

## Zumba versus Low-Impact Aerobics for Body Fat Reduction in Overweight Female Students: A Randomized Trial

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### Abstract

**Background:** Overweight among female university students is an increasing public health concern associated with unfavorable metabolic profiles and long-term health risks. Aerobic exercise is widely recommended to improve body composition; however, direct comparative evidence between different aerobic exercise modalities remains limited.

**Objective:** This study aimed to compare the effectiveness of Zumba and low-impact aerobic exercise in reducing body fat percentage among overweight female university students.

**Methods:** This randomized experimental study employed a pretest–posttest two-group design. Twenty-six overweight female students (body mass index 23.0–24.9 kg/m<sup>2</sup>) were randomly allocated to a Zumba group or a low-impact aerobic exercise group (n=13 per group). Both interventions were conducted three times per week for eight weeks under instructor supervision. Body fat percentage was measured using handheld bioelectrical impedance analysis before and after the intervention. Statistical analyses included paired and independent t-tests with a significance level of 0.05.

**Results:** Both exercise modalities resulted in significant reductions in body fat percentage after eight weeks (p<0.001). The Zumba group demonstrated a greater mean reduction compared with the low-impact aerobic group (–5.52% vs –3.50%). The between-group mean difference was –2.02% (95% confidence interval: –3.32 to –0.72; p=0.004), indicating a significantly greater effect of Zumba exercise.

**Conclusion:** Both Zumba and low-impact aerobic exercise were effective in reducing body fat percentage among overweight female university students. However, Zumba produced a significantly greater reduction, suggesting it may be a more effective and engaging aerobic exercise option for improving body composition in this population.

### Keywords

Zumba; Aerobic Exercise; Body Fat Percentage; Overweight; Young Adults

### Introduction

Overweight remains a growing public health concern worldwide, particularly among young adults transitioning into university life. This population is vulnerable to unfavorable lifestyle changes, including reduced physical activity, increased sedentary behavior, and irregular dietary patterns, which collectively contribute to excess body fat accumulation. Elevated body fat percentage in early adulthood is clinically relevant, as it is associated with increased risks of metabolic disorders such as type 2 diabetes mellitus, hypertension, dyslipidemia, and cardiovascular disease later in life.<sup>1–3</sup> Recent epidemiological evidence indicates that excess adiposity during young adulthood may persist into later life stages, amplifying long-term cardiometabolic risk.<sup>4</sup>

Regular physical activity is a cornerstone intervention for the prevention and management of overweight and obesity. Aerobic exercise, in particular, has been consistently shown to reduce body fat percentage through increased energy expenditure, enhanced fat oxidation, and favorable metabolic adaptations.<sup>5,6</sup> A recent dose–response meta-analysis demonstrated that moderate-to-vigorous aerobic exercise produces clinically meaningful reductions in body fat and body weight among adults with overweight or obesity.<sup>7</sup> These findings reinforce current global physical activity recommendations that emphasize the importance of structured aerobic exercise for improving body composition and metabolic health.<sup>8</sup>

Low-impact aerobic exercise represents one of the most commonly prescribed forms of physical activity for individuals with overweight due to its relatively low mechanical load and favorable safety profile. This exercise modality is typically performed at light-to-moderate intensity and is characterized by continuous rhythmic movements that minimize joint stress while maintaining aerobic demand.<sup>9</sup> Several experimental studies have reported significant reductions in body fat percentage following structured low-impact aerobic exercise programs among young adult women.<sup>10,11</sup> However, despite its safety and accessibility, the magnitude of body fat reduction associated with low-impact aerobic exercise may be limited by its lower relative exercise intensity and total energy expenditure.

In contrast, Zumba is a dance-based aerobic exercise modality that integrates dynamic movements, music-driven choreography, and intermittent intensity fluctuations. Zumba sessions often elicit moderate-to-high cardiovascular demand while engaging large muscle groups simultaneously, resulting in higher caloric expenditure compared with traditional low-impact aerobic exercise.<sup>12</sup> Systematic reviews and experimental studies have shown that Zumba training can improve cardiorespiratory fitness, reduce body fat percentage, and enhance overall body composition in women with overweight or obesity.<sup>12</sup> Moreover, higher exercise intensity has been associated with increased excess post-exercise oxygen consumption, which may further contribute to fat loss beyond the exercise session itself.<sup>13,14</sup>

Beyond physiological mechanisms, adherence and motivation play a critical role in the effectiveness of exercise-based interventions. Dance-based exercise programs such as Zumba have been reported to improve intrinsic motivation, enjoyment, and exercise adherence, particularly among young women.<sup>15</sup> Exercise enjoyment has been identified as a key determinant of long-term physical activity participation, which is essential for sustaining favorable changes in body composition.<sup>16</sup> Therefore, exercise modalities that are both metabolically effective and psychologically engaging may offer greater clinical value for overweight populations.<sup>17</sup>

Despite the growing body of evidence supporting the individual benefits of low-impact aerobic exercise and Zumba, direct comparative studies between these two modalities remain scarce, particularly among overweight female university students.<sup>18</sup> Existing studies often evaluate these interventions independently or focus on heterogeneous populations, limiting the ability to draw conclusions regarding their relative effectiveness. This lack of head-to-head comparative evidence represents an important gap in the literature, especially given the need for practical, evidence-based exercise recommendations tailored to young adult women in academic settings.

