International Journal of Sport, Exercise and Health Research

Research Article

IJSEHR 2025; 9(2): 54-58

www.sportscienceresearch.com
Received: 16-11-2025
Accepted: 03-02-2026
Published: 12-02-2026
DOI: 10.31254/sportmed.9204

Comparison of Anthropometric and Somato-Functional Indicators Between Physically Active and Sedentary Women

Stefan Alecu

Department of Physicat Education and Special Motricity, Faculty of Physical Education and Mountain Sports, Transilvania University, Brasov, Romania

Abstract

The study aimed to compare anthropometric and somato-functional indicators between physically active and sedentary women aged 40–50 years. Thirty participants were included, divided equally into two groups (15 active, 15 sedentary). Anthropometric data (height, weight, BMI, waist, hip, waist-to-hip ratio) and skinfolds (triceps, suprailiac, thigh) were measured. Body fat percentage was calculated using the Jackson & Pollock formula, and functional tests included the 6-minute walk, Flamingo, and tapping tests. Independent sample t-tests and Pearson correlations were applied ($p < 0.05$). Active women had lower BMI (23.9 vs. 26.8 kg/m²), waist (80.3 vs. 88.1 cm), and body fat (25.9% vs. 30.2%) values. Functional performance was better in the active group for all tests: 6-minute walk (645 vs. 571 m), Flamingo (3.2 vs. 5.8 errors), and tapping (55.6 vs. 48.7 taps). Negative correlations between body fat and performance confirm that regular physical activity reduces adiposity, improves balance, and enhances functional capacity in middle-aged women

Keywords: Physical activity, Adult women, Body composition, Somato-functional tests, Balance, Coordination.

INTRODUCTION

Maintaining optimal health during middle age largely depends on the level of physical activity and body composition. After the age of 40, basal metabolism decreases, muscle mass is reduced, and body fat percentage tends to increase, especially in the abdominal area. These changes may favor the development of cardiovascular diseases, metabolic syndrome, and a decline in functional capacity.

Regular physical activity plays an essential role in preventing these processes. Exercise helps maintain body weight, regulate body composition, and improve somatic and motor functions. Numerous studies [1,3] have shown that women who engage in moderate or vigorous physical activity have better-preserved muscle mass, higher body density, and superior aerobic capacity compared to sedentary women.

The assessment of anthropometric and somato-functional parameters provides objective information on health status and the body's level of adaptation. Measurements such as body mass index (BMI), waist-to-hip ratio, skinfold thickness, and physical performance tests (6-minute walk, Flamingo, Tapping) allow for a comprehensive evaluation of physical condition. These instruments are frequently used in research related to physical education and public health.

In this context, the present study aims to compare anthropometric and somato-functional indicators between physically active and sedentary women aged 40-50 years. The goal is to highlight the influence of physical activity on body composition, aerobic capacity, balance, and coordination, key parameters for maintaining health and quality of life in adulthood.

MATERIALS AND METHODS

The study included 30 women aged between 40 and 50 years, divided into two groups: 15 physically active and 15 sedentary. All participants were informed about the research objectives and signed a consent form. Inclusion criteria were: good health status, absence of chronic diseases, no hormonal treatments, and no participation in physical rehabilitation programs during the last six months. The aim of this study was to compare anthropometric and somato-functional indicators between physically active and sedentary women. The research sought to highlight differences in body composition aerobic capacity,

***Corresponding author:**
Dr. Stefan Alecu
Department of Physicat Education and Special Motricity, Faculty of Physical Education and Mountain Sports, Transilvania University, Brasov 500036, Romania.
Email: alecu.stefan@unitbv.ro

balance, and coordination determined by the level of physical activity. The hypothesis was that physically active women would have a lower body fat percentage and higher performance in somato-functional tests (6-minute walk, Flamingo, and tapping) compared to sedentary women, with statistically significant differences ($p < 0.05$).

Anthropometric Measurements

Height (cm), weight (kg), body mass index (BMI = kg/m²), waist and hip circumference (cm) were recorded. The waist-to-hip ratio (WHR) was calculated to assess fat distribution. Skinfolds were measured on the right side of the body in three sites according to the Jackson and Pollock method [4,6] triceps, suprailiac, and thigh. Two readings were taken for each site, and if the difference exceeded 2 mm, a third was performed, with the mean recorded. The sum of the three skinfolds (Σ) was used to calculate body density according to the Jackson and Pollock equation for women:

$D = 1.0994921 - 0.0009929 \cdot \Sigma + 0.0000023 \cdot \Sigma^2 - 0.0001392 \cdot age$
Body fat percentage was estimated using the Siri formula [7,8]
Body fat (%) = 495 ÷ D − 450.

