or unstructured exercise program or no exercise program on lipid levels and muscle strength in elderly women. Pender’s Health Promotion Model guided this descriptive
investigation. The hypotheses to be tested were as follows:

1. There will be no difference in lipid levels among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program.

2. There will be no difference in muscle strength among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program.

The sample consisted of 101 elderly women 65 and over and was drawn from an established chair aerobics program for senior citizens, a local women's Sunday School class, and from a local meal site. All of the participants were from a rural Northeast Mississippi town.

A demographic survey tool, developed by the researcher, was used to obtain information regarding the demographics, health history, perceptions of personal health, as well as level and frequency of exercise. Depending on responses to the exercise questions, subjects were assigned to the structured exercise group, the unstructured exercise group, or the no-exercise group. The DADE RXL Dimension lipid analyzer was utilized to assess
lipid panels, and the Chatillon dynamometer was utilized
to determine the muscle strength on the dominant side of
the participants in six different muscle groups. The
results of the muscle testing were divided up into upper
body and lower body muscle strength. Descriptive
statistics, ANOVA, and LSD post hoc testing were used to
analyze the data. This chapter summarizes and discusses
the findings and conclusions of the study. It also
discusses implications for nursing and recommendations for
further research.

Summary of the Findings

Demographic. The sample consisted of 101 Caucasian
females between the ages of 65 and 88 years. The mean age
was 73.81. Those participating in a structured exercise
program (exercise class) made up 29.7% of the total
participants. The unstructured exercise group made up 42%,
and the no-exercise group was 29.7% of the total subjects.
Most of the women lived alone (46.5%) or with spouse
(46.5%). The structured exercise group had 50% of subjects
living alone, 40% living with spouse, and 10% living with
family or friend. The unstructured exercise group had 32%
living alone, 58% living with spouse, and 9% living with
family or friend. Finally, the no-exercise group had 64%
living alone, 36% living with spouse, and none living with
genealogy or friends. This was significant in that the no-
exercise group tended to live alone, and this could have
led to feelings of depression and a tendency to stay home
and not participate in exercise as often. The unstructured
exercise group had a larger percentage who lived with
their spouse, thus may have had a tendency to do things
with their spouse for exercise and not join any formal
exercise classes.

The educational level of the participants was
surprisingly high with a mean education of 12.2 years of
schooling. Most participants had private insurance (54.5%)
or Medicare (38.6%) as their primary insurance.

Over three fourths of the participants (77.2%) stated
that they watched the fat intake in their diet. The
structured exercise group had 80% of its subjects
reporting watching fat in their diet. The unstructured
exercise group had 72% of its subjects watching fat, and
the no-exercise group had 82% watching their fat intake.
The no-exercise group had the highest percentage of
participants monitoring their fat intake. A reason for
this may be that this group of women recognized that they
were in poorer health and needed to watch fat intake more
closely. Also, monitoring fat intake may have been a mechanism to compensate for not exercising.

Only 16.8% of the 101 participants were on medication to lower their cholesterol. The structured exercise group had 13% of the participants on medication to lower their cholesterol, while the unstructured exercise group had 16% on cholesterol-lowering medication, and the no-exercise group had 21% on medication to lower their cholesterol. The researcher noted that as exercise participation decreased, use of the cholesterol lowering medication increased. The participants from the structured and unstructured exercise groups may have been exercising to keep lipid levels low without taking medication. Conversely, the women in the no-exercise group may have been taking the cholesterol-lowering medication rather than exercising to control lipid levels. This may be why there was no significant difference among the groups concerning lipid levels due to the compensation of the no-exercise group with medication.

A large number (62.4%) of the participants had a positive family history of heart attack or stroke, although none of these participants had a prior diagnosis of heart attack or stroke, since this resulted in
exclusion from the study. The structured exercise group had 66% of the subjects with a positive family history of heart attack or stroke while the unstructured exercise group had 62%, and the no-exercise group had 57%. The researcher surmised that since the structured exercise group had a larger percentage of family history of heart attack or stroke, this may have motivated them to be involved in a structured exercise class.

An interesting outcome of the study was the self-rating of health among the participants. A large number of participants (75.2%) felt that physical problems interfered not at all or hardly any with their daily activities. The total number of participants rating themselves in excellent or good health was 71.3%, while only 3% of the participants rated themselves in poor health. A significant finding concerning the self-health rating was that the no-exercise group rated themselves lower than the two exercise groups. Once again, these findings could have been due to the fact that the no-exercise group had more subjects who lived alone, which led to increased feelings of depression and minimal involvement with activities. Also, with all the emphasis
placed on health in the news and magazines, the subjects may have perceived themselves as unhealthy.

