FUNCTIONAL FITNESS CHANGES REGARDING THE LEVEL OF PHYSICAL ACTIVITY IN OLDER ADULTS

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Abstract

The aim of this study was to determine the differences in the components of functional fitness regarding the level of physical activity in adults between 60 and 80 years of age. Senior Fitness Test (SFT) was used in a sample of 497 men and 446 women in order to determine the level of functional fitness, while International Physical Activity Questionnaire (IPAQ) was used to determine the level of physical activity. The analysis of variance (ANOVA) showed that old male subjects who belonged to high activity group had statistically significant results in comparison to the low activity group, in terms of upper and lower body muscle strength and lower body flexibility. Female subjects in high activity group also had statistically significant results in terms of strength and dynamic balance performance, compared to the women in the low activity group. Based on the obtained results and their analysis, it can be concluded that older people who belong to the high activity group have higher level of functional fitness in comparison to the low activity group. In this way, the old adults who are physically active can be functionally independent for a longer period of time while performing the activities of daily living, thus reducing the risk of falls and injuries.

Key words*: functional independence, physical activity, fitness, differences*

Introduction

The aging process is a biological reality that has its own dynamic, largely beyond human control, which is why the period between 60 and 65 years of age is considered as the beginning of old age in many developed countries (Gorman, 1999). Changes that occur during the aging are greatly affected by the inherited or genetic factors (Chodzko-Zajko, 1998), as well as by external factors such as diet, stress, smoking and physical activity (Bokovye & Blair, 1994). In order to be physically independent and able to take care of themselves, elderly must have certain level of motor skills, such as muscular strength, aerobic endurance, flexibility and agility / dynamic balance.

These abilities are associated with functional fitness, which is according to Rikli & Jones (2001) defined as a physical *capacity* to *perform normal* everyday *activities safely* and *independently without undue fatigue*. By improving the level of functional fitness, the elderly can get physical, social and economic benefit (Brill, 2004). Adequate physical activity and exercise programs are necessary for improving motor skills which are part of functional fitness (Nelson, Rejeski, Blair, Duncan, Judge et al. 2007, ACSM, 2009b). Physical activity refers to body movement produced by the contraction of skeletal muscles that result in energy expenditure (Caspersen, Powell & Christenson, 1985; ACSM, 2009a). According to the World Health Organization (WHO, 1997a), physical activity has positive and long-term effects in improving muscle strength, aerobic endurance, flexibility and balance performance in older people. Physical activity also limits the impact of secondary aging through restoration of functional capacity in previously sedentary older adults (ACSM, 2009a).

The lack of physical activity is considered as one of the biggest public health problems of modern society (Pedišić, Jurakić, Rakovac Hodar & Dizdar, 2011). The lack of adequate level of physical activity can lead to a decline in physical and physiological function of man, which can have negative impact on their normal daily activities (Collins, Rooney, Smalley & Havens, 2004). It is known that inactivity is associated with many types of chronic diseases such as coronary artery disease, stroke, hypertension, Type 2 diabetes, and osteoporosis (Katzmarzyk, Gledhill & Shephard, 2000). Although physical activity statistically significantly reduces the risk of chronic diseases associated with the advancing age (ACSM, 2009a), a small number of old adults are physically active.

According to the Department of the Environment, Sport and Territories in 1995, in Australia, only 13% of males aged between 60 and 69 and about 12% of females of the same age are vigorously active. For people aged between 70 and 78 years, 16% of males are vigorously active in comparison to only about 4% of females (Daley & Spinks, 2000). According to the data from the National Health Interview Survey (NHIS) in 2002, 74% of U.S. adults aged between 65 and 74 years did not engage in any regular leisure-time physical activity; 83% of those aged over 75 were not regularly active (Collins et al ., 2004). According to the data from 2002, in Europe, 79.6% of people over 65 were not involved in any vigorous physical activity during one week (European Opinion Research Group, 2003). The aim of this paper is to determine the differences in the components of functional fitness regarding the level of physical activity in people aged between 60 and 80 years.

Methods

The sample of examinees

The sample comprised of 943 people aged between 60 and 80 years, living independently in the community on the territories of the city of Niš and city of Kruševac in Serbia. Of the total number of subjects, there were 497 men and 446 women. All subjects were mentally and physically able to participate in the study.

The sample of measuring instruments

Senior Fitness Test (SFT)
Senior Fitness Test was used to assess functional fitness (Rikli et al., 2001). SFT is a battery of tests that measure the physical capacity of older adults to perform the activities of daily living. This battery of tests can be used in independent-living people aged 60 to 90 years and more. For the purposes of this study, 5 tests that are part of SFT batteries were used. Those were the following tests: 1. Chair Stand Test (to assess lower-body strength), 2 Arm Curl Test (to assess upper-body strength), 3. 2-Minute Step Test (to assess aerobic endurance), 4. Chair Sit-and-Reach Test (for assessment of lower-body flexibility) and 5. 8-Foot Up-and-Go Test (to assess the agility / dynamic balance). Rikli & Jones (1999a) established the adequate reliability of all test items used in the SFT test.

