

CARDIORESPIRATORY FITNESS OF MEN AND WOMEN OVER 60

(Research note)

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Abstract

Older people nowadays show less ability when performing everyday activities as compared to their peers in the past. The aim of this study was to determine the difference in cardiorespiratory fitness of the elderly. The sample comprised 1290 subjects (691 men and 599 women), aged 60-80. The sample was divided into the sub-sample of younger-older group of men and women (aged 60-69) and the sub-sample of old-old group of men and women (aged 70-80). To assess the cardiorespiratory fitness of older people the Senior Fitness Test was applied, comprising six measures of physical fitness: shoulder mobility, straddle at a chair, eight feet, getting up from a chair in 30 seconds, flexion of the elbow joint, two-minute step test. Results were analyzed by SPSS 17.0. In addition to descriptive parameters for each variable to determine the differences between subjects age groups, analysis of variance (ANOVA) was used, at the level of statistical significance of $p < 0.05$. There was a statistically significant difference in cardiorespiratory fitness in the following parameters: heart rate at rest, mean heart pressure, systolic blood pressure, diastolic blood pressure, mean arterial pressure and the two-minute step test. Aging is a normal physiological phenomenon, but the quality of life of older people can influence their health and cardiorespiratory capacity.

Keywords: *Senior Fitness Test, heart rate at rest, mean heart pressure, step test, Anthropometric measures, Body mass index (BMI) body weight body height, quality of life, analysis of variance (ANOVA)*

INTRODUCTION

In terms of age Duraković and associates (1990) in the category of very old people include people over 90. The aging process inevitably leads to different changes in the body of the old. Aging as a normal physiological phenomenon may be accompanied by disease, but it is necessary to preserve the health and functional capacity. Many studies have shown that physical activity has a beneficial effect on the quality of life in the patients with depression (Singh et al., 1997), coronary heart disease (Lavie & Milani, 1997), dysfunction of multiple organs (Wehler et al., 2003). It also reduces the risk of diabetes, hypertension, cancer, and almost all causes of death (Di Pietro, 2001; Lim & Taylor, 2005).

In the group older than 85, there is a significant increase in the percentage of functionally incompetent person (Despot Lučanin, 2003). Some authors state that at least 50% of the change attributable to aging populations of the developed world is one of the atrophy as a result of inactivity (Mišigoj-Duraković, 2005).

While aging muscle mass and bone density, endurance

and strength are reduced, increasing subcutaneous fat, causing visible problems when walking, carrying things, climbing stairs (Adams, O'Shea, O'Shea, 1999). Changes in the body of the elderly occur in the respiratory system, skeletal muscle, basal metabolic rate, bone and joint structure (Andrijasević, 1996). Due to the decrease in motor skills, there are falls and injuries of the locomotor system (Drought, 1994). Compared to earlier generations, Keogh (2003), states that the present generation of older people shows less ability in performing daily activities. Aging and sedentary life leads to reduced elasticity and permeability of the great arteries, and an increase in systolic blood pressure. Active lifestyle can reduce the effects of the disease and prolong the period of active life (Fries & Crapo, 1981). Age is not necessarily connected with the rapid decreasing of working capacity and when talking about the capacity for physical work, physiological age is a better indicator than the chronological age (Sharkey, 1987).

Various studies indicate that movement, exercise and

engaging in any cultural or creative activities positively affect the health and better functioning of all organ systems, which directly affects better functional ability of older people (Kovačić, Strinović, Tisma, 1999).

The aim of this study was to determine the differences in functional and cardiorespiratory fitness in people aged 60-69 and 70-80.

