# Effects of a 5-year Exercise Program on Functional Performance of Older Adults

C. Jessie Jones, FACSM • Roberta E. Rikli, FACSM • Robin Wotipka California State University, Fullerton • Center for Successful Aging

### **ABSTRACT**

Few studies have investigated long-term effects of physical activity on the aging process. **PURPOSE:** The purpose of this study was to determine the effect of a 5-year exercise program on maintaining functional performance in older adults. METHODS: Over the five-year study, 40 older adults (19 men and 21 women) ages 61-82 were regular participants in the program. Four items from the Senior Fitness Test were used to measure aerobic endurance, upper and lower body strength, and agility/dynamic balance. Participants took part in a structured group exercise program that emphasized strength and aerobic conditioning for five years (75 minutes, twice per week) on a university campus. The exercise program included warm-up, aerobic training (treadmills, bicycles, and NuSteps), strength conditioning (pneumatic, plate weight, and free weight equipment), and cool-down. Exercise variables were adjusted to encourage a moderate-intensity work-out. Because of the extreme heterogeneity among older adults, this study looked at individual differences along with a traditional group design to analyze 5-year trends in physical performance scores. **DATA ANALYSIS:** To assess whether significant differences were evident between baseline and 5-year follow-up scores, repeated measures ANOVAs were conducted for each of the four dependent variables: chair stand, arm curl, six-minute walk, and 8 foot up and go scores. In addition, mean and standard deviations were calculated for the group in each of the five years. Percent change for each SFT item was also calculated between baseline and year five scores. **RESULTS:** With the exception of upper body strength, which improved significantly for both men and women between baseline and year 5 (p < .05), there were no statistically significant improvements or declines in the remaining three functional fitness measures. A high level of individual variability was evident for both genders across all test items. The variability in scores appears to be related to initial fitness level, adherence rate, and various medical/health conditions. Analysis of mean scores further indicated that, on average, aerobic endurance of regular exercisers declined approximately 3% in men and 2% women, and balance and mobility declined 5% for men. In addition, mean performance improved in lower body strength for men and women (6% and 8% respectively), and balance and mobility mean scores for women improved 2%). Refer to Table 1 and Figures 2-5. **DISCUSSION:** Because of differences in subject characteristics, assessment tools, exercise protocols, and analysis procedures, it is difficult to make meaningful comparisons with other studies investigating the effects of physical activity on the aging process. Despite not having a non-exercising control group which is a clear limitation of the study, the scientific literature clearly indicates significant declines in multiple fitness parameters among older adults who are physically inactive 5, 10-12, 14-15. **CONCLUSIONS:** A structured group-exercise intervention can be effective in reducing and/or reversing age-associated changes in functional performance.

# INTRODUCTION

Few studies have investigated long-term of physical activity on the aging process on older adults. In recent years, most short-term intervention or cross-sectional studies suggest that as much as 50% of the age-related decline in physiological parameters such as aerobic endurance and muscular strength can be preventable through appropriate exercise intervention 1-14. However, more longitudinal studies are needed to address the question of whether a structured, instructor-based strength and cardiovascular endurance program for older adults can reverse or slow age-related changes in strength, aerobic endurance, and functional mobility. **PURPOSE:** The purpose of this study was to determine the effect of a 5-year exercise program on maintaining functional performance in older adults.

#### **METHODOLOGY**

**Subject:** Eight-five community-dwelling older adults were recruited to participate in a university-based exercise program. At the beginning of the study, each participant completed an informed consent. Over the five-year study, 40 subjects were regular participants in the structured program (24 weeks/year), thus resulting in a final N of 40 older adults (19 men and 21 women) ages 61-82. Dropouts or inconsistent participation over the 5-year period were due to illness or injury, parking issues, schedule conflicts, moving from the area, loss of interest, and death.

Subjects completed a health-activity questionnaire and four physical assessments (arm curl, chair stand, 6-minute walk, and 8 ft. up and go) prior to the beginning of the study and then again each year over a five-year period. Participants took part in a structured group- exercise program for five years (75 minutes, twice per week, 24 weeks/year) on a university campus. The exercise program included warm-up, aerobic training (treadmills, bicycles, and NuSteps), strength conditioning (pneumatic, plate weight, and free weight equipment), and cool-down. Exercise variables were adjusted to encourage a moderate-intensity work-out. The average compliance (based on individual class attendance records for the five-year period) was approximately 78%, according to daily charts kept by the instructors.