Hypotheses. The hypotheses tested were as follows: There will be no significant difference in lipid levels among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program, and there will be no significant difference in lipid levels among elderly women who participate in a structured exercise program, those who participate in an unstructured exercise program, and those who have no exercise program.

The first hypothesis to be discussed related to a comparison of lipid levels among the three exercise groups and revealed no significant difference. Only one study was found in the review of literature with similar findings. The present study concurred with Fitzgerald and Singleton (1996) who researched the relationship of self-reported exercise patterns and lipid levels in a group of women. Like the present study, the Fitzgerald and Singleton study also found no significant differences in lipid levels among an active and inactive group of women. They also found a trend among the HDL (high-density lipoprotein) between the two groups, but, like the present study, not
enough to be significant. It was suggested that had the sample size been larger, there may have been a significance noted. It is also important to note that the self-reporting mechanism in the Fitzgerald and Singleton study in relation to amounts of exercise had merit. The self-reported physical exercise correlated with the strength of the women.

A majority of the studies reviewed in the literature had findings concerning the relationship between lipid levels and exercise of elders that differed from the current study. Kennedy and DeVoe (1996) utilized sedentary Mexican-American women. They assigned the women to either a control or an exercise group. This study found that after 12 months both the HDL and triglyceride levels had significant differences among the groups. The Kennedy and DeVoe study differed from the present study in that in the current study exercise was self-reported and women exercised at different intensities.

Another study in which the findings differed from the research under investigation was conducted by Stefanick in 1998. Stefanick (1998) researched the effects of either exercise or the National Cholesterol Education Program Diet (NCEPD) with lipoprotein levels. Stefanick noted that
there were no significant differences between the groups with relation to HDL. There was, however, a significant difference in the LDL in the diet and exercise group. Stefanick’s (1998) study differed from the present study, as there were no differences in the cholesterol levels of the participants in the present study.

Maines et al. (1997) also looked at lipid levels in subjects before and after an exercise program. After a 12-week intensive exercise program, significant differences were noted in the HDL and triglyceride levels. This study by Maines et al. (1997) utilized both men and women in the study, whereas the current study only utilized women 65 and over.

One possible reason for the results of the current study differing from several of the studies in the review of literature was that most of the other studies used a pretest and posttest to determine lipid levels, whereas the current study utilized a self-reported questionnaire to assign subjects to the groups. The studies in the review of literature did not ascertain how physically fit the subjects were and placed them in certain groups accordingly. Therefore, they may have placed someone who was very unfit into a high-intensity exercise program and
lipid results may have been significantly different after the exercise regimen.

The results of this study may have been different from the majority of those reviewed because the no-exercise group had a higher percentage of participants taking medication to lower lipid levels versus using exercise. This group also had a higher percentage of subjects watching the fat intake in their diet; therefore, their lipid levels may have been lower. A repeated study excluding women on lipid-lowering medications would be beneficial.

The second hypothesis to be discussed was in relation to a comparison of muscle strength of elder women based on the exercise group. The findings from the current research were similar to those found in the Goldbeck-Wood (1997) study. Goldbeck-Wood sought to assess the effectiveness of a home-based exercise program of strength and balance on falls and injuries in elderly women. Goldbeck-Wood found that the walking group at home experienced fewer falls than the control group, which did not have an exercise program. These findings were indicative of improved muscle strength due to the decreased number of falls. The
findings from the current study also revealed improved muscle strength for those elderly women who exercised.

Findings from the Fiatarone et al. (1994) study were similar to those of the current researcher. The Fiatarone et al. study looked at physical frailty in elderly nursing home residents. Fiatarone et al. hypothesized that increasing frailty in elders was due to a lack of nutritional intake and muscle disuse. Muscle strength increased significantly after a 10-week resistance program.

In another research investigation, the USDA Human Nutrition Research Center on Aging (1996) studied the effects of resistance training on strength. After one year, the exercise group had significantly increased muscle strength from 35% to 76% above the control group. Therefore, the findings of the current research support the Goldbeck-Wood (1997), the Fiatarone et al. (1994), and the USDA Human Nutrition Research Center on Aging (1996) study.

