

ORIGINAL SCIENTIFIC PAPER**Ilija Stijepić¹**¹School of Applied Medical Sciences Prijedor, Bosnia and Herzegovina**UDK: 796.012.11****DOI: 10.7251/SIZEN0119041S****EFFECTS OF A 12-WEEK STRENGTH AND BALANCE EXERCISE PROGRAM
ON FUNCTIONAL FITNESS OF OLDER MEN****Abstract**

For the majority of mature adults, the maintenance of independent functioning, intact cognitive abilities, and good mental status could be the most important achievements in late life. Functional fitness is defined as the physical capacity to perform daily activities independently and without the appearance of fatigue. Functional fitness can be measured using the Senior Fitness Test – SFT. The experimental group consisted of 30 men mean age 76,9±6,27. Participants completed a 12-week strength and balance exercise program. The participants were evaluated before and after completing the exercise program for lower- and upper-body strength, aerobic endurance, lower- and upper-body flexibility, agility and dynamic balance. To determine the changes in particular parameters, paired samples T-test was used. The statistical significance was set at $p < 0.05$. Statistically significant improvements were found in all tests.

Aging is a biological process which sooner or later affects the human organism. Aging is proces that changes the biochemical composition of the tissue and decline in functional abilities is inevitable. People who are physically inactive can lose as much as 3% to 5% of their muscle mass each decade after age 30, and the decline is even faster after age 60(Melton, Khosla, Riggs, 2000). Maximum oxygen intake- VO₂ max is one of the most important factors for determining the work capacity and the ability of elderly individuals to perform independendetly everyday activities and tasks. Age related VO₂ max. decline is approximately 0,75-1% per year or 10% per decade in sedentary individuals(Rogers et al. 1990; Hawkins & Wiswell, 2003). VO₂ max, decline is much lower in physically active individuals, about 5% per decade (Wiswell et al. 2001; Betik & Hepple, 2008) However,

people today reach higher average life expectancy and the number of elderly people is increasing. These aging trends have an economic and social impact and present challenges to families, and health care providers to meet the needs of aging individuals. For the majority of mature adults, the maintenance of independent functioning, intact cognitive abilities, and good mental status could be the most important achievements in late life. Functional fitness is defined as the physical capacity to perform daily activities independently and without the appearance of fatigue. Functional fitness can be measured using the Senior Fitness Test – SFT. SFT is designed to assess lower- and upper-body strength, aerobic endurance, lower- and upper-body flexibility, agility and dynamic balance (Rikli and Jones, 1999).

Most of aging-associated factors that affects the human organism can be reduced by a regular exercise (Bates et al.. 2009; Carvalho, Marques i Mota 2009; Cavani et al. 2002). Physical training provides the individual with positive influence on their own health, functional abilities and motor skills. In order to achieve positive effects of physical activity, it is necessary that the exercise programs are adjusted by the type, intensity, frequency and duration for each individual.

METHOD

The experimental group consisted of 30 men mean age $76,9 \pm 6,27$. The participants were recruited on a voluntary basis after we've placed an ad poster inviting people to participate in the exercise program in the local community and in a local geriatric center. Inclusion criteria included men aged 65 or more, independent in performing daily life activities and attendance rate over 80%. Exclusion criteria included major diseases or conditions such as severe heart disease, uncontrolled hypertension, dizziness and acute phase of other diseases.

Senior Fitness Test protocol developed by Rikli and Jones (1999) was used to obtain data. Senior Fitness Test measures physical parameters associated with functional ability. Test battery is used for assessment of the functional-fitness levels of people 60 years of age and older. The physical parameters of the subjects were evaluated before and after completing the exercise program for arm-curl test (upper extremity strength), chair-stand test (lower extremity strength), 2-min step test (aerobic endurance), 8-ft up-and-go (dynamic balance and agility), back-scratch test (upper extremity flexibility), and chair sit-and-reach test (lower extremity flexibility)(Rikli and Jones, 2013).

