

The impact of physical activity on body fat and self-esteem in adult women

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Abstract

Background. An active life entails many physical, social, and psychological benefits, and there is a direct proportionality between physical activity and life expectancy. According to the 2018 Special Eurobarometer, the proportion of Europeans who have never exercised or played a sport continues to grow.

Aims. Through this study we aimed at analyzing the effect of physical activity programs on the percentage of body fat and self-esteem in adult women.

Methods. The participants selected in the study were 89 adult women aged 23 to 57, the average age being 31.62 (SD = 6.60). Anthropometric measurements were made, and questionnaires were applied to collect data and interpret them according to the Rosenberg Self Esteem Scale. The data thus obtained were statistically processed using IBM SPSS 23.0 software, by performing descriptive analysis, checking distribution and means comparison.

Results. Between the means of body fat percentages, calculated before and after subject's participation in the physical training program, the differences were quite significant ($t = 30.765$, $df = 88$, $p = .000$), the outcome effect being quite substantial ($d = 3.26$). Significant differences were also recorded in the assessment of self-esteem (SE) before and after participation in the intervention programs ($z = -7.910$, $df = 88$, $p = .000$, $d = -.84$).

Conclusions. The study found that the effect of the participation of some adult women in the physical activity programs consisted of a decrease in the percentage of their body fat and subsequently an increase in self-esteem.

Key words: physical activity, self-esteem, body fat, adult women

Introduction

The human body was conceived for motility and needs regular physical activity not only for optimal functioning, but also to reduce the risk of developing a disease. According to Physical Activity Guidelines (1), physical activity has been defined as “any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level.” An active life entails many physical, social, and psychological benefits, and there is a direct proportionality between physical activity and life expectancy. Nowadays, active populations tend to live longer than inactive ones.

Sedentary lifestyle is a risk factor for the development of many chronic diseases, including cardiovascular disease (CVDs), one of the leading causes of mortality in the world. A low intensity of physical exertion, or its absence, is the main cause of the increase in the proportion of body fat in all individuals, regardless of the social category. Due to the galloping technology, there has been a sharp decrease of physical effort required to carry out daily household

chores, for moving from one place to another, and even for practicing recreational activities (including those involving a physical exertion component).

According to the Special Eurobarometer 2018 (3), a survey in which 28,031 subjects participated showed that in 2017 the share of Europeans who have “never exercised or played a sport continues to increase. Almost half of Europe's population (46%) never exercise or play a sport, while 14% rarely do so. In contrast, 40% of Europeans exercise or practice a sport with a certain regularity, of which 7% regularly exercise or play a sport. Compared to 2013, the share of those who never exercise or play a sport increased by 4 p.p. (i.e. from 42% to 46%), while the percentage of those who rarely do so decreased from 17% to 14%. This shows that the long-term trend has continued from 2009, when 39% of respondents declared they never perform physical activity”.

According to the Prospective Studies Collaboration (***, 2009), both a sedentary lifestyle and obesity are responsible for a considerable part of health problems and mortality rate. The largest ongoing study, which examines

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the link between obesity and mortality, covering nearly one million adults in Europe and North America, shows that mortality rises sharply along with the increase of Body Mass Index (BMI) and as soon as individuals exceed the 25 kg/m² threshold, the lower limit of the overweight category.

The European Health Interview Survey of 2014 (2) reveals that almost 1 in 6 adults in the EU is considered obese. The share of overweight and obesity increases with age, a model being valid for women in all European countries: the older they are, the higher the share of overweight and obese people. This increase can also be observed in Romania: in the 18-24 age group, the percentage of obese persons was 1.2%; in the 25-34 age category, 4.8%; in the 35-44 age group, 7.2%; in the 45-64 age group, 12.6%; in the 65-74 age group, 16.0%; and in the 75+ age group, 11.4%.

Physical exercise practiced outdoors or in gyms, in winter or summer, in any form whatsoever, brings substantial benefits to the human body. According to Sonstroem (1998), there are many individual, social and environmental factors that influence mental health, including self-esteem. Self-esteem is a term used in psychology to express the degree of positivity of individuals towards themselves.

