THE EFFECTS OF COMMINUTY-BASED EXERCISE ON THE PHYSICAL FUNCTION OF OLDER ADULT WOMEN

by

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(Under the Direction of Michael Horvat)

ABSTRACT

Introduction. A key component in preserving mobility and independence in later years is maintaining the fitness capacity needed to perform normal everyday activities such as lifting and carrying objects, climbing stairs, getting in and out of transportation vehicles, and walking far enough to do one's own shopping and errands (Paterson & Warburton, 2010). Therefore, the primary purpose of this study was to determine any differential effects of exercise on the physical fitness of older adults with different levels of physical function. The secondary aim was to observe and compare the exercise habits of these functionally diverse older adult women. Specifically, the amount of time spent exercising was considered in relation to levels of physical fitness. **Methods.** A convenience sample of 30 women (n = 30, m_{age} = 69 years) recruited from the YWCO in Athens, Georgia completed participation in this study. Two groups of participants (high n=13, mod/low n=17) were formed according to their physical ability to live independently as determined by the Composite Physical Function (CPF) scale for the first study. Two groups (n=15 and n=15) were formed according to the amount of time they spent engaged in exercise

for the second study. **Results.** *Study 1* The results of the 3 X 2 mixed ANOVA statistical analysis showed no significant interaction effect for time*group for any of the six subtests (chair stand, arm curls, 2-min step, chair sit &reach, back scratch, and 6-ft up & go) of the SFT. *Study 2* Statistical analysis showed a significant interaction effect for time*group for the 8-foot Up & Go test. **Conclusions.** Community-based exercise programs offering a variety of exercise types to people with varying levels of functional ability, can be useful in maintaining or improving fitness and independence. Second, these programs may also be capable of improving the self-efficacy of lower functioning older adults toward performing daily tasks. Additionally, self-report instruments such as activity logs may be useful to track and gain an understanding of the exercise habits of older adults.

INDEX WORDS: Physical function, Aging, Physical fitness, Older adults, Activities of daily living

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DEDICATION

My work is dedicated to my beautiful and devoted wife, Wendy, who has been my #1 fan through it all. Without her constant love and support I would not have been able to accomplish this life goal.

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CHAPTER 1

INTRODUCTION

Functional movement is characterized by the relationship between physical action and the appropriate environmental context in which it is to be performed. Therefore actions such as walking and carrying are considered functional movements, as they are a means of moving oneself or an object from one place to another. These types of movements mediate physical function due to their goal-directed nature, which is critical for maintaining independence in a given environment. Defined as the capacity of an individual to carry out the physical activities of daily living, physical function is an independent predictor of functional independence, disability, morbidity, and mortality (American College of Sports Medicine, 2011). Aging is often associated with declines in physical function affecting vital processes that are critical to independence, social engagement, and quality of life (Vaughan et al., 2012). Among several other factors, physical function is determined in part by aspects of physical fitness. A key component in preserving mobility and independence in later years is maintaining the fitness capacity needed to perform normal everyday activities such as lifting and carrying objects, climbing stairs, getting in and out of transportation vehicles, and walking far enough to do one's own shopping and errands (Paterson & Warburton, 2010). According to the American College of Sports Medicine (ACSM), components of fitness include cardiorespiratory fitness, muscular strength and endurance, body composition, flexibility, and neuromotor fitness. Neuromotor fitness is associated with motor skills such as balance, coordination, gait, and agility. Smooth execution of functional movement patterns requires adequate levels of core, upper, and lower

extremity strength, flexibility, mobility, and postural control. These fitness components are therefore essential for producing efficient patterns of movement for daily task performance. Programs of regular exercise that include cardiorespiratory, resistance, flexibility, and neuromotor exercise beyond activities of daily living to improve and maintain physical fitness and health are essential for most adults (ACSM, 2011).

Daily tasks or activities of daily living can be classified into basic activities of daily living (BADL) and instrumental activities of daily living (IADL) (Lawton & Brody, 1969). BADL are composed of self-care behaviors such as ambulating, dressing, grooming, bathing, feeding, and toileting while IADL facilitate independent living through behaviors such as transportation, telephone use, meal preparation, housekeeping, laundry, and shopping. These common daily tasks contain movement patterns that have been developed across the lifespan. Changing or eliminating the normal patterns of movement associated with daily activities can be considered an indication of the onset of disability. In this context, pre-clinical disability has been defined as a change in frequency or modification of daily tasks (Higgins et al., 2012), and has been established as a transitional stage that occurs prior to the onset of disability in some individuals (Manty et al., 2007). Approximately 20% of individuals aged 70 or older report difficulty with performing activities of daily living (Penninx et al., 2001). These older adults may no longer be able to appropriately utilize and execute movement patterns associated with activities of daily living (ADL) as a result of declining physical fitness. This type of progressive disability is severe as it limits the autonomy of older adults.

Although mature nervous system function and motor skills are achieved in the earlier stages of life, changes in movement patterns also occur during adulthood and the latter stages of the lifespan (Cech & Martin, 2002). Older adults need to practice, learn new, and relearn known

motor skills as part of task training, recreational pursuits, or rehabilitation (Voelcker-Rehage, 2008). Therefore, opportunities for exercise that foster fitness, efficient functional movement skills, and self-efficacy toward performing daily tasks are needed to impede the progression of the disablement process among older adults. As such, community-based modes of exercise aimed to equip older adults with neuromotor (balance, coordination, and agility), physical (aerobic endurance, muscle strength, and flexibility), and functional components of fitness necessary for daily life should be explored and developed (Vaughan et al., 2012).

Statement of the Problem

While aging is an inevitable process, it is an individual experience that has considerable variability. Older adults of the same chronological age may differ in physiological age and function due to differences in genetic makeup, lifestyle choices, cognitive ability, and several other variables. Understanding how exercise affects individuals with varying levels of functional ability will provide further insight into the role of exercise during the aging process. It will also aid in the development of exercise programs that are appropriate for a wider spectrum of older adults. Therefore, the primary purpose of this study is to observe and compare older adults with different levels of physical function to determine any differential effects of exercise on their physical fitness. Additionally, time constraints are commonly reported by older adults as disincentives to participate in exercise and physical activity (Smith et al., 2012). The amount of time that older individuals spend engaged in exercise depends on multiple factors such as self-efficacy for physical activity, motivational factors, and other social obligations that may fill their schedules. A secondary purpose of this study is then to investigate how the amount of time spent exercising by older adults with varying functional ability, effects how they maintain or improve their fitness over time. Self-report instruments are widely used as physical activity measures.

However, the usefulness of such measures by older adults to determine the optimal amount of time spent exercising to enhance fitness components and physical function is still largely unknown.

Study Aims

The specific aims of this research study are to:

1) Determine and compare the effects of 10-weeks of community-based exercise on the cardiovascular endurance, muscular strength, flexibility, and balance fitness components of older adult women with high and moderate-low levels of physical function.

2) Observe the self-reported exercise habits of high and moderate-low functioning older adult women during 10-weeks of community-based exercise and determine the effect of these habits on the improvement and maintenance of fitness.

Hypotheses

The hypotheses for this proposed research study are as follows:

1) It is hypothesized that 10-weeks of exercise will improve all fitness components as measured by the Senior Fitness Test for high, moderate, and low functioning women.
2) It is hypothesized that women who report exercising more minutes will show greater levels of physical fitness and report higher levels of physical function. Furthermore, it is hypothesized that the self-reported estimate of minutes spent exercising per week at baseline will be greater than the actual amount of reported time spent exercising at the midpoint and end of the 10-week exercise period for all participants.

Significance of Study

Aging is often closely linked with declines in physical function and the ability to perform activities of daily living. These limitations are caused by a progressive loss of muscle strength,

flexibility, and balance and predispose older individuals to transitioning into disability and frailty (Biggan et al., 2014). In order to circumvent the natural components of aging, exercise programs should be developed to postpone functional limitations in tasks of basic daily living. These programs must be suited to the highly variable individual capabilities of the older adult population. Additionally, they must be motivating enough to ensure active participation at an enjoyable level and increase the frequency of physical activity in a social, interactive setting. Much can still be learned about how exercise affects the process of aging for the broad spectrum of older adults. Due to the lack of related evidence, this study will be performed to investigate the effects of exercising in a community-based setting on the overall fitness and physical function of older adult women.

Definition of Terms

Basic activities of daily living (ADL): composed of self-care behaviors such as ambulating, dressing, grooming, bathing, feeding, and toileting (Lawton & Brody, 1969)

Aerobic activity: cardiovascular-based physical activity of moderate to vigorous intensity that increases heart rate and breathing and is relative to an individual's fitness level

Agility: the ability to move quickly and easily and to change the position of the body efficiently; involves a combination of balance, strength, flexibility, and coordination

Balance activity: Physical activity aimed at reducing the risk of falls and injury from falls

Cognitive function: operations of the brain such as information processing, memory, reasoning, inhibition, perception, and verbal fluency that contribute to intelligent behavior

Community-based program: composed of a series of physical activity training sessions that take place outside of the home in a group setting with similar aged older adults

Coordination: movement of a combination of body parts in a manner to achieve smooth, efficient movement patterns

Exercise: a subset of physical activity that is planned, structured, and repetitive for the purpose of improving or maintaining physical fitness (Caspersen, Powell, Christenson, 1985)

Flexibility: refers to the range of motion of a joint and the muscle length across that joint; necessary for regular physical activity and daily life

Frailty: a multifaceted health concern that involves a progressive decline in muscle strength, weight loss, decreased activity, fatigue, slowed processing of sensory information, and decreased performance of functional tasks (Biggan et al., 2014)

Functional limitations: self-reported frequency in restrictions or difficulty in walking, lifting, or carrying; exacerbated by sedentary behavior and leads to disability

Functional movement: movement patterns that contribute to the performance of activities of daily life

Functional performance: the observable ability to perform tasks of daily living or assessments based on tasks of daily living

Home-based program: series of physical activity training sessions taking place inside the home usually in an individual manner

Instrumental activities of daily living: activities that involve more complex cognitive functions and facilitate independent living through behaviors such as transportation, telephone use, meal preparation, and financial management (Lawton & Brody, 1969)

Movement efficiency: related to the speed, accuracy, and qualitative manner with which older adults perform activities of daily living.

Physical activity: any bodily movement produced by skeletal muscles resulting in energy expenditure (Caspersen, Powell, & Christenson, 1985)

Physical fitness: the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure pursuits and to meet unforeseen emergencies (Caspersen, Powell, Christenson, 1985).

Physical function: the capacity of an individual to carry out the physical activities of daily living

Self-efficacy: concerned with beliefs in capabilities to successfully carry out courses of action

Task-modification: a change in the way in which older adults perform tasks of every day living as in relying on the handrail to climb stairs or on the armrests to rise from a chair; independently associated with estimates of functional limitation, physiological impairment, and self-reported physical function (Manini et al., 2006)

CHAPTER 2

REVIEW OF LITERATURE

Older adults with impaired physical function have been shown to benefit from training that incorporates task-specific movements into the training program (Bean et al., 2002; Alexander et al., 2001; de Vreede et al., 2005; Roaldsen et al., 2014). Functional training that utilizes task specificity highlights the neural control of movement and is capable of addressing several factors responsible for functional limitation such as avoidance, endurance, strength, and balance (Manini et al., 2007). Several studies have investigated the effectiveness of functional training methods with older adults. Roaldsen et al. (2014) evaluated the short term effects of a 12-week progressive, task-specific group balance training program in community dwelling older adults with balance deficits and fear of falling. Older adults (n=59) included in this study were at least 65 years of age and reported falling or the fear of falling within the last 12 months. Participants were randomly assigned to the intervention group (n=38) or the control group (n=21). The experimental training program was carried out three times per week, in 45-minute sessions, in groups of six to seven subjects. The program included exercises aimed at maintaining balance in sitting and standing positions, during walking and while reacting to loss of balance. Exercises also included dual-tasking as the participants performed a cognitive and/or motor task while also performing advanced balance exercises. Balance training was individualized and varied by adjusting the area of the base of support, changing the positioning of the arms, adding head movements, varying the exercise speed, and by adding dual-tasks. Activities performed during training included walking while carrying filled glasses, closing

buttons, or stepping over objects and were related to functions commonly used in typical daily activities. The authors found that this type of task-specific balance training improved overall function as well as basic and advanced lower extremity function in older adults as measured by the Late Life Function and Disability Instrument (LLFDI). In the context of physical function, the participants in this study by Roaldsen et al. (2014) improved their individual capacity to carry out activities relevant to effective community living.

