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Effects of Different Group Fitness Programs on Body Composition and Functional Capacity

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Abstract: *Group fitness programs are widely used as non-pharmacological interventions for improving body composition and functional capacity in women. However, limited evidence directly compares the effectiveness of different group exercise modalities under identical experimental conditions.Objective: To compare the effects of Zumba, women's fitness, and Pilates programs on body composition and aerobic capacity in adult women. A total of 101 healthy women were assigned to four groups: Zumba (n = 23), women's fitness (n = 31), Pilates (n = 26), and control (n = 21). Experimental groups participated in supervised training programs three times per week for 12 weeks (60 min/session), while the control group maintained habitual activities. Body composition was assessed using bioelectrical impedance analysis, and aerobic capacity was estimated through the UKK 2-km Walk Test. Mixed-design ANOVA and Cohen's d effect sizes were used to evaluate intervention effects. Significant group × time interactions were observed for all analyzed variables ($p < 0.01$). The Zumba group achieved the greatest reductions in body weight (-4.4 kg) and body fat percentage (-4.9%), alongside the largest increase in VO_2max (+6.3 $ml \cdot kg^{-1} \cdot min^{-1}$). The fitness group also demonstrated significant improvements in body composition and aerobic capacity, although to a lesser extent. Pilates produced moderate but significant improvements, while the control group showed negligible changes. Effect size analysis revealed large effects for Zumba in body fat reduction (d = 1.09), body water percentage (d = 1.21), and VO_2max (d = 1.46). Women's fitness showed large effects for VO_2max (d = 1.01), whereas Pilates generated small-to-moderate effects across variables. All three exercise programs positively influenced body composition and functional capacity in women. However, Zumba produced the most pronounced improvements in reducing adiposity and enhancing aerobic fitness, suggesting that high-volume aerobic group exercise may represent the most effective strategy for improving health-related fitness in adult women.*

Keywords: *Aerobic exercise, VO_2max, body fat percentage, women, Pilates, Zumba*

Introduction

A reduced level of physical activity and an increase in obesity today are important health problems that negatively affect body composition (increase in the proportion of fat tissue and decrease in the proportion of muscle) and increase the risk of chronic diseases. The World Health Organization recommends that adults get at least 150–300 minutes of moderate-intensity or 75–150 minutes of high-intensity aerobic activity per week, including strength training, to improve functional capacity and general health. One of the popular forms of exercise, especially among women, are group fitness programs. These programs often include choreographed dance moves to music (eg, aerobics, Zumba®, combination workouts) and are supervised by instructors, making them engaging and fun for a wide range of participants. The main purpose of group fitness is to improve body composition (decreasing fat tissue, increasing muscle mass) and cardiorespiratory endurance, strength and flexibility.

Some studies show that group fitness programs can have a positive effect on body composition and health. For example, Barranco-Ruiz et al. (2019) found in a 16-week study that women who regularly participated in choreographed group training (Zumba and Zumba with body weight exercises) had significant improvements in parameters of body composition and cardiovascular health. Similarly, Špirtović et al. (2023) in a 12-week intervention with mixed aerobics recorded a decrease in body mass by about 2.5%, waist diameter by 3.4% and the percentage of fat tissue by 10.6%, with a significant increase in the proportion of muscle mass. Recent research by Špirtović et al. (2025) confirmed that different types of group aerobic programs (mix aerobics, kickboxing aerobics, step aerobics) during 12 weeks significantly reduce body mass and the proportion of fat tissue and improve the lipid profile in obese

young women. These results show that structured group training can lead to improvements in body composition and cardiometabolic status.

However, findings on the impact of group fitness programs are not always consistent. For example, Delextrat et al. (2015) reported that an 8-week Zumba intervention significantly increased maximal aerobic capacity (VO_2max) of participants but did not lead to significant changes in body composition. In other words, women achieved better results on endurance tests after the Zumba program (VO_2max +3.6%), but there was no statistically significant reduction in body fat. We find similar contradictory results in other studies: some (Bjelica, 2020) show improvements in body composition after Zumba and fitness training, while others (Delextrat et al., 2015) do not find significant changes in fat deposits.