# Instrumentation

Four items from the Senior Fitness Test 12 were used to measure aerobic endurance, upper and lower body strength, and agility/dynamic balance. Refer to Figure 1 for brief details of measurement protocols.

#### **Data Analysis**

To assess whether significant differences were evident between baseline and 5-year follow-up scores, repeated measures ANOVAs were conducted for each of the four dependent variables: chair stand, arm curl, six-minute walk, and 8 foot up and go scores. In addition, mean and standard deviations were calculated for the group in each of the five years. Percent change for each SFT item was also calculated between baseline and year five scores.

## **RESULTS**

With the exception of upper body strength, which improved significantly for both men and women between baseline and year 5 (p <.05), there were no statistically significant improvements or declines in the remaining three functional fitness measures. A high level of individual variability was evident for both genders across all test items. The variability in scores appears to be related to initial fitness level, adherence rate, and various medical/health conditions. Analysis of mean scores further indicated that, on average, aerobic endurance of regular exercisers declined approximately 3% in men and 2% women, and balance and mobility declined 5% for men. In addition, mean performance improved in lower body strength for men and women (6% and 8% respectively), and balance and mobility mean scores for women improved 2%). Refer to Table 1 and Figures 2-5.

#### DISCUSSION

Because of differences in subject characteristics, assessment tools, exercise protocols, and analysis procedures, it is difficult to make meaningful comparisons with other studies investigating the effects of physical activity on the aging process 5, 10, 11, 14, 15. Despite not having a non-exercising control group which is a clear limitation of the study, the scientific literature clearly indicates significant declines in multiple fitness parameters among older adults who are physically inactive. In the 60-90 year age range, typical declines in physical fitness parameters for both male and female are as follows: lower body strength, 15% per decade (1.5% per year) 11, 13; upper body strength, 10% per decade (1% per year) 1, 11; and aerobic endurance 10% per decade (1% per year) 6, 11-13, and functional mobility, 12% (about 1% per year) 11.

#### CONCLUSION

A structured group-exercise intervention can be effective in reducing and/or reversing age-associated changes in functional









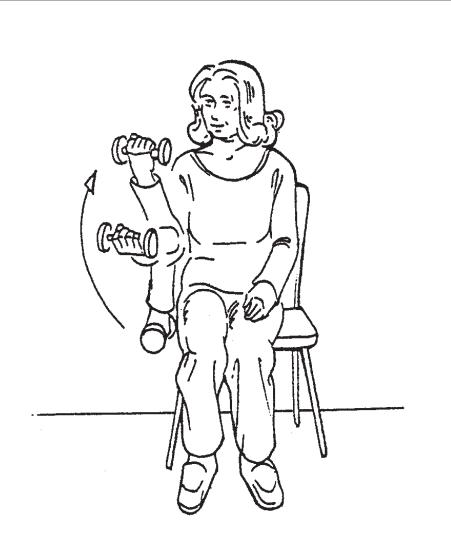




# **Functional Fitness Test Items—Brief Overview** Rikli & Jones (2001) Senior Fitness Test Manual, Human Kinetics

## Arm Curl

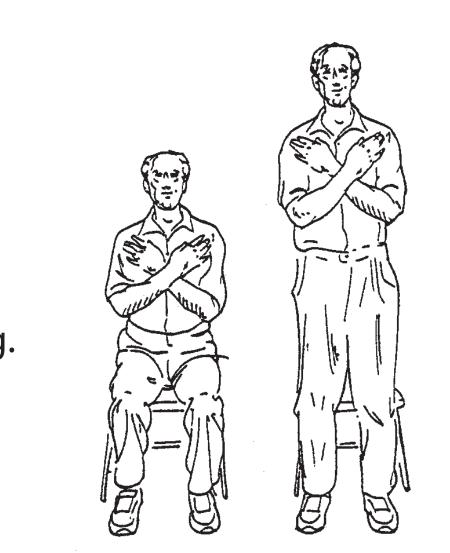
To assess upper body strength needed for performing household and other activities involving lifting and carrying things such as groceries, suitcases, and grandchildren.