Somato-Functional Evaluations

Aerobic capacity was assessed using the 6-minute walk test [9,11]. Participants walked the maximum distance possible along a 30 m corridor, and results were expressed in meters. Static balance was measured with the Flamingo test [12,13] by counting the number of balance losses (falls) during 60 seconds. Coordination and movement speed were assessed using the tapping test [14,15], counting the number of valid taps in 30 seconds.

The 6-Minute Walk Test was used to assess aerobic capacity and endurance. Each participant was instructed to walk the maximum possible distance along a 30-meter straight corridor within six minutes, maintaining a steady pace without running. The total distance covered (in meters) was recorded. This test reflects submaximal aerobic performance and is widely used to evaluate functional fitness in adults.

The Flamingo test evaluated static balance and postural control. Participants were asked to stand on one leg on a narrow beam or flat surface, maintaining balance as long as possible within a 60-second period. Each loss of balance or ground contact was counted as an error. The total number of errors indicated the subject's ability to maintain stability; a lower number of errors represents better balance and neuromuscular control.

The Tapping test measured coordination and movement speed. Participants alternately tapped two circles (or points) placed 30 cm apart using the dominant hand for 30 seconds. The number of valid taps completed within the time limit was recorded. This test evaluates the precision and speed of fine motor control, being an indicator of neuromuscular efficiency and coordination.

Data Analysis

Data were entered and processed using SPSS v26. Descriptive statistics were calculated for each variable: mean (X), standard deviation (SD), minimum and maximum values (Min, Max), coefficient of variation (CV%), and 95% confidence interval (CI 95%). Differences between the two groups (active and sedentary) were analyzed using the independent samples t-test, with the significance level set at $p < 0.05$. Correlations between anthropometric and functional performance variables were examined using Pearson's correlation coefficient (r).

Results were presented as descriptive tables for each variable category (anthropometric, skinfold, and functional performance), and scatter plots were used to illustrate significant relationships.

RESULTS

The analysis of anthropometric data presented in Table 1 clearly shows that physically active women exhibit a more favorable body profile compared to sedentary women. The significant differences observed in weight, body mass index, waist circumference, and waist-to-hip ratio reflect the beneficial impact of regular physical activity on body composition.

The lower mean body weight and BMI values among active women indicate effective maintenance of body mass within healthy limits. These results suggest a stable energy balance, likely due to higher energy expenditure and better dietary control. The mean waist-to-hip ratio of 0.81 in the active group, compared to 0.86 in the sedentary group, highlights this contrast and confirms the role of physical activity in preventing abdominal obesity.

The coefficient of variation (CV%) below 10% for all variables indicates good sample homogeneity and result stability. This demonstrates a uniform data distribution within groups, enhancing confidence in the statistical validity of the observed differences. Moreover, the lack of overlap in the 95% confidence intervals (CI 95%) between groups for BMI, weight, waist circumference, and waist-to-hip ratio confirms the consistency of these differences. The p-values below 0.05 for the main variables confirm the hypothesis that the level of physical activity significantly influences body structure. From a biological perspective, these findings reflect the body's functional adaptations to exercise: reduced fat mass, preserved muscle mass, and an optimized balance between body segments.

Active women show significantly lower values for all three measured skinfolds (triceps, suprailiac, and thigh), indicating a reduced accumulation of subcutaneous adipose tissue. The sum of skinfolds is approximately 30% lower compared to that of sedentary women, and the difference is statistically significant ($p < 0.001$).

Body density is higher in the active group (1.05 g/cm³) compared to the sedentary group (1.03 g/cm³), reflecting a greater proportion of lean mass. Consequently, the percentage of body fat is significantly lower in active women (25.90%) than in sedentary women (30.20%), confirming a more balanced body composition.

In summary, the data show that regular physical activity is associated with a reduction in fat mass and the maintenance of a healthier body structure in middle-aged women.

Table 3 shows clear differences between active and sedentary women in somato-functional performance. Active women covered a significantly greater distance in the 6-minute walk test (645.00 ± 52.00 m) compared to sedentary women (571.00 ± 60.00 m; $p < 0.001$). This result indicates better aerobic capacity and higher physical endurance in the active group.

In the Flamingo test, active women made fewer errors (3.20 ± 1.40) than sedentary women (5.80 ± 1.90; $p < 0.001$), reflecting superior postural control and balance.