The validity of test items in the SFT test has been confirmed by the great number of authors (Rikli et al., 2001). There were two people involved in SFT measurement, one was writing down the data while the other was explaining the method of conducting the tests. All subjects were familiar with the research aim and its implementation, and there were no contraindications for SFT. The study was approved by the Ethics Committee of the Faculty of Sport and Physical Education, Niš, University of Niš, in accordance with the Helsinki Declaration of 1975 (WMA, 2008).

IPAQ questionnaire
A long version of International Physical Activity Questionnaire (IPAQ) for self-assessment was used to assess levels of physical activity. It includes four domains of physical activity: work-related, transportation, housework / gardening and leisure-time activity (IPAQ, 2002). Reliability and validity of IPAQ questionnaire has been confirmed in 12 countries (Craig, Marshall, Sjostrom, Bauman, Booth et al., 2003). Pedišić et al. (2011) determined the appropriate reliability of the Croatian version of IPAQ questionnaire. On the basis of the guidelines for calculating results of IPAQ questionnaires (IPAQ, 2005), the subjects were divided into three categories according to the level of physical activity: low, moderate and high. The difference in functional fitness among subjects has been determined according to these three categories.

Statistical analysis
Collected data have been analyzed in statistical program SPSS 17.0 (SPSS Inc., Chicago, IL). Each variable is represented by mean value and standard deviation (mean ± SD). To determine statistically significant differences in the components of functional fitness according to three levels of physical activity (low, moderate and high), we used univariate analysis of variance (ANOVA). Bonferroni test was used to determine which of three levels of physical activity distinguishes the subjects the most. To accept a statistically significant difference, significance level $p \leq 0.05$ was used.

Results

The results in Table 1 show that in men aged between 60 and 80 years, depending on the level of physical activity, there are statistically significant differences in three tests used in the SFT battery of tests, and those are: Chair-sit and reach test, Chair stand test and Arm curl test. Observing the differences in groups, men who belong to the low activity group had statistically significant weaker results in Chair-sit and reach test, in comparison to the moderate and high activity groups.

In Chair stand test, males in low group had statistically lower results than males in high activity group. In Arm curl test, men who belonged to high activity group had statistically better results in comparison to those in low and moderate group.

Table 1 Differences in the components of functional fitness depending on the level of physical activity in men (Mean ± SD)

Men (N=497)	Low	Moderate	High	p
Chair sit and-reach test (cm +/-)	-1.81±12.69*O	4.46±11.41O	1.16±9.43*#	0.00
8-foot up-and-go test (sec)	6.95± 1.59	6.98±1.39	6.75±1.63	0.46
Chair stand test (no. of stands)	11.81± 5.07*	13.70±5.12	14.11±5.81*#	0.00
Arm curl test (no. of reps)	15.27± 6.30*	14.45±4.79#	17.50±6.94*#	0.00
2-minute step test (no of steps)	91.14±24.97	93.23±24.10	91.46±23.44	0.93

*- determines statistically significant difference between low and high activity group
O- determines statistically significant difference between low and moderate activity group
#- determines statistically significant difference between moderate and high activity group

The results in Table 2 show that in women aged between 60 and 80, depending on the level of physical activity, there are statistically significant differences in three tests used in the SFT battery of tests: 8-foot up-and-go test, chair stand test and Arm curl test. Observing the differences between the groups, in all three tests, women who belonged to the low activity group had significantly lower results in comparison to the high activity group.

Table 2 Differences in the components of functional fitness depending on the level of physical activity in women (Mean ± SD)

Women (N=446)	Low	Moderate	High	p
Chair sit and-reach test (cm +/-)	1.78±15.15	3.33±11.94	2.03±10.78	0.718
8-foot up-and-go test (seconds)	7.25±1.49*	6.93±1.33	6.74±1.44*	0.02
Chair stand test (no. of stands)	11.30±5.28*	12.95±4.28	13.48±5.42*	0.00
Arm curl test (no. of reps)	10.64±5.15*	12.55±5.71	13.79±6.14*	0.00
2-minute step test (no of steps)	80.54±25.30	79.75±26.60	81.85±24.37	0.87
*- determines statistically significant difference between low and high activity group				