Most of the studies regarding muscle strength looked at before and after groups with an exercise intervention. They did not look at different levels of exercise nor did they look at several muscle groups. Therefore, it was
important to add data concerning various levels of exercise for elderly women to the nursing research database. The parallels drawn from the previous citations in the literature and the additional findings in this study elucidate the significance of the relationship between structured and unstructured exercise and muscle strength.

Muscle strength in the current study and in the review of literature was significantly affected by physical exercise. All of the studies went about data collection in different ways, using males and females and some type of exercise program. The current study utilized self-reported activity levels to obtain information and arrived at the same conclusion; the exercise groups did have more muscle strength than the groups that did not exercise.

Unlike lipid levels, muscle strength was significantly influenced by the amount of physical activity. Muscle strength must be worked on over a period of time. Increasing muscle strength cannot be obtained by taking a pill, while it is possible to lower lipid levels by taking medication. Perhaps, this was why there was a
significant difference in the muscle strength and not in the lipid levels of the elderly women.

The findings of the current study support the use of Pender's Health Promotion Model to explore different levels of exercise and its effects on muscle strength and lipid levels. Pender believed that certain factors could influence a person's engagement in a health promotion activity. This was evident in the effects of living arrangements and the self-rating of personal health. It was unclear if the living arrangement and the self-health rating were causal to the diminished exercise. It was also unclear if the diminished exercise preceded the feeling of poor health or vice versa. Pender felt that how a person perceived health, their health status, the benefits, behaviors, and barriers to health influenced their physical health. There were some definite correlations between perceived health status and their involvement in a health promotion behavior.

Limitations

The design of this study imposes certain constraints upon the generalization of these findings. The study, although open to all women in a rural Northeast Mississippi town, only had Caucasian women participate.
Therefore, the findings could not be generalized to all Northeast Mississippi women.

The current study had two other potential limitations. The first limitation was bias. The sample size utilized in the present study may not have been representative of all women 65 and over in Mississippi since this was a convenience sample and not ethnically diverse. A larger sample may have provided different findings, particularly with the HDL levels in the exercise groups.

The second bias concerned instrumentation. The researcher’s demographic tool had no established validity and reliability but was reviewed and edited twice by peer review and a panel of experts for face validity. Although the questionnaire had been fully explained to them and the importance of answering the questions honestly, there may have been a tendency for the participants to discuss and to answer as their colleagues did.

Conclusions

Based on the results of this study, several conclusions were made as follows:
1. For the participants in this study, there was a significant difference among the three exercise groups with respect to living arrangements.

2. For the participants in this study, there was a significant difference among the exercise groups with respect to the rating of personal health.

3. For the participants in this study, there was a significant difference among the exercise groups in relation to both upper and lower body strength.

4. Pender’s Health Promotion Model was an appropriate framework for investigation of the health promotion activity of exercise.

Implications

A number of implications for nursing science were derived from this study. Implications are suggested for nursing theory, research, education, and practice.

Theory. Nursing theory was tested throughout this research. A portion of Pender’s Health Promotion Model was validated through the answer to the perceived health-rating question. Pender believed that how a person perceives his or her health will affect their participation in a health-promoting behavior. The participants who did not exercise regularly rated
themselves lower than the subjects in both the formal and informal exercise groups.

Research. While the benefits of exercise on muscle strength and lipid levels are documented to some extent in the literature, the benefits of unstructured exercise (gardening, walking, or housework) have not been clearly noted. The findings of this study suggest that more research effort is needed to gain greater insight into exactly how much and what type of exercise is beneficial to elderly women. It is important to note that not every elderly woman is able to go out to a formal exercise class to maintain health. Women need to know that certain types of exercise at home may be just as important. It would also be important to research larger groups of women from different ethnic backgrounds to note significant findings.

Education. As the public is aware of the importance of exercise and maintaining good health, it is essential that future nurses be aware of the benefits of home, informal exercise. The findings of this study demonstrate the importance of educating healthcare professionals with respect to type and amount of exercise that are needed to maintain health for the individual.
Practice. In providing primary care to elders, the health care professional must acknowledge the important role of exercise in the life of the elder. Assessment of health beliefs and prior related behaviors of the individual are important to note so that proper education can follow as to the importance of exercise in their life. Additionally, exercise prescriptions should be incorporated into the elderly woman’s plan of care to increase muscle strength, and perhaps prolong independence.

The findings of this study contribute to existing knowledge of exercise benefits. The relationship of exercise levels or intensities to the amount of physical strength and lipid levels is important to note and to disseminate to other healthcare workers and individuals. This topic of structured versus unstructured exercise benefits in elderly women is a fertile ground for gerontological nursing research.