### **30-Second Chair Stand**

To assess lower body strength, needed for numerous tasks such as climbing stairs, walking and getting out of a chair, tub, or car. Also reduces the chance of falling.

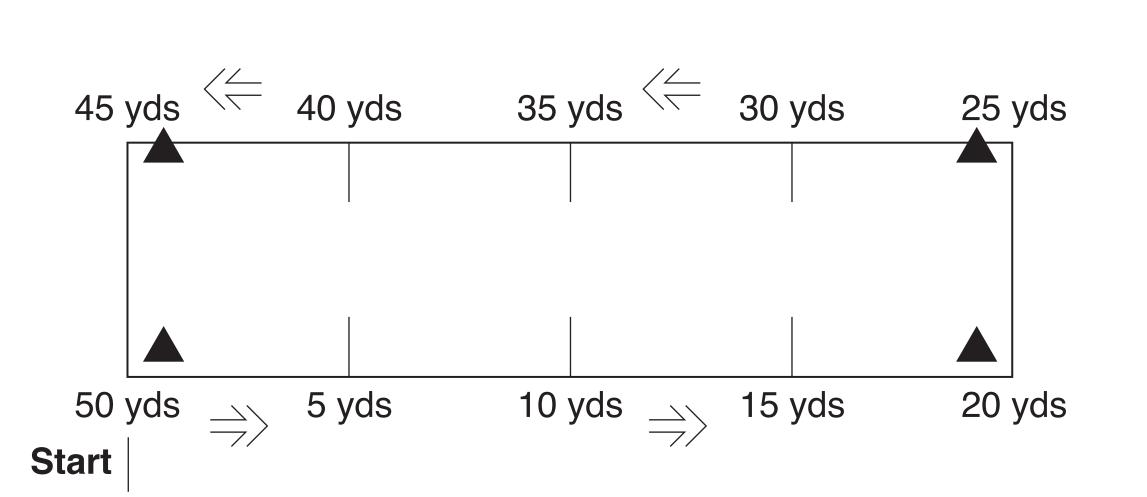
**Description:** Number of full stands that can be completed in 30 seconds with arms folded across chest.



#### 6-Minute Walk

The score is the total number of yards walked in 6 minutes to the nearest 5-yard (4.57-m) indicator. The test administrator or aide records the nearest 5-yard (4.57-m) mark.

50 yards (45.72-m) measured into 5-yard (4.57-m) segments



# 8-Foot Up-and-Go

To assess agility/dynamic balance, important in tasks that require quick maneuvering such as getting off a bus in time, or getting up to attend to something in the kitchen, to go to the bathroom, or to answer the phone.



**Description:** Number of seconds required to

get up from a seated position, walk 8 feet (2.44 m), turn, and return to seated position.

