Acta Kinesiologiae Universitatis Tartuensis, 2019. Vol. 25, pp. 51–57
https://doi.org/10.12697/akut.2019.25.04

BODY COMPOSITION AND PHYSICAL ABILITY OF TRAINED AND NON-TRAINED ELDERLY WOMEN

Kertu Hernits, Ivi Vaher

Department of Physiotherapy, Tartu Health Care College, Tartu, Estonia

ABSTRACT

Body composition and physical ability affect the life quality and health condition of elderly people. The aim of this study was to evaluate and compare body composition and physical ability of regularly trained and non-trained elderly women. 22 elderly women in the average age 74 years were divided into two groups based on their physical activity: twice a week training and non-training groups. Body weight, body height, blood pressure and waist-hip ratio were measured, and the body composition was evaluated with a SECA 525 analyser. A handgrip strength test, a "Timed Up and Go" test, "Five Times Sit to Stand" test were also performed by the participants. Based on the results of the study, the following conclusions were made: regularly training women had lower body mass index and systolic blood pressure than non-trained women in the same age; regularly training women had lower body fat mass and higher total body water, fat-free mass and muscle mass than non-training women in the same age; regularly training women had greater hand grip strength than non-training women in the same age; regularly training women performed "Five Times Sit to Stand" test and "Timed Up and Go" test faster than non-training women in the same age.

Keywords: *elderly, body composition, physical activity*

INTRODUCTION

By 2050, the largest share of the Estonian population is expected to be 55–69 and the share of those over 65 is 25.4%. Therefore, it is increasingly important to pay attention to the quality of life and health of this age group [13]. Among other factors, the health of the elderly is affected by the body composition. Regardless of gender, fat-free mass decreases with age at the expense of bone and muscle mass and fat mass increases [12]. The loss of muscle mass results in a decrease in muscle function, including muscle strength and endurance. From the age of 50, muscle mass decreases by 1–2% per year and muscle strength by 2–3% per year [1]. Due to changes in body composition, the elderly often remain physically inactive, thereby increasing the risk of developing chronic diseases such as cardiovascular disease and type 2 diabetes [15]. Studies [5, 4] confirm that only few elderly people consciously engage in moderate exercise for at least 30 min five or more days a week. In addition, it has been found that the physical activity of older people comes primarily from daytime walking, and only 10% of the elderly additionally engage in weight training twice or more a week [4].

The aim of the study was to evaluate the body composition and physical ability of regularly trained and non-trained elderly women.

MATERIALS AND METHODS

Subjects

The study (UT Human Research Ethics Committee 282 / T-6, 15.06.2018) included elderly women aged 65–85 (Table 1). Group I consisted of women who had been engaged in regular training for 4–5 years and participated in a gymnastics session twice a week, 60 min once. Group II consisted of women who did not exercise regularly.

Procedures

Anthropometric measurements, body composition and other health measures (waist-hip ratio and blood pressure (RR)), and physical fitness testing were performed in the two groups on the same day before noon. The day before the physical fitness test, the subjects were asked to leave without training. Body composition was measured using a bioelectrical resistance "SECA 525" analyser based on the relationship between body volume and resistance. To evaluate the strength of the hand grip a Hand-Grip Strength Test was performed using a "Jamar" hydraulic hand dynamometer (Model J00105). To evaluate the physical ability of the elderly the "Timed Up and Go" test and "Five Times Sit to Stand" test were used.

Statistical analysis

Study data were analysed in the SPSS 23 data processing program. Arithmetic mean and standard deviation (Mean±SD) were computed for all parameters. All variables were checked for normal distribution using the Shapiro Wilk test before data analysis. The mean values were compared between study groups using Student's t-criterion (independent test t-test), with significance level $p < 0.05$.

RESULTS

Body mass index (BMI) and systolic blood pressure values were lower in the trained elderly group than in the non-trained women (Table 1). There was no significant difference between the two groups in age, weight, diastolic blood pressure, and waist-hip ratio.

Table 1. Anthropometric and blood pressure parameters of the subjects (Mean±SD)

	Trained	Non-trained
Age (y)	73.67 ± 4.87	75.20 ± 7.33
Height (cm)	162.80 ± 6.31	157.26 ± 5.29*
Body mass (kg)	67.13 ± 9.88	74.15 ± 10.99
BMI (kg/m^2)	25.32 ± 3.37	29.88 ± 3.22*
Hip-waist ratio	0.84 ± 0.06	0.83 ± 0.06
Systolic Blood pressure (mmHg)	122.21 ± 6.90	148.20 ± 10.23*
Diastolic blood pressure (mmHg)	81.63 ± 7.31	79.60 ± 8.77

* $p<0.05$

The body water content of trained and non-trained older women differed by 4.1%, fat mass 6.3%, fat-free mass 6%, and muscle mass 3.7% respectively (Table 2). Right handgrip strength was 2 kg higher in trained than in non-trained women (Table 2).