Recommendations

Based on the findings of this study, the following recommendations are made for future research in nursing:
1. Replication of the study with a larger, randomized sample to include a more culturally diverse group of women.

2. Further testing of the demographic tool concerning health practices and beliefs to establish validity and reliability of the tool.

3. Conduction of more research using the Pender Health Promotion Model as a framework for examining other health promotion behaviors.

4. Conduction of research with a larger sample size to determine significance of HDL levels.

5. Comparison of men and women at different exercise levels to determine how various levels of exercise affect the groups.

6. Comparison of various structured exercise programs to ascertain how different types of exercise classes (tai chi, water aerobics, step aerobics, etc.) would affect lipid levels and muscle strength.

7. Replication of the study on elderly women, excluding those who are on lipid-lowering medication.
References


APPENDIX A

APPROVAL OF COMMITTEE ON USE OF HUMAN SUBJECTS IN EXPERIMENTATION OF MISSISSIPPI UNIVERSITY FOR WOMEN
April 16, 1999

Ms. Lisa D. Foley  
c/o Graduate Program in Nursing  
Campus  

Dear Ms. Foley:

I am pleased to inform you that the members of the Committee on Human Subjects in Experimentation have approved your proposed research provided you follow the guidelines set forth by Dr. Mark Bean and Dr. Mary Pat Curtis.

I wish you much success in your research.

Sincerely,

Susan Kupisch, Ph.D.  
Vice President  
for Academic Affairs

SK: wr

cc: Mr. Jim Davidson  
Dr. Mary Pat Curtis  
Dr. Lynn Chilton
APPENDIX B

LETTERS TO GROUP COORDINATORS
Dear Meal Site Coordinator,

As a graduate student at Mississippi University for Women, School of Nursing in Columbus, Mississippi, I am required to perform a research study in partial fulfillment of the Master of Science in Nursing degree. The study I plan to undertake is entitled Effects of Exercise on Lipid Levels and Muscle Strength in Women 65 and Over.

The purpose of this study will be to determine if different levels of exercise affect the muscle strength and lipid (cholesterol) levels in women 65 and over. I am requesting your assistance and written permission to utilize your Meal Site group in my proposed study.

Participation by the subjects will be on a voluntary basis, and subjects will be informed of the details of the study and of their rights as subjects. Subjects will be assured that neither their agreement nor their refusal to participate in the study will be kept confidential and will not in any way jeopardize their participation in the group. On the day of testing, a blood sample will be taken from the arm, testing of muscle strength and a small demographic survey will be completed. No risks have been identified.

I am enclosing a sample consent form that will be completed before the actual research can be carried out. Please have the leader of the Meal Site sign this form and return to me. Thank you for your consideration in this endeavor.

Sincerely,

Lisa Foley, BSN, RNC
November 20, 1998

Joy Sunday School Class
Highway 15 South
New Albany, MS 38652

Dear Joy Sunday School Teacher,

As a graduate student at Mississippi University for Women, School of Nursing in Columbus, Mississippi, I am required to perform a research study in partial fulfillment of the Master of Science in Nursing degree. The study I plan to undertake is entitled, Effects of Exercise on Lipid Levels and Muscle Strength in Women 65 and Over.

The purpose of this study will be to determine if different levels of exercise affect the muscle strength and lipid (cholesterol) levels in women 65 and over. I am requesting your assistance and written permission to utilize your Joy Sunday school Class in my proposed study.

Participation by the subjects will be on a voluntary basis, and subjects will be informed of the details of the study and of their rights as subjects. Subjects will be assured that neither their agreement nor their refusal to participate in the study will be kept confidential and will not in any way jeopardize their participation in the group. On the day of testing, a blood sample will be taken from the arm; muscle strength testing and a small demographic survey will be completed. No risks were identified.

I am enclosing a sample consent form that will be completed before the actual research can be carried out. Please have the president of the Sunday school class sign this form and return to me. Thank you for your consideration in this endeavor.

Sincerely,

Lisa Foley, BSN, RNC

Signature:______________________________ Date:________
November 20, 1998

First Baptist Church Chair Aerobics Program  
802 East Bankhead St.  
New Albany, MS 38652

Dear Chair Aerobics Program Coordinator,

As a graduate student at Mississippi University for Women, School of Nursing in Columbus, Mississippi, I am required to perform a research study in partial fulfillment of the Master of Science in Nursing degree. The study I plan to undertake is entitled, Effects of Exercise on Lipid Levels and Muscle Strength in Women 65 and Over.