Therefore, this study aimed to compare the effectiveness of Zumba and low-impact aerobic exercise in reducing body fat percentage among overweight female university students using a randomized experimental design. By directly comparing these two commonly implemented aerobic exercise modalities, the findings of this study are expected to provide clinically relevant evidence to inform exercise prescription strategies for overweight young women in university and community-based health promotion programs.

## Methods

This study employed a randomized experimental design with a pretest–posttest two-group approach. The study was classified as a randomized controlled trial because participants were randomly allocated to one of two exercise intervention groups. No modifications to the study design, eligibility criteria, or outcome measures were made after the trial commenced.

The study population consisted of 164 female undergraduate students enrolled in the Physiotherapy Study Program, Faculty of Medicine, Universitas Udayana. Participants were recruited voluntarily through academic announcements and informational briefings. Eligibility screening was conducted prior to enrollment. Inclusion criteria were female students aged 18–21 years with a body mass index (BMI) between 23.0 and 24.9 kg/m<sup>2</sup> (Asian cut-off for overweight), in good general health, and willing to participate as indicated by written informed consent. Exclusion criteria included a history of musculoskeletal injury, cardiovascular or respiratory disease, current participation in other structured exercise programs, or any medical condition that could limit safe engagement in aerobic exercise.

Sample size determination was performed using a power analysis based on previous experimental studies evaluating changes in body fat percentage following aerobic exercise interventions. Assuming a moderate effect size (Cohen's  $d = 0.80$ ), a significance level of 0.05, and a statistical power of 80%, a minimum of 12 participants per group was required. To anticipate potential attrition, 13 participants were allocated to each group, resulting in a total sample size of 26 participants. All enrolled participants completed the intervention and were included in the final analysis.

Random allocation to either the Zumba group or the low-impact aerobic exercise group was conducted using a computer-generated random number sequence. Allocation concealment was ensured through the use of sealed, opaque envelopes that were opened sequentially after baseline measurements were completed. The randomization and allocation processes were performed by an independent researcher who was not involved in outcome assessment or data analysis. Due to the nature of the exercise interventions, blinding of participants and instructors was not feasible. However, outcome assessment and statistical analysis were conducted without knowledge of group allocation to minimize potential assessment bias.

Both exercise interventions were conducted over an eight-week period with a frequency of three sessions per week (Monday, Wednesday, and Friday), resulting in a total of 24 sessions. All sessions were supervised by a certified exercise instructor and held at the Integrated Biomedical Laboratory Unit, Cakra Vidhya Usadha Building, Faculty of Medicine, Universitas Udayana. Participants in the Zumba group performed dance-based aerobic exercise characterized by dynamic, music-driven movements involving large muscle groups. Each session lasted approximately 60 minutes and consisted of a 10-minute warm-up, 40 minutes of core Zumba movements performed at moderate-to-high intensity, and a 10-minute cool-down. Participants in the low-impact aerobic exercise group performed structured aerobic routines with continuous rhythmic movements designed to minimize joint impact while maintaining aerobic demand. Session duration, frequency, and structure were matched to the Zumba group, with exercise intensity guided by the instructor using perceived exertion cues to ensure adherence to the intended intensity range.

The primary outcome of this study was body fat percentage, which was assessed using a handheld bioelectrical impedance analysis device (Omron HBF-306, Omron Healthcare, Japan). Bioelectrical impedance analysis has demonstrated acceptable validity and reliability for estimating body fat percentage in adult populations when standardized measurement protocols are applied.<sup>12–13</sup> Measurements were conducted before and after the eight-week intervention under standardized conditions, including similar hydration status and time of day for each participant.

Baseline measurements were obtained prior to randomization, followed by implementation of the assigned exercise intervention. Post-intervention measurements were performed within one week after the final exercise session using identical procedures and equipment. Participants were instructed to maintain their usual dietary habits and physical activity levels outside the supervised exercise sessions throughout the study period.