Table 2. Results of body composition and fitness tests of the subjects (Mean±SD)

	Trained	Non-tained
Total body water (%)	48.01 ± 3.32	43.92 ± 2.49*
Body fat mass (%)	35.39 ± 4.42	41.69 ± 3.35*
Body fat free mass (%)	64.44 ± 4.59	58.41 ± 3.36*
Body muscle mass (%)	28.77 ± 2.06	25.10 ± 1.59*
Hand grip strength– right hand (kg)	10.69 ± 1.75	8.65 ± 2.63*
Hand grip strength – left hand (kg)	9.19 ± 2.40	8.60 ± 1.22
Timed up and go test (s)	6.62 ± 0.48	8.22 ± 0.66*
Five times sit to stand test (s)	8.49 ± 1.77	9.52 ± 1.60

* ($p<0.05$).

The "Timed Up and Go" test was performed 1.6 seconds faster by trained group. The mean results for left handgrip strength and "Five Time Sit to Stand" test between the two groups were similar.

DISCUSSION

The BMI values of regularly trained and non-trained elderly women indicate that the group of non-trained elderly did not fall within the normal range (Table 1), which according to earlier studies [2,9] is 24–29 kg/m^2. High BMI (over 29 kg/m^2), which expresses obesity, significantly increases the risk of developing cardiovascular disease and is also a contributor to early mortality [2,7]. In addition to high BMI, the risk factors for cardiovascular disease include high blood pressure and increased waist-hip ratio. The blood pressure values of the participants in this study were within the normal range, which according to the literature is 121/83–151/93 mmHg in 60–89-year-olds [18]. The waist-hip ratio is used to express abdominal obesity, and for women the risk factor is considered to be > 0.8 [10]. In our study, the mean waist-hip ratio results for both groups were above the threshold. The higher the waist-hip ratio in older women, the greater the risk of developing cardiovascular disease and thereby dying [16]. At the same time, researchers have pointed out that risk thresholds are significantly dependent on age and gender and that women have a critical ratio> 0.9 [16]. Regularly trained women had higher lean and muscle mass values and lower fat mass than non-trained women. The proportion of fat mass in women over 65 could be in the range of 34–44% and healthy muscle mass is considered to be in the range of 27–30% [8,11]. In our study, the average fat mass ratio of both trained and untrained women was within the predetermined healthy range, but the result for the trained elderly group was close to the lower limit of normal. Dolan et al. [8] have found that too low fat percentage can negatively affect the health of the elderly and lead to early mortality. However, women who exercise regularly have a lower percentage of fat throughout their lives than those who do not exercise regularly [20]. In addition, studies [15, 22] confirm that regular muscle training, which provides the necessary muscle mass and strength reduces the risk of falls, plays an important role in maintaining the good shape and health of the elderly. Muscle mass values of trained older women remained within normal limits and were higher than those of non-trained women, which can be considered as a result of regular exercise. The average lean muscle mass percentage of non-trained older women did not fit within the limits.

Regular exercise also has a positive effect on body water content. The percentage of body water was higher in the trained group compared to the non-trained group. The body water content depends on the age of the person and in women aged 60–89 the normal body water content is considered to be 44–52% [21]. Often people with a higher percentage of body fat have a lower water content and people with a low fat content have a higher water content [17, 19].

Changes in body composition that occur during the aging process significantly affect the physical performance of the elderly. A result of a hand grip strength less than 20kg is considered to be the limit of diagnosis for sarcopenia [6]. In the present study, the hand grip strength of both groups of the elderly was significantly less than 20kg, and it can be assumed that despite even regular training, the muscle mass of the trained women has also decreased. At the same time, the physical abilities of the subjects in both groups were very good, and the risk of falls were minimal. According to the literature, women between the ages of 60 and 89 should pass the "Timed Up and Go" test in 8.1 to 13.6 s. A score of more than 13.6 s is an increased risk of falls [14]. Similar results were obtained for the "Five Times Sit to Stand" test in both study groups, within the normal limits. A score is considered to be good if it is between 8 and 14 s [3].

In conclusion, regularly trained elderly women had lower BMI, systolic blood pressure, body fat, higher total body water, lean body and muscle mass and physical ability than non-trained women on the same age.

REFERENCES

1. Abellan Van Kan G. (2009) Epidemiology and consequences of sarcopenia. J Nutr Health Aging, 13(8): 708–712. https://doi.org/10.1007/s12603-009-0201-z
2. Bahat G, Tufan F, Saka B, Akin S, Ozkaya H, Yucel N, Erten N, Karan MA. (2012) Which body mass index (BMI) is better in the elderly for functional status? Arch Gerontol Geriatr, 54(1): 78–81. https://doi.org/10.1016/j.archger.2011.04.019
3. Bohannon RW. (2006) Reference values for the five-repetition sit-to-stand test: a descriptive meta-analysis of data from elders. Percept Mot Skills, 103(1): 215–222. https://doi.org/10.2466/pms.103.1.215-222
4. Bennett JA, Winters-Stone K. (2011) Motivating older adults to exercise: what works? Age Ageing, 40: 148–149. https://doi.org/10.1093/ageing/afq182
5. Craig R, Mindell J, Hirani V. (2009) Health Survey for England 2008: Physical activity and fitness. Health and Social Care Information Centre, 2–20.
6. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, Boirie Y, Cederholm T, Landi F, Martin FC, Michel JP, Rolland Y, Schneider SM, Topinková E, Vandewoude M, Zamboni M (2010). Sarcopenia: European consensus on definition and diagnosis.