In addition to aerobic dance programs, popular group fitness programs also include methods such as Pilates, which combines strength, stability and flexibility exercises. Gökalp and Kirmizigil (2025) showed that an 8-week reformer Pilates program in obese and overweight women significantly improved body composition and increased muscle strength and endurance. These results indicate that programs like Pilates, although less focused on cardio, can work to reduce fat content and increase muscle mass, which favors better functional ability of the exerciser.

Functional capacity, and thus cardiovascular performance, is often measured by estimating VO_2max. In field conditions, e.g. UKK 2-kilometer walking test, in which the subject walks 2 km as fast as he can, with time and heart rate measured at the end of the test. According to Otinwa (2005), based on the obtained values, the UKK Institute's formula is applied to calculate the fitness index (Fitness Index) or estimate VO_2max. This provides an objective indicator of the aerobic endurance of the exerciser, which can be compared with norms and progress can be monitored.

In light of the above findings, it is clear that group fitness programs can have a beneficial effect on body composition and functional capacity, but with certain limitations and variability of effects. Previous research shows that changes in body composition in women participating in group training are often modest and that they differ depending on the type of program, intensity and length of the intervention. Furthermore, increases in aerobic capacity were observed already after several weeks of exercise (eg a significant increase in VO_2max after 8 weeks of Zumba). Further systematic research comparing different group fitness programs – from dynamic aerobic training to strength and flexibility programs – is needed to more precisely determine their impact on weight loss, body fat percentage and improvement in fitness.

Method

Sample of participants

A total of 101 female participants participated in the research, divided into four groups: Zumba group (n=23), Fitness group (n=31), Pilates group (n=26) and control group (n=21). All subjects were healthy, with no recorded chronic diseases, injuries or medical conditions that could limit participation in exercise programs. Participation in the research was voluntary, and all respondents signed an informed consent before inclusion.

The average age of the subjects in the Zumba group was 32 ± 4.8 years, in the Fitness group 31 ± 5.1 years, in the Pilates group 29 ± 4.6 years, while in the control group the average age was 31 ± 5.0 years.

The average body height of the subjects was uniform between the groups. In the Zumba group it was 167.1 ± 5.8 cm, in the Fitness group 166.8 ± 6.2 cm, in the Pilates group 167.4 ± 5.6 cm, and in the control group 166.9 ± 5.9 cm, which indicates a high degree of sample homogeneity in terms of basic anthropometric characteristics.

The research is planned to be carried out in the fitness centers "Sparta" and "Elite Fit" in Pale, where the subjects from the experimental groups will attend organized group exercise programs, while the control group will continue with their usual daily activities without participating in a structured training program.

Sample of measuring instruments

The body composition of the test subjects was assessed using a multi-frequency body composition analyzer Tanita MC-545N (Tanita Corp., Tokyo, Japan), based on the bioelectrical impedance analysis (BIA) method. The device was used to determine body mass (kg), body fat percentage (%), muscle mass (kg), total body water (%) and metabolic age. All measurements were carried out according to the manufacturer's recommendations, under standardized laboratory conditions.

Aerobic capacity was assessed using the UKK 2-km Walk Test, a validated field test for assessing the cardiore-

spiratory fitness of adults. During the test, the time needed to cover the distance of 2 km and the heart rate immediately after the end of the test were recorded.

Maximum oxygen uptake values (VO_2max; $ml \cdot kg^{-1} \cdot min^{-1}$) were calculated using the standard UKK equation for women: $VO_2max = 116.2 - (2.98 \times time) - (0.11 \times heart\ rate) - (0.14 \times age) - (0.39 \times BMI)$

In doing so, the body mass index (BMI) was used exclusively as a constituent element of the aforementioned equation for estimating VO_2max, and was not analyzed as a separate research variable.