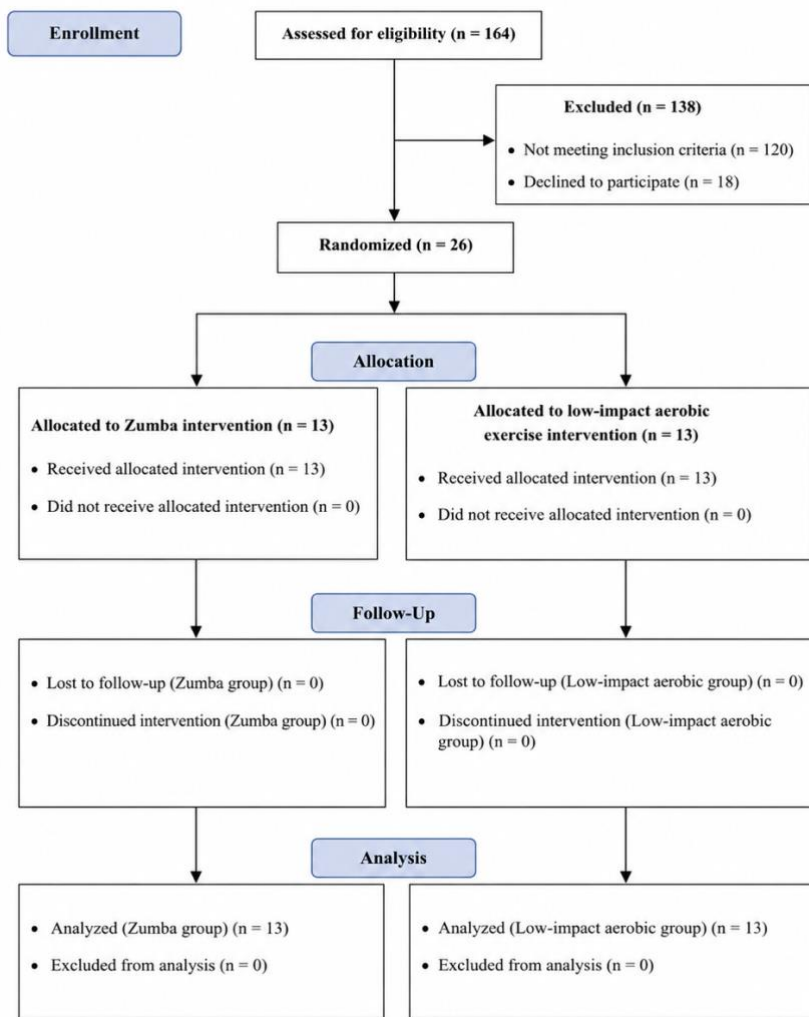
Statistical analysis was conducted using appropriate statistical software, with the level of significance set at  $\alpha = 0.05$ . Descriptive statistics were presented as mean  $\pm$  standard deviation. Data normality was assessed using the Shapiro–Wilk test, and homogeneity of variance was evaluated using Levene's test. Within-group differences in body fat percentage before and after the intervention were analyzed using paired t-tests, while between-group differences were examined using independent t-tests. Effect sizes were calculated using Cohen's  $d$ , and 95% confidence intervals were reported to quantify the magnitude and precision of the observed effects.

This study was approved by the Research Ethics Committee of the Faculty of Medicine, Universitas Udayana (Ethical Approval No. 709/UN14.2.2.VII.14/LT/2021). All participants provided written informed consent prior to participation, and all procedures were conducted in accordance with established ethical research principles.

## Results

A total of 164 participants were assessed for eligibility. Of these, 138 participants were excluded because 120 did not meet the inclusion criteria and 18 declined to participate. Subsequently, 26 eligible participants were randomized into two intervention groups, consisting of the Zumba intervention group ( $n = 13$ ) and the low-impact aerobic exercise group ( $n = 13$ ). All participants in

both groups received the allocated interventions, and no participants failed to receive treatment. During the follow-up period, no participants were lost to follow-up or discontinued the intervention in either group. Therefore, all randomized participants were included in the final analysis, with 13 participants analyzed in each intervention group, as illustrated in Figure 1.



**Figure 1.** CONSORT Flow Diagram of Participant Enrollment, Allocation, Follow-Up, and Analysis.

Baseline characteristics of participants are summarized in Table 1. The mean age of participants was comparable between groups, with a mean age of 19.69 ± 1.10 years in the Zumba group and 20.15 ± 2.88 years in the low-impact aerobic group. Mean body mass index values were also similar between groups (24.19 ± 0.57 kg/m<sup>2</sup> and 23.88 ± 0.65 kg/m<sup>2</sup>, respectively), indicating comparable baseline anthropometric profiles.

**Table 1.** Baseline characteristics of participants

Variable	Zumba (n = 13)	Low-impact aerobic (n = 13)
Age (years), mean ± SD	19.69 ± 1.10	20.15 ± 2.88
Body mass index (kg/m <sup>2</sup> ), mean ± SD	24.19 ± 0.57	23.88 ± 0.65

Normality testing using the Shapiro–Wilk test demonstrated that body fat percentage data were normally distributed in both groups at baseline and after the intervention ( $p > 0.05$ ). Levene’s test confirmed homogeneity of variance between groups at both measurement points ( $p > 0.05$ ). Changes in body fat percentage following the intervention are presented in Table 2. In the Zumba group, mean body fat percentage decreased from 33.87 ± 1.02% at baseline to 28.35 ± 1.58% after eight weeks, corresponding to a mean reduction of 5.52%. This reduction was statistically significant ( $p < 0.001$ ) and demonstrated a large effect size (Cohen’s  $d = 3.90$ ; 95% CI: 2.41 to 5.39). In the low-impact aerobic exercise group, mean body fat percentage decreased from 33.90 ± 1.00% to 30.40 ± 1.65%, yielding a mean reduction of 3.50%. This within-group change was also statistically significant ( $p < 0.001$ ) and associated with a large effect size (Cohen’s  $d = 2.44