Report of the European Working Group on Sarcopenia in Older People. Age Ageing; 39: 412–423. https://doi.org/10.1093/ageing/afq034

7. Dey DK, Rothenberg E, Sundh V, Bosaeus I, Steen B. (2001) Body mass index, weight change and morality in the elderly. A 15 y longitudinal population study of 70-y-olds. Eur J Clin Nutr, 55: 482–492. https://doi.org/10.1038/sj.ejcn.1601208
8. Dolan CM, Kraemer H, Browner W, Ensrud K, Kelsey JL. (2007) Associations between body composition, anthropometry, and mortality in women aged 65 years and older. Am J Public Health, 97(5): 913–918. https://doi.org/10.2105/AJPH.2005.084178
9. Douketis JD, Paradis G, Keller H, Martineau C. (2005) Canadian guidelines for body weight classification in adults: application in clinical practice to screen for overweight and obesity and to assess disease risk. Can Med Assoc J, 172(8): 995–998. https://doi.org/10.1503/cmaj.045170
10. Fauziana R, Jeyagurunathan A, Abdin E, Vaingankar J, Sagayadevan V, Shafie S, Sambasivam R, Chong SA, Subramaniam M. (2016) Body mass index, waist-hip ratio and risk of chronic medical condition in the elderly population: results from the Well-being of the Singapore Elderly (WiSE) Study. BMC Geriatrics, 16: 125. https://doi.org/10.1186/s12877-016-0297-z
11. Janssen I, Heymsfield SB, Wang ZM, Ross R. (2000) Skeletal muscle mass and distribution in 468 men and women aged 18–88-yr. J Appl Physiol, 89(1): 81–88. https://doi.org/10.1152/jappl.2000.89.1.81
12. Kyle UG, Melzer K, Kayser B, Picard-Kossovsky M, Gremion G, Pichard C. (2006) Eight-year longitudinal changes in body composition in healthy Swiss adults. J Am Coll Nutr, 25(6): 493–501. https://doi.org/10.1080/07315724.2006.10719564
13. Leetmaa R, Võrk A, Kallaste E. (2004). Vanemaealine tööjõud tööturul ja tööelus. Poliitikauuringute Keskuse Praxis toimetised, 19/2004.
14. Lusardi MM, Pellecchia GL, Schulman M. (2003) Functional performance in community living older adults. J Geriatr Phys Ther, 26(3): 14–22. https://doi.org/10.1519/00139143-200312000-00003
15. McPhee JS, French DP, Jackson D, Nazroo J, Pendleton N, Degens H. (2016) Physical activity in older age: perspectives for healthy ageing and frailty. Biogerontology, 17: 567–580. https://doi.org/10.1007/s10522-016-9641-0
16. Price GM, Uauy R, Breeze E, Bulpitt CJ, Fletcher AE. (2006) Weight, shape, and mortality risk in older persons: elevates waist-hip ratio, not high body mass index, is associated with a greater risk of death. Am J Clin Nutr, 84: 449–460. https://doi.org/10.1093/ajcn/84.2.449
17. Rosén T, Bosaeus I, Tölli J, Lindstedt G, Bengtsson BA. (1993) Increased body fat mass and decreased extracellular fluid volume in adults with growth hormone deficiency. Clin Endocrinol, 38(1): 63–71. https://doi.org/10.1111/j.1365-2265.1993.tb00974.x

18. Narain R, Saxena S, Goyal AK. (2016) Cardiovascular risk prediction: a comparative study of Framingham and quantum neural network based approach. Patient Prefer Adherence, 10: 1259–1270. https://doi.org/10.2147/PPA.S108203
19. Shah AH, Bilal R. (2009) Body composition, its significance and models for assessment. Pakistan J Nutr, 8(2): 198–202. https://doi.org/10.3923/pjn.2009.198.202
20. Tanaka H, Desouza CA, Jones PP, Stevenson ET, Davy KP, Seals DR. (1997) Greater rate of decline in maximal aerobic capacity with age in physically active vs. sedentary healthy women. J Appl Physiol, 83(6): 1947–1953. https://doi.org/10.1152/jappl.1997.83.6.1947
21. Watson PE, Watson ID, Batt RD. (1980) Total body water volumes for adult males and females estimates from simple anthropometric measurements. Am J Clin Nutr, 33(1): 27–39. https://doi.org/10.1093/ajcn/33.1.27
22. Yang NP, Hsu NW, Lin CH, Chen HC, Tsao HM, Lo SS, Chou P. (2018) Relationship between muscle strength and fall episodes among the elderly: the Yilan study, Taiwan. BMC Geriatr, 18(1): 90. https://doi.org/10.1186/s12877-018-0779-2

Correspondence to:

Ivi Vaher
Tartu Health Care College
Nooruse 5, 50411, Tartu, Estonia
Tel: +372 512 8823
E-mail: ivivaher@nooruse.ee