De Vreede et al. (2005) were also able to demonstrate the effectiveness of functional-task exercise. The functional task exercise program investigated by de Vreede et al. was designed for older women and was aimed to improve daily tasks in the domains of moving with a vertical component, moving with a horizontal component, carrying an object, and changing between lying-sitting-standing positions. The 12-week program was divided into three phases. The practice phase lasted two weeks and consisted of exercises involving short simple tasks. The variation phase consisted of applying these tasks in various training conditions and environments. The final phase, the daily tasks phase, consisted of a combination of the four domains, to make the tasks as similar to daily tasks as possible. An example of an exercise included in the daily task phase is the "rise from a chair, step onto a raised platform, and take different objects from a high shelf" task. Time, weight, distance walked, and number of repetitions were noted when appropriate for all exercises during training. As measured by the Assessment of Daily Activity Performance (ADAP), the data showed that the functional exercise program was more effective than a traditional resistance training program in improving the performance of daily tasks in older women. Also, the effects of the functional-task exercises were preserved for longer than the gain in strength achieved with resistance exercises.

Manini et al. (2007), in a similar fashion to de Vreede et al. (2005), aimed to determine the efficacy of resistance training, functional training, or a combination of resistance and functional training in older adults who modify tasks of everyday life. Individuals who self-reported modification of daily tasks were recruited for this study, as these individuals are at risk of subsequent disability. Task modification has previously been quantified using self-report, however, Manini et al. (2006) developed an objective semicontinuous scale that quantifies subtle ways in which individuals complete simple and demanding tasks. A composite modification score (MOD score) was generated by summing the modifications of several tasks. These tasks included rising from a chair, climbing stairs, lifting a laundry basket, rising from a kneeling position, and rising from a supine position. Higher composite MOD scores indicated more task modifications or disabilities being exhibited by the participants. For example, the laundry basket lift and carry was scored as follows: 0 = lifts, carries, and places basket on top of shelf; 1 = able to lift top of basket above shelf height, but then requires assistance; 2 = unable to lift the top of the basket past shelf height; 3 = unable to lift basket above carrying height; 4 = unable to lift basket from the floor; 5 = refuses to attempt the task. In addition to task modification, timed performance of the previously mentioned tasks as well as muscle strength was also evaluated. Participants (n=49) who qualified for this study had lower isometric strength, higher summed MOD score, were more likely to be women, and were older than individuals who did not qualify for the study. Participants were randomly assigned to either the resistance training group, functional training group, or the resistance and functional training group. All participants reported to training two times per week for 10 weeks with each session lasting 30-45 minutes. Resistance training consisted of performing three lower body exercises (leg press, leg extension, and leg curl) and three upper body exercises (tricep extension, arm curl, and shoulder press).

Two sets using a 10-repetition maximum weight was performed for each exercise during each session. Participants in the functional training group performed five exercises two days per week: rising from a chair, rising from a kneeling position, stair climbing, vacuuming a carpet with a weighted vacuum cleaner, and lifting and carrying a weighted laundry basket. Participants in the resistance and functional training group performed one day of resistance training and one day of functional training per week. The major finding of this study was that older adults who modify tasks of everyday life adapt according to their specific mode of training. Those who performed only functional training improved in both components of functional ability (task modification and timed performance), but did not have consistent adaptations in muscle strength. Those individuals in the resistance training group increased muscle strength but only reduced task modification and not timed performance. Participants in the mixed training group showed less dramatic, but consistent improvements in both components of functional ability and muscle strength. Also, it should be noted that timed performance decreased only in those participants performing functional training (functional and mixed training groups). These data suggest an important role of task specificity when designing exercise programs to improve physical function in lower functioning older adults (Manini et al., 2007).

Physical fitness is defined as the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure pursuits and to meet unforeseen emergencies (Caspersen, Powell, Christenson, 1985). The level of physical fitness among adults greatly influences their ability to remain physically active, perform daily tasks, and remain functionally independent. Therefore, it is important to understand the appropriate amounts and types of exercise for developing and maintaining overall fitness in older adults. The purpose of the Position Stand by the American College of Sports Medicine (ACSM)

(2011) is to provide guidance to professionals who counsel and prescribe individualized exercise to apparently healthy adults of all ages. These recommendations also may apply to adults with certain chronic diseases or disabilities. The ACSM suggests that a program of regular exercise that includes cardiorespiratory, resistance, flexibility, and neuromotor exercise beyond activities of daily living to improve and maintain physical fitness and health is essential for most adults. According to ACSM, most adults should engage in moderate-intensity cardiorespiratory exercise training for at least 30 minutes per day, five days per week. Additionally, the ACSM recommends that on two to three days per week, adults perform resistance exercises for each of the major muscle groups, and neuromotor exercise involving balance, agility, and coordination. Also, to maintain joint range of movement, a series of flexibility exercises for each major muscle-tendon group should be performed on at least two days per week. Exercise programs for adults should be modified according to individual levels of habitual physical activity, physical function, health status, exercise responses, and stated goals (ACSM, 2011). Also, adults who are unable or unwilling to meet the targets outlined by ACSM can still benefit from engaging in amounts less than recommended and by reducing time spent engaged in sedentary behavior. It is important to emphasize that the American College of Sports Medicine recommends that adult exercise should exceed merely performing activities of daily living. This should be reflected when designing exercise programs for older adults by incorporating movements that address all components of fitness into the program.

CHAPTER 3

THE EFFECTS OF EXERCISE ON THE PHYSICAL FITNESS OF HIGH AND MODERATE-LOW FUNCTIONING OLDER ADULT WOMEN[1]

[1]Mason, R., & Nocera, J. To be submitted to *Clinical Kinesiology*

ABSTRACT

Introduction. Understanding how exercise affects individuals with varying levels of functional ability will provide further insight into the role of exercise during the aging process. It will also aid in the development of exercise programs that are appropriate for a wider spectrum of older adults. Therefore, the primary purpose of this study is to observe the exercise habits of older adults with different levels of physical function to determine any differential effects of exercise on their physical fitness and functional ability. Specifically it is the primary aim of this study to determine and compare the effects of 10-weeks of community-based exercise on the cardiovascular endurance, muscular strength, flexibility, and balance fitness components of older adult women with high and moderate-low levels of physical function. **Methods.** Participants were placed in either the high functioning (n=13) or moderate/low functioning (n=17) groups based on their level of physical functioning. Fitness components were measured by the Senior Fitness Test and physical function determined by the Composite Physical Function Scale (Rikli & Jones, 2013). The Senior Fitness Test (SFT) (Rikli & Jones, 2013) was used to assess the overall fitness of both groups of participants at baseline, after five weeks, and again after 10 weeks of exercising. **Results.** The results of the 3 X 2 mixed ANOVA statistical analysis showed no significant interaction effect for time*group for any of the six subtests (chair stand, arm curls, 2-min step, chair sit &reach, back scratch, and 6-ft up & go) of the SFT. However, the main effect of time was significant for all fitness components and the main effect of group was significant for all fitness components except lower extremity flexibility. **Discussion.** This study provides a few noteworthy findings. First, community-based exercise programs offering a variety

of exercise types to people with varying levels of functional ability, can be useful in maintaining or improving fitness and independence. Second, these programs may also be capable of improving the self-efficacy of lower functioning older adults toward performing daily tasks. Additionally, self-report instruments such as activity logs may be useful to track and gain an understanding of the exercise habits of older adults.

Key words: Senior Fitness Test, exercise, physical function, physical fitness, disability

Introduction & Literature Review

Participation in exercise and regular physical activity can provide numerous physiological, cognitive, and psychological health benefits in the aging population (Smith et al., 2012). Impairments in fitness components such as muscle strength and balance influence the development of disability. In addition to muscle strength and balance, aerobic endurance, agility, mobility, and flexibility have also been shown to be significant determinants of physical independence (Huang et al. 2010). This is consistent with the notion that physical fitness factors greatly on the ability to successfully perform routine daily tasks. This includes functional tasks such as simple housework, lifting and carrying objects, negotiating steps, and walking far enough to shop and complete errands (Rikli & Jones, 2013). Defined as the capacity of an individual to carry out the physical activities of daily living, physical function is an independent predictor of functional independence, disability, morbidity, and mortality (American College of Sports Medicine, 2011). Aging is often associated with declines in physical function affecting vital processes that are critical to independence, social engagement, and quality of life (Vaughan et al., 2012). Older adults transitioning toward disability may no longer be able to appropriately utilize and execute movement patterns associated with activities of daily living (ADL) as a result of declining physical fitness. Programs of regular exercise that include cardiorespiratory, resistance, flexibility, and neuromotor exercise beyond activities of daily living to improve and maintain physical fitness and health are then essential for most adults (ACSM, 2011). Although mature nervous system function and motor skills are achieved in the earlier stages of life, changes in movement patterns also occur during adulthood and the latter stages of the lifespan (Cech & Martin, 2002). Older adults need to practice, learn new, and relearn known motor skills as part of task training, recreational pursuits, or rehabilitation (Voelcker-Rehage, 2008).

Therefore, opportunities for exercise that foster fitness, efficient functional movement skills, and self-efficacy toward performing daily tasks are needed to impede the progression of the disablement process among older adults. As such, community-based modes of exercise aimed to equip older adults with neuromotor (balance, coordination, and agility), physical (aerobic endurance, muscle strength, and flexibility), and functional components of fitness necessary for daily life should be explored and developed (Vaughan et al., 2012).

As the population of older adults is continuing to increase and become more diverse, it will be important to recognize individual differences in level of functioning (Lees, Clark, Nigg, & Newman, 2005). While aging is an inevitable process, it is an individual experience that has considerable variability. Older adults of the same chronological age may differ in physiological age and function due to differences in genetic makeup, lifestyle choices, cognitive ability, and several other variables. Exercise programs such as the one on this study should be designed to accommodate the variable capabilities and functional levels of older adult women. Additionally, they must be motivating enough to ensure active participation at an enjoyable level and increase the frequency of physical activity in a social, interactive setting. While this is true it is often the case that opportunities for exercise in community-based settings are not accommodating to individuals of all levels of functioning. Instruction of proper movement technique and motivational factors that promote adherence are often lacking. Exercise classes at community centers and facilities for adults will most likely contain individuals with varied levels of disability, as this is the nature of the older adult population. For example, a step aerobics class at the local senior center may have a participant who is highly functional and does not suffer from any level of disability exercising next to someone who is the same age but has low

cardiovascular endurance and poor balance. The effect and benefit of exercise on both types of individuals in this kind of environment is largely unknown.

Understanding how exercise affects individuals with varying levels of functional ability will provide further insight into the role of exercise during the aging process. It will also aid in the development of exercise programs that are appropriate for a wider spectrum of older adults. Therefore, the primary purpose of this study is to observe the exercise habits of older adults with different levels of physical function to determine any differential effects of exercise on their physical fitness. Specifically it is the primary aim of this study to determine and compare the effects of a 10-week community-based exercise program that emphasizes functional movement and fitness components on older adult women with high and moderate-low levels of physical function. Fitness components will be measured by the Senior Fitness Test and physical function determined by the Composite Physical Function Scale (Rikli & Jones, 2013). It was expected that 10-weeks of exercise will improve all fitness components as measured by the Senior Fitness Test for high, moderate, and low functioning women.

Methods

Participants. A convenience sample of 30 women (n = 30, m_{age} = 69 years) was recruited from the YWCO in Athens, Georgia completed participation in this study. Initially 37 women agreed to participate. However, seven participants were forced to withdraw for various reasons including hospitalization due to sickness, moving away, and summer travel. Participants were recruited in person while they attended exercise classes at the YWCO and also by posting flyers and sign-up sheets at the facility. All potential participants completed a medical history questionnaire to screen for conditions that may have inhibited safe exercise participation. Exclusion criteria included history of stroke, heart attack, osteoarthritis, neurological disease,

mental illness, and fracture or joint replacement within the last six months. Individuals reporting one or more of such conditions were excluded from participation in this study. Additionally, the participant medical history form provided demographic information related to age, sex, height, weight, marital status, employment status, and dwelling status. Participants were also asked to report an average amount of time per week they routinely spent involved in planned exercise.