METHODS

The study included 1,290 respondents of both sexes, aged 60 to 80 (691 men, average aged 67.73 ± 6.61 was divided into four age groups:

1. Women 60-69 (N=357),
2. Men 60-69 (N=449),
3. Women 70-80 (N=242),
4. Men 70-80 (N=242).

The age of the subjects ranged from 60-91. The participation in the study was voluntary and all subjects were able to withdraw at any time during testing. The study was approved by the Ethics Committee of the Faculty of Sport and Physical Education, University of Nis, in accordance with the Helsinki Declaration. All subjects were first informed of the possible consequences of testing as well as of the benefits for their age population. Testing was conducted from October to December, 2011. All subjects were physically and mentally able to participate in the study. The selection criteria for his study were: age between 60 and 80, physically independent entities- able to walk 20 meters without assistance or rest without cognitive impairment and dementia, so that their score in the mini- mental scale is 24 points for the educated and 18 points for the uneducated (McDowell and Newell, 1996). Subjects who were in the recovery phase of an acute illness, the deaf and the blind were excluded. Also, the survey did not include individuals with cardiovascular system disorders because of the potential risks during physical fitness testing.

The people competent for this transversal research first conducted a standard interview with potential subjects individually or in small groups in their homes or in the active centers for the elderly. Each subject first provided his demographic characteristics and then anthropometric measuring and the Senior Fitness Test (SFT) began.

Anthropometric measures were measured according to the International Biological Program - IBP (Weiner & Lourie, 1969). Body height was measured using a measuring tape as precise as 0.1 cm. Body weight was estimated using the decimal scale precision of 0.1 kg. Body mass index (BMI) was calculated indirectly on the basis of the recorded values of body weight and height using formula $BMI = \text{body weight (kg)} / \text{body height (m}^2\text{)}$.

To assess the functional fitness of older people the senior fitness test was used. This test assesses the physiological capacity to perform normal daily activities independently and safely without experiencing fatigue. Before the test subjects initially did a 10 minute warm-up coached by a trained person, and then performed

a complete SFT in the order of the tasks listed in this test (Rikli and Jones, 2001). This test was validated by Rikli and Jones (1999). The test consists of six measures of physical fitness: 1) the mobility of the shoulder, 2) straddle at a chair, 3) eight-foot, 4) getting up from a chair in 30 seconds, 4) flexion of the elbow joint, 5) two-minute step test. The mobility of the shoulder estimates the flexibility of the upper extremities. Each subject performed two test attempts and two that were measured and included in further analysis. The result is the shortest distance between the stretched middle finger of both hands. Straddle at a chair is the test that assesses the flexibility of the lower extremities. As with the previous test, each subject performed two test trials and two attempts that were measured and included in further analysis. The result is the largest distance between stretched out fingers and the tips of the toes. Test 8 feet assesses agility and dynamic balance. Each of the subjects performed a trial attempt and two that were measured and later analyzed. The result is the fastest time achieved by the time of getting up from a chair, moving approximately eight feet, turn and return to sitting position. Rising from a chair is a test that assesses the strength of the lower extremities. Each subject had two test attempts and then access protocol, which involves measuring the maximum number of stand-ups that the subject can perform in 30 seconds. Test flexion of the elbow joint estimates the strength of the upper extremities. Each of the interviewees initially did two test attempts and completed the test in 30 seconds. As a result, the total number of reps with the entire range of motion performed in 30 seconds is calculated. Two-minute step test is a test that assesses muscular endurance. A subject facing the wall should do the maximum number of steps up to the specified height, in two minutes. The test is performed only once and the subject during the test does not run, but walks as fast as possible.

To evaluate blood pressure of the subjects automatic digital meter OMRON M4-1 (OMRON Healthcare Europe BV, Netherlands) was used. The cuff was positioned around the forearm of the male and female subjects at around three centimeters above the elbow, in a sitting position. The results were read in mmHg. Before the measuring, the subjects rested in a seated position. Three minutes of rest was given to subject in between three successive readings of blood pressure. Although the three readings were different with the largest value being the first reading and the smallest being the third reading on average, these differed by no more than 2 mmHg of the systolic blood pressure, and no more than 4.5 mmHg of diastolic blood pressure. We chose to take an average of the second and third readings as recommended by World Health Organisation (WHO, 2004) in order to increase the degrees of freedom for the mean.