# Table 1 Functional Fitness Scores by Gender and Study Year

Age (yr)			Upper Body Strength  Arm Curl  (reps)			Lower Body Strength  Chair Stand  (reps)			Aerobic Fitness 6-Min Walk (yd)			Balance & Mobility 8-Ft Up & Go (sec)		
21	68	4	21	17.3	4.4	21	14.5	2.5	21	656	62	20	5.3	1.4
21	69	4	20	19.7	4.2	21	16.8	3.3	20	671	67	20	5.1	1.1
21	70	4	21	20.2	4.3	20	15.9	2.8	20	660	60	19	4.9	0.7
21	71	4	21	20.2	4.2	21	15.7	4.1	20	636	65	21	4.6	0.8
21	72	4	21	20.8	3.9	21	16.3	4.1	20	629	89	20	4.6	0.7
21	73	4	19	20.1	3.9	20	15.6	3.1	21	638	84	21	5.2	1.4
			2.7 <i>p</i> <.05			1.1			-18.0			-0.1		
				16%			8%			-3%			-2%	
19	72	5	19	15.8	4.4	19	14.3	2.8	18	675	68	19	4.8	1.1
19	73	5	18	18.3	4.5	17	15.5	2.6	14	692	87	17	4.9	1.0
19	74	5	18	19.6	4.5	18	15.7	3.2	16	698	94	18	4.9	0.9
19	75	5	18	19.2	5.2	17	15.8	3.3	18	686	92	17	4.6	0.8
19	76	5	18	19.2	4.6	19	14.7	3.2	16	665	112	17	4.8	0.9
19	77	5	19	18.5	5.4	19	15.1	2.8	19	659	119	16	5.1	1.1
				2.6 17%	<i>p</i> <.05		0.8 6%			-15.9 -2%			0.2 5%	
	21 21 21 21 21 21 19 19 19	(yr)  N  M  21  68  21  70  21  71  21  72  11  73  19  74  19  75  19  76	(yr)  N M SD  21 68 4 21 69 4 21 70 4 21 71 4 21 72 4 21 73 4  21 73 5 19 73 5 19 74 5 19 75 5 19 76 5	Age (yr)  N M SD N  21 68 4 21 20 21 70 4 21 21 71 4 21 21 72 4 21 21 73 4 19  19 72 5 19 19 73 5 18 19 74 5 18 19 75 5 18 19 76 5 18 19 76 5 18	Age (yr)  N M SD N M  21 68 4 21 17.3 21 69 4 20 19.7 21 70 4 21 20.2 21 71 4 21 20.2 21 72 4 21 20.8 21 73 4 19 20.1  2.7 16%  19 72 5 19 15.8 19 73 5 18 18.3 19 74 5 18 19.6 19 75 5 18 19.2 19 76 5 18 19.2 19 77 5 19 18.5	Age (yr)       Arm Curl (reps)         N       M       SD       N       M       SD         21       68       4       21       17.3       4.4         21       69       4       20       19.7       4.2         21       70       4       21       20.2       4.3         21       71       4       21       20.2       4.2         21       72       4       21       20.8       3.9         21       73       4       19       20.1       3.9         2.7       p<.05	Age (yr)  N M SD N M SD N  21 68 4 21 17.3 4.4 21 21 69 4 20 19.7 4.2 21 21 70 4 21 20.2 4.3 20 21 71 4 21 20.2 4.2 21 21 72 4 21 20.8 3.9 21 21 73 4 19 20.1 3.9 20  19 72 5 19 15.8 4.4 19 19 73 5 18 18.3 4.5 17 19 74 5 18 19.6 4.5 18 19 75 5 18 19.2 5.2 17 19 76 5 18 19.2 5.2 17 19 76 5 18 19.2 5.4 19  2.6 p<.05	Age (yr)       Arm Curl (reps)       Chair Star (reps)         N       M       SD       N       M       SD       N       M         21       68       4       21       17.3       4.4       21       14.5         21       69       4       20       19.7       4.2       21       16.8         21       70       4       21       20.2       4.3       20       15.9         21       71       4       21       20.2       4.2       21       15.7         21       72       4       21       20.8       3.9       21       16.3         21       73       4       19       20.1       3.9       20       15.6         2.7       p<.05	Age (yr)  N M SD N M SD N M SD N M SD  21 68 4 21 17.3 4.4 21 14.5 2.5 21 69 4 20 19.7 4.2 21 16.8 3.3 21 70 4 21 20.2 4.3 20 15.9 2.8 21 71 4 21 20.2 4.2 21 15.7 4.1 21 72 4 21 20.8 3.9 21 16.3 4.1 21 73 4 19 20.1 3.9 20 15.6 3.1  2.7 p<.05 19 72 5 19 15.8 4.4 19 14.3 2.8 19 73 5 18 18.3 4.5 17 15.5 2.6 19 74 5 18 19.6 4.5 18 15.7 3.2 19 75 5 18 19.2 5.2 17 15.8 3.3 19 76 5 18 19.2 5.2 17 15.8 3.3 19 76 5 18 19.2 4.6 19 14.7 3.2 19 77 5 19 18.5 5.4 19 15.1 2.8	Age (yr)  N M SD N M SD N M SD N M SD N  21 68 4 21 17.3 4.4 21 14.5 2.5 21 21 69 4 20 19.7 4.2 21 16.8 3.3 20 21 70 4 21 20.2 4.3 20 15.9 2.8 20 21 71 4 21 20.2 4.2 21 15.7 4.1 20 21 72 4 21 20.8 3.9 21 16.3 4.1 20 21 73 4 19 20.1 3.9 20 15.6 3.1 21  2.7 p<.05  19 72 5 19 15.8 4.4 19 14.3 2.8 18 19 73 5 18 18.3 4.5 17 15.5 2.6 14 19 74 5 18 19.6 4.5 18 15.7 3.2 16 19 75 5 18 19.2 5.2 17 15.8 3.3 18 19 76 5 18 19.2 4.6 19 14.7 3.2 16 19 77 5 19 18.5 5.4 19 15.1 2.8 19  2.6 p<.05  0.8	Age (yr)  N M SD N M SD N M SD N M SD N M  21 68 4 21 17.3 4.4 21 14.5 2.5 21 656 21 69 4 20 19.7 4.2 21 16.8 3.3 20 671 21 70 4 21 20.2 4.3 20 15.9 2.8 20 660 21 71 4 21 20.2 4.2 21 15.7 4.1 20 636 21 72 4 21 20.8 3.9 21 16.3 4.1 20 629 21 73 4 19 20.1 3.9 20 15.6 3.1 21 638	Age (yr)       Arm Curl (reps)       Chair Stand (reps)       6-Min Walk (yd)         N       M       SD       A       A       A       A       A       A       A       A       A       A       A       A       A	Age (yr)       Arm Curl (reps)       Chair Stand (reps)       6-Min Walk (yd)       8-Chair Stand (reps)         N       M       SD        N       M       SD       N       M       SD       N       M       SD       N       M       SD       N       M       SD       N       M       SD       N       M       SD       N       M       SD       N       M       SD       N       M       SD       A       A       10       10       10       10       10	Age (yr)       Arm Curl (reps)       Chair Stand (reps)       6-Min Walk (yd)       8-Ft Up & (sec)         N       M       SD       N       M       SD       N       M         21       688       4       21       17.3       4.4       21       14.5       2.5       21       656       62       20       5.3         21       699       4       20       19.7       4.2       21       16.8       3.3       20       671       67       20       5.1       2.1       4.9       2.8       20       660       60       19       4.9       2.1       4.6       21       2.0       8.9       20       4.6       21       5.2       2.