The tapping test results also confirm better coordination and execution speed in active women (55.60 ± 4.90) compared to sedentary women (48.70 ± 5.60; $p < 0.001$).

Overall, all differences are statistically significant ($p < 0.05$), confirming that regular physical activity improves aerobic capacity, balance, and coordination—key aspects for maintaining functionality and autonomy in middle-aged women.

Table 1: Descriptive and comparative statistics for main anthropometric indicators

Variable	Group	Min	Max	X	SD	CV%	CI (95%) Lower	CI (95%) Upper	p
Age (years)	Active	40.00	49.00	45.20	2.80	6.20	43.60	46.80	0.72
	Sedentary	40.00	50.00	45.60	3.00	6.60	43.90	47.30	
Height (cm)	Active	156.00	174.00	164.10	5.20	3.20	161.20	167.00	0.68
	Sedentary	155.00	175.00	163.40	6.10	3.70	160.00	166.80	
Weight (kg)	Active	55.00	75.00	64.20	5.90	9.20	61.00	67.40	0.01*
	Sedentary	62.00	85.00	71.80	7.30	10.20	68.00	75.60	
BMI (kg/m²)	Active	20.80	27.50	23.90	2.10	8.80	22.80	25.00	0.00*
	Sedentary	23.50	30.50	26.80	2.50	9.30	25.40	28.20	
Waist (cm)	Active	72.00	90.00	80.30	5.60	7.00	77.30	83.30	0.00*
	Sedentary	79.00	98.00	88.10	6.40	7.30	84.70	91.50	
Hip (cm)	Active	91.00	106.00	98.60	4.80	4.90	96.00	101.20	0.04*
	Sedentary	95.00	112.00	102.50	5.30	5.20	99.60	105.40	
Waist-to-hip ratio	Active	0.75	0.87	0.81	0.04	4.90	0.79	0.83	0.01*
	Sedentary	0.80	0.93	0.86	0.05	5.80	0.83	0.89	

Legend: Min – minimum value; Max – maximum value; X – mean; SD – standard deviation; CV% – coefficient of variation; Lower CI / Upper CI – lower and upper limits of the 95% confidence interval; p – result of the independent samples t-test; *p < 0.05 – statistically significant difference.

Table 2: Descriptive and comparative statistics for skinfolds and body composition

Variable	Group	Min	Max	X	SD	CV%	CI (95%) Lower	CI (95%) Upper	p
Triceps (mm)	Active	11.00	22.00	16.40	3.10	18.90	14.70	18.10	0.00*
	Sedentary	17.00	31.00	22.70	4.50	19.80	20.10	25.30	
Suprailiac (mm)	Active	12.00	25.00	18.10	4.00	22.10	15.90	20.30	0.00*
	Sedentary	18.00	35.00	26.50	5.20	19.60	23.60	29.40	
Thigh (mm)	Active	14.00	27.00	20.80	4.20	20.20	18.40	23.20	0.00*
	Sedentary	22.00	38.00	29.30	5.00	17.10	26.50	32.10	
Sum of skinfolds (mm)	Active	42.00	70.00	55.30	9.40	17.00	50.20	60.40	0.00*
	Sedentary	63.00	96.00	78.50	11.70	14.90	72.10	84.90	
Body density (g/cm³)	Active	1.03	1.06	1.05	0.01	0.60	1.04	1.05	0.00*
	Sedentary	1.02	1.04	1.03	0.01	0.70	1.02	1.03	
Body fat percentage (%)	Active	20.00	31.00	25.90	3.50	13.50	24.00	27.80	0.00*
	Sedentary	25.00	36.00	30.20	3.80	12.60	28.20	32.20	

Legend: Min – minimum value; Max – maximum value; X – mean; SD – standard deviation; CV% – coefficient of variation; Lower CI / Upper CI – lower and upper limits of the 95% confidence interval; p – result of the independent samples t-test; *p < 0.05 – statistically significant difference.