Two groups of participants were formed according to their physical ability to live independently as determined by the Composite Physical Function (CPF) scale. The CPF is a self-report 12-item scale capable of assessing physical function across a wide range of activities from basic ADLs such as bathing and dressing to instrumental ADLs including gardening and shopping (Rikli & Jones, 2013). Each item can be scored from "0" to "2" (0 = cannot do; 1= can do with help; 2 = can do without help) based on the participants perceived ability to perform the task in question. The CPF scale can be used to categorize individuals as "high functioning", "moderate functioning", or as "low functioning" and at risk for loss of independence. High functioning are those who indicate that they can perform all 12 items on their own without assistance, thus receiving a perfect score of 24. Both the definition of moderate functioning and its interpretation are adjusted for age. It is important that younger age groups have more stringent criteria than older age groups for being assessed as moderate functioning as age-related declines in physical capacity after the age of 60 are commonly reported to decline at least 10%-15% per decade (Patterson et al., 2007). Whereas a score of 14 (ability to perform a minimum of seven CPF activities without assistance) is required for a rating of moderate of those aged 90 years and older, higher scores of 20, 18, and 16, respectively, are needed in order for those in their 60s, 70s, and 80s to be rated as moderate functioning (Rikli & Jones, 2013). Using this age-adjusted

scoring the participants were placed in either the high functioning (n=13) or moderate/low functioning (n=17) groups.

Procedure. All participants were required to read and sign the University of Georgia Institutional Review Board consent form prior to commencing any screening, testing, or exercising. As part of a Senior Fitness Initiative, each participant from both groups was encouraged to continue her normal routine of attending group exercise classes at the YWCO and also to exercise on their own at home for a 10-week period. Weekly exercise logs were used throughout the study as a method of self-reporting to record and compare the exercise habits of participants from each group with varying levels of functional independence. The participants were instructed to use the weekly exercise log to record each bout of planned exercise in which they participated during the10-week study. The Senior Fitness Test (SFT) (Rikli & Jones, 2013) was used to assess the overall fitness of both groups of participants at baseline, after five weeks, and again after 10 weeks of exercising. The SFT is commonly used to assess physical fitness in older adults, as it represents an easy-to-use field test battery that allows for the assessment of physical fitness components vital to maintaining independent functioning (Sardinha et al., 2015).

Exercise & Fitness Assessments

Weekly Exercise Log. A weekly exercise log was given to each participant for them to record the type and duration of each bout of exercise (Appendix C). Participants only received credit for planned exercise and not for other forms of physical activity such as housework, grocery shopping, or doing laundry. The weekly exercise logs were used as a method of self-reporting to record and compare the exercise habits of participants from each group with varying levels of functional independence. Participants received reminders to continue tracking their exercise in-person and by email on a weekly basis. Weekly exercise logs were submitted for

review at the midpoint and at the end of the 10-week exercise period. The number of weekly minutes of exercise performed by the high functioning and moderate/low functioning groups were then tallied and recorded at these time points. The average number of minutes exercised was then calculated for each group after five weeks and 10 weeks of exercise.

Senior Fitness Test. The Senior Fitness Test consists of seven items, including one alternate test for measuring aerobic endurance. The SFT items are as follows: 1) 30-second chair stand; 2) arm curl; 3) chair sit-and-reach; 4) back scratch; 5) 6-minute walk; 6) 2-minute step; and 7) 8-foot up-and-go. The purpose of the 30-second chair stand is to measure lower extremity strength, which is necessary for tasks such as transferring from a chair, walking, and climbing stairs. The total number or complete stands able to be completed in 30 seconds was recorded. The arm curl component of the SFT measures upper extremity strength, which is needed to perform household activities such as lifting and carrying groceries, suitcases, or grandchildren. The total number of bicep curls completed with correct form with the dominant arm while holding a five-pound weight in 30 seconds was recorded. The chair sit-and-reach test will be administered to assess lower body flexibility, which is important for good posture and normal gait patterns. Lower body flexibility also contributes to performing mobility tasks such as getting in and out of a car or bed. From a sitting position at the end of a chair, with one leg extended and hands reaching toward toes, the number of inches (+ or -) between extended fingers and tip of toe was be measured during the chair sit-and-reach test. Upper body flexibility was measured by the back scratch test. Shoulder flexibility is vital for tasks such as combing one's hair, putting on a coat, and reaching for a seat belt. During this test, the number of inches between middle fingers (+ and -) was measured while reaching over the shoulder with arm and up the middle of the back with the other arm. The 2-minute step test was chosen for the assessment of aerobic

endurance because space and time limited the use of the 6-minute walk. Aerobic endurance is important for walking distances, climbing stairs, and for other activities such as shopping or sightseeing. The 2-minute step test entails recording the number of full steps completed in two minutes while raising each knee to a point midway between the patella and iliac crest. The recorded score was equal to the number of times the right knee reaches the required height. The final component of the SFT is the 8-foot up-and-go test and is intended to assess agility and dynamic balance. These fitness components are essential for quick maneuvering which is required for activities such as rushing to answer a telephone or to use the restroom. The 8-foot up-and-go test requires an individual to rise from a chair, walk forward 8-feet, change direction and return to their seated position in the chair. The fastest time from two trials was recorded to nearest hundredth of a second. Each test item of the SFT has accompanying performance standards for men and women ages 60 to 94-plus based on a national study of more than 7,000 Americans (Rikli and Jones, 2013). Additionally, the SFT provides threshold values on each test item that help to identify if an older adult is at risk for mobility loss.

Exercise Protocol. For a 10-week period participants were monitored while performing their normal exercise routines within the Athens, GA community. The majority of this exercise took place at the Athens YWCO with the remaining exercise taking place at home or in other settings. While at the YWCO, participants attended a variety of exercise classes designed for older adults. The classes were either 30 or 60 minutes in duration and collectively, emphasized all components of physical fitness. There was no limit placed on the participants in terms of type or amount of classes they were allowed to attend in each week. It was common for the women in both groups to exercise together in the same classes as well as attend different classes on an individual basis. The exercise classes offered at the YWCO during the time of the study focused

on functional movements and included Group Strength Training, Pilates, Silver Sneakers and Step and Sculpt. After baseline testing the participants were educated on how to execute proper posture during exercise and while performing daily activities. The researchers collaborated with the YWCO instructors to ensure that proper execution of functional movements was emphasized during class time. Instructors were also asked to associate the movements being taught to activities of daily living. For example, when performing arm strengthening exercises instructors were asked to relate these movements to functional tasks such as lifting and carrying items similar to laundry baskets, grocery bags, or grandchildren. The type and duration of class participation and other exercise activity was recorded on the weekly exercise log (Appendix C).

Statistical Analysis

Senior Fitness Test. The Senior Fitness Test was administered to each group before, at midpoint, and following 10 weeks of community-based exercise. The Senior Fitness Test (SFT) measures the components of fitness with a chair stand test, arm curl test, 2-minute step test, chair sit & reach test, back scratch test, and 8-foot up & go test. Each test is scored separately as there is no composite score for the SFT. As such, a separate mixed 3 (time) x 2 (group) ANOVA, with time as the within subjects factor and group based on level of physical function as the between-subjects factor, was run for each subtest of the SFT. Analyses were conducted using SPSS 22 software ("SPSS IBM, New York, USA). The $p = 0.05$ rejection level was used in all analyses.

Weekly Self-Reported Exercise. The number of weekly minutes of exercise performed by the high functioning and moderate/low functioning groups were tallied and recorded at the midpoint and after 10 weeks of exercise. The estimation of time spent exercising reported on the health and medical history questionnaire before the study was used as the pre-exercise value for self-report exercise.

Results

Senior Fitness Test. The results of the 3 X 2 mixed ANOVA statistical analysis showed no significant interaction effect for time*group for any of the six subtests (chair stand, arm curls, 2-min step, chair sit &reach, back scratch, and 6-ft up & go) of the SFT. However, the main effect of time was significant for all fitness components and the main effect of group was significant for all fitness components with the exception of lower extremity flexibility (chair sit and reach test). Means and standard deviation for each of the six subtests scores for both groups are presented in Table 3.2 and in Graphs 3.1-3.6. The results for each SFT subtest are reported below.

Chair Stand Test. Statistical analysis showed no significant interaction effect for time*group, $F(2,52)=.089$, $p=.915$, $n^2=.003$ for number of chair stands at any of the three time points. The main effect of time showed a statistically significant difference in chair stands at the 3 time points, $F(2,52)=26.983$, $p<.0005$, partial $n^2=.509$. The main effect of group showed a statistically significant difference in chair stands between physical function groups, $F(1,26)=7.387$, $p=.012$, partial $n^2=.221$. The mean scores for the high function group for pre-, mid-, and post-tests were 17.5, 20.8, and 22.9 respectively. Percent change from baseline to midpoint was 18.8%. The high function group mean score for chair stands also increased from midpoint to post-test with a percent change of 10.1%. The moderate/low function group showed larger percent changes between time points. Mean scores for the moderate/low function group increased from 12.5 to 15.3 yielding a percent change of 22.4%. Percent change between midpoint and post-test was 14.4% with mean scores increasing from 15.3 to 17.5.

Arm Curls Test. Mean scores for the high function group increased over time and were 21.8, 25.9, and 27.15 for pre-, mid-, and post-tests, respectively. Percent change between

baseline and midpoint was 18.8% and was 4.8% between midpoint and post-test. The moderate/low function group mean scores at pre-, mid-, and post- tests were 19.4, 21.3, and 23.2. Baseline to midpoint percent change was calculated to 9.8% and midpoint to post-test percent change was 8.9%. Statistical analysis showed no significant interaction effect for time*group, $F(2,52)=.743$, $p=.481$, partial $n^2=.028$ at any of the data collection time points. The main effect of time showed a statistically significant difference in arm curls at the three time points, $F(2,52)=10.636$, $p<.0005$, partial $n^2=.290$. The main effect of group showed a statistically significant difference in arm curls between physical function groups, $F(1,26)=6.969$, $p=.014$, partial $n^2=.211$.

2-Minute Step Test. The high function group averaged 113, 131.9, and 142.54 steps at the three data collection time points. The percent change between baseline and midpoint was 16.7% and was calculated to be 8.1% between midpoint and post-test. The moderate/low function group mean scores increased by 18.5% between baseline and midpoint and also increased between midpoint and post-test with a percent change of 8.4%. There was no significant interaction effect between time*group for the 2-minute step test, $F(2,50)=.032$, $p=.853$, partial $n^2=.001$ at any of the three data collection time points. The main effect of time showed a significant difference in steps at the 3 time points, $F(2,50)=14.08$, $p<.0005$, partial $n^2= .360$. The main effect of group showed a significant difference in steps between physical function groups, $F(1,26)=10.71$, $p=.003$, partial $n^2=.292$.

Chair Sit & Reach Test. There was no significant interaction effect between time*group for the chair sit & reach test, $F(2,52)=.967$, $p=.387$, partial $n^2=.036$. The main effect of time showed a significant difference in inches reached at the 3 time points, $F(2,52)=15.235$, $p<.0005$, partial $n^2=.369$. However, the main effect of group did not show a significant difference in inches

reached between physical function groups, F(1,25)=4.09, p=.054, partial n^2=.136. The high function group increased their mean scores by 67.6% and 14% between baseline and midpoint and between midpoint and post-test, respectively. The moderate/low function group increased by 47% between baseline and midpoint and increased by 76% between midpoint and post-test.

Back Scratch Test. There was no significant interaction effect between time*group for inches reached on the back scratch test, F(2,52)=1.1, p=.341, partial n^2=.115 at any of the three data collection time points. The main effect of time showed a significant difference in inches reached at the 3 time points, F(2,50)=3.321, p=.044, partial n^2=.117. The main effect of group showed a significant difference in inches reached during the back scratch test between physical function groups, F(1,26), p<.0005, partial n^2=.484. The high function group increased their mean scores by 45.7% and 25% between baseline and midpoint and between midpoint and post-test, respectively. The moderate/low function group increased by 47.8% between baseline and midpoint and increased by 36% between midpoint and post-test.

8-Foot Up & Go Test. There was a 12.6% percent change for the high function group between pre- and post-test. The percent change for the same group between midpoint and post-test was 7.6%. The moderate to low function group improved by 13.7% and 6.3%, respectfully, during the two periods between data collection time points. There was no significant interaction effect between time*group for the 8-ft Up & Go test, F(2,52)=.06, p=.942, partial n^2= .002. The main effect of time showed a significant difference between midpoint and post-exercise tests, F(2,52)=4.099,p=.022, partial n^2=.136. The main effect of group showed a significant difference in Up & Go scores between physical function groups, F(1,26)=13.071,p=.001, partial n^2=.335.