Figure 2 **Arm Curl Scores by Gender** 

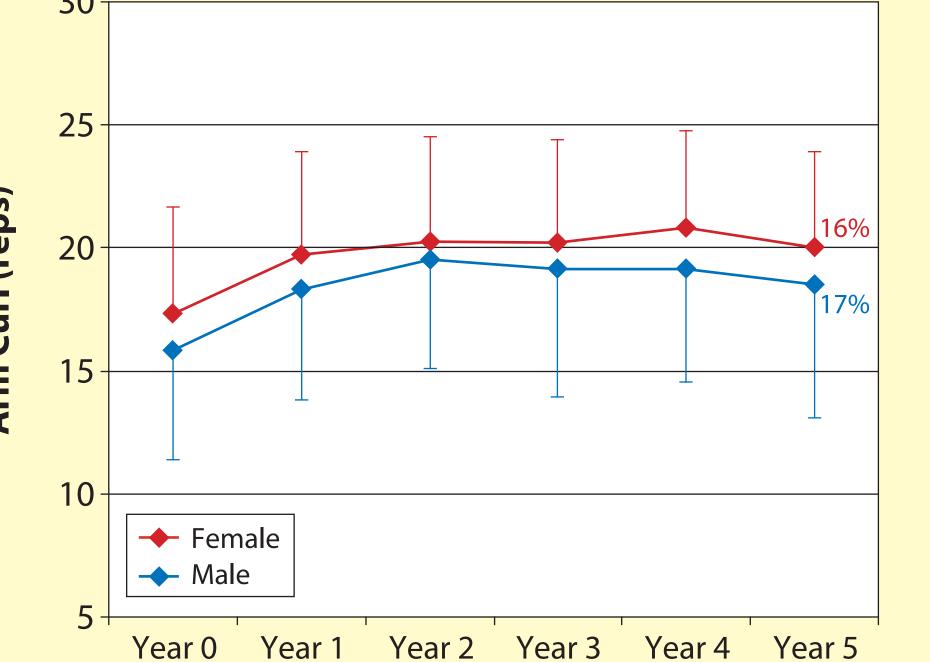
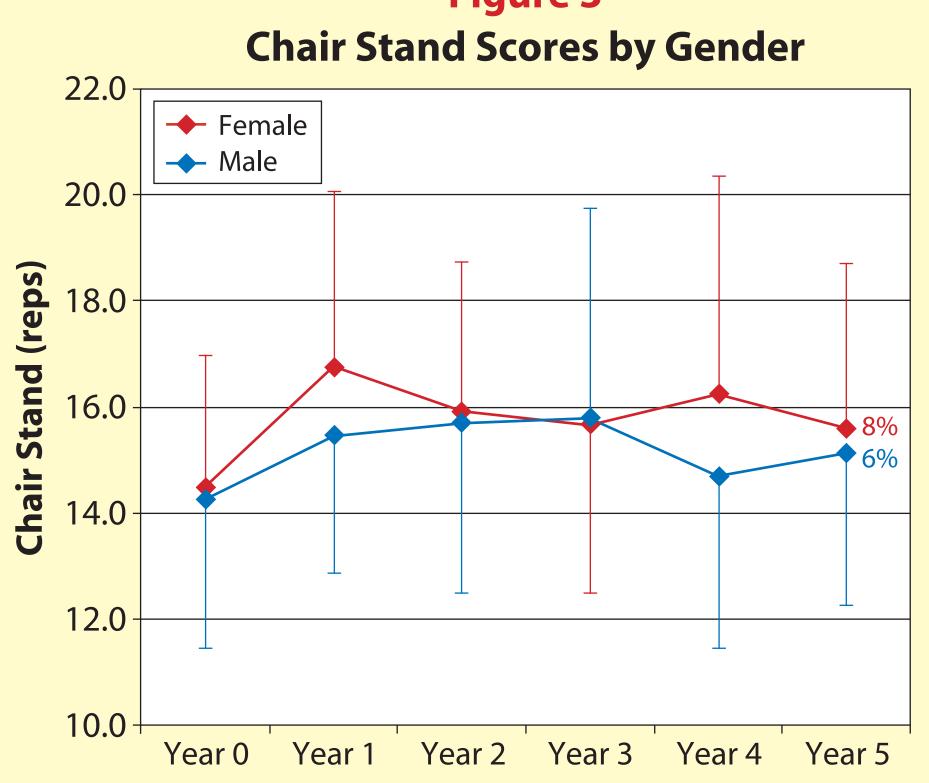