Self-esteem is an assessment we make about ourselves that can take many forms (global or multidimensional, mood or disposition, personal or collective). For example, Rosenberg (1979) distinguishes between high self-esteem (positive) and low self-esteem (negative). He defines self-esteem as a complex cognitive and affective synthesis and considers that self-esteem dictates the better or worse attitude of an individual towards himself/herself. Most psychologists define self-esteem as the overall assessment of self-worth as a person.

Physical activities can be ways in which practitioners become more aware of their personal worth and can fulfill their potential. Sports practitioners have a positive perception of how they look and feel. There are studies that suggest that one way to improve self-esteem is to exercise, since physical activity has an important contribution to improving one's mental and physical health. According to Mansour et al. (2013), by improving mobility and effectiveness, physical exercise has positive effects on self-esteem. Findlay & Bowker (2009) mention that top athletes reach a high level of competitiveness, an athletic body and a high degree of self-esteem compared to non-athletes. According to Megakli et al. (2015), a 12-week exercise program, containing aerobic and endurance exercise, has the potential to improve physical self-perception and self-esteem in obese women

In a two-year prospective study, Elavski (2010) examined the physical activity model and self-esteem in a sample of 143 middle-aged women. The results of the study support the hierarchical and multidimensional structure of self-esteem and indicate that middle-aged women can improve the way they perceive their physical condition and attractiveness by continuously participating in physical activity, increasing self-efficacy and maintaining their BMI within a healthy range.

Our study was conducted to analyze the effect of physical activity on the percentage of body fat and self-

esteem in adult women who regularly participate in workouts in gyms.

Hypotheses

In this study we started from the following hypotheses:

a) A physical activity program practiced by adult women for 12 months will have the effect of reducing the percentage of body fat and increasing self-esteem;

b) The type of physical activity practiced can influence the reduction of the body fat percentage and the self-esteem score.

Materials and methods

Research protocol

a) *Period and place of the research*

The research took place for 12 months, i.e. between January 2016 and January 2017, in two gyms in the city of Oradea, the subjects participating in three physical training sessions per week.

b) *Subjects and groups*

The study was attended voluntarily by 89 adult women, clients of some gyms in Oradea, aged between 23 and 57, the average age being 31.62 years (SD = 6.60). Depending on the type of physical activity practiced, the sample was divided into 5 groups: circuit group (18 subjects), softball group (18 subjects), fitball group (18 subjects), aerobics group (18 subjects) and taekwondo group (17 subjects).

c) *Tests applied*

The subjects were assessed for fat percentage and self-esteem before and after participating in the training program. In order to assess the percentage of body fat, skinfold thickness measurement was made using a Digital Body Fat Caliper, and the percentage of body fat was calculated based on the measurement of five skinfolds (biceps, subscapular, abdominal, suprailiac or flank and thigh), using the formula below (Cordun, 2011):

Body fat% = (sum of 5 skinfolds (mm) x 0.15) + 5.8 + body surface area) m²;

BSA = body surface area was calculated using the Du Bois nomogram.

To assess subjects' self-esteem, a survey was conducted using the Rosenberg Self-Esteem Scale related questionnaire. The purpose of the questionnaire was to find the answer to the question whether self-esteem is influenced by physical activity or not. Subjects had to write down all the answers and had 10 minutes at their disposal. The questionnaires were anonymous, and the consent of each person included in the survey sample had been previously given.

Interpretation of the self-esteem scale related questionnaire results

This scale was developed to measure the overall sense of self-worth and self-acceptance. The questionnaire includes 10 items with 4 possible answers ranging between "I totally disagree with..." (1 point) and "I totally agree with..." (4 points). Items 2,5,6,8,9 are quoted in reverse order. Scores that can be obtained by the participants range between 10 and 40 points, where a low score indicates a low self-esteem. When rating the results, the values ranging between 10-16 points indicate a low self-esteem level for the respondents; between 17-33 points indicate

an average self-esteem level; 34-40 points indicate a high self-esteem level.

d) *Statistical processing*

Descriptive statistical analysis of the collected data was performed, normal distribution was tested and comparisons between the average scores recorded were made. Statistical information processing was done using IBM SPSS, version 23.0. The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to test the normal distribution. In the case of data with normal distribution, the t (Student) test was used to compare the averages of the paired variables, and in the case of values with uneven distribution or ranks, the Wilcoxon signed-rank test was used. For the analysis of three or more groups, the ANOVA test was employed in the case of data with normal distribution, or the non-parametric Kruskal-Wallis test in the case of values with uneven distribution or ranks. The significance threshold for the tests used was $\alpha = 0.05$ (5%), 0.01 (1%) or 0.001.