Participants completed a 12-week exercise program consisting of two 45 minute classes per week for first 5 weeks and three 45 minute classes per week for next 7 weeks. Each class

began with 10 minute warm-up and stretching activities followed by 30 minutes of strength and balance exercises and 5 minute cool-down and stretching activities.

The intensity and complexity of exercises increased during the program with the observed progress of the participants.

The collected data were processed using the Shapir-Wilk test in order to evaluate data distribution. To determine the changes in particular parameters, paired samples T-test was used. The statistical significance was set at $p < 0.05$. The procession and evaluation of data was carried out using the statistical software SPSS 16.0

RESULTS

Paired samples T-test was used to determine the changes in particular parameters of functional fitness. For each variable the mean value of the initial (initial) and final measurement, standard deviation, T-test value and level of significance was evaluated. The size of the effect for variables was calculated using Eta square.

Table 1. Results of Senior Fitness Test parameters pre and posttesting for elderly men with paired T-test calculations

TEST	Mean (SD)		Prosječna Razlika (Mean) (SD)	t (df=29)	p<0.05 (2-tailed)	Eta kvadrat
	Inicijalno Mjerenje	Završno mjerenje				
chair-stand test	12.470 (2.837)	14.170 (2.493)	-1,700 (1,664)	-5,596	0.000*	0.52
arm-curl test	17,930 (3,403)	18,570 (3,380)	-0,633 (1,245)	-2,786	0,009*	0.21
8-ft up-and-go	9,386 (3,236)	7,917 (2,176)	1,469(1,610)	4,998	0,000*	0.43
back-scratch test	-10.20 (6.915)	-8.90 (6.250)	-1,300 (1,705)	-4.176	0,000*	0.37
chair sit-and-reach	-5.83 (4.928)	-5.10 (4.923)	-0,733(1,437)	-2,796	0,009*	0.21
2 min. step test	100,07 (9,766)	100,87 (9,940)	-0,800(2,024)	-2,165	0,039*	0.14

Statistically significant improvements with significance set to $p < 0.05$ were found in all tests. By calculating the coefficient of the significance of the difference between the initial and the

final measurement (eta square) we concluded that the greatest impact of the exercise program was achieved in the chair-stand test and 8-ft up-and-go test, while the smallest impact was achieved with a 2 minute test step which was in line with expectations given that in the training program the emphasis was not on aerobic exercises.

DISCUSSION

Targeted lower and upper extremity strengthening exercises using the participants' own body weight and dumbbells as resistance and balance exercises were proved to be effective in significantly increasing measures of functional fitness in elderly subjects. Other researchers have demonstrated that targeted lower extremity training results in improved lower body strength in elderly subjects (Schlicht et al., 2001; Yates & Dunnagan, 2001). As reported by Rogers et al., balance depends on the sensory input and organization, muscular strength, coordination of activity, level of attention, disease and medications. The decrease in at least one of these factors leads to negative balance scores. Physical activity may decrease or eliminate several of these negative factors. Decline in the ability to maintain balance is associated with a decrease in lower extremity maximal and explosive force (Izquierdo et al., 199; Pržulj, 2007). Strength training has had a positive impact on improving gait safety and stability in the elderly population (Hess and Woollacott 2005; Pijnappels et al., 2008; Orr et al., 2008). Exercise program with elderly subjects conducted by Di brezzo et al. (2005) showed a significant improvements in the 8-ft up-and-go test, back-scratch test and chair-stand test. *Toraman, Erman, Agyar* (2004) conducted a 9 week multicomponent exercise program.

Their research has shown statistically significant improvement in 8-ft up-and-go test, chair-stand test and arm-curl test. Brovold et al. (2013), despite an exercise protocol with a high-intensity aerobic interval, found a small effect on SFT.

CONCLUSION

After completing a 12-week exercise program, we found statistically significant improvements with significance set to $p < 0.05$ for all measured variables. Our 12-week exercise program that targets subjects strength and balance can be effective and low-cost solution to improving older adults physical ability and health. Physical activity is critical to maintaining strength, flexibility and balance in this population. In addition to improving

physical ability, the benefit of completing the exercise program is the education of the elderly on the benefits of physical activity.

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