Discussion and conclusion

The results obtained in this research prove that in both male and female high activity group, the subjects had greater upper and lower body muscle strength than those in the low activity group (Table 1 and 2). The strength is a motor ability that manifests itself in almost all physical activities (Jorgić & Radovanovic, 2010), and is therefore extremely important for independent daily functioning of elderly people. According to Zatsiorsky & Kraemer (2006), the results of cross-sectional and longitudinal data proved that, in the period between 60 and 70 years of age, strength level drops by about 15% and then by 30% in the following age period; therefore, it is extremely important to develop and maintain strength in older people. According to Radovanovic & Ignjatovic (2009), the studies in which older people had relatively intensive trainings show that people in this age have the ability to increase their muscle power and strength performance by regular training. Lower body muscle strength is important for performing daily activities such as: climbing stairs, walking distance, rising from a chair, etc.., while the upper body muscle strength is important while carrying food supplies and for many other common tasks (Rikli et al., 2001). Due to the above mentioned daily activities in which muscular strength of elderly is expressed, high level of physical activity is important because they increase and maintain muscle strength, but also allow them to function independently for longer period of time. Male subjects who belonged to high and moderate activity group had higher flexibility in comparison to the subjects from the low activity group (Table 1). Aging is associated with changes in the elasticity and compliance of connective tissue, which results in statistically significant decreases in flexibility and range of motion (Chodzko-Zajko, 1998). Irregular shape, tighter meshing and decreased linear pull in collagen tissue leads to decreased flexibility with aging (Daley et al., 2000). Sit and reach test shows that flexibility declines about 15% per decade, while the greatest decline can be noticed in elderly people (Spirduso, Francis & MacRae, 2005). If the decline in flexibility and range of motion are caused by aging, there is evidence which prove that the reduced flexibility is the result of reduced physical activity of elderly persons (Campanelli, 1996). According to Spirduso et al. (2005), a decline in flexibility appears due to physical inactivity. Together with the strength loss, declining flexibility plays an important part in increasing the risk of falls and injuries among elderly people (ACSM, 2006). Therefore, as it is the case with muscle strength, it is necessary to maintain a higher level of physical activity among elderly in order to preserve flexibility and range of motion. Physical activity should include exercises of moving the joints through their complete range of motion (Spirduso, et al., 2005) and tretching exercise is recommended (Rider & Daly, 1991).

Female high activity group had better-developed dynamic balance compared to the low activity group (Tbl 2). With the aging process, there are also changes in musculoskeletal and sensory system that disturb the balance and postural status, which can lead to undesirable falls in the elderly (Lord & Ward, 1994). Balance impairment has been identified as a primary risk factor in the occurrence of falls (Tinetti, Speechley, Ginter, 1988).

According to Voorrips, Lemmink, et al. (1993), the *more active the individual, the less the degree of postural sway*. This is one more reason why physical activity in older adults is important. Rikli & Busch (1986) found that *older* females who *participated* in *vigorous activity* from *periods* ranging from *6 weeks* to *10 years* showed *better balance* performance *than inactive* females of the same age. On the basis of the results and their analysis, it can be concluded that older people who belong to high activity group have higher level of functional fitness in comparison to the low activity group. Higher level of physical activity contributes to higher values of functional fitness, in other words - greater development of motor skills, especially strength, flexibility performance and the dynamic balance. In that way, physically active older people can be independent in performing the activities of daily activities for a longer period of time, also reducing the risk of falls and injuries.

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PROMJENE FUNKCIONALNOG FITNESA U ODNOSU NA RAZINU TJELESNE AKTIVNOSTI STARIJIH OSOBA

Sažetak

Cilj ovog istraživanja bio je utvrđivanje razlika u komponentama funkcionalnog fitnesa u odnosu na razinu tjelesne aktivnosti odraslih osoba uzrasta između 60 i 80 godina. "Senior Fitness Test" (SFT) je korišten na uzorku od 497 muškaraca i 446 žena s ciljem utvrđivanja funkcionalnog fitnessa, a "International physical Activity Questionnaire (IPAQ) je korišten za utvrđivanje razine tjelesne aktivnosti. Analiza varijance (ANOVA) pokazala je da stariji muškarci koji pripadaju grupi jako aktivnih imaju statistički značajne rezultate u usporedbi sa grupom slabo aktivnih u smislu snage gornje i donje muskulature tijela, kao i fleksibilnosti donje gdijela tijela. Žene u grupi jako aktivnih također imaju statistički značajno bolje rtezulteta u smislu snage i izvođenja dinamičke ravnoteže u usporedbi sa ženama slabo aktivbe grupe. Temeljem dobivenih rezultata i analiza, može se zaključiti kako starije osobe koje pripadaju grupi jako aktivnih osoba imaju višu razinu funkcionalnog fitnesa u odnosu na grupu slabo aktivnih. Na taj način, tjelesno aktivne osobe starijeg uzrasta mogu biti funkcionalno nezavisne u duljem razdoblju vremena dok se bave zadaćama svakodnevnog življenja, kao id a reduciraju rizike pada i povreda.

***Ključne riječi**: funkcionalna nezavisnost, tjelesna aktivnost, fitnes, razlike*

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