Discussion

The benefits of exercise for older adults have been established in the research literature and are well known. There is evidence that habitual exercise can minimize the physiological effects of an otherwise sedentary lifestyle and prolong active life expectancy (Chodzko-Zajko et al., 2009). The heterogeneity observed among older adults and their level of physical function has important implications for research and clinical practice. This notion supports the concept that tailoring exercise programs and interventions to specific deficits and the current state of physical functioning is an important consideration. Research has left little doubt that exercise interventions for older adults need to consider the individual functional needs of participants. As such, the success of aerobic and resistance training for obese men and women (Chmelo et al., 2015), balance training for individuals at risk for falls (Roaldsen et al., 2014), and water exercise for those with osteoarthritis (Hale, Waters, & Herbison) have all been shown to be effective for older adults with these specific physical function deficits. Despite the plethora of data showing an overall benefit of exercise training for improving, or maintaining functional ability in older adults, there is likely to be large individual variability in functional responses to exercise. Attention to individual differences and identification of factors that influence efficacy of exercise as a therapy for aging-related loss of physical function, have important clinical significance. Moreover, the specific amount of exercise necessary to elicit maximal improvements in physical outcomes may differ between types of individuals. Exercise training studies that show efficacy for improving functional ability often report main effects or mean group differences without expressing the extent of variability for these tasks. Therefore, it was the primary purpose of this study to observe the exercise habits of older adult women with different levels of physical function abilities, to determine any differential effects of exercise on their physical fitness.

The specific aim of the study was to determine and compare the effects of 10-weeks of community-based exercise on the cardiovascular endurance, muscular strength, flexibility, and balance fitness components of older adult women with high and moderate-low levels of physical function. The results of the statistical analysis indicate that the impact of time (10-weeks of exercise) on the fitness-related outcome measures did not differ based on level of physical function at any time during the study. In other words, older adult women from this sample were able to improve fitness over time regardless of their initial level of physical function as indicated by their initial score on the Composite Physical Function scale and group assignment. Over the course of 10 weeks the women from both groups improved their SFT scores related to leg strength, arm strength, cardiovascular endurance, leg flexibility, arm flexibility, as well as mobility and dynamic balance. This finding is consistent with the hypothesis that all participants would increase their scores on all SFT subtests over time. The exercise classes offered at the YWCO provided the participants with a variety of options in terms of which fitness components to train. Many of the exercise classes such as Pilates and Silver Sneakers emphasized multiple fitness components making them highly beneficial to the overall fitness of the participants. By offering programs of regular exercise that include cardiorespiratory, resistance, flexibility, and neuromotor exercise beyond activities of daily living, the Athens YWCO is equipped to improve and maintain the fitness and health of its members (ACSM, 2011). Additionally, the implementation of the Senior Fitness Initiative at the YWCO greatly influenced the participants in terms of their morale and enthusiasm toward exercise. They were highly engaged and eager to learn more about their individual level of fitness.

While the high functioning group consistently had significantly better SFT scores as compared to their counterparts, they did not improve at a greater rate or more significantly over

time as compared to the moderate/low functioning group. However, it should be noted that the percent change during the second half of the study between midpoint and post-tests, was higher for the moderate/low functioning group for all six subtests of the Senior Fitness Test. This implies that the group with lower amounts of functional ability continued to improve and were more resistant to the plateau effect shown by the high function group. The lower functioning individuals seemed to be inspired by their gains and were highly motivated to keep pace with the other women in the study. This finding suggests that there may be some benefit to integrating community-based exercise classes with people of various functional skill sets when resources or logistics are not conducive to separating them. This should only be done with qualified instructors who are able to offer modifiable exercise opportunities to the variable older adult population.

As it was also an aim of this study to compare the exercise habits of older adult women functioning at different levels of independence, self-report weekly exercise logs were used to track the time spent exercising of each participant. Prior to the 10-week exercise period, both groups were asked to estimate the amount of time they spent engaged in exercise on a weekly basis. An interesting finding was that the actual number of recorded minutes during the study (mid- and post-) was lower than the estimated averages reported by both groups prior to commencing the 10-week exercise period. Perhaps this can be explained by social desirability, which can lead to over-reporting of physical activity (Sallis & Saelens, 2000). This common limitation of self-report instruments appears to have held true for the weekly exercise logs and this sample of older adult women. Despite this limitation, there were some benefits of utilizing the weekly exercise logs to self-report exercise activity. The participants often reported the feeling of being held accountable for their exercise activity because they were forced to write it

down and track it over 10 weeks. The weekly exercise logs seemed to produce a sense of pride among the participants and may have motivated them to be more physically active. Initiating exercise programs and adhering to them is often problematic for older adults (Tak et al., 2012). Using weekly exercise logs may help to alleviate this problem among older adults. Also, all participants consistently reported performing exercise activity at home and in other settings outside of the YWCO. This indicates that senior fitness initiatives such as the one implemented during this study may be helpful in improving the overall exercise habits of older adults. These findings suggest that, although sometimes limited in effectiveness, self-report instruments to track the exercise habits of older adults in a community-based setting may be useful when more scientific and reliable options are not available. It is possible that these instruments may have cognitive and physical benefits for older adults. Their use requires the highly complex task of recall and may motivate individuals to be more active by holding them accountable for the amount of time they choose to be engaged in exercise.

The groups in this study were determined by level of physical functioning as measured by the Composite Physical Function scale. The CPF is a self-report 12-item scale capable of assessing physical function across a wide range of daily activities. The high function group consisted of those women who indicated that they could perform all 12 items on their own without assistance, thus receiving a perfect score of 24. CPF scores of 20, 18, and 16, respectively, were needed in order for those in their 60s, 70s, and 80s to be rated as moderate functioning (Rikli & Jones, 2013). Low functioning individuals were those unable to report scores high enough to achieve a moderate rating. The participants rated as moderate and low functioning were combined into one group (moderate/low function). The average CPF score of this group at the beginning of the study was 20 and increased to 22 when the CPF was

administered again after the 10-week exercise program. This finding indicates that participation in fitness and exercise initiatives in a community-based setting can improve the perceived ability of older adults to function independently.

In conclusion, this study provides a few noteworthy findings. First, community-based exercise programs offering a variety of exercise types to people with varying levels of functional ability have both physical and psycho-social benefits. These programs can be useful in maintaining and improving fitness and independence. Second, these programs may also be capable of improving the self-efficacy of lower functioning older adults toward performing daily tasks. Finally, self-report instruments such as activity logs may be useful to track and gain an understanding of the exercise habits of older adults. This study was limited due to the nature of the community from which the participants were recruited. The YWCO members were highly educated and most already had an established history of physical activity and exercise. Additionally they were extremely competitive and eager to improve. Future research should build upon using multimodal exercise regimes focusing on proper format, periodic assessment and feedback, and encouragement of home-based activities. More importantly exercise programs should teach older adults to move correctly while generalizing movements to activities commonly encountered by the population.

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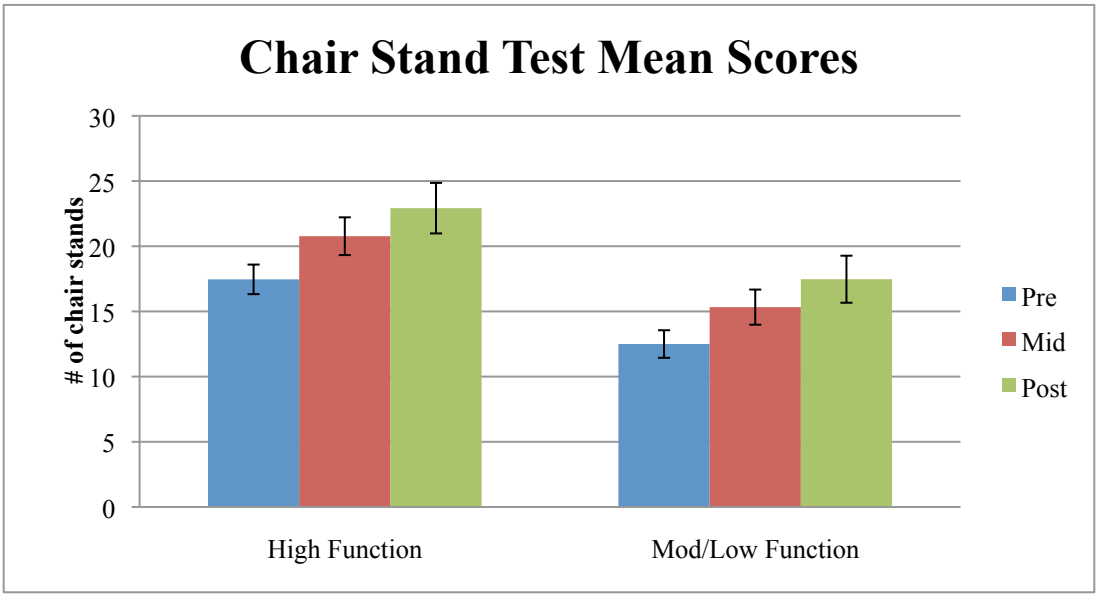
Table 3.1 Demographics and Clinical Features of Participants by Group

	High Function	Mod/Low Function
# of Women	n=13	n=17
	mean (SD)	mean (SD)
Age (Years)	67.2 (5.7)	70.2 (5.1)
CPF Score	24	20.4 (3.7)
Exercise (min/week)	803 (715)	526 (377)

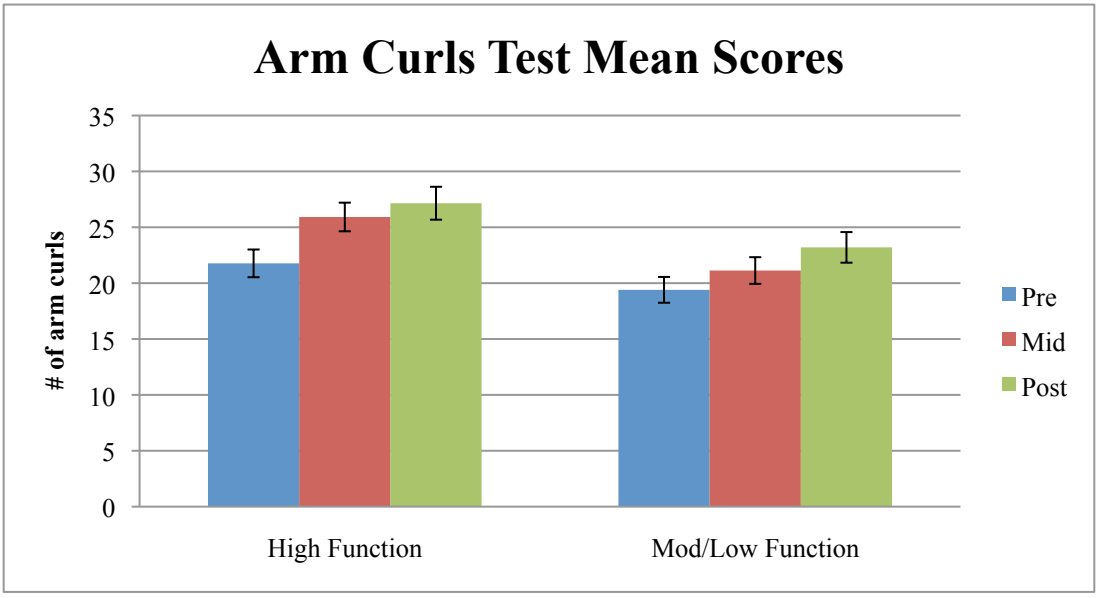
Table 3.2 Senior Fitness Test Mean Scores

	High Function			**Mod/Low Function**		
	Pre-	**Mid-**	**Post-**	**Pre-**	**Mid-**	**Post-**
Chair Stands	17.5 (5.5)	20.8 (7.0)	22.9 (9.7)	12.5 (2.3)	15.3 (2.8)	17.5 (3.2)
Arm Curls	21.8 (4.4)	25.9 (5.1)	27.2 (6.2)	19.4 (4.5)	21.1 (4.2)	23.2 (4.4)
2-Minute Step	113.1 (20.8)	131.9 (18.1)	142.5 (17.6)	96.1 (23)	113.9 (24.6)	123.5 (23.9)
Chair S&R (inches)	3.4 (4.8)	5.7 (3.4)	6.5 (4)	1.7 (3)	2.5 (2.5)	4.4 (2.7)
Back Scratch (inches)	1.1 (3.3)	1.6 (2.5)	2 (2.2)	-4.6 (4.1)	-2.5 (3.5)	-1.6 (3.7)
8-Ft. Up & Go (seconds)	5.7 (1.2)	5 (.79)	4.6 (.76)	7.3 (2.8)	6.3 (2)	5.9 (1.7)