Results

To process the data collected after performing the measurements and applying the "Self-esteem scale" related questionnaire, the distribution of the recorded scores was verified (Table I).

Considering the results of the Kolmogorov-Smirnov test, the data recorded concerning the percentage of body fat were normally distributed, while in the case of self-esteem, data were not normally distributed. Consequently, in order to verify the significance of the differences between the averages of the results from the initial test (T1) and those from the final test (T2), the parametric tests were used in the first case and the non-parametric tests in the latter case.

Table I

Distribution of body fat (BF) and self-esteem (SE) before and after participation in the intervention program (N = 89).

Variables	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
BF (%) T1	.082	89	.199	.984	89	.351
BF (%) T2	.060	89	.200*	.991	89	.833
SE T1	.099	89	.031	.953	89	.003
SE T2	.139	89	.000	.916	89	.000

a. t-test; b. Wilcoxon signed ranks test

Table II

Significance of differences between average body fat (BF) and self-esteem (SE) scores in the subjects included in the study (N = 89).

Pair variables	Mean	Std. Deviation	Std. Error Mean	t ^a /z ^b	df	Sig. (2 tailed)	d
BF (%) T1 - BF (%) T2	22.8806	2.42151	.25668	30.765	88	.000	3.26
SE T2 - SE T1	17.8679	1.90217	.20163	.818	88	.000	-.84

a. t-test; b. Wilcoxon signed ranks test

According to Table II, in the subjects (N = 89) participating in a 12-month training program in gyms, the percentage of body fat decreased, and the self-esteem score increased. As regards the averages of the body fat

percentage, calculated before and after the participation in trainings, the differences were significant ($t = 30.765$, $df = 88$, $p = .000$), the size of the effect being substantial ($d = 3.26$). Significant differences were also recorded in the average scores recorded in the self-esteem (SE) assessment before and after participation in the intervention programs ($z = -7.910$, $df = 88$, $p = .000$, $d = -.84$).

Table III

ANOVA test for comparing the means of the body fat percentage (BF) by type of physical activity and time of assessment.

ANOVA						
Time	Variable		Sum of Squares	df	Mean Square	F Sig.
T1	BF (%)	Between Groups	6.320	4	1.580	.260 .903
		Within Groups	509.687	84	6.068	
		Total	516.006	88		
T2	BF (%)	Between Groups	29.861	4	7.465	2.173 .079
		Within Groups	288.547	84	3.435	
		Total	318.407	88		

Since the sample was divided into five groups, depending on the type of physical activity performed, the comparison of group averages/means was performed using ANOVA and Kruskal Wallis tests, depending on the distribution of data. In this way, it was checked whether there were significant differences between the mean percentage of body fat tissue or self-esteem, depending on the type of physical activity performed and the time of measurement (Tables III and IV).

Although at the end of the study the whole sample was found to have a reduced percentage of body fat and increased self-esteem, in both cases the differences between the means recorded in the five groups were not significant ($F = .260$, $sig. = .903$ for T1 and $F = 2.173$, $sig. = .079$ for T2; respectively $\chi^2 = 1.029$, $sig. = .905$ for T1 and $\chi^2 = 1.859$, $sig. = .762$ for T2).

Table IV

Kruskal Wallis test to compare self-esteem (SE) means by type of physical activity and time of assessment.

Test Statistics ^{a,b}				
Time	Variable	Chi-Square (χ^2)	df	Asymp. Sig.
T1	SE	1.029	4	.905
T2	SE	1.859	4	.762

a. Kruskal Wallis Test

b. Grouping Variable: Type of physical activity performed

To assess the influence of the type of physical activity on the percentage of body fat and self-esteem, the means recorded in each group of subjects at the two time moments of the study were compared. The analysis of the distribution following the application of the Shapiro-Wilk test revealed that the scores recorded for the percentage of body fat variable were normally distributed, and the scores recorded for the self-esteem variable were not normally distributed (Table I). Consequently, the comparison of the means of the body fat variable was performed using the t-test for paired samples (Table V), and the comparison of the means of self-esteem was made using the Wilcoxon test (Table VI).