Experimental program

The experimental program lasted 12 weeks, with a frequency of three training sessions per week, which makes a total of 36 training sessions per group. The duration of each training session was 60 minutes and included the introductory part (10 min), the main part (45 min) and the final part with stretching and relaxation exercises (5 min). The intensity of the exercise varied depending on the characteristics of the program and ranged from 65–85% of maximum heart rate (HRmax) in the Zumba group, 60–80% of HRmax in the Fitness group, and 50–70% of HRmax in the Pilates group. During the experimental period, the principle of progressive loading was applied through a gradual increase in the complexity of the exercises, the volume of work and the intensity of the load. Accordingly, the programs were organized through three consecutive phases: adaptation (weeks 1–4), development (weeks 5–8), and progressive phase (weeks 9–12). The characteristics and progression of the experimental programs are shown in Table 1.

Table 1.Progression *of experimental programs over 12 weeks*

Program phase	Zumba	Fitness	Pilates
S1–S4 Adaptation phase	Salsa, Merengue, Cumbia and Reggaeton basic steps; simple choreography; continuous aerobic work (65–70% HRmax)	Aerobic exercises, squats, lunges, thrusts, rowing with elastic bands; 2×12–15 repetitions; 60–65% HRmax	Hundred, Roll-Up, Single Leg Stretch, Spine Stretch; breathing control and activation of the body center; 50–60% HRmax
S5–S8 Development phase	More complex choreographies; changes in the direction of movement; longer aerobic intervals; 70–80% HRmax	Step aerobics, circuit training, squats, lunges, push-ups and rowing with dumbbells (1-3 kg); 3×12–15 repetitions; 65–75% HRmax	Double Leg Stretch, Shoulder Bridge, Side Kick Series, Swan; prolonged isometric contractions; 55–65% HRmax
S9–S12 Progressive phase	High-energy Zumba sequences; Salsa-Reggaeton-Cumbia combinations; shorter recovery intervals; 75–85% HRmax	Circuit training with aerobic and resistance exercises; squats, lunges, push-ups, push-ups, rows and trunk exercises; increased volume of work; 70–80% HRmax	Plank, Side Plank, Swimming, Teaser modifications and advanced stabilization exercises; 60–70% HRmax

Statistical data processing

Statistical data analysis was performed using the IBM SPSS Statistics 26.0 software package (IBM Corp., Armonk, NY, USA). Basic descriptive statistics were calculated for all analyzed variables, including arithmetic mean (M) and standard deviation (SD).

Before conducting inferential statistical procedures, the normality of data distribution was checked using the Shapiro–Wilk test, while the homogeneity of variances was assessed using Levene's test. Considering that all the analyzed data met the requirements for the application of parametric statistical procedures, the results of the mentioned tests are not presented in the paper in order to avoid unnecessary load on the tabular presentation.

To evaluate the effects of the experimental treatment, an analysis of variance with repeated measurements (Mixed-design ANOVA) was used, where the time factor included two levels (initial and final measurement), while the group factor included four levels (Zumba, Fitness, Pilates and control group). The main effects of time and group were analyzed, as well as the interaction effect of group × time.

In order to assess the practical significance of the changes between the initial and final measurements, the effect size was calculated using Cohen's coefficient (Cohen's d). The obtained values were interpreted according to standard criteria: $d < 0.20$ negligible effect, 0.20–0.49 small effect, 0.50–0.79 moderate effect and ≥ 0.80 large effect. The level of statistical significance was set at $p < 0.05$.

Results

The results of the initial measurement indicate a high degree of homogeneity between the experimental and control groups in all observed variables. The average values of body height ranged from167.0 cm in the Zumba group, 168.5 cm in the Fitness group, 166.5 cm in the Pilates group and 167.8 cm in the Control group. Based on the graph

shown, a decrease in the value of the body mass index (BMI) can be observed in all experimental groups after the implemented exercise program. The largest decrease was recorded in the Zumba group (24.8 → 23.3), followed by the Fitness group (24.6 → 23.4), while the smallest change was registered in the Pilates group (25.3 → 24.7). The control group showed a minimal reduction in BMI values (24.8 → 24.6), which indicates a greater effect of organized exercise programs compared to no intervention.