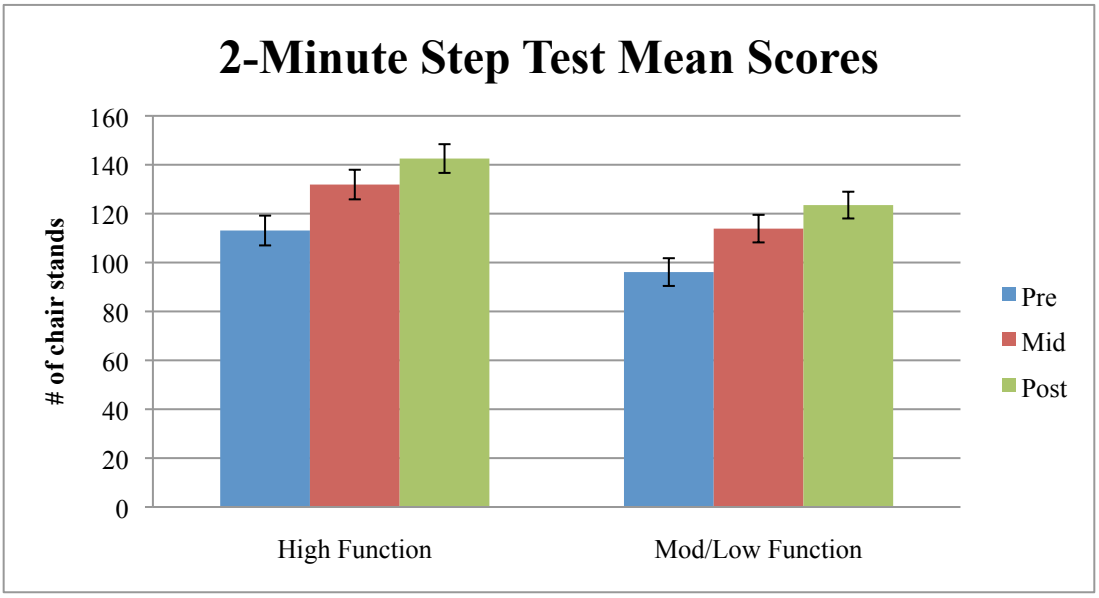
Graph 3.1 Chair Stand Test Mean Scores by Group and Time



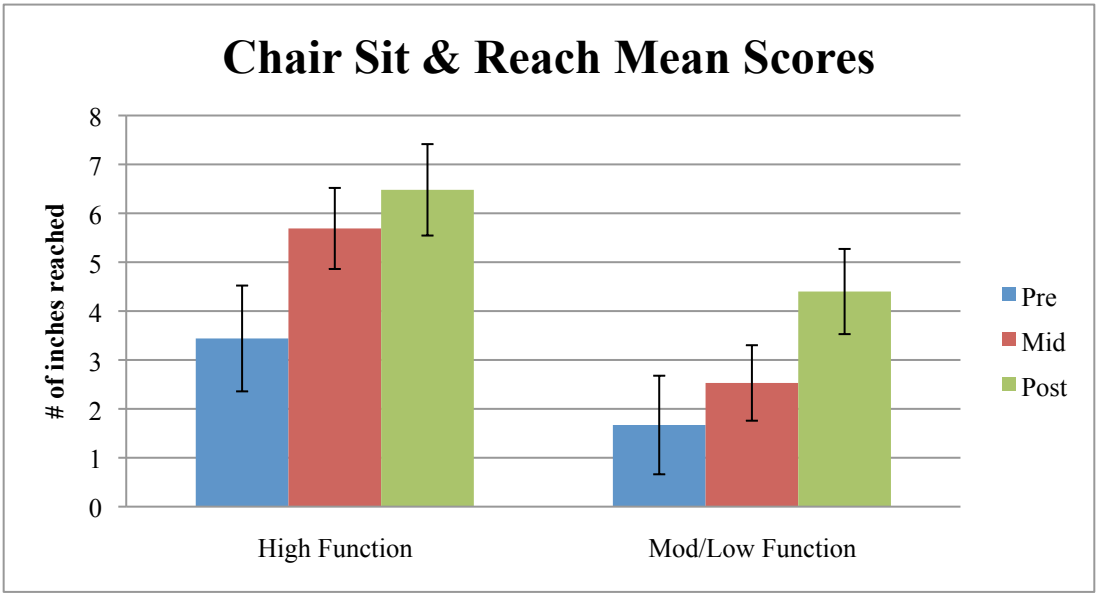
Graph 3.2 Arm Curl Test Mean Scores by Group and Time



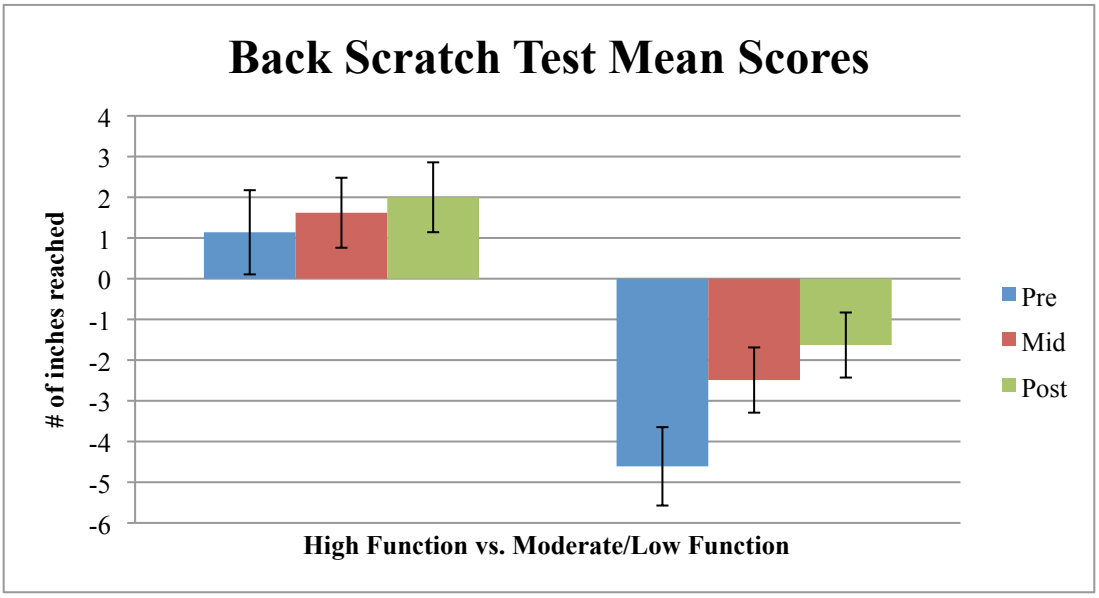
Graph 3.3 2-Minute Step Test Mean Scores by Group and Time



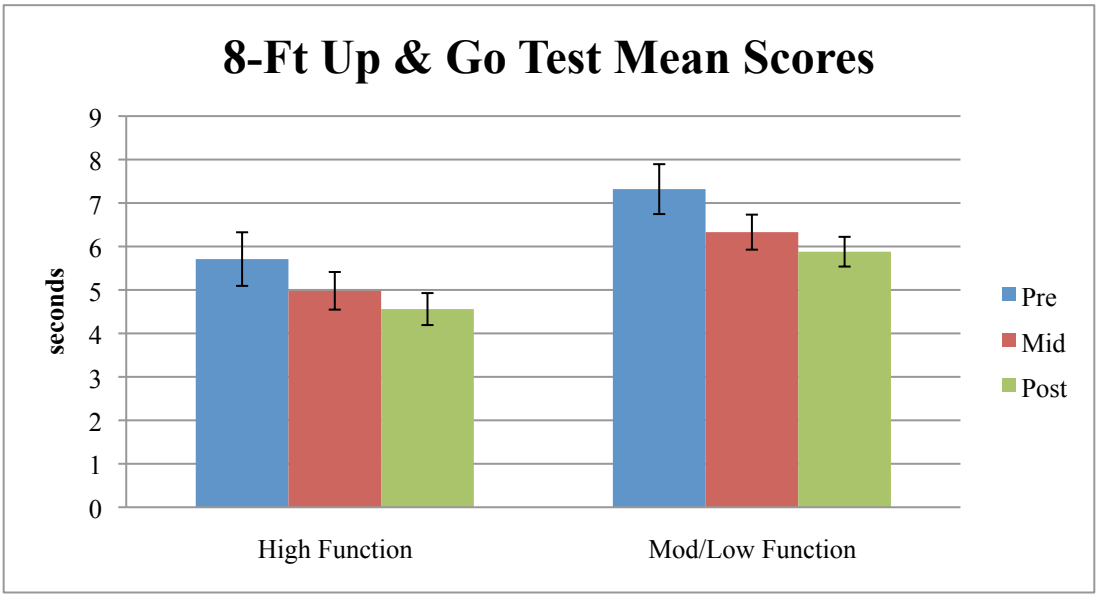
Group 3.4 Chair Sit & Reach Test Mean Scores by Group and Time



Graph 3.5 Back Scratch Test Mean Scores by Group and Time



Graph 3.6 8-Foot Up & Go Test Mean Scores by Group and Time



CHAPTER 4

THE SELF-REPORTED EXERCISE HABITS OF OLDER ADULT WOMEN AND THE ASSOCIATED EFFECTS ON PHYSICAL FITNESS[2]

[2]Mason, R. and Nocera, J. To be submitted to the *Journal of Aging and Physical Activity*

ABSTRACT

Introduction. The amount of time that older adults exercise is influenced by their fitness, physical function, and self-efficacy to participate in physical activity. As the population of older adults is continuing to increase and become more diverse, it will be important to recognize and investigate differences among them (Lees, Clark, Nigg, & Newman, 2005), including variance in exercise time. The relationship between self-reported exercise habits, fitness levels, and physical function were investigated during this study. **Methods.** Participants were placed into Group 1 (n=15) if they reported an estimate that was equal to or lower than 360 minutes of exercise per week. Group 2 (n=15) consisted of those participants who estimated averaging more than 360 minutes of exercise per week. Participants were instructed to continue their normal routines of attending group exercise classes at the YWCO for a 10-week period. Weekly exercise logs were used throughout the study as a method of self-reporting to record and compare the exercise habits of participants from each group with varying levels of functional independence. The Senior Fitness Test (SFT) (Rikli & Jones, 2013) was used to assess the overall fitness of both groups of participants at baseline, after five weeks, and again after 10 weeks of exercising. **Results.** Statistical analysis showed no significant interaction effect for time*group for chair stands, arm curls, 2-min step, chair sit &reach, and back scratch tests. However, a significant interaction effect existed for time*group for the 8-foot Up & Go test. Also, the main effect of time was significant for all fitness components while the main effect of group was significant only for the 8-foot Up & Go test. **Discussion.** Study findings suggest that perhaps six hours of exercise in a community-based setting such as the Athens YWCO is the threshold for

considerably improving one's mobility, coordination, and dynamic balance as measured by the 8-foot Up & Go task. Also, further consideration should be given to utilizing tests similar to the 8-foot Up & Go that are designed to be more sensitive and complex when assessing the physical fitness of older adults.

Key words: self-report, exercise time, activity logs, exercise habits, Senior Fitness Test

Introduction & Literature Review

Physical fitness is defined as the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure pursuits and to meet unforeseen emergencies (Caspersen, Powell, Christenson, 1985). The level of physical fitness among adults greatly influences their ability to remain physically active, perform daily tasks, and remain functionally independent. The American College of Sports Medicine (ACSM) suggests that a program of regular exercise that includes cardiorespiratory, resistance, flexibility, and neuromotor exercise beyond activities of daily living to improve and maintain physical fitness and health is essential for most adults. Exercise programs for adults should be modified according to individual levels of habitual physical activity, physical function, health status, exercise responses, and stated goals (ACSM, 2011). Therefore, it is important to understand the appropriate amounts and types of exercise for developing and maintaining overall fitness in older adults. Also, adults who are unable or unwilling to meet the targets outlined by ACSM can still benefit from engaging in amounts less than recommended and by reducing time spent engaged in sedentary behavior.