Table V

Comparison of the mean percentage of body fat (BF) before and after the intervention program according to the type of physical activity performed by the subjects. Paired Samples Test^a

Physical activity type	Pair BF	Paired Differences					t	df	Sig. (2-tailed)	d
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Circuit	BF T1 - BF T2	5.709	1.560	.3677	4.933	6.485	15.526	17	.000	3.77
Softball	BF T1 - BF T2	5.161	1.188	.2800	4.570	5.752	18.427	17	.000	4.46
Fitball	BF T1 - BF T2	5.378	2.110	.4974	4.328	6.427	10.811	17	.000	2.62
Aerobic	BF T1 - BF T2	4.377	1.153	.2716	3.803	4.950	16.109	17	.000	3.91
Tae-Bo	BF T1 - BF T2	4.405	1.094	.2654	3.843	4.968	16.595	16	.000	4.15

Table VI

Comparison of self-esteem (SE) means before and after the intervention program by type of physical activity performed by the subjects. Test Statistics^{a,b}

Type of physical activity	Pair	Z	Asymp. Sig. (2-tailed)	Effect size r
Circuit	Self-esteem T2 - Self-esteem T1	-3.729 ^c	.000	-.90
Softball	Self-esteem T2 - Self-esteem T1	-3.732 ^c	.000	-.91
Fitball	Self-esteem T2 - Self-esteem T1	-3.480 ^c	.001	-.84
Aerobic	Self-esteem T2 - Self-esteem T1	-3.753 ^c	.000	-.91
Tae-Bo	Self-esteem T2 - Self-esteem T1	-3.188 ^c	.001	-.80

a. Type of physical activity = Circuit, Softball, Fitball, Aerobic, Tae-Bo; b. Wilcoxon Signed Ranks Test; c. Based on negative ranks.

Table VII

Means and standard deviation in body fat percentage and self-esteem by group and time of measurement. Descriptive Statistics^a

Variables and Time	Circuit (N=18)	Softball (N=18)	Fitball (N=18)	Aerobic (N=18)	Tae-Bo (N=17)
	Mean	Mean	Mean	Mean	Mean
	(StDev)	(StDev)	(StDev)	(StDev)	(StDev)
BF (%) T1	23.17 (2.88)	22.47 (2.65)	22.85 (2.23)	22.76 (1.73)	23.17 (2.66)
BF (%) T2	17.47 (1.82)	17.30 (1.99)	17.47 (1.36)	18.39 (1.21)	18.76 (2.61)
BF % T1 – T2	5.71 (1.06)	5.16 (0.67)	5.38 (0.87)	4.38 (0.51)	4.41 (0.06)
SE T1	21.72 (7.31)	22.61 (7.06)	24.17 (8.17)	21.89 (6.38)	23.06 (9.97)
SE T2	28.28 (7.26)	27.67 (6.13)	27.50 (6.58)	25.72 (6.40)	26.82 (7.66)
SE T2 – T1	6.56 (-0.05)	5.06 (-0.94)	3.33 (-1.59)	3.83 (0.02)	3.76 (-2.31)

The data in Table V, which presents the results obtained when comparing the average percentage of body fat, show that in all groups performing physical activity the differences between the mean scores recorded at the two time moments of the study were significant and the effect size was quite substantial. We obtained the same findings following the review of the results obtained after applying the Wilcoxon test for the self-esteem variable (Table VI).

Discussions

According to Sziva et al. (2009), aging results in a change in body composition - a gradual increase in weight and body fat percentage, while lean body mass (LBM) decreases. These negative changes in the human body composition can lead to metabolic syndrome, physical exercise being recommended as a mediator for the positive

change in human body composition (Theodorakopoulos et al., 2017).