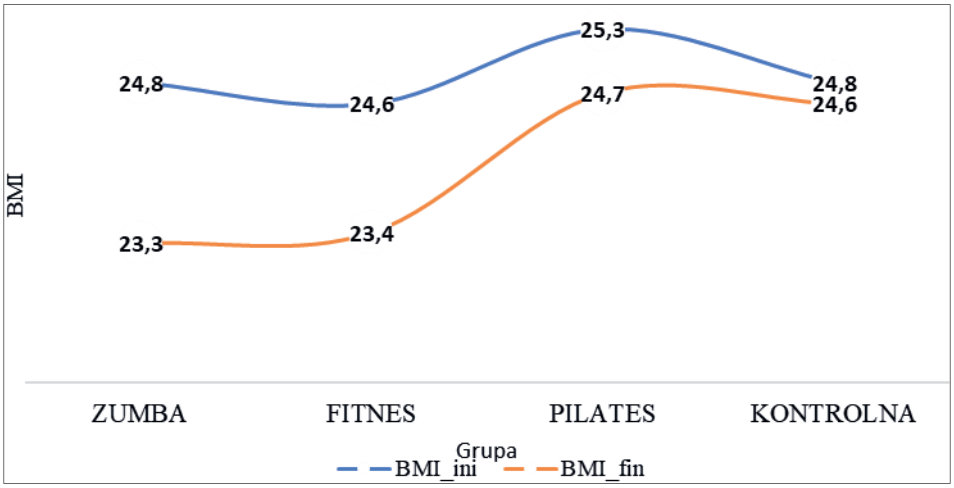

***Chart 1.Tendency** of change in BMI during the experimental treatment*

The values of the total percentage of body fat were almost identical between the groups (34.5–35.1%). A similar pattern was observed in muscle mass, percentage of body water, metabolic age and total energy requirements. Initial values of VO_2max ranged between 31.1 and 31.8 ml·kg^{-1}·min^{-1}, which further confirms the comparable aerobic capacity of the subjects before the start of the intervention. This distribution of initial results enables a reliable assessment of the effects of applied programs during the experimental period.

***Table 2.** Descriptive parameters from the initial measurement*

Variable	Zumba (n=23) M±SD	Fitness (n=31) M±SD	Pilates (n=26) M±SD	Control (n=21) M±SD
Body weight (kg)	69.3±9.6	69.8±10.4	70.1±8.9	69.9±9.8
Total fat (%)	34.8±4.6	35.1±4.9	34.5±4.2	34.9±4.8
Muscle mass (kg)	25.6±3.2	25.4±3.5	25.7±3.0	25.5±3.4
Water (%)	45.2±3.1	45.0±3.4	45.4±3.0	45.1±3.2
Metabolic years	43.8±6.3	44.2±6.5	43.6±5.9	44.0±6.2
Total requirements (kcal)	2038±212	2047±224	2029±205	2035±218
VO_2max (ml·kg^{-1}·min^{-1})	31.5±4.2	31.1±4.5	31.8±4.0	31.4±4.3

After the end of the intervention period, differences between the groups were evident in almost all analyzed variables. The most pronounced changes were recorded in the Zumba group, which achieved the lowest average body weight (69.9±8.8 kg), the lowest body fat percentage (29.9±4.2%) and the highest VO_2max value (37.8±4.4 ml·kg^{-1}·min^{-1}). The fitness program also resulted in significant improvements, while the changes in the Pilates group were more moderate. The control group showed minimal oscillations between the initial and final measurements, with all values remaining almost unchanged. Observed between the groups, the results indicate a superior effect of the Zumba program in improving the body composition and functional abilities of the subjects.