Most adults should engage in moderate-intensity cardiorespiratory exercise training for at least 30 minutes per day, five days per week (ACSM, 2011). Additionally, the ACSM recommends that on two to three days per week, adults perform resistance exercises for each of the major muscle groups, and neuromotor exercise involving balance, agility, and coordination. Also, to maintain joint range of movement, a series of flexibility exercises for each major muscle-tendon group should be performed on at least two days per week. Furthermore, older adults need to practice, learn new, and relearn known motor skills as part of task training, recreational pursuits, or rehabilitation (Voelcker-Rehage, 2008). Opportunities for exercise that

foster fitness, efficient functional movement skills, and self-efficacy toward performing daily tasks are needed to impede the progression of the disablement process among older adults. As such, community-based modes of exercise aimed to equip older adults with neuromotor (balance, coordination, and agility), physical (aerobic endurance, muscle strength, and flexibility), and functional components of fitness necessary for daily life should be explored and developed (Vaughan et al., 2012).

While there is evidence that habitual exercise can minimize the physiological effects of aging and disease, and prolong active life expectancy, many older individuals do not engage in regular physical activity (Ashe, Miller, Eng, & Noreau, 2009). Time constraints, lack of knowledge, fear of falling, and lack of transportation are all factors that contribute to sedentary behavior (Mathews et al., 2010). The amount of time that older adults exercise is influenced by their fitness, physical function, and self-efficacy to participate in physical activity. As these factors differ between individuals so does the amount of time individuals spend engaged in planned exercise. As the population of older adults is continuing to increase and become more diverse, it will be important to recognize and investigate differences among them (Lees, Clark, Nigg, & Newman, 2005), including variance in exercise time.

Exercise classes at community centers and facilities for adults will most likely contain individuals with varied levels of disability and different exercise habits. For example, classes at the local senior center may have participants who are highly functional, do not suffer from any level of disability, and exceed the recommendations for adult exercise participation. In the same class there may also be individuals with functional limitations who exercise inconsistently and fall short of the appropriate exercise recommendations for adults. There is still much to learn

about how this type of interaction in community settings affects the improvement and maintenance of fitness of older adult participants.

Self-report instruments continue to be the most widely used type of physical activity measure (Sallis & Saelens, 2000). Thus it is important to identify the strengths of these measures and as well as improve their quality. The usefulness of self-report instrumentation by older adults to determine the optimal amount of time spent exercising to enhance fitness components and physical function is still largely unknown. The relationship between self-reported exercise habits, fitness levels, and physical function was investigated during this study. It is the expectation of the researchers that women who report higher amounts of exercise time will show increased levels of fitness and physical function as compared to those with less exercise time. It is also expected that the self-reported estimate of minutes spent exercising per week at baseline will be greater than the actual amount of reported time spent exercising at the midpoint and end of the 10-week exercise period for all participants.

Methods

Participants. A convenience sample of 30 women ($n = 30$, $m_{age} = 69$ years) recruited from the YWCO in Athens, Georgia completed participation in this study. Initially 37 women agreed to participate. However, seven participants were forced to withdraw for various reasons including hospitalization due to sickness, moving away, and summer travel. Participants were recruited in person while they attended exercise classes at the YWCO and also by posting flyers and sign-up sheets at the facility. All potential participants completed a medical history questionnaire to screen for conditions that may have inhibited safe exercise participation. Exclusion criteria included being male, history of stroke, heart attack, neurological disease, and fracture or joint replacement within the last six months. Individuals reporting one or more of

such conditions were excluded from participation in this study. Additionally, the participant medical history form provided self-reported demographic information related to age, sex, height, weight, marital status, employment status, and dwelling status. Participants were also asked to report an average amount of time per week they routinely spent involved in planned exercise. Two groups of participants were stratified according to the amount of time each participant reported exercising over the 10-week exercise period. The average number of weekly minutes spent exercising over the 10-week period was calculated for each participant. The median of those 10-week averages (360 minutes) was used as a dividing line producing two groups of participants. Participants were placed into Group 1 (n=15) if they reported a 10-week average that was equal to or lower than 360 minutes of exercise per week. Group 2 (n=15) consisted of those participants who reported an average exceeding 360 minutes of exercise per week.

Procedure. All participants were required to read and sign the University of Georgia Institutional Review Board consent form prior to commencing any screening, testing, or exercising. After being screened, each participant from both groups was instructed to continue her normal routine of attending group exercise classes at the YWCO for a 10-week period. Weekly exercise logs were used throughout the study as a method of self-reporting to record and compare the exercise habits of participants from each group with varying levels of functional independence. The participants were instructed to use the weekly exercise log to record each bout of planned exercise in which they participated at the YWCO or elsewhere on their own.

The Senior Fitness Test (SFT) (Rikli & Jones, 2013) was used to assess the overall fitness of both groups of participants at baseline, after five weeks, and again after 10 weeks of exercising. The SFT is commonly used to assess physical fitness in older adults, as it represents

an easy-to-use field test battery that allows for the assessment of physical fitness components vital to maintaining independent functioning (Sardinha et al., 2015).

Physical function and level of disability was measured by the Composite Physical Function (CPF) scale (Rikli & Jones, 2013). The CPF scale is a self-report 12-item scale capable of assessing physical function across a wide range of activities. It was administered to both groups before and after completion of the study.

Physical Function Assessment

Composite Physical Function Scale. Each item of the CPF scale can be scored from "0" to "2" (0 = cannot do; 1= can do with help; 2 = can do without help) based on the participants perceived ability to perform the task in question. The CPF scale can be used to categorize individuals as "high functioning", "moderate functioning", or as "low functioning" and at risk for loss of independence. High functioning are those who indicate that they can perform all 12 items on their own without assistance, thus receiving a perfect score of 24. Both the definition of moderate functioning and its interpretation are adjusted for age. It is important that younger age groups have more stringent criteria than older age groups for being assessed as moderate functioning as age-related declines in physical capacity after the age of 60 are commonly reported to decline at least 10%-15% per decade (Patterson et al., 2007). Whereas a score of 14 (ability to perform a minimum of seven CPF activities without assistance) is required for a rating of moderate of those aged 90 years and older, higher scores of 20, 18, and 16, respectively, are needed in order for those in their 60s, 70s, and 80s to be rated as moderate functioning (Rikli & Jones, 2013).

Exercise & Fitness Assessments

Weekly Exercise Log. A weekly exercise log was given to each participant for them to record the type and duration of each bout of exercise (Appendix). Participants only received credit for planned exercise and not for other forms of physical activity such as housework, grocery shopping, or doing laundry. The weekly exercise logs were used as a method of self-reporting to record and compare the exercise habits of participants from each group with varying levels of functional independence. Participants received reminders to continue tracking their exercise in-person and by email on a weekly basis. Weekly exercise logs were submitted for review at the midpoint and at the end of the 10-week exercise period. The number of weekly minutes of exercise performed by the high functioning and moderate/low functioning groups were then tallied and recorded at these time points. The average number of minutes exercised was then calculated for each group after five weeks and 10 weeks of exercise.

Senior Fitness Test. The Senior Fitness Test consists of seven items, including one alternate test for measuring aerobic endurance. The SFT items are as follows: 1) 30-second chair stand; 2) arm curl; 3) chair sit-and-reach; 4) back scratch; 5) 6-minute walk; 6) 2-minute step; and 7) 8-foot up-and-go. The purpose of the 30-second chair stand is to measure lower extremity strength, which is necessary for tasks such as transferring from a chair, walking, and climbing stairs. The total number or complete stands able to be completed in 30 seconds was recorded. The arm curl component of the SFT measures upper extremity strength, which is needed to perform household activities such as lifting and carrying groceries, suitcases, or grandchildren. The total number of bicep curls completed with correct form with the dominant arm while holding a five-pound weight in 30 seconds was recorded. The chair sit-and-reach test will be administered to assess lower body flexibility, which is important for good posture and normal

gait patterns. Lower body flexibility also contributes to performing mobility tasks such as getting in and out of a car or bed. From a sitting position at the end of a chair, with one leg extended and hands reaching toward toes, the number of inches (+ or -) between extended fingers and tip of toe was be measured during the chair sit-and-reach test. Upper body flexibility was measured by the back scratch test. Shoulder flexibility is vital for tasks such as combing one's hair, putting on a coat, and reaching for a seat belt. During this test, the number of inches between middle fingers (+ and -) was measured while reaching over the shoulder with arm and up the middle of the back with the other arm. The 2-minute step test was chosen for the assessment of aerobic endurance because space and time limited the use of the 6-minute walk. Aerobic endurance is important for walking distances, climbing stairs, and for other activities such as shopping or sightseeing. The 2-minute step test entails recording the number of full steps completed in two minutes while raising each knee to a point midway between the patella and iliac crest. The recorded score was equal to the number of times the right knee reaches the required height. The final component of the SFT is the 8-foot up-and-go test and is intended to assess agility and dynamic balance. These fitness components are essential for quick maneuvering which is required for activities such as rushing to answer a telephone or to use the restroom. The 8-foot up-and-go test requires an individual to rise from a chair, walk forward 8-feet, change direction and return to their seated position in the chair. The fastest time from two trials was recorded to nearest hundredth of a second. Each test item of the SFT has accompanying performance standards for men and women ages 60 to 94-plus based on a national study of more than 7,000 Americans (Rikli and Jones, 2013). Additionally, the SFT provides threshold values on each test item that help to identify if an older adult is at risk for mobility loss.

Exercise Protocol. For a 10-week period participants were monitored while performing their normal exercise routines within the Athens, GA community. The majority of this exercise took place at the Athens YWCO with the remaining exercise taking place at home or in other settings. Home exercise was reported by self-report. While at the YWCO, participants attended a variety of exercise classes designed for older adults. The classes were either 30 or 60 minutes in duration and collectively, emphasized all components of physical fitness. There was no limit placed on the participants in terms of type or amount of classes they were allowed to attend in each week. It was common for the women in both groups to exercise together in the same classes as well as attend different classes on an individual basis. The exercise classes offered at the YWCO during the time of the study included the following: Water Exercise, Dance Aerobics, Easy Yoga, Group Strength Training, Morning Jump Start, Pilates, Silver Sneakers, Step & Sculpt, Stretch It Out, Yoga, Zumba, and Functional Movement. Each class attended and its duration was recorded on the weekly exercise log. The participants were frequently monitored in person by the researchers while attending exercise classes.

Statistical Analysis

Senior Fitness Test. The Senior Fitness Test was administered to each group before, at midpoint, and following 10 weeks of community-based exercise. The Senior Fitness Test (SFT) measures the components of fitness with a chair stand test, arm curl test, 2-minute step test, chair sit & reach test, back scratch test, and 8-foot up & go test. Each test is scored separately as there is no composite score for the SFT. As such, a separate mixed 3 (time) x 2 (group) ANOVA, with time as the within subjects factor and group based on level of physical function as the between-subjects factor, was run for each subtest of the SFT. Analyses were conducted using SPSS 22 software ("SPSS IBM, New York, USA). The $p = 0.05$ rejection level was used in all analyses.

Weekly Self-Reported Exercise. The number of weekly minutes of exercise performed by Group 1 and Group 2 were tallied, recorded, and averaged at the midpoint and after 10 weeks of exercise. The estimation of time spent exercising reported on the health and medical history questionnaire before the study was used as the pre-exercise value for self-report exercise.

Results

Senior Fitness Test. The results of the 3 X 2 mixed ANOVA statistical analysis showed no significant interaction effect for time*group for chair stands, arm curls, 2-min step, chair sit &reach, and back scratch tests. However, the statistical analysis did show a significant interaction effect for time*group for the 8-foot Up & Go test. Also, the main effect of time was significant for all fitness components while the main effect of group was significant only for the 8-foot Up & Go test. Means and standard deviations for each of the six subtests scores for both groups are presented in Table 4.2 and in Graphs 4.1-4.6. The results for each SFT subtest are reported below.

Chair Stand Test. Statistical analysis showed no significant interaction effect for time*group, $F(2,52)=2.288$, $p=.112$, $n^2=.081$ for number of chair stands at any of the three time points. The main effect of time showed a statistically significant difference in chair stands at the 3 time points, $F(2,52)=46.768$, $p<.0005$, partial $n^2=.643$. The main effect of group did not show a statistically significant difference in chair stands, $F(1,26)=4.164$, $p=.052$, partial $n^2=.138$.