In our study, following participation in the physical training programs in gyms, it can be seen that for the entire sample included in the study the body fat percentage decreased by 5.01%, i.e. from 22.88 to 17.87% (Table II). Differentiated by type of physical activity, the decreases in the body fat percentage of the participants were as follows: circuit group - 5.71%, fitball group - 5.38%, softball group - 5.16%, tae bo group - 4.41% and aerobics - 4.38% (Table VII). However, although there were differences between the averages/mean results of the subjects included in the five groups, the ANOVA analysis shows that they were not significant (see Table 3 above); thus, it can be concluded that the type of physical activity performed is not decisive in reducing the body fat percentage.

Bicer (2013) found that the average self-esteem increased as an effect of aerobic exercise practiced for 12 weeks by a group of students; before the intervention it was 33.21% and after the intervention it increased to 36.32%, which allowed to conclude that self-esteem is positively influenced by physical exercise.

In a study conducted on 300 subjects aged 20-60, which analyzed the relationship between physical activity and self-esteem, Sani et al. (2016) estimated, using a pattern, that physical activity is directly and indirectly associated with self-esteem.

In a comparative study conducted on 84 students, Mousavi & Pour (2016) concluded that participation in an aerobic exercise program for 8 weeks contributed to increased self-esteem.

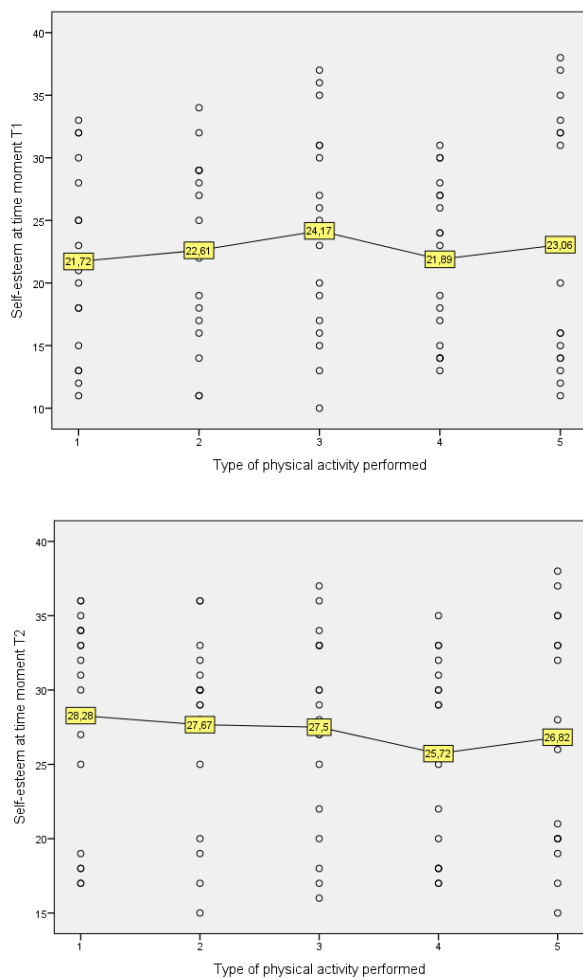


Fig. 1 – Dispersion diagram and interpolation line of self-esteem score means by type of physical activity and assessment time.

Similar results were obtained in our study, self-esteem increasing by 4.51 p.p., from 22.69 p.p. at the beginning of the physical activity program to 27.20 at its end (Table II), this indicator being maintained at a medium level. Increases in the final self-esteem score were also found in the physical activity groups (Fig. 1), the highest increase being recorded in the circuit group (6.56 p.p. – from 21.72 to 28.28) and the lowest improvement in the fitball group (3.33 p.p. – from 27.17 to 27.50). However, according to the data presented in Table IV above, the differences

between the groups were not significant ($\chi^2 = 1.859$, $df = 4$, $p = .762$), which means that self-esteem is not influenced by the type of physical activity practiced, only regular physical training being important.

Conclusions

1. In the sample of adult women participating in our study, physical activity performed for 12 months, three times a week, led to a decrease in body fat percentage and an increase in self-esteem, validating the hypothesis that physical activity positively influences the two dependent study variables.

2. Regarding the effect of the type of physical activity on the two reviewed aspects, the study reveals that the differences between the average scores recorded at the beginning of the study and those recorded at its end are not significant, which means that physical activity practice and not the type of physical exercise practiced is important.

Conflicts of interest

The authors hereby state that there is no conflict of interest involving this study.

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