The purpose of this study will be to determine if different levels of exercise affect the muscle strength and lipid (cholesterol) levels in women 65 and over. I am requesting your assistance and written permission to utilize your Chair Aerobics Program in my proposed study.

Participation by the subjects will be on a voluntary basis, and subjects will be informed of the details of the study and of their rights as subjects. Subjects will be assured that neither their agreement nor their refusal to participate in the study will be kept confidential and will not in any way jeopardize their participation in the group. On the day of testing, a blood sample will be taken from their arm; muscle strength and a small demographic survey will be completed.

I am enclosing a sample consent form that will be completed before the actual research can be carried out for your review. Please have the leader of the aerobics class sign this form and return to me. Thank you for your consideration in this endeavor.

Sincerely,

Lisa Foley, BSN, RNC

________________________________________________________________________________________
Signature:_________________________ Date:___________
Letter of Introduction and
Informed Consent

I give my permission to Lisa Foley, BSN, RNC, to participate in the research study she will be conducting on women 65 and over. I understand that the study will begin around the middle of March and will only require approximately one hour to complete. I understand that during this meeting time of approximately one hour, different tests will be completed. I will complete a demographic survey. I will then have muscle strength tested with the use of a dynamometer on six different muscle groups and will have a venipuncture performed for lipid (cholesterol) analysis at no cost to me.

I understand that there are no foreseeable risks for me and the only discomfort may be a venipuncture. I understand that my confidentiality will be maintained at all times by not using my name on any information obtained. I understand that participation in this study is voluntary and I may withdraw from the study at any time. I understand that by participating in this study, I will not be incurring any additional medical costs.

Further information regarding this study may be obtained from:

Lisa D. Foley, BSN, RNC
1497 State Highway 348
Blue Springs, MS 38828
Phone: (601) 534-3229

I have been given a verbal description of this study and have no further questions to be answered. I grant permission to Lisa D. Foley, BSN, RNC, to include me in her research study.

Signature:__________________________ Date:_____________
APPENDIX D

DEMOGRAPHIC AND HEALTH CHARACTERISTIC INFORMATION
Demographic and Health Characteristic Information

Thank you for agreeing to participate in my research. In addition to completing the muscle strength and cholesterol testing, I would like for you to give additional information providing individual characteristics.

CODE:_____________

1. Age________

2. Race
   ___ White
   ___ African American
   ___ Other (please specify)______________________________

3. Marital status
   ___ Married
   ___ Single
   ___ Widowed
   ___ Divorced

4. Living arrangement
   ___ Alone
   ___ With Spouse
   ___ With family/friend

5. How many years of schooling did you have (including college)? ________

6. Current insurance
   ___ Medicaid
   ___ Medicare
   ___ Private insurance
   ___ Other (please specify):____________________________________

7. Do you try and watch your fat intake in your diet?
   ___ Yes
   ___ No

8. Are you currently on medications to lower your cholesterol?
   ___ Yes
   ___ No
9. Did your parents, grandparents, or siblings ever have a heart attack or stroke?
   ____ Yes
   ____ No

10. Have you ever had a heart attack or stroke?
    ____ Yes
    ____ No

11. Number of doctor visits in the last year__________________

12. Number of times hospitalized in the last year________________

13. How would you rate your personal health?
    ____ Excellent
    ____ Good
    ____ Fair
    ____ Poor

14. How much do health problems interfere with daily activities?
    ____ None
    ____ Hardly any
    ____ Some
    ____ A great deal

15. Do you participate in a formal exercise program (exercise classes) at least two to three times per week for a duration of 20 minutes?
    ____ Yes
    ____ No

16. Are you involved in any type of activity that involves muscle strengthening or aerobic activity in your home (such as gardening, walking, or housework) that occurs at least two to three times per week for at least 20 minutes total?
    ____ Yes
    ____ No
APPENDIX E

LIPID LEVEL NORMAL RANGES
Lipid Level Normal Ranges

<table>
<thead>
<tr>
<th>Lipid Type</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>&lt; 200 mg/100 ml</td>
</tr>
<tr>
<td>High-density Lipoprotein (HDL)</td>
<td>&gt; 30 mg/100 ml</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>10-190 mg/100 ml</td>
</tr>
<tr>
<td>Low-density Lipoprotein (LDL)</td>
<td>Individual calculation based on participant’s other values</td>
</tr>
</tbody>
</table>

Source: Dade RXL Dimension Reference Values from local hospital that will be completing the testing.