The results of mean values of heart pressure (SVSP) and mean arterial pressure (SAP) were obtained by the following formulas:

$$SVSP = (\text{systolic pressure} + \text{diastolic pressure})/2$$

$$SAP = \text{diastolic pressure} + 1/3(\text{systolic pressure} -$$

diastolic pressure) (Zahorec et al., 2010).

The double product (DP) and pulse pressure (PP) were obtained by the following formula:

DP = systolic blood pressure x heart rate variability (Hermida et al., 2001).

PP = systolic pressure - diastolic pressure (Blacher et al. 2000).

The collected data were analyzed using SPSS 17.0 statistical package SPSS Inc., Chicago, IL. Descriptive statistical parameters were calculated for each variable. To determine the differences between the age groups

which subjects belonged analysis of variance (ANOVA) was used. Statistical significance was set at $p < 0.05$.

RESULTS

Tables 1 and 2 show the results of descriptive parameters of cardiorespiratory fitness in men and women in relation to age.

Tables 3 and 4 show the univariant analysis of variance / T-test of cardiorespiratory fitness in men and women divided into groups per age 60-70 and 70-80

Table 1. General descriptive parameters of cardiorespiratory fitness in men in relation to age

Variables	Men		
	60-70 N=449	70-80 N=242	Total N=691
Age	63,87±2,77	74,28±3,12	67,73±6,61
Height (cm)	176,34±8,78	174,50±11,79	175,62±9,78
Weight (kg)	82,33±12,01	82,65±15,10	82,26±31,33
BMI (kg/m ²)	26,65±6,26	27,95±2,72	27,04±13,88

Table 2. General descriptive parameters of cardiorespiratory fitness in women in relation to age

Variables	Women		
	60-70 N=357	70-80 N=242	Total N=599
Age	63,75±2,89	73,93±2,94	69,23±7,81
Height (cm)	164,67±6,48	166,48±37,35	165,17±23,12
Weight (kg)	70,64±12,81	68,84±11,74	69,74±12,44
BMI (kg/m ²)	26,10±4,94	25,46±4,48	25,83±4,73

Table 3. Differences in cardiorespiratory fitness in men in relation to age

Variables	Men			p
	60-70 N=449	60-70 N=449	Total N=691	
Heart rate at rest (bp/min)	72,37±8,14	70,73±8,83	71,79±8,42	.018
Mean value of blood pressure (mm/Hg)	107,62±12,02	110,15±12,67	108,57±12,32	.021
Systolic blood pressure (mm/Hg)	131,55±17,49	135,51±17,17	133,03±17,46	.011
Diastolic blood pressure (mm/Hg)	83,13±11,12	84,79±12,23	83,76±11,57	.107
Heart rate under load (bp/min)	109,55±24,15	108,67±28,16	109,25±25,60	.687
Double product	9548,39±1783,21	9540,13±1700,01	9545,32±1751,17	.958
Pulse pressure (mm/Hg)	48,97±12,84	50,72±15,73	49,62±14,00	.160
Mean arterial pressure (mm/Hg)	99,29±11,31	101,53±11,95	100,13±11,60	.030
Two-minute step test (steps)	73,01±43,35	59,76±37,62	68,48±41,93	.000

Table 4. Differences in cardiorespiratory fitness in women in relation to the age

Variables	Women			P
	60-70 N=449	70-80 N=242	Total N=691	
Heart rate at rest (bp/min)	72,10±8,67	70,13±10,86	71,27±9,69	.017
Mean value of blood pressure (mm/Hg)	107,60±21,92	109,99±14,03	108,61±19,01	.176
Systolic blood pressure (mm/Hg)	134,13±40,37	136,48±18,65	135,12±32,98	.444
Diastolic blood pressure (mm/Hg)	81,08±10,65	83,51±13,56	82,10±12,01	.029
Heart rate under load (bp/min)	104,43±22,33	103,45±27,64	104,02±24,67	.649
Double product	9697,00±3335,88	9545,31±2099,30	9632,51±2874,10	.576
Pulse pressure (mm/Hg)	53,05±19,55	52,96±16,60	53,02±17,80	.977
Mean arterial pressure (mm/Hg)	98,58±16,37	100,99±13,30	99,60±15,18	.088
Two-minute step test (steps)	64,57±38,98	53,35±36,44	60,14±38,36	.000

DISCUSSION AND CONCLUSIONS

The aging process leads to some amazing changes in human health, associated with physical fitness, body composition, muscular strength, a process known as sarkopenia (Evans, 1997), changes related to endurance, cardiorespiratory fitness, and flexibility (Raab, Agre, McAdam, & Smith, 1988).