***Table 3.** Descriptive parameters from the final measurement*

Variable	Zumba (n=23) M±SD	Fitness (n=31) M±SD	Pilates (n=26) M±SD	Control (n=21) M±SD
Body weight (kg)	64.9±8.8	66.5±9.8	68.5±8.6	69.3±9.7
Total fat (%)	29.9±4.2	31.6±4.5	32.8±4.0	34.5±4.7
Muscle mass (kg)	27.8±3.3	27.1±3.4	26.6±3.0	25.6±3.3

Water (%)	49.0±3.0	47.8±3.2	46.8±2.9	45.2±3.1
Metabolic years	38.2±5.8	39.9±6.0	41.0±5.6	43.7±6.0
Total requirements (kcal)	2118±225	2102±219	2078±208	2032±216
VO_2max (ml·kg^{-1}·min^{-1})	37.8±4.4	35.6±4.2	33.9±3.8	31.5±4.2

Analysis of the group × time interaction showed statistically significant effects for all analyzed variables ($p<0.01$), which confirms that the changes during the experimental period depended on the type of applied program. The largest reduction in body weight was achieved in the Zumba group (-4.4 kg), followed by the Fitness (-3.3 kg) and Pilates group (-1.6 kg), while the control group recorded a minimal change (-0.6 kg). A similar trend was registered for body fat percentage, where the Zumba program led to the greatest reduction (-4.9%), with F=12.31 ip=.001. The most pronounced increase in aerobic capacity was achieved in the Zumba group (+6.3 ml·kg^{-1}·min^{-1}), then in the Fitness (+4.5 ml·kg^{-1}·min^{-1}) and Pilates group (+2.1 ml·kg^{-1}·min^{-1}), while no practically significant change was registered in the control group. The highest F value was obtained precisely for VO_2max (F=15.86; p=.001), which indicates that this variable was the most sensitive to the applied interventions.

Table 4. *Mixed ANOVA (group × time)*

Variable	Zumba ini/fin	Fitness ini/fin	Pilates ini/fin	Control ini/fin	F	Sig.
Body weight (kg)	-4.4	-3.3	-1.6	-0.6	8.94	.001
Total fat (%)	-4.9	-3.5	-1.7	-0.4	12.31	.001
Muscle mass (kg)	+2.2	+1.7	+0.9	+0.1	7.48	.001
Water (%)	+3.8	+2.8	+1.4	+0.1	9.85	.001
Metabolic years	-5.6	-4.3	-2.6	-0.3	6.72	.001
Total requirements (kcal)	+80	+55	+49	-3	4.11	.009
VO_2max (ml·kg^{-1}·min^{-1})	+6.3	+4.5	+2.1	+0.1	15.86	.001

The effect size analysis showed clear differences in the effectiveness of the applied programs. The Zumba program achieved the greatest effects in all analyzed variables, with large effects registered for total fat (d=1.09), body water (d=1.21), metabolic age (d=0.89) and especially VO_2max (d=1.46). The fitness program also showed significant adaptations, with large effects for VO_2max (d=1.01) and body water percentage (d=0.84), while the effects on other variables were mostly moderate. The Pilates program produced small to moderate effects, with the largest effect recorded for VO_2max (d=0.53). In contrast, the control group showed negligible effects in all analyzed indicators (d=0.02–0.08), which confirms that the observed changes are the result of the applied experimental programs. Observing the overall pattern of results, it can be concluded that Zumba was the most effective modality for improving the body composition and functional capacities of the test subjects.