Arm Curls Test. Statistical analysis showed no significant interaction effect for time*group, $F(2,52)=2.138$, $p=.128$, partial $n^2=.076$ at any of the data collection time points. The main effect of time showed a statistically significant difference in arm curls at the 3 time points, $F(2,52)=30.593$, $p<.0005$, partial $n^2=.541$. The main effect of group did not show a statistically significant difference in arm curls between groups, $F(1,26)=3.731$ $p=.064$, partial $n^2=.125$.

2-Minute Step Test. There was no significant interaction effect between time*group for the 2-minute step test, $F(2,52)=1.048$, $p=.358$, partial $n^2=.039$ at any of the three data collection time points. The main effect of time showed a significant difference in steps at the 3 time points, $F(2,52)=37.344$, $p<.0005$, partial $n^2= .590$. The main effect of group did not show a significant difference in steps between groups, $F(1,26)=1.513$, $p=.230$, partial $n^2=.055$.

Chair Sit & Reach Test. There was no significant interaction effect between time*group for the chair sit & reach test, $F(2,52)=1.290$, $p=.284$ partial $n^2=.047$. The main effect of time showed a significant difference in inches reached at the 3 time points, $F(2,52)=34.784$, $p<.0005$, partial $n^2=.572$. The main effect of group did not show a significant difference in inches reached between physical function groups, $F(1,26)=2.730$, $p=.110$, partial $n^2=.095$.

Back Scratch Test. There was no significant interaction effect between time*group for inches reached on the back scratch test, $F(2,52)=1.102$, $p=.340$, partial $n^2=.041$ at any of the three data collection time points. The main effect of time showed a significant difference in inches reached at the 3 time points, $F(2,52)=14.705$, $p<.0005$, partial $n^2=.361$. The main effect of group did not show a significant difference in inches reached during the back scratch test between groups, $F(1,26)=2.202$, $p=.150$, partial $n^2=.078$.

8-Foot Up & Go Test. There was a significant interaction effect between time*group for the 8-ft Up & Go test, $F(2,52)=4.685$, $p=.013$, partial $n^2= .153$. The main effect of time also showed a significant difference between the three time points, $F(2,52)=32.932$, $p=<.0005$, partial $n^2=.559$ The interaction effect of time*group was significant at time point 1 $F(1,28)=7.321$, $p=.011$, $n^2=.207$ and time point 3 $F(1,28)=5.852$, $p=.023$, $n^2=.190$.

Discussion

It was the purpose of this study to better understand the relationship between self-reported exercise habits, fitness levels, and physical function. In addition, the effectiveness self-reporting to measure the amount of time spent exercising by older adults with varying functional ability and exercise habits was investigated. For this study, participants were placed into Group 1 (n=15) if they initially reported an estimated exercise time that was equal to or lower than 360 minutes per week. Group 2 (n=15) consisted of those participants who estimated averaging more than 360 minutes per week. The results of the statistical analyses suggest that exercise over time did not impact five of the six fitness components measured by the SFT more significantly for one group as compared to the other. Those five fitness components include leg strength, arm strength, cardiovascular endurance, lower extremity flexibility, and upper extremity flexibility. Participants who reported exercising more than six hours per week did not benefit more on these components from 10 weeks of exercise than those that reported exercising less than six hours per week. However, this was not the case when considering the results of the 8-foot Up & Go test. At two of the three data collection time points there was a statistically significant difference between the experimental groups. These findings suggest that perhaps six hours of exercise in a community-based setting such as the Athens YWCO is the threshold for considerably improving one's mobility, coordination, and dynamic balance associated with the 8-foot Up & Go task. The 8-foot Up & Go task is more complex in nature as compared to the other tests of the SFT. For example, rising from a chair, walking forward, changing direction, and returning to a seated position is much more involved than doing arm curls repeatedly from a seated position. This implies that in order to enhance functional ability related to more complex movements, a greater amount of routine exercise participation is required. An additional consideration is related to the

nature of the tests that were administered. Perhaps tests similar to the 8-foot Up & Go that are designed to be more sensitive and complex should be utilized to assess the physical fitness of older adults.

Another finding of interest is related to the physical function outcome measure, the CPF scale. There was no significant difference in CPF scores between groups at baseline or post-exercise during the study. Both groups contained individuals functioning at different levels (high, moderate, and low) as determined by the CPF scale. There was a minimal difference in the mean CPF scores between the two groups. This supports the notion that perceived ability related to daily tasks and functional independence is influenced by more than exercise and physical fitness. These findings help to put into perspective the role of exercise in maintaining physical function and raises questions regarding the influence of contributing factors. It should be considered, however, that the participant sample for this study was not typical of the average older adult population. The women in the study routinely far exceeded the ACSM guidelines and recommendations for adult exercise. It is likely that other samples of older adults would report exercising much less, thus possibly changing the relationship between exercise time, fitness, and physical function.

In conclusion, study findings suggest that perhaps six hours of exercise in a community-based setting such as the Athens YWCO is the threshold for considerably improving one's mobility, coordination, and dynamic balance as measured by the 8-foot Up & Go task. Also, further consideration should be given to utilizing tests similar to the 8-foot Up & Go that are designed to be more sensitive and complex when assessing the physical fitness of older adults. Finally, study findings support the notion that perceived ability related to daily tasks and functional independence is influenced by more than exercise and physical fitness. Self-report

instruments such as activity logs may be useful to track and gain an understanding of the exercise habits of older adults. The use of self-report instruments may have cognitive and physical benefits for older adults as keeping exercise logs requires the use of the highly complex task of recall and may also motivate individuals to be more active by holding them accountable for the amount of time they choose to be engaged in exercise.

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Table 4.1 Demographics and Clinical Features of Participants by Group

	Group 1 (0-360 min.)	Group 2 (360+min.)
# of Women	n=15 mean	n=15 mean
Age (years)	68.7	69.1
CPF (pre-)	21.3	22.6
CPF (post-)	21.9	23.7

Table 4.2 Senior Fitness Test Mean Scores

	Group 1 (0-360 min.)			Group 2 (360+ min.)		
	Pre-	**Mid-**	**Post-**	**Pre-**	**Mid-**	**Post-**
Chair Stands	13.2 (3.5)	16.1 (5.5)	17.4 (3.3)	16.5 (5.5)	19.9 (7.1)	23 (9.6)
Arm Curls	19.3 (3.9)	21.9 (4.6)	22.9 (3.9)	21.3 (5.4)	25.1 (5.3)	27.5 (6.3)
2-Minute Step	97.1 (24.1)	120.5 (24.7)	127 (26.5)	110.2 (20.1)	124.3 (22.4)	138.5 (16.8)
Chair S&R (inches)	1.5 (2.7)	3.0 (2.8)	4.2 (3.3)	2.9 (4.6)	5.1 (3.7)	6.8 (3.3)
Back Scratch (inches)	-2.8 (5)	-1.6 (4.1)	-.733 (3.9)	-.23 (3.9)	.54 (2.8)	.96 (3.0)
8-Ft. Up & Go (seconds)	7.5 (2.7)	6.2 (1.9)	5.8 (1.7)	5.5 (1.2)	5.1 (1.2)	4.6 (.87)