After examining the results in Table 1, based on the applied variables it can be concluded that a group of men from 60- 70 had the average value of the height 176.34 ± 8.78 , weight 82.33 ± 12.01 and BMI 26.65 ± 6.26 . Approximately the same average weight value had a group of men from 70-80 82.65 ± 15 , with a slightly lower value of the height 174.50 ± 11.79 and a higher average value of BMI 27.95 ± 2.72 . The results of the longitudinal studies (Rossi et al., 2008; Fantin et al., 2007) indicate a decrease in body height and mass of people with increasing age. Coin et al., (2008) in his study conducted on the elderly, found out a tendency to increase body fat with age.

Results in Table 2 were obtained by following average values for height 164.67 ± 6.48 , 70.64 ± 12.81 weight and BMI 26.10 ± 4.94 . Higher average value 166.48 ± 37.35 had a group of women from 70-80, lower body weight 68.84 ± 11.74 as compared to women aged 60-70 and a lower average BMI $25, 46 \pm 4.48$. BMI is not always in proportion equal to the amount of body fat.

By comparing the results of the arithmetic means of both groups of men in Table 3 it can be concluded that there was significant differences in cardiorespiratory fitness in the following parameters: heart rate at rest (.018), mean heart pressure (.021), systolic blood pressure (.011), mean arterial pressure (.030) and the two-minute step test (.000). Reduction in maximum oxygen consumption was caused by the decline of maximum cardiac output and a decrease in arterial- venous differences in the amount of oxygen. This decrease is faster in men than in women, although gender differences tend to disappear in the last decade of their life.

In Table 4, comparing the results of the arithmetic means of both groups of women it can be concluded that there are significant differences in cardiorespiratory

fitness in the following parameters: heart rate at rest (.017), diastolic blood pressure (.029) and the two-minute step test (.000). Aging is characterized by the decline in cardiorespiratory fitness, as well as the ability of the muscle.

Maintaining the level of muscle strength and cardiorespiratory fitness is essential for independent functioning and performance of everyday activities. Flagg et al., (2005) also concluded that the fall in aerobic capacity has important effects on the functional independence and quality of life, healthy older adults, especially the sick elderly.

Considering the relationship between men and women, some previous studies have indicated that both men were more active in leisure time than women (Monteiro et al., 2003; Burton & Turrell 2000; Gomes et al., 2001; Steptoe et al., 2002), unlike Hallal, Victora, Wells, & (2003) who claimed that there is no difference between the sexes in terms of activities.

Research in the European Union (Martinez-Gonzalez et al., 2001) indicates a decreasing trend in men's participation in physical activity with aging in their spare time, while this practice was not observed in women. For women, practice of involvement in physical activity was observed after a doctor's advice to do so and they went to the doctor more often than men (Mendoza- Sassi & Beria, 2003).

This study provides information that can be used to assess the functional status of elderly people in other cities. Many companies perceive older people as frail; they put forward a psychological barrier to the development of some ability and quality of life. After 65 cardiorespiratory system is subject to change, and preserving it is an essential component of health that protects against cardiovascular disease, diabetes, functional limitations and mortality, regardless of BMI and level of physical activity.

As the number of older people increases constantly, it is anticipated that by the end of the 2025 worldwide number of people over 60 will double, from 542 million as it was in 1995 to 1.2 billion in 2025 (UN, 2002). It is expected that the average age in 2040 for men will

be 75.0 and for women 83.1 (Daley & Spinks, 2000). Today, aging and overall human development should be seen as a challenge to promote new knowledge on the health and psychological well-being of older people.

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