Table 5. *Effect size (Cohen's d) for pre-post changes in anthropometric and functional variables across study groups*

Variable	Zumba	Fitness for women	Pilates	Control
Body weight	0.48**	0.32**	0.18*	0.06*
Total fat (%)	1.09****	0.73***	0.39**	0.08*
Muscle mass (kg)	0.67***	0.50***	0.30**	0.03*
Water (%)	1.21****	0.84****	0.47**	0.04*
Metabolic years	0.89****	0.61***	0.42**	0.05*
Total requirements (kcal)	0.38**	0.25**	0.16*	0.02*
VO_2max (ml·kg^{-1}·min^{-1})	1.46****	1.01****	0.53***	0.02*

Legend: *Cohen's d < 0.20 = negligible effect*; Cohen's d = 0.20–0.49 = small effect**; Cohen's d = 0.50–0.79 = moderate effect***; Cohen's d ≥ 0.80 = large effect*****

The graphic display additionally confirms the results obtained by statistical analysis. The largest relative changes were recorded in the Zumba group, which achieved a 5.8% reduction in body mass, a 14% reduction in body fat and a 20% increase in VO_2max. The fitness program led to somewhat smaller but still pronounced adaptations, including a 14.5% increase in aerobic capacity and a 10% decrease in body fat. The Pilates group achieved moderate improvements in all observed indicators, while the changes in the control group were minimal and without practical significance. Viewed as a whole, the graph clearly shows that the intensity of positive changes was proportional to the demands and metabolic load of the applied programs, with Zumba achieving the most favorable adaptive response.

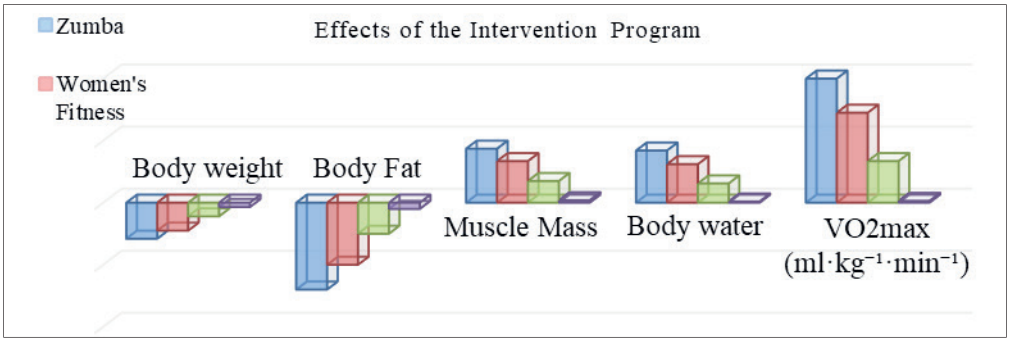

Chart 2. *Changes Following the Intervention Program Between Groups*

Discussion

The results of this research showed that all three experimental programs led to positive changes in the parameters of body composition and functional abilities of women, with the greatest effect achieved in the Zumba group. The most pronounced changes were registered in the reduction of body fat percentage, increase in muscle mass, increase in body water and improvement of aerobic capacity. Such findings confirm earlier research indicating that group aerobic exercise programs are an effective strategy for improving the health status of women (Ljubojević et al., 2022).

The biggest changes in this research were recorded in the respondents included in the Zumba program. The decrease in body mass and percentage of body fat, with a simultaneous increase in VO_2max values, agree with the results of previous studies that showed that Zumba training leads to significant improvements in cardiorespiratory endurance and body composition in women of different ages (Donath et al., 2014; Ljubojević et al., 2022). A possible explanation for such results lies in the fact that Zumba involves continuous aerobic work of medium and high intensity with the engagement of large muscle groups for a long period of time.

The increase in VO_2max value was one of the most significant changes in this research. The obtained results confirm the findings of Donath et al. (2014), who state that Zumba training can produce significant cardiorespiratory adaptations due to high energy expenditure and the intermittent nature of the load. Also, a systematic review by Tsugusi et al. (2019) showed that regular participation in Zumba programs significantly improves aerobic capacity and reduces risk factors associated with a sedentary lifestyle.

The obtained results are additionally supported by a recent meta-analysis that showed that Zumba programs achieve a significant reduction in fat tissue and an increase in VO_2max values in adult women, with the greatest effects registered in programs lasting at least eight weeks (Chavarrias et al., 2021). These findings almost identically follow the results obtained in this research, where the biggest changes were recorded precisely in the parameters of aerobic capacity and body composition.

The fitness program for women also led to significant improvements in the analyzed variables. The obtained results support recommendations that highlight the benefits of combined aerobic-strength training for improving body composition and functional abilities of adult women (Garber et al., 2011). The simultaneous decrease in fat tissue and increase in muscle mass indicate a favorable adaptive response of the organism, which is also confirmed by the results of the meta-analysis by Schwingshackl et al. (2013).

The increase in muscle mass registered in the Fitness group can be explained by the combination of aerobic and resistance exercises, which represent a strong stimulus for muscle hypertrophy and preservation of lean body mass.

A systematic review by Zouit et al. (2023) showed that programs that include strength training components lead to significant improvements in muscle mass, body composition, and functional ability in women.

The Pilates program led to statistically significant, but slightly smaller changes compared to the other two experimental treatments. Similar results were reported by Cruz-Ferreira et al. (2011), who determined that Pilates improves functional abilities, body posture and muscular endurance, but has a smaller effect on fat tissue reduction compared to programs with a dominant aerobic component. Smaller effects in this research are probably a consequence of the lower energy expenditure characteristic of Pilates training.

Although the effects of the Pilates program were smaller compared to Zumba and the Fitness program, the results are in line with modern systematic reviews that indicate that Pilates can significantly improve certain parameters of body composition, especially the reduction of body mass and the percentage of fat tissue, but the effects are usually of moderate intensity (Pereira et al., 2022; Silva et al., 2022). Similarly, Parveen et al. (2023) conclude that Pilates is an effective intervention for improving women's health, especially in the domain of postural control, functional ability and quality of life, while changes in body composition are generally less pronounced than with higher intensity aerobic programs.

A particularly significant finding is the increase in muscle mass in all experimental groups. These results suggest that the reduction in body mass was not the result of a loss of lean body mass, but primarily of a reduction in adipose tissue. This finding is of practical importance because it confirms that properly programmed recreational activity can simultaneously improve body composition and preserve the muscular status of the organism (Garber et al., 2011).

The main contribution of this research is reflected in the direct comparison of three widely represented recreational programs in women using an identical experimental design. The obtained results indicate that all analyzed programs can represent effective models for improving women's health, with Zumba achieving the greatest effects on body composition and cardiorespiratory abilities.

The results of this research confirm the modern trend in the literature according to which programs with a dominant aerobic component have the greatest effects on reducing fat tissue and increasing cardiorespiratory fitness, while programs like Pilates show more significant effects in the domain of functional stability, posture and neuromuscular control. This pattern has been confirmed in several recent studies during the last few years (Pereira et al., 2022; Parveen et al., 2023; Chavarrias et al., 2021).

Conclusion

The results of this research show that Zumba, fitness and Pilates programs during 12 weeks led to statistically significant improvements in body composition and functional capacity of women. All experimental groups achieved a decrease in body mass and percentage of fat tissue, an increase in muscle mass and an improvement in aerobic capacity, while no significant changes were recorded in the control group.

The most pronounced effects were achieved in the Zumba program, which resulted in the greatest reduction in body mass and fat tissue and the greatest increase in VO_2max. The fitness program showed significant and practically important effects on most of the analyzed indicators, while Pilates led to moderate, but statistically significant improvements. The obtained findings indicate that programs with a dominant aerobic component achieve greater effects on improving body composition and cardiorespiratory capacity compared to programs with a lower metabolic load.

The practical value of this research is reflected in the confirmation that different forms of group fitness are effective models for improving the health status of women, whereby Zumba can be recommended as the most effective program for reducing fat tissue and improving aerobic fitness. Future research should include longer intervention periods, control of eating habits and monitoring of long-term maintenance of the achieved effects in order to further clarify the mechanisms of adaptation to different group fitness programs.

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