Table 3: Descriptive and comparative statistics – somato-functional evaluations

Variable	Group	Min	Max	X	SD	CV%	CI (95%) Lower	CI (95%) Upper	p
6-minute walk (m)	Active	560.00	720.00	645.00	52.00	8.10	617.00	673.00	0.00*
	Sedentary	480.00	660.00	571.00	60.00	10.50	537.00	605.00	
Flamingo (errors/60 s)	Active	1.00	6.00	3.20	1.40	43.80	2.40	4.00	0.00*
	Sedentary	3.00	9.00	5.80	1.90	32.80	4.90	6.70	
Tapping (taps/30 s)	Active	48.00	63.00	55.60	4.90	8.80	52.90	58.30	0.00*
	Sedentary	40.00	58.00	48.70	5.60	11.50	45.60	51.80	

Legend: Min – minimum value; Max – maximum value; X – mean; SD – standard deviation; CV% – coefficient of variation; Lower CI / Upper CI – lower and upper limits of the 95% confidence interval; p – result of the independent samples t-test; *p < 0.05 – statistically significant difference.

Table 4: Pearson correlations between anthropometric and functional variables

Correlated Variables	R	p-value
Body fat percentage (%) – 6-minute walk (m)	−0.48	0.01*
Body fat percentage (%) – Tapping (taps)	−0.42	0.02*
Waist-to-hip ratio – Flamingo (errors)	+0.46	0.01*
Sum of skinfolds – BMI (kg/m²)	+0.61	0.00*

Legend: r – Pearson correlation coefficient; p – level of statistical significance (*p < 0.05 – statistically significant correlation)

Table 4 highlights clear relationships between body composition and somato-functional performance. The moderate negative correlation between body fat percentage and the distance covered in the 6-minute walk test (r = −0.48, p = 0.01) indicates that individuals with higher adipose tissue have lower aerobic capacity. The negative relationship between body fat percentage and the tapping test (r = −0.42, p = 0.02) confirms that lower body fat levels are associated with better coordination and execution speed.

The positive correlation between waist-to-hip ratio and the number of errors in the Flamingo test (r = 0.46, p = 0.01) suggests that central fat distribution negatively affects static balance. Moreover, the strong association between the sum of skinfolds and BMI (r = 0.61, p = 0.00) confirms the direct link between subcutaneous fat and total body mass.

Overall, these results demonstrate that a more favorable body composition is correlated with better functional performance, reinforcing the importance of maintaining optimal body weight and reduced adiposity for physical health in middle-aged women.

DISCUSSION

The research results confirm the working hypothesis, demonstrating that physically active women display superior anthropometric and functional values compared to sedentary women.

The comparative analysis revealed significantly lower values for body weight, body mass index (BMI), waist circumference, and waist-to-hip ratio in the active group. These differences reflect a more balanced body composition and a healthier distribution of adipose tissue [16,17]. A waist-to-hip ratio below 0.85 in the active group indicates a predominance of peripheral fat, which is considered less metabolically risky, while sedentary women approach or exceed this threshold.

Significant differences in skinfold thickness (triceps, suprailiac, thigh) confirm the effect of physical activity on reducing subcutaneous adipose tissue. Active women showed higher body density and approximately four percentage points lower body fat compared to sedentary women.

Functional test performance [18] also confirmed a superior overall physical capacity in the active group. The longer distance covered in the 6-minute walk test indicates enhanced aerobic capacity, which was negatively correlated with body fat percentage (r = −0.48). The Flamingo and Tapping test results demonstrate better postural control and coordination, confirming the positive influence of physical activity on balance and reaction speed.

Negative relationships between body fat percentage and physical performance highlight the interdependence between body composition and functional capacity. The higher the body fat percentage, the lower the endurance and coordination performance. These findings support the idea that an optimal level of physical activity not only maintains body weight but also directly contributes to improving functional parameters essential for quality of life.

The results have practical importance for developing training and prevention programs aimed at middle-aged women. Introducing regular physical activities adapted to individual fitness levels can significantly reduce the risk of abdominal obesity, metabolic disorders, and functional decline. These conclusions are supported by the data obtained and are consistent with recent scientific literature, which recommends physical exercise as a primary intervention for maintaining health in this age group.

The main limitation of the study is the sample size of 30 subjects, which restricts the generalization of results. However, the balanced structure of the groups and the consistency of the observed differences provide credibility to the conclusions.

Future research could include a larger number of participants and a longitudinal analysis to evaluate the evolution of anthropometric and functional indicators over time.

CONCLUSION

The study results confirm the working hypothesis, highlighting the positive effects of regular physical activity on body composition and somato-functional performance in women aged 40 to 50 years. Physically active women showed significantly lower values for body weight, body mass index, waist circumference, and waist-to-hip ratio, indicating a healthier distribution of adipose tissue. The active group also had a lower body fat percentage and higher body density, confirming a more balanced body composition.