Figure 3



6-Minute Walk Scores by Gender

Figure 4

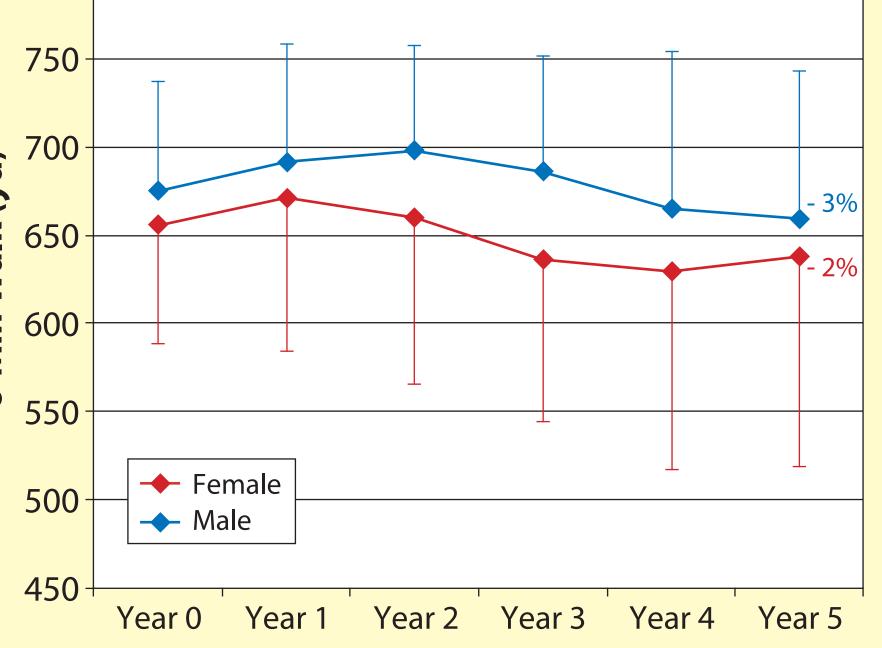


Figure 5 8-Ft Up & Go Scores by Gender