Graph 4.1 Chair Stands Test Mean Scores by Group & Time

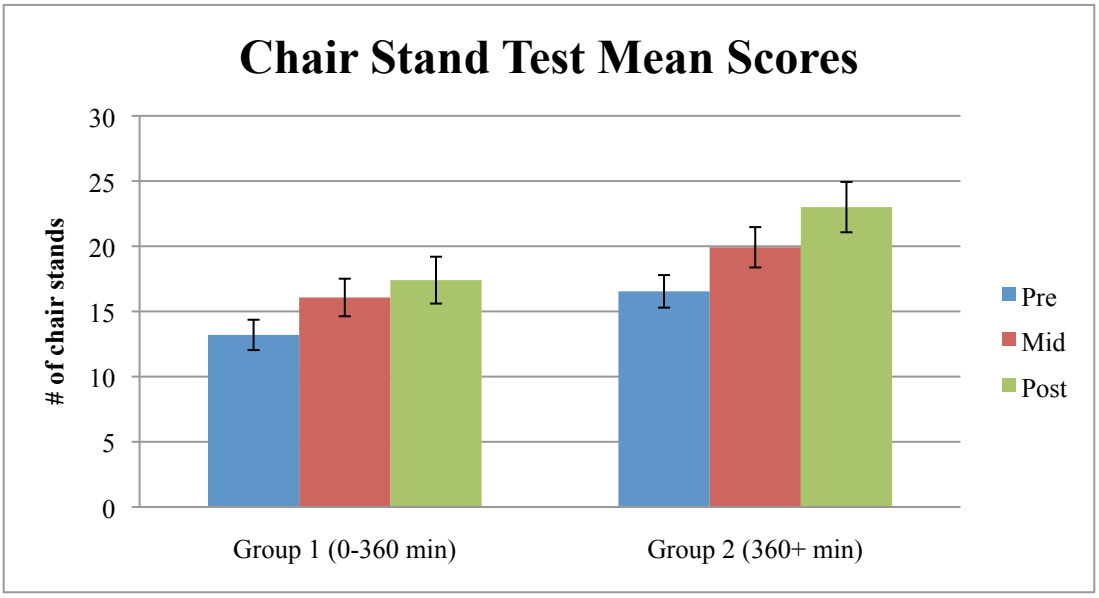


Table 4.2 Arm Curls Test Mean Scores by Group & Time

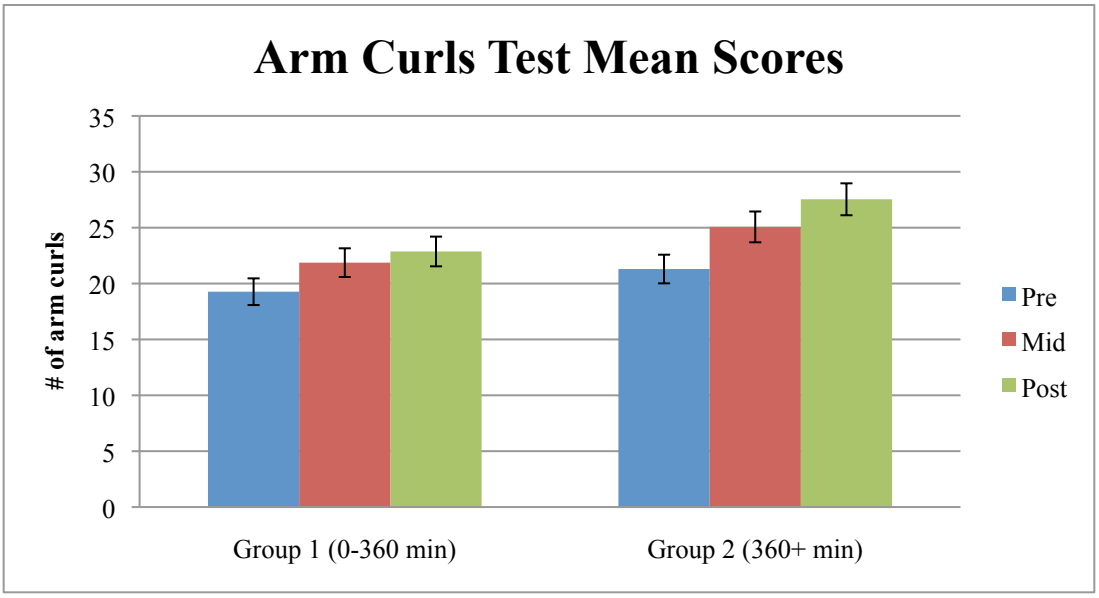


Table 4.3 2-Minute Step Test Mean Scores by Group & Time

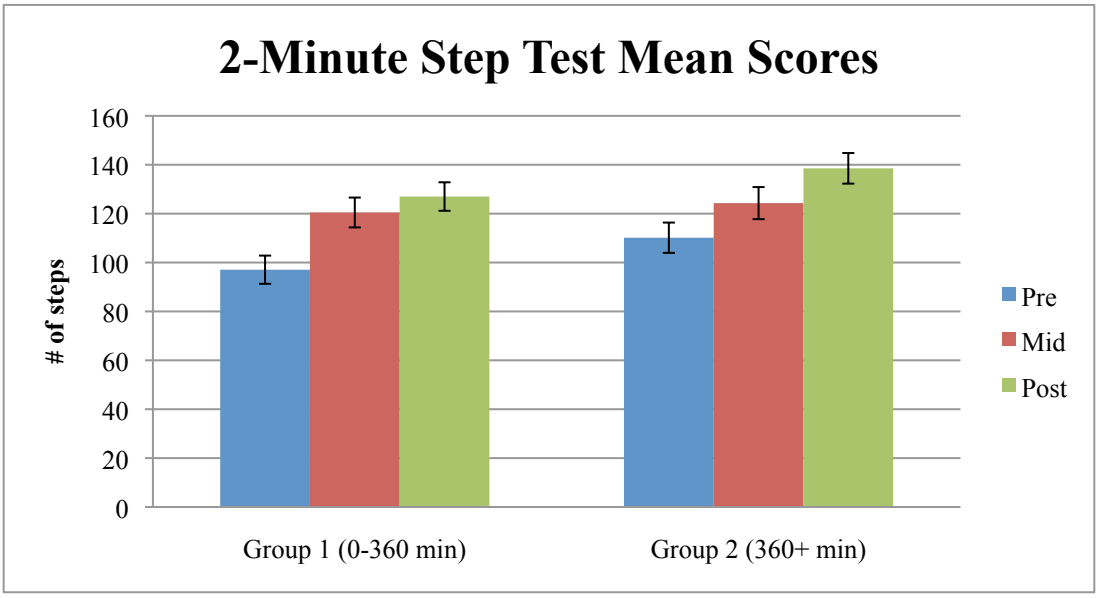


Table 4.4 Chair Sit & Reach Mean Scores by Group & Time

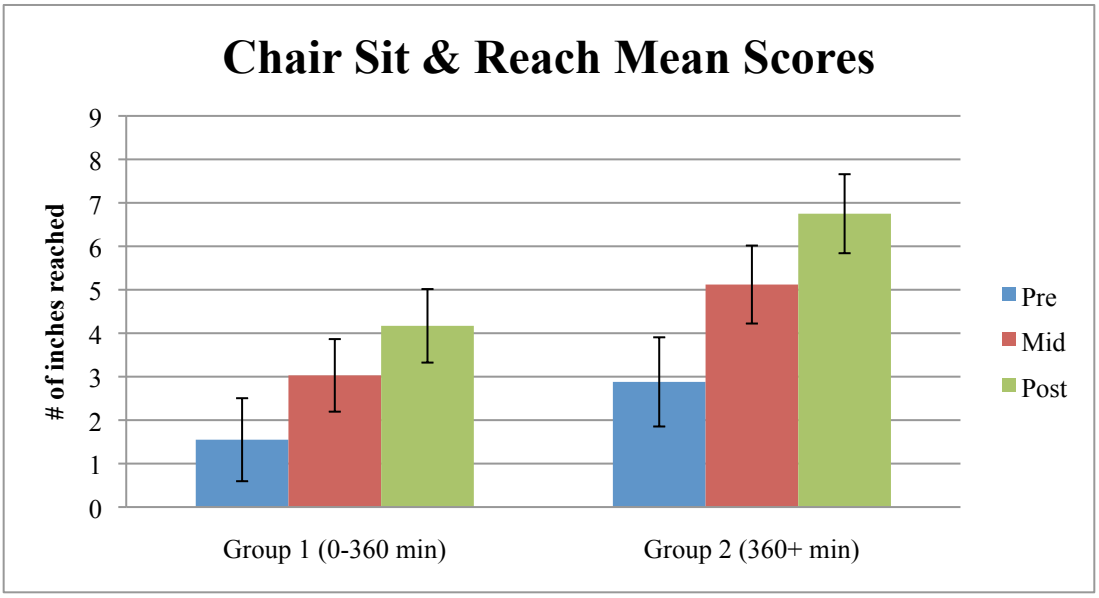


Table 4.5 Back Scratch Test Mean Scores by Group & Time

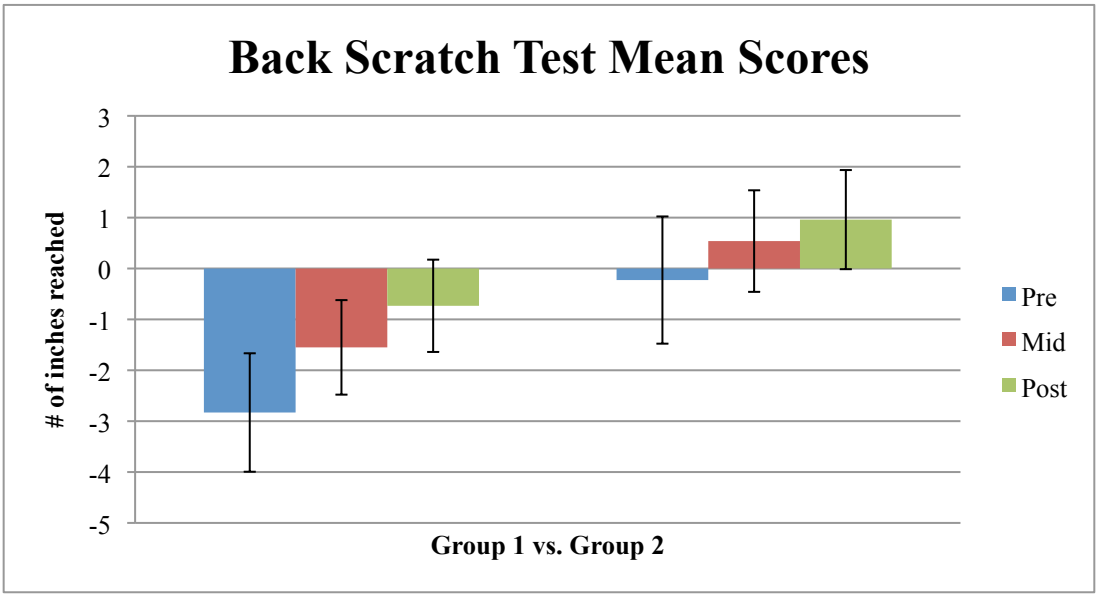
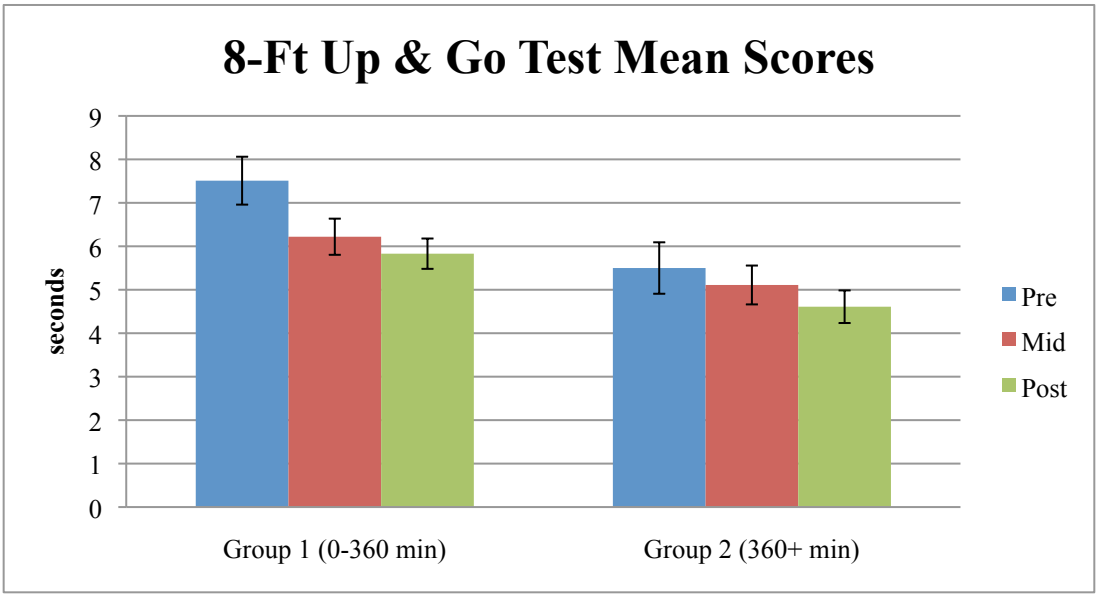


Table 4.6 8-Foot Up & Go Test Mean Scores by Group & Time



CHAPTER 5

CONCLUSIONS

Aging is often associated with declines in physical function affecting vital processes that are critical to independence, social engagement, and quality of life (Vaughan et al., 2012). Defined as the capacity of an individual to carry out the physical activities of daily living, physical function is an independent predictor of functional independence, disability, morbidity, and mortality (American College of Sports Medicine, 2011). A key component in preserving mobility and independence in later years is maintaining the fitness capacity needed to perform normal everyday activities such as lifting and carrying objects, climbing stairs, getting in and out of transportation vehicles, and walking far enough to do one's own shopping and errands (Paterson & Warburton, 2010). Smooth execution of functional movement patterns requires adequate levels of core, upper, and lower extremity strength, flexibility, mobility, and postural control. Older adults with functional limitations may no longer be able to appropriately utilize and execute movement patterns associated with activities of daily living (ADL) as a result of declining physical fitness. This type of progressive disability is severe as it limits the autonomy of older adults. Therefore, older adults need to practice, learn new, and relearn known motor skills as part of task training, recreational pursuits, or rehabilitation (Voelcker-Rehage, 2008). Community-based modes of exercise aimed to equip older adults with neuromotor (balance, coordination, and agility), physical (aerobic endurance, muscle strength, and flexibility), and functional components of fitness necessary for daily life need to be explored and further developed (Vaughan et al., 2012). Aging is an individual experience that has considerable variability. Learning how exercise affects individuals with varying levels of functional ability is important in order to better understand the role of exercise during the aging process. As part of

this line of research, two studies were performed. The first study investigated how different levels of physical function affect the response to exercise and maintenance of fitness in older adult women. The second study aimed to observe and compare the exercise habits of these functionally diverse older adult women. Specifically, the amount of time spent exercising was considered in relation to levels of physical fitness. Based on the findings from these two studies it has been concluded that community-based exercise programs offering a variety of exercise types to people with varying levels of functional ability, can be useful in maintaining or improving fitness and independence. Second, these programs may also be capable of improving the self-efficacy of lower functioning older adults toward performing daily tasks. Additionally, self-report instruments such as activity logs may be useful to track and gain an understanding of the exercise habits of older adults. The use of such tools may have cognitive and physical benefits for older adults and may also motivate individuals to be more active by holding them accountable for the amount of time they choose to be engaged in exercise.

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APPENDIX A

COMPOSITE PHYSICAL FUNCTION SCALE

Composite Physical Function (CPF) Scale

Even if you did not do the following activities, please indicate what you think your ability to do them during the past week would have been. Please circle the most appropriate response using the scale below:

I cannot do = 0
I can do with difficulty or with help = 1
I can do = 2

1. Take care of your own personal needs - like dressing yours
   0 1 2
2. Bathe yourself, using tub or shower
   0 1 2
3. Climb up and down a flight of stairs - like in a house
   0 1 2
4. Walk outside one or two blocks
   0 1 2
5. Do light household activities - like cooking, dusting, washing dishes, sweeping a walkway
   0 1 2
6. Do own shopping for groceries or clothes
   0 1 2
7. Walk 1/2 mile (6-7 blocks)
   0 1 2
8. Walk 1 mile (12-14 blocks)
   0 1 2
9. Lift and carry 10 pounds (full bag of groceries)
   0 1 2
10. Lift and carry 25 pounds (medium to large suitcase)
   0 1 2
11. Do most heavy household chores - like scrubbing floors, vacuuming, raking leaves
   0 1 2
12. Do strenuous activities - like hiking, digging in garden, moving heavy objects, etc.
   0 1 2

total score = _____

APPENDIX B

SENIOR FITNESS TEST SCORE SHEET

FINAL SENIOR FITNESS TEST RESULTS

Name:

	TEST 1 Date:	TEST 2 Date:	TEST 3 Date:
CHAIR STAND **Score:** **Percentile ranking:**			
ARM CURL **Score:** **Percentile ranking:**			
2-MINUTE STEP **Score:** **Percentile ranking:**			
CHAIR SIT & REACH **Score:** **Percentile ranking:**	inches	inches	inches
BACK SCRATCH **Score:** **Percentile ranking:**	inches	inches	inches
8-FT UP & GO **Score:** **Percentile ranking:**	seconds	seconds	seconds

APPENDIX C

WEEKLY EXERCISE LOG

Weekly Exercise & Physical Activity Record

Week # or Week of: _____

Record exercise and physical activity (include # of minutes per day for each activity)

Example: Monday – Treadmill (10 minutes), Silver Sneakers class (60 minutes)

Sunday	
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	