Superior performance in the 6-minute walk, Flamingo, and Tapping tests demonstrates better aerobic capacity, balance, and coordination among active participants. The identified correlations show that a lower body fat level is associated with better physical functionality. These findings emphasize the importance of consistent physical exercise for maintaining health, preventing abdominal obesity, and reducing the risk of metabolic disorders. Regular physical activity, adapted to age and individual fitness levels, is an essential factor in maintaining functional capacity and quality of life in middle-aged women.

Conflicts of interest

None declared.

Financial Support

None declared.

ORCID ID

Stefan Alecu: https://orcid.org/0009-0002-2252-4238

REFERENCES

1. Shi H, Hu FB, Huang T, Schernhammer ES, Willett WC, Sun Q, et al. Sedentary behaviors, light-intensity physical activity, and healthy aging. JAMA Netw Open. 2024;7(6):e2416300.

2. Schrempft S, Jackowska M, Hamer M, Steptoe A. Associations between social isolation, loneliness, and objective physical activity in older men and women. BMC Public Health. 2019;19(1):74.
3. Wang X, Breneman CB, Sparks JR, Blair SN. Sedentary time and physical activity in older women undergoing exercise training. Med Sci Sports Exerc. 2020;52(12):2590-2598.
4. Marin-Jimenez N, Cruz-Leon C, Sanchez-Oliva D, Jimenez-Iglesias J, Caraballo I, Padilla-Moledo C, et al. Criterion-related validity of field-based methods and equations for body composition estimation in adults: a systematic review. Curr Obes Rep. 2022;11(4):336-349.
5. Nevill AM, Metsios GS, Jackson AS, Wang J, Thornton J, Gallagher D. Can we use the Jackson and Pollock equations to predict body density/fat of obese individuals in the 21st century? Int J Body Compos Res. 2008;6(3):114-121.
6. Kupusinac A, Stokić E, Doroslovački R. Predicting body fat percentage based on gender, age and BMI by using artificial neural networks. Comput Methods Programs Biomed. 2014;113(2):610-619.
7. Deurenberg P, Leenen R, Van der Kooy K, Hautvast JG. In obese subjects the body fat percentage calculated with Siri's formula is an overestimation. Eur J Clin Nutr. 1989;43(8):569-575.
8. Guerra RS, Amaral TF, Marques E, Mota J, Restivo MT. Accuracy of Siri and Brozek equations in the percent body fat estimation in older adults. J Nutr Health Aging. 2010;14(9):744-748.
9. Agarwala P, Salzman SH. Six-minute walk test: clinical role, technique, coding, and reimbursement. Chest. 2020;157(3):603-611.
10. Bohannon RW, Crouch R. Minimal clinically important difference for change in 6-minute walk test distance of adults with pathology: a systematic review. J Eval Clin Pract. 2017;23(2):377-381.
11. Cheng DK, Nelson M, Brooks D, Salbach NM. Validation of stroke-specific protocols for the 10-meter walk test and 6-minute walk test conducted using 15-meter and 30-meter walkways. Top Stroke Rehabil. 2020;27(4):251-261.
12. Cortell-Tormo JM, Sánchez PT, Chulvi-Medrano I, Tortosa-Martínez J, Manchado-López C, Llana-Belloch S, et al. Effects of functional resistance training on fitness and quality of life in females with chronic nonspecific low-back pain. J Back Musculoskelet Rehabil. 2018;31(1):95-105.
13. Uzunkulaoğlu A, Yıldırım İB, Güneş Aytekin M, Ay S. Effect of flamingo exercises on balance in patients with balance impairment due to senile osteoarthritis. Arch Gerontol Geriatr. 2019;81:48-52.
14. Yao T. Chinese journal of medical instrumentation. Zhongguo Yi Liao Qi Xie Za Zhi. 2022;46(4):449-453.
15. Georgi M, Gingras B, Zentner M. The Tapping-PROMS: a test for the assessment of sensorimotor rhythmic abilities. Front Psychol. 2022;13:862468.
16. Frank AP, de Souza Santos R, Palmer BF, Clegg DJ. Determinants of body fat distribution in humans may provide insight about obesity-related health risks. J Lipid Res. 2019;60(10):1710-1719.
17. Salamunes ACC, Stadnik AMW, Neves EB. The effect of body fat percentage and body fat distribution on skin surface temperature with infrared thermography. J Therm Biol. 2017;66:1-9.
18. Patrizio E, Calvani R, Marzetti E, Cesari M. Physical functional assessment in older adults. J Frailty Aging. 2021;10(2):141-49.