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Comparison of the Effectiveness of Circuit Weight Training and Aerobic Exercise on Reducing Body Fat Percentage and Body Mass Index in Women

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Abstract

This study aims to compare the effectiveness of Circuit Weight Training (CWT) and aerobic exercise on reducing body fat percentage and Body Mass Index (BMI) in women with overweight to obesity categories. The main premise of this study is that structured physical exercise can improve body composition, while exercise methods that combine elements of resistance and cardiorespiration, such as CWT, are thought to have greater potential than conventional aerobic exercise. The study uses a quantitative approach with a quasi-experimental two-group pretest-posttest design. The sample consisted of 30 overweights to obese women who were divided into two groups, namely the CWT group and the aerobic exercise group. The intervention was given for eight weeks with a frequency of three times per week. Measurement instruments include Bioelectrical Impedance Analysis to measure body fat percentage, as well as stadiometers and digital scales to calculate BMI. Data were analyzed using descriptive statistics, normality test, paired sample t-test, independent sample t-test, and effect size. The results showed that the CWT group experienced a decrease in average body fat from 284.47 to 216.00, while the aerobic exercise group decreased from 243.80 to 220.33. In the BMI variable, the CWT group decreased from 270.67 to 233.20, while the aerobic exercise group decreased from 253.67 to 242.33. The paired sample test showed a significant decrease in body fat ($p = 0.018$), but a significant decrease in BMI ($p = 0.079$). The results of the independent sample showed that there was no significant difference between the CWT group and aerobic exercise in posttest body fat ($p = 0.869$) or posttest BMI ($p = 0.689$). Thus, structured physical exercise has been shown to influence body fat reduction, while CWT shows a tendency to be more effective descriptively, but has not been shown to be significantly superior to aerobic exercise.

Keywords: Circuit Weight Training, aerobic exercise, body fat percentage, Body Mass Index (BMI), overweight,

INTRODUCTION

Overweight and obesity are global health problems that are increasing with changes in modern lifestyles, low physical activity, increased sedentary behavior, and imbalances between energy intake and expenditure. This condition not only has an impact on physical appearance but is also closely related to an increased risk of non-communicable diseases, such as type 2 diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease, metabolic disorders, and a decrease in quality of life. In the context of health and exercise, body composition control is one of the important indicators to assess the effectiveness of exercise programs, especially in individuals with overweight and obesity categories. The two most used indicators are body fat percentage and Body Mass Index (BMI), as both provide an overview of anthropometric status, body tissue composition, and potential metabolic health risks.

BMI is often used as a practical indicator in classifying weight status because the calculation is simple, which is based on a comparison of weight and height. However, BMI has limitations because it cannot distinguish the composition of fat mass and lean free mass. Therefore, measuring body fat percentage is important to provide more specific information about the accumulation of adipose tissue. Recent studies have shown that physical exercise interventions play a significant role in improving body composition, lowering body fat, improving metabolic profile, improving cardiorespiratory fitness, and supporting sustainable weight management (Wang et al., 2022; Jayedi et al., 2024; Men et al., 2025; Huang et al., 2025). Other evidence also suggests that physical exercise combined with dietary regulation, nutrition education, or mealtime restriction may reinforce anthropometric and metabolic changes in overweight and obese populations (Bogataj et al., 2021; Kotarsky et al., 2021; Long et al., 2023; Li et al., 2024; Dai et al., 2025).

Although the benefits of physical exercise have been widely proven, choosing the most effective exercise method to lower body fat percentage and BMI is still an important issue. Some people choose aerobic exercise because it is considered easy to do, does not require complex equipment, and has long been recommended for calorie burning. Aerobic exercise such as jogging, cycling, swimming, or moderate-intensity gymnastics has been shown to increase energy expenditure and improve cardiorespiratory capacity (Li et al., 2021; Jia et al., 2022; Špirtović et al., 2023; Cicek et al., 2024; Jayedi et al., 2024; Sun et al., 2025; Ben Cheikh et al., 2025). However, aerobic exercise performed in monotony often has limitations in maintaining or increasing muscle mass, even though muscle mass plays an important role in maintaining the basal metabolic rate and the sustainability of body fat loss (Wang et al., 2022; Mesinovic et al., 2025). In addition, exercise adherence can decrease if the form of exercise is considered repetitive and less varied, so an exercise approach is needed that is not only physiologically effective, but also attractive and applicable to overweight and obese individuals (Mendonça et al., 2022; Gao et al., 2025).

Circuit Weight Training (CWT) is a form of training that combines several weight or resistance training posts in a row with a relatively short rest time. These characteristics make CWT an efficient, intensive, and able exercise to increase metabolic responses during and after exercise (Emamdoost et al., 2021; Sardeli et al., 2022; John et al., 2023; Davis et al., 2024). However, in practice, there are still many overweight and obese individuals who do not understand whether CWT is more effective than conventional aerobic exercise in reducing body fat and BMI. This issue shows the need for empirical evidence that directly compares the two exercise methods in a single controlled study design, as some previous studies still show variation in results based on the type of exercise, intervention dose, subject characteristics, and body composition indicators used (Oh et al., 2023; Binmahfoz et al., 2025; Huang et al., 2025).

International literature shows that aerobic exercise, resistance training, and combination training have a positive contribution to changes in body composition. Aerobic exercise has been shown to be effective in losing weight, improving fat metabolism, improving cardiorespiratory fitness, and supporting blood glucose control in overweight and obese individuals (Jia et al., 2022; Jayedi et al., 2024; Sun et al., 2025). A meta-analysis of aerobic exercise and weight loss in adults showed that the body's response to exercise was influenced by the dosage of exercise, duration, frequency, and intensity applied (Jayedi et al., 2024). Other research has also shown that aerobic exercise combined with diet or lifestyle interventions can have a greater impact on weight loss and improvement of metabolic parameters (Dai et al., 2025; Long et al., 2023).

Meanwhile, resistance training has the advantage of maintaining or increasing muscle mass, increasing strength, improving physical function, and promoting metabolic adaptations that favor body fat loss. Systematic review and meta-analysis show that resistance training during weight loss programs can improve body composition, muscle strength, and cardiometabolic health in overweight or obese individuals (Binmahfoz et al., 2025; Mesinovic et al., 2025). In addition, resistance training combined with aerobic exercise has been shown to have a broader effect than a single intervention, especially in improving fitness, changes in body composition, and improving metabolic indicators (Oh et al., 2023; Mendonça et al., 2022; Kong et al., 2022; Cao et al., 2022). The EXOFFIT study also emphasizes the importance of comparing aerobic exercise, resistance, and combinations in a time-matched manner so that the effectiveness of each method can be assessed more objectively (Davis et al., 2024).

In the context of circuit training, several studies have shown that circuit training models can provide cardiorespiratory and neuromuscular stimuli simultaneously. Circuit exercise training has been reported to improve cardiorespiratory index, body image, and body composition in obese students (John et al., 2023). Circuit resistance training is also associated with changes in inflammatory markers in obese men, indicating the potential of this exercise in influencing more complex physiological responses (Emamdoost et al., 2021). In addition, high-intensity functional training and concurrent training models show positive results on body composition, physical fitness, and psychological health in overweight or obese populations (Liu et al., 2026; Gao et al., 2025; Tianyang et al., 2025). The findings reinforce the view that exercises that combine elements of strength and cardiorespiration have the potential to be effective strategies for improving body composition.

Based on the literature, the most recommended solution for body composition control is the application of structured physical exercise of appropriate intensity, frequency, and duration. Aerobic exercise remains a top choice because it is easily accessible and safe for various age groups and has been shown to contribute to increased energy expenditure, cardiorespiratory capacity, and weight control (Jayedi et al., 2024; Sun et al., 2025). However, combination exercises such as CWT offer additional advantages because they can stimulate energy burning, improve muscle work, improve cardiorespiratory capacity, and potentially increase excess post-exercise oxygen consumption (COPD). COPD describes increased oxygen consumption after exercise as related to physiological recovery processes, energy replenishment, tissue repair, and increased post-workout energy expenditure. Therefore, CWT is expected to have a greater influence on lowering body fat percentage than aerobic exercise that focuses only on moderate-intensity sustained activities, as resistance-based and combination-based exercises have been shown to maintain muscle mass, increase strength, and improve body composition more comprehensively (Mendonça et al., 2022; Oh et al., 2023; Davis et al., 2024; Binmahfoz et al., 2025).

However, there are still some research gaps. First, most previous studies have addressed aerobic exercise, resistance, or combinations in different population and design contexts, so the results cannot always be directly compared (Kong et al., 2022; Cao et al., 2022; Davis et al., 2024). Second, some studies emphasize weight loss, while body fat percentage indicators have not always been analyzed simultaneously with BMI. In fact, a decrease in BMI does not necessarily reflect a decrease in body fat if it is not accompanied by a body composition analysis, because weight changes can be influenced by muscle mass, body fluids, and lean free mass (Wang et al., 2022; Mesinovic et al., 2025; Huang et al., 2025). Third, studies are still needed that compare the effectiveness of CWT and aerobic exercise directly with relatively equivalent duration of interventions, exercise frequency, and subject characteristics. Fourth, in a practical context, there is still limited evidence that can be used by coaches, fitness instructors, health practitioners, and overweight-obese individuals to determine the most efficient, applicative, and data-driven exercise methods, especially on exercise programs that emphasize a combination of body fat reduction and BMI control (John et al., 2023; Gao et al., 2025; Men et al., 2025).

This study aims to analyze and compare the effectiveness of Circuit Weight Training and aerobic exercise on the reduction of body fat percentage and Body Mass Index in women with overweight to obesity categories. Specifically, the study was directed to determine changes in body fat percentage and BMI values before and after the intervention, as well as to compare the differences in effectiveness between the CWT group and the aerobic exercise group. The novelty of this study lies in the direct comparison between CWT and aerobic exercise using two main indicators of body composition, namely body fat percentage and BMI. The study not only assessed general weight changes but also paid attention to more specific indicators of body fat. Thus, the results of the research are expected to make an empirical contribution to the development of a more targeted weight loss exercise program. The scope of this study was limited to structured exercise interventions over a specific period, with overweight to obese female subjects, as well as body composition measurements using relevant instruments such as Bioelectrical Impedance Analysis, digital scales, and stadiometers. The results of this study are expected to be the basis for practical recommendations that the selection of exercise methods needs to consider the main objectives of the exercise, time efficiency, physiological response, and sustainability of the exercise program.

METHODS

Research Design

This study uses a quantitative approach with a quasi-experimental method. The design used is a two-group pretest-posttest design, which is a research design that involves two groups of treatment with pre- and post-intervention measurements. The first group received Circuit Weight Training (CWT) treatment, while the second group received aerobic exercise treatment. This design was chosen because it is suitable to test the effectiveness of two forms of exercise against changes in body composition, specifically body fat percentage and Body Mass Index (BMI), under controlled intervention conditions. The pretest-posttest model allows researchers to compare the changes that occurred in each group as well as compare the results between the two exercise groups. This approach is widely used in sports intervention research because it can describe the effects of exercise on physiological and anthropometric indicators after a specific period of exercise (Wang et al., 2022; Jayedi et al., 2024; Davis et al., 2024).

Participants

The population in this study is women with overweight to obese categories who meet the criteria to participate in a structured physical exercise program. The research sample amounted to 30 people who were selected based on inclusion and exclusion criteria. The inclusion criteria include female participants, being in the overweight or obese category based on BMI indicators, being in a healthy condition to do physical activity, willing to participate in a series of exercise programs, and signing an informed consent. Exclusion criteria included participants who were experiencing musculoskeletal injuries, had a history of illness that limited moderate to high intensity physical activity, took fat-burning supplements during the study, or did not follow an exercise program consistently.

The sample was divided into two groups, namely 15 participants in the CWT group and 15 participants in the aerobic exercise group. The group division was carried out by considering the equality of the initial characteristics of the participants so that the comparison of intervention results could be carried out more objectively. The use of a sample of overweight-obese women is relevant because this group has a higher risk of increased body fat and metabolic disorders, thus requiring safe, measurable, and applicative exercise interventions. Previous studies have shown that physical exercise interventions in overweight and obese populations can contribute to body fat reduction, fitness improvement, as well as improved overall health quality (Jia et al., 2022; Long et al., 2023; Huang et al., 2025).

Research Instruments

The main instruments used in this study include Bioelectrical Impedance Analysis (BIA), stadiometer, digital scales, and exercise monitoring sheets. BIA is used to measure participants' body fat percentage before and after the intervention. This instrument was chosen because it is practical, noninvasive, and widely used in body composition measurements in sports and health research. Stadiometers are used to measure height, while digital scales are used to measure weight. Height and weight data are then used to calculate BMI values. Exercise monitoring sheets are used to record participants' attendance, type of exercise, intensity, duration, and participant compliance during the program.

The use of body fat percentage and BMI indicators is carried out because both provide complementary information. BMI can describe your weight status in general, while body fat percentage gives a more specific picture of adipose tissue accumulation. In exercise intervention studies, it is not enough to measure body composition using body weight or BMI alone, because exercise can decrease fat mass while maintaining or increasing lean free mass. Therefore, the use of BIA as a measure of body fat percentage is important to strengthen the interpretation of changes in body composition (Wang et al., 2022; Mesinovic et al., 2025; Binmahfoz et al., 2025).

Research Procedure

The research procedure is carried out through three main stages, namely the initial stage, the intervention stage, and the final stage. In the initial stage, all participants were explained the objectives, benefits, procedures, and potential risks of the research. After the participant expresses their willingness, an informed consent is filled. Furthermore, the researcher conducted initial measurements in the form of height, weight, BMI, and body fat percentage as pretest data. The intervention phase was carried out for eight weeks with a frequency of exercise three times per week. The CWT group underwent training consisting of several weight or resistance training posts that were carried out in sequence with relatively short rest breaks. The form of exercise is structured to involve the main muscle groups of the upper body, lower body, and core parts of the body. The characteristics of this exercise aim to combine strength and cardiorespiratory stimuli in a single training session. The aerobic exercise group underwent exercises based on sustained rhythmic activities of moderate intensity, such as jogging, aerobic gymnastics, or other cardiorespiratory activities tailored to the participants' abilities. The intensity of the exercise is controlled in the range of 60–80% of the maximum heart rate to keep the exercise in a safe and effective zone for fitness development and energy burning.

Data Analysis

The research data was analyzed quantitatively using descriptive and inferential statistics. Descriptive statistics are used to describe the mean, median, standard deviation, variance, minimum value, maximum value, and data range on each variable. The prerequisite test was carried out through the normality test using the Kolmogorov-Smirnov and Shapiro-Wilk, as well as the homogeneity test using the Levene's test. Because the sample size is relatively small, the Shapiro-Wilk results are used as the primary reference in assessing the distribution of data.

To test the difference in pretest and posttest values in a group, a paired sample t-test is used.

The test aims to find out if there is a significant change in body fat percentage and BMI after participants follow the exercise program. Furthermore, an independent sample t-test was used to compare the results of the posttest between the CWT group and the aerobic exercise group. This test aims to find out if there is a difference in effectiveness between the two training methods. In addition to significance values, this study also analyzed effect sizes using Cohen's d, Hedges' correction, and Glass's delta. Analysis of effect measures is important to determine the extent of the impact of the intervention practically, not just based on statistical significance. The interpretation of the results was carried out at a significance level of 0.05. Thus, a p value < 0.05 indicates a significant difference, while a p value > 0.05 indicates that the difference is not statistically significant. This analytical approach is relevant to sports intervention research that assesses the effectiveness of exercise on changes in body composition and anthropometric indicators (Kong et al., 2022; Cao et al., 2022; Jayedi et al., 2024; Dai et al., 2025).

Research Ethics

This study pays attention to the principles of research ethics, including informed consent, data confidentiality, participant anonymity, and training security principles. All participants were given clear information about the research procedure before participating in the program. The identity of the participants is not included in the reporting of the research results and the data obtained is only used for academic purposes. The training program is also prepared considering the principles of safety, progressivity, and participant ability. If the participant experiences a physical complaint or a condition that makes it impossible to continue the exercise, the participant is given the opportunity to stop participation without any consequences. This principle is important because exercise intervention research in overweight and obese individuals needs to consider safety aspects, individual physiological responses, and risk of injury during physical activity (Oh et al., 2023; Gao et al., 2025).

RESULTS

The results of the descriptive analysis showed a change in the value of body fat percentage and Body Mass Index (BMI) after participants received exercise interventions. In the Circuit Weight Training (CWT) group, the average body fat value before the intervention was 284.47 and decreased to 216.00 after the intervention. The average difference in decline in the CWT group was recorded at -53.47. Meanwhile, in the aerobic exercise group, the average body fat value before the intervention was 243.80 and decreased to 220.33 after the intervention, with a difference in average decrease of -31.27. Based on these data, descriptively the CWT group showed a greater reduction in body fat than the aerobic exercise group.

Table 1. Descriptive statistic

Variabel	Kelompok	Mean	Median	Variance	Std. Deviation	Minimum	Maximum	Range
Fat Pre	CWT	284.47	282.00	726.981	26.963	241	331	90
Fat Pre	Aerobic Exercise	243.80	268.00	8043.029	89.683	29	324	295
Fat Post	CWT	216.00	224.00	3327.429	57.684	25	275	250
Fat Post	Aerobic Exercise	220.33	246.00	6798.238	82.451	23	289	266
Fat	CWT	-53.47	-54.00	21.267	4.612	-61	-46	15
Fat	Aerobic Exercise	-31.27	-29.00	13.067	3.615	-39	-27	12
BMI Pre	CWT	270.67	272.00	382.095	19.547	234	302	68
BMI Pre	Aerobic Exercise	253.67	265.00	4432.667	66.578	28	305	277
BMI Post	CWT	233.20	245.00	3614.457	60.120	25	278	253
BMI Post	Aerobic Exercise	242.33	255.00	4061.667	63.731	23	288	265
BMI	CWT	-21.27	-22.00	36.638	6.053	-27	-2	25
BMI	Aerobic Exercise	-14.33	-14.00	6.810	2.610	-18	-11	7

In the BMI variable, the CWT group had an average pretest of 270.67 and an average posttest of 233.20, with an average decrease difference of -21.27. The aerobic exercise group had an average pretest of 253.67 and an average posttest of 242.33, with an average decrease difference of -14.33. Descriptively, the decrease in BMI in the CWT group was also seen to be greater than in the aerobic exercise group. These findings indicate that both exercise methods produce positive changes to body composition indicators, but CWT shows a greater tendency to decrease body fat and BMI. These findings are in line with evidence that combination exercise and resistance training can contribute to changes in body composition, increased muscle strength, as well as improvements in metabolic indicators in overweight and obese individuals (Mendonça et al., 2022; Oh et al., 2023; Davis et al., 2024; Binmahfoz et al., 2025).

The results of the normality test show that not all data is normally distributed. On the body fat variable, the Fat Pre data of the CWT group were normally distributed with Shapiro-Wilk values p = 0.953, but the aerobic group was not normally distributed with p = 0.000. Fat Post data in both groups were also not normally distributed with a value of p = 0.000. In the body fat difference data, the CWT group was normally distributed with p = 0.591, while the aerobic group was not normally distributed with p = 0.024.

Table 2. Normality test result

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Fat Pre	CWT	.071	15	.200*	.978	15	.953
	Aerobic Exercise	.359	15	.000	.658	15	.000
Fat Post	CWT	.278	15	.003	.680	15	.000
	Aerobic Exercise	.341	15	.000	.650	15	.000
Fat	CWT	.126	15	.200*	.954	15	.591
	Aerobic Exercise	.268	15	.005	.860	15	.024
BMI Pre	CWT	.093	15	.200*	.978	15	.955
	Aerobic Exercise	.317	15	.000	.619	15	.000
BMI Post	CWT	.339	15	.000	.562	15	.000
	Aerobic Exercise	.314	15	.000	.579	15	.000
BMI	CWT	.221	15	.048	.736	15	.001
	Aerobic Exercise	.205	15	.089	.868	15	.031

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

In the BMI variable, the BMI Pre data of the CWT group was normally distributed with p = 0.955, while the aerobic group was not normally distributed with p = 0.000. Post BMI data in both groups were not normally distributed, p = 0.000 each. BMI difference data also showed abnormal distribution in the CWT group with p = 0.001 and the aerobic group with p = 0.031. Thus, the normality results show that most of the data do not meet the normal distribution assumptions. This condition needs to be considered in the interpretation of the results, because the use of parametric tests such as paired sample t-tests and independent sample t-tests ideally requires a normal distribution of data. This caution is important because exercise intervention studies in overweight and obese groups often show high variation in individual responses, influenced by the body's initial condition, exercise adherence, diet, and differences in participants' physiological adaptations (Wang et al., 2022; Jayedi et al., 2024; Huang et al., 2025).

Table 3. Paired sample test result

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Fat Pre – Fat Post	45.967	100.511	18.351	8.435	83.498	2.505	29	.018
Pair 2	BMI Pre – BMI Post	24.400	73.432	13.407	-3.020	51.820	1.820	29	.079

The results of the paired sample t-test showed that there was a significant difference between the body fat values before and after the intervention. The average value of the difference between Fat Pre and Fat Post is 45.967 with a standard deviation of 100.511. The t-value is 2.505 with a degree of freedom of 29 and the significance value p = 0.018. Because the p< value is 0.05, it can be concluded that the overall exercise intervention has a significant effect on the reduction of body fat in the participants. These results show that exercise programs, both CWT and aerobic exercise, can produce positive changes in body fat indicators. These findings are in line with the results of previous studies that show that aerobic exercise, resistance training, and combination exercise can improve body composition in overweight and obese individuals (Jia et al., 2022; Wang et al., 2022; Jayedi et al., 2024; Men et al., 2025).

In contrast to the body fat variable, the results of the paired sample t-test on BMI showed an average difference value of 24,400 with a standard deviation of 73,432. The t-value is 1.820 with a degree of freedom of 29 and the significance value of p = 0.079. Because the p> value is 0.05, the difference in BMI before and after the intervention cannot be statistically significant. Although there was a descriptive decrease in BMI, the change was not inferentially strong enough to conclude that there was a significant effect of the intervention on BMI. Therefore, body fat percentage can be a more sensitive indicator to assess changes in body composition than BMI alone (Wang et al., 2022; Mesinovic et al., 2025; Huang et al., 2025).

Table 4. Paired sample effect size

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	Upper
Pair 1	LemakPre - LemakPost	Cohen's d	100.511	.457	.077	.830
		Hedges' correction	101.834	.451	.076	.820
Pair 2	IMTPre - IMTPost	Cohen's d	73.432	.332	-.038	.697
		Hedges' correction	74.399	.328	-.038	.688

Analysis of the effect size showed that the change in body fat had a Cohen's d value of 0.457 and Hedges' correction of 0.451. This value is in the category of small to medium effects. This means that exercise interventions have a practically meaningful effect on body fat loss, although the magnitude of the effect does not belong to the high category. In the BMI variable, Cohen's d value was 0.332 and Hedges' correction was 0.328. This value indicates a small effect. These findings are in line with the results of the significance test which shows that the BMI decrease has not been statistically significant, despite the positive direction of change.

The interpretation of these effect measures is important because the value of statistical significance does not necessarily reflect the magnitude of the practical benefit of an intervention. In physical exercise research, effect measures can help explain whether the changes that occur have practical meaning for the exercise program and the health of the participants. The small to moderate effect on body fat suggests that the intervention has potential benefits on body composition, but is likely still affected by exercise duration, intensity, nutrient control, and participant adherence. Previous research has also shown that body composition responses to exercise can vary depending on the type of exercise, the dosage of exercise, the duration of the program, and the characteristics of the population (Kong et al., 2022; Cao et al., 2022; Jayedi et al., 2024; Binmahfoz et al., 2025).

Table 5. Independet sample test result

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Fat Post	Equal variances assumed	1.162	.290	-.167	28	.869	-4.333	25.982	-57.554	48.888
	Equal variances not assumed			-.167	25.056	.869	-4.333	25.982	-57.837	49.171
BMI Post	Equal variances assumed	.023	.880	-.404	28	.689	-9.133	22.622	-55.472	37.205
	Equal variances not assumed			-.404	27.905	.689	-9.133	22.622	-55.479	37.212

The results of the independent sample t-test were used to compare the results of the posttest between the CWT group and the aerobic exercise group. In the Fat Post variable, Levene's test showed a significance value of $p = 0.290$, so that the homogeneity of variance assumption was met. The results of the t-test showed a value of $t = -0.167$ with a degree of freedom of 28 and a significance value of $p = 0.869$. Because the p> value was 0.05, there was no significant difference between the CWT group and the aerobic exercise group in body fat values after the intervention. In the BMI Post variable, Levene's test showed a significance value of $p = 0.880$, so the assumption of homogeneity of variance was also met. The results of the t-test showed a value of $t = -0.404$ with a degree of freedom of 28 and a significance value of $p = 0.689$. Because the p> value was 0.05, there was no significant difference between the CWT group and the aerobic exercise group in BMI values after the intervention. Thus, although descriptively the CWT group showed a greater decrease than the aerobic group, the differences between the groups have not been shown to be statistically significant.

These results show that CWT cannot be declared significantly superior to aerobic exercise based on the results of posttest body fat and BMI. A more appropriate statement for scientific publications is that CWT shows a tendency for better effectiveness descriptively but has not been inferently proven to be more effective than aerobic exercise. These findings are in line with several studies that show that different modes of exercise, whether aerobic, resistance, or combination, can provide benefits to body composition, but the magnitude of the effect can vary depending on the intervention design, program duration, exercise intensity, and subject characteristics (Oh et al., 2023; Davis et al., 2024; Gao et al., 2025). Therefore, the results of this study support the use of both forms of exercise as a body composition improvement strategy, noting that the claim of CWT superiority needs to be further tested through a larger sample count and stricter intervention control.

Table 6. Independent sample effect size

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
LemakPost	Cohen's d	71.154	-.061	-.776	.655
	Hedges' correction	73.133	-.059	-.755	.638
	Glass's delta	82.451	-.053	-.768	.664
IMTPost	Cohen's d	61.952	-.147	-.863	.571
	Hedges' correction	63.676	-.143	-.839	.555
	Glass's delta	63.731	-.143	-.858	.577

The independent sample effect size showed that the difference in Fat Post between the CWT group and the aerobic group had a Cohen's d value of -0.061, Hedges' correction of -0.059, and Glass's delta of -0.053. These values show very small effects. In the BMI Post variable, Cohen's d value was -0.147, Hedges' correction was -0.143, and Glass's delta was -0.143. The value is also in the very small effect category. These results reinforce the findings of the independent sample t-test that the difference in posttest results between the CWT and aerobics groups is not statistically or practically strong enough.

In practical terms, the very small size of the effect on the intergroup comparison suggests that the main benefit of the intervention is more apparent in pretest-posttest changes, especially in body fat reduction, rather than in the clear difference between CWT and aerobic exercise. In other words, both exercise methods have the potential to improve body composition, but the data of this study do not provide strong evidence that one method is noticeably superior to the other. This condition can be affected by the relatively limited number of samples, variations in participants' initial conditions, possible differences in exercise adherence, and the absence of strict control over nutritional intake. Several previous studies have also confirmed that the effectiveness of exercise in reducing body fat and BMI is strongly influenced by the interaction between exercise, diet, duration of intervention, and individual physiological responses (Long et al., 2023; Jayedi et al., 2024; Dai et al., 2025; Mesinovic et al., 2025).

Based on the overall results, exercise interventions had a significant effect on body fat loss but did not have a significant effect on BMI. CWT showed a tendency to descriptively lower body fat and BMI than aerobic exercise, but the difference between groups was not significant. Therefore, it can be scientifically stated that CWT and aerobic exercise both have the potential to improve body composition, with a tendency for better outcomes in CWT, but further research is still needed with a larger sample count, stricter dietary control, longer duration of interventions, as well as additional statistical analysis to strengthen the validity of the findings.

DISCUSSION

The findings of this study show that structured physical exercise interventions have a positive influence on changes in body composition, especially on the reduction of body fat. Rationally, these results are understandable because physical exercise increases energy expenditure, improves metabolic capacity, and encourages the use of energy substrates during and after activity. In overweight and obese individuals, body fat accumulation is generally related to energy imbalances, low physical activity, and weak metabolic regulation. Therefore, the application of regular exercise can be an important stimulus to reduce adipose tissue and improve the status of body composition (Wang et al., 2022; Jayedi et al., 2024; Huang et al., 2025).

Descriptively, Circuit Weight Training (CWT) shows a tendency to have better results than aerobic training. This tendency can be explained through the characteristics of CWT which combines elements of resistance and cardiorespiratory training in a single training session. Circuit model exercises demand repeated involvement of large muscle groups, relatively short rest periods, and sufficient exercise intensity to improve cardiometabolic response. These conditions allow the body to experience increased energy needs, muscle activation, and metabolic adaptations that are more complex than conventional aerobic exercise which is predominantly rhythmic and continuous. However, since the differences between groups have not been proven to be inferentially significant, these results are more appropriate to interpret as an empirical bias, rather than as evidence that CWT is superior to aerobic exercise.

The results of this study are supported by various previous studies that show that aerobic exercise, resistance training, and combination exercise can contribute to improving body composition in overweight and obese individuals. Aerobic exercise has been reported to be effective in increasing energy expenditure, improving cardiorespiratory fitness, and supporting fat mass reduction when done programmatically with adequate exercise doses (Cardoso et al., 2021; Li et al., 2021; Jia et al., 2022; Valsdottir et al., 2023; Jayedi et al., 2024; Sun et al., 2025; Chang et al., 2026). Recent meta-analyses have also shown that the weight loss response through aerobic exercise is strongly influenced by exercise dose, frequency, intensity, and program duration (Jayedi et al., 2024). This reinforces the finding that aerobic exercise remains relevant as an intervention method to improve body composition.

On the other hand, results showing a better tendency to CWT are in line with research that states that resistance training and combination training provide additional benefits through increased strength, maintenance of lean free mass, as well as increased post-workout energy requirements (Brellenthin et al., 2021; Azócar-Gallardo et al., 2022; Mendonça et al., 2022; Ogawa et al., 2023; Isenmann et al., 2023; Oh et al., 2023; Binmahfoz et al., 2025; Mesinovic et al., 2025). Research on circuit exercise training has also shown that circuit training can improve cardiorespiratory index, body composition, and body perception in obese students (John et al., 2023). In addition, studies on circuit resistance training have shown an effect on physiological and inflammatory responses in obese men, indicating that this exercise model has an impact not only on anthropometric dimensions, but also on broader biological mechanisms (Emamdoost et al., 2021).

However, the findings of this study also show a difference with some previous studies that reported that combination exercise or high-intensity exercise can produce greater effects than single aerobic exercise (Kong et al., 2022; Cao et al., 2022; Gao et al., 2025). These differences can be due to variations in intervention design, program length, sample count, participant characteristics, nutrition control, and exercise compliance levels. Some studies that show greater effects usually apply longer intervention durations, stricter dietary controls, or higher exercise intensity. In addition, the effects of exercise on populations with certain metabolic conditions may differ due to the influence of hormonal responses, inflammation, lipid profiles, and organ function that accompany obesity (Słomko et al., 2021; Kim et al., 2022; Murawska-Ciałowicz et al., 2022; Lin et al., 2023; Shi et al., 2025; Xie et al., 2025). Thus, this contradiction does not negate the potential of CWT but suggests that the effectiveness of an exercise method is strongly influenced by the context of the implementation and the characteristics of the study subjects (Long et al., 2023; Dai et al., 2025; Davis et al., 2024).

Theoretically, changes in body composition through physical exercise can be explained through the principles of energy balance, metabolic adaptation, and neuromuscular response. Aerobic exercise works primarily through increased oxygen use, calorie burning during activity, as well as increased cardiorespiratory capacity. Moderate-intensity aerobic activity that is carried out on a sustainable basis allows the body to use fat as one of the main sources of energy, thus contributing to the decrease in adipose tissue when accompanied by consistency of exercise and lifestyle settings (Cardoso et al., 2021; Jia et al., 2022; Luo et al., 2023; Jayedi et al., 2024; Sun et al., 2025).

CWT has a more complex theoretical basis because it combines aerobic work and resistance. Resistance training stimulates muscle contractions, increases energy requirements, and helps maintain lean free mass. Fat-free mass is important because it plays a role in maintaining basal metabolism. In addition, exercises with short rest breaks can increase cardiovascular load, so CWT is able to provide a dual stimulus to the muscular and cardiorespiratory systems. This combination explains why CWT can descriptively produce better changes in body composition than aerobic exercise alone (Azócar-Gallardo et al., 2022; Zhou et al., 2022; Bennie et al., 2023; Ogawa et al., 2023; Oh et al., 2023; Davis et al., 2024; Binmahfoz et al., 2025; Mesinovic et al., 2025).

A developmental interpretation of these findings suggests that exercise programs for overweight and obese individuals should be oriented not only towards weight loss, but also on improving the quality of body composition. BMI has limitations because it cannot distinguish between changes in fat mass and lean free mass. Therefore, the use of body fat percentage as a key indicator becomes more relevant in evaluating the effectiveness of exercise. This is in line with studies that emphasize the importance of body composition analysis in sports intervention research, as weight changes do not necessarily reflect actual physiological changes (Wang et al., 2022; Huang et al., 2025; Mesinovic et al., 2025). Thus, the development of training programs in the future needs to integrate anthropometrics, body composition, fitness, and exercise compliance evaluations simultaneously.

The results of this study have several practical implications for coaches, fitness instructors, health practitioners, and overweight or obese individuals. First, structured physical exercise can be used as a nonpharmacological strategy to improve body composition. Exercise programs that are carried out consistently, measurably, and according to the ability of participants can help reduce body fat and support the control of health risks related to obesity (Wang et al., 2022; Jayedi et al., 2024; Men et al., 2025). Second, CWT can be used as an efficient alternative to exercise because it combines strength training and cardiorespiratory training in one session. This model is suitable for individuals who have limited time but still need exercises that stimulate many components of fitness. Variation in movement in CWT can also reduce exercise saturation and increase participant engagement. However, its application needs to pay attention to the principles of progressivity, correct movement techniques, appropriate intensity, and the initial conditions of participants for the exercise to remain safe and effective (John et al., 2023; Gao et al., 2025; Davis et al., 2024).

Third, aerobic exercise remains a relevant option, especially for beginners, individuals with limited facilities, or participants who require a form of exercise with lower technical risks. Aerobic exercise is easy to modify, can be done independently, and has important benefits for cardiorespiratory health. Thus, the selection of training methods should not be based solely on claims of superiority of one method, but need to consider the objectives of the exercise, participant preferences, availability of facilities, safety, and sustainability of the program. Fourth, the results of this study confirm the need for a more comprehensive training approach. The combination of CWT and aerobic exercise can be considered a complementary strategy, especially if the goal of the program is not only to lose weight, but also to improve body composition, improve fitness, and build long-term physical activity habits. For further research and practice, control of nutritional intake, monitoring of exercise intensity, longer duration of interventions, and the use of more detailed body composition indicators need to be considered so that the effectiveness of exercise programs can be assessed more accurately (Guan et al., 2022; Long et al., 2023; Yang et al., 2023; Soroń-Lisik et al., 2024; Zaki et al., 2024; Dai et al., 2025; Binmahfoz et al., 2025).

CONCLUSION

Based on the results of the study, it can be concluded that structured physical exercise interventions have a positive impact on changes in the body composition of women with overweight to obesity categories. Circuit Weight Training (CWT) and aerobic exercise both show a tendency to lower body fat percentage and Body Mass Index (BMI) after a given exercise program. However, a more pronounced change was seen in the body fat percentage variable, so this indicator is more sensitive in describing changes in body composition compared to BMI. Descriptively, the CWT group showed a greater decrease in body fat percentage and BMI than the aerobic exercise group. This shows that CWT has the potential to be an effective exercise method because it combines elements of resistance and cardiorespiratory training in a series of exercises. The combination allows the body to obtain more complex stimuli through increased muscle activity, energy expenditure, as well as metabolic responses during and after exercise. Nonetheless, comparisons between the CWT group and aerobic exercise have not shown a statistically significant difference. Therefore, CWT cannot be declared to be absolutely superior to aerobic exercise. A more precise finding is that CWT has a tendency to be more descriptively effective, whereas both methods of exercise can still be used as an alternative intervention to improve body composition. The results of this study confirm that the selection of training methods needs to be adjusted to the program objectives, the physical condition of the participants, the availability of facilities, the safety of the training, and the sustainability of the implementation. To obtain stronger evidence, further research needs to involve larger sample counts, longer duration of interventions, stricter control of nutrient intake, and more comprehensive measurements of body composition.

RECOMMENDATION

Based on the results of the study, Circuit Weight Training (CWT) can be recommended as an alternative exercise program to help reduce body fat percentage and improve body composition in overweight and obese individuals. This program can be applied by trainers, fitness instructors, and health practitioners because it combines elements of strength training and cardiorespiration in one relatively efficient training session. However, the implementation of CWT needs to pay attention to the principles of progressivity, correct movement techniques, intensity regulation, and the initial condition of participants so that the training remains safe and in accordance with individual abilities. Aerobic exercise is also still recommended as an easy-to-implement exercise option, especially for beginners or individuals who are not used to doing weight training. Aerobic exercise can be the initial stage before participants switch to combination training or CWT. In practice, the combination of aerobic exercise and resistance-based exercise can be a more comprehensive strategy to support body fat loss, maintain cardiorespiratory fitness, and improve the consistency of physical activity. For subsequent researchers, it is recommended to use larger sample sizes, longer duration of interventions, and stricter controls on diet and physical activity outside of exercise programs. In addition, body composition measurement should not only rely on BMI, but also use other indicators such as body fat percentage, muscle mass, waist circumference, and metabolic parameters so that the results of the study are more comprehensive. Follow-up research can also compare variations in intensity, frequency, and form of CWT exercise to determine the most effective protocols for overweight and obese populations.

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