

**The effects of an outdoor recreational exercise program on selected physical abilities among elderly**

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**Abstract**

This study evaluated the effects of a 12 week outdoor recreational exercise program on the functional capacity of 45 sedentary elderly people, aged 60 to 75 years. The functional capacity variables were comprised of dynamic balance, muscular endurance, sit and reach flexibility, and muscular coordination. Participants were allocated to one exercise group (n= 30) and one control group (n=15). Exercise was performed for one hour twice a week for the experimental group, whereas the control group did not participate in any kind of exercise. Participants were pre and post-tested for the selected variables. Significant differences ( $p < .05$ ) were found between the exercise and non- exercise groups. The main effects of the training program were significant for all four variables examined, indicating that subjects who participated in the exercise program had a significant higher level of physical abilities than the control group. Findings are discussed in terms of design and measurement improvements and the need to focus research efforts on multiple components of wellbeing in relation to fitness level in the elderly.

Keywords: functional capacity, aging, exercise program

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### **Introduction**

Aging is a complex process involving numerous variables (e.g. genetics, lifestyle factors, chronic diseases) that interact with one another, greatly influencing the manner in which we age (Spirduso, 1995). In 1991, an estimated 31.8 million elderly adults resided in the United States, consisting of 19.0 million elderly women and 12.8 million elderly men (American Association of Retired Persons, 1992). In addition, by the year 2030, more than 22% of all Americans will be 65 or older. Thus, it is critically important to understand the biological and physiological changes that occur in increasing age, especially in women. Motor control research on older women is warranted due to the higher ratio of females to males in this age group, and the high risk of limiting conditions involving functional capacity (Horton, 1992).

Research has identified that age is related to the decline motor functions including endurance, reaction time, balance, flexibility, gait velocity, and muscle strength (Agre, et al., 1988; Raad, et al., 1988; Rikli & Edwards, 1991; Judge, Underwood & Gennosa 1993). For years, these performance declines were thought to be a normal and necessary consequence of aging. However, several recent studies indicate these declines relate more to lifelong physical activity level than to age. For example, older physically active women were found to have performance patterns of flexibility, balance, and reaction time tasks more similar to younger subjects than their older inactive peers (Rikli & Busch, 1986).

Based on these findings interest has emerged, which examines the relationship between musculoskeletal health and exercise in older adults (Vuori, 1995). Muscle mass, strength, power, and endurance are all important components of functional ability and are the major causes of limited mobility and activity (Avlund, et al., 1994), especially for women (Horton, 1992). It is worthwhile to emphasize that the improvement in muscle strength in old or very old people have been shown to be accompanied by better coordination, better balance, shorter reaction time, increased gait speed, and increased flexibility, all of which are important elements or indicators of mobility (Fiatarone et al., 1990). Elderly women who participated in a 25-week exercise program gained significant range of motion in ankle plantar flexion, shoulder flexion, shoulder abduction, and left

neck rotation (Raad, et al., 1988). Healthy elderly women were found to have higher performance levels, in comparison to frail elderly women on grip strength, movement time, kinematics movement characteristics, and basic functional movement abilities. As such, stronger individuals reacted and move faster, spent less absolute time in acceleration and deceleration, produced fewer adjustments in movements, and generated higher peak velocity and impulse (Meyer, Goggin & Jackson, 1995).

Spirduso and McRae (1990) stated that it would be extremely useful to know the contribution that different levels of muscle strength and power might make toward the prevention of injuries, accidents and fatalities at a very old age. In support of this position, Fiatarone, et al. (1990) demonstrated that enhanced motor unit recruitment and control was important for strength improvement as a result of resistance training. Thus stronger or strength-trained older individuals are more likely to show improved gross motor movements. Bassey et al. (1992) found significant correlation between leg power and functional gross motor performance activities, such as rising from a chair and walking up stairs, in frail elderly subjects.

Until recently little is known about the minimal amount of exercise needed to improve functional ability of women 60 years and over (Meyer, Goggin & Jackson 1995). In most studies, the frequency of exercise varied from 2 to 5 days per week ( $M=3.54$ ) and 54 min, sessions (McAuley & Rudolf, 1995). However the benefit of lower frequency training regiments has not been adequately addressed (Valliant & Asu, 1985) and, therefore, the minimum stimulus required to facilitate improvement of functional status is not well established in older populations. In an intervention study by Matsouka et al., (2003), it was indicated that the women who had participated in a three months exercise program, three or even two – times per week, reported significant improvements in all examined variables of functional ability. The authors of the present study hypothesized that older people who participate in regular outdoor physical activity program would improve their status on selected physical abilities in a relatively short time. The purpose of this study was to evaluate the effects of a well round outdoor 12-week exercise program, which focused on the basic physical abilities of sedentary elderly.

## **Methodology**

### **Sample**

Participants in this study were 45 healthy elderly people between the ages of 60 and 75 years ( $M=64.8$ ,  $SD= 4.7$ ), with their body weight averaging 80.59 kg ( $SD= 5.60$ )

and their height being 1.57 m ( $SD = .07$ ). Subjects were permanent residents in a town located in Northern Greece, members of the Public Care Institutes for the Elderly (PCIE), who had not been involved in any physical activity for at least 6 months before the exercise program began. The participants were assigned into one experimental group ( $n=30$ ) and one control group ( $n=15$ ). For the most part, the participants had graduated from a first-degree education (41.3%), while the majority of them were retired (61.5%). The participant's involved in the study had previous professions as civil servants (35.3%), and free professionals (32.3%). With regard to their familial situation the results showed that the majority of the participants (70.4%) were married, and lived with their spouse (70.4%). The majority of the participants (70.5%) had a moderate daily mobility level according to the AAHPERD exercise consent form for adults (Osness, Adrian, Mclark, Hoeger, Raad & Wisnell, 1990). Subjects had similar general health status. Specifically, the participants of this study did not suffer from seriously cardiovascular (coronary illness, infarction), respiratory, neurological diseases, or other serious orthopaedics problems. The more important problems of health that they faced were mainly orthopaedic related (34.4%), as well as problems of high pressure (31.5%), which did not constitute as an obstacle in their attendance in the research.

### **Questionnaire**

Physiological Measures: Since there are no national norms for the physical fitness of individuals over 60 years of age, the evaluation of the four parameters of functional ability of seniors was based on American Association for Health Physical Education Recreation and Dance (AAHPERD) Functional Fitness Assessment for Adults Over 60 (Osness et al., 1990). The correct procedures were explained and demonstrated to all subjects, and any questions about the testing were answered. The assessment for each subject lasted approximately 1 hr. The tests were administered in the following order:

1. Flexibility of the lower back, hip and posterior thigh was evaluated using the sit-and-reach test. The test used a box, which was placed on the floor with a scale measuring in cm with 23 cm supposed to be 0. Each subject sat with both legs extended, knees in contact with the floor, and placed its flexed feet against the lateral surface of the box. Participants then reached as far as possible toward or beyond its feet using smooth, consistent movement. The highest score of three trials was recorded.

2. The timed agility test was conducted on 31-ft course marked by traffic cones. The participants started from a seated position, stood up and walked as quickly and safely as possible around the marked course.
3. The timed manual coordination test required the subject to sit at a table and manipulate three soda pop cans on designated marking in the correct order.
4. The muscular strength and endurance test measured the number of seated biceps curls completed in 30 sec using the dominant hand. Females curled a 4-lb weight and males curled 6-lb weight.

### **Process**

The duration of the whole program applied was 12 weeks consisting of: 1 week of pretesting, 10 weeks of training through the intervention program, and 1 week post-testing. Prior to program onset, a trained exercise specialist demonstrated proper form and technique for each activity.

**Preprogram Procedures.** Prior to the enrollment in the training program, all subjects of the experimental group were required to provide a signed letter of clearance from their personal physician regarding their participation in the program. At the onset of the program, individuals were informed that they would be participating in an exercise program and were inducted on a brief demonstration of the program's content.

During the first week, both the experimental and control groups completed the Revised Physical Activity Readiness Questionnaire (PAR-Q; Thomas, Reading, & Shephard, 1992) and a short demographic questionnaire assessing age, height, and weight. Finally, the training program began with each participant being tested for the selected variables: dynamic balance; muscular endurance; sit and reach flexibility; and muscular coordination.

**Intervention Program:** The experimental group participated in the 10-week intervention program twice a week with each exercise session approximately 45 min in length. The control group did not follow any physical activity program. The training program was based on the Long Term Physical Activity Workshop (Ecclestone, 1997), and consisted of outdoor leisure activities and callisthenic exercises for the improvement of flexibility, general strength, coordination, and reinforcement of self-esteem and self-confidence. Specifically, the intervention phase took place in the natural environment and consisted of basics training components of fitness using wooden sticks, parts of the trees, and sandbags as well as, exercises using the weight of their body. The exercise intensity according to the American Heart Association varied 50 to 75% of their

maximum heart rate, as determined by a pilot study. Subjects were taught to monitor their pulse rate according to perceived exertion (Ecclestone, 1997).

Post program Procedures: At the conclusion of the 10-week training program, during the last week (12<sup>th</sup>), each participant completed once again the functional ability measures.

### Results

The normality of the distribution and the equality of variances for the four selected variables were checked through the Kolmogorov-Smirnov test for each group. The results for all variables revealed a normal distribution and equality of variances in all groups, with values in some cases approaching 1 ( $p \approx 1.000$ ). The Bartlett-Box and Cochran's C test used to check the differences among groups in the selected variables at the pre test revealed that there was no difference beyond the .05 level of significance for any of the groups.

The mean scores for pre and posttest were then examined through the t-test for paired group's analysis to determine if the experimental group comparing with the control had significantly improved in each of the four physical abilities. The analysis revealed that dynamic balance had significantly improved in the experimental group ( $t=7.99$   $p=.001$ ), while no significant difference was observed in the control group ( $t=1.56$   $p=.153$ ). The picture for the other three physical abilities was exactly the same, as far as the difference between pre and post-test is concerned. The t values for muscular endurance were: experimental group,  $t=-10.38$   $p=.001$  and control group  $t=0.71$   $p=.494$ . For flexibility the t values were: experimental group,  $t=-12.62$   $p=.001$ , and control group  $t=-.69$   $p=.509$ . Finally, for muscular coordination the equivalent t values were: experimental group,  $t=3.70$   $p=.002$ , and control group  $t=.81$   $p=.437$ . The scores for the pre and post-test for both groups on the selected variables are presented in Table 1.

**Table 1.** Means and Standard Deviations on Selected Physical Abilities among Elderly

EXPERIMENTAL GROUP		CONTROL GROUP	
Pre-program	Post-program	Pre-program	Post-program

VARIABLES	M	SD	M	SD	M	SD	M	SD
Muscular endurance(s)	23.46	4.01	32.10	4.40	21.50	2.99	21.90	3.60
Flexibility (cm)	22.50	5.40	34.13	5.60	26.50	6.57	26.70	6.91
Muscular coordination(s)	11.90	3.20	9.23	1.36	12.40	2.27	12.30	2.15
Dynamic balance(s)	24.70	3.52	22.90	3.01	27.51	3.69	27.51	3.69

### Discussion and Conclusions

The above-presented results reveal that the outdoor training program applied to the sedentary elderly produced significant improvements to all the selected physical abilities. The lack of improvement for the subjects of the control group gives additional support to the idea that the program applied was responsible for the improvement of the experimental groups. It seems that even a 10 week program is capable of producing significant changes to basic physical abilities, such as the ones selected for the present study. Significant improvements of elderly people on a number of physical abilities after following a training program have been reported by various researchers. Agre et al (1988), Brown, McCartney & Sale (1990), Nichols et al. (1993), Welsh and Rutherford (1996), and Frontera et al. (1988), have reported significant improvements on strength, while Raad et al. (1988) and Rikli and Edwards (1991) have found significant improvements on flexibility. Improvements on dynamic balance have been reported by Lord, Caphan & Ward (1993), Lord, Ward & Williams (1996), and Shumway-Cook et al. (1997), while Rikli and Edwards (1991) and Bouchard C., Shephard R.J. & Stephens (1994) have reported significant improvements on muscular coordination.

Although, most intervening programs last between three and six months, Mihalko and McAuley (1996) have reported significant strength improvements on subjects 71 to 101 years old after following an eight week training program. Nichols et al. (1995) have also reported significant strength improvements on men and women over 60 years old after following a strength training program twice a week for 12 weeks. Brown and Holloszy (1993) reported significant differences in the flexibility of elderly subjects after following a training program for 12 weeks, while Wolfson et al. (1996) claim that elderly people who participate three times a week on a training program can significantly improve their dynamic balance after 12 weeks. Frontera et al. (1990) also claim that two



thirds of the improvement in strength in elderly people can be achieved between 12 and 16 weeks time.

In the current study it was found that participation twice weekly produced significant improvements to sedentary elderly. The importance of this finding is that older sedentary elderly with limited free time can benefit from participating in exercise programs, which also calls for slightly reduced dropout rates, i.e. 27% with 1 day/week against 36% with 3 days/week (Oldridge, 1991). It should be noted that there was not a single dropout during the application of the program thus strengthening the findings of this study.

In conclusion, physical activity cannot retard the fundamental processes of aging, but well-trained individuals can gain the equivalent of mobility independence. Practical exercise prescriptions should take due account both of safety and of the special interests and needs of elderly women. While recreational exercise programs should take place twice weekly to produce results. A well-designed exercise regimen with various activities enjoyable to older people will induce pleasant tiredness and, at the same time, will initiate a slow but progressive improvement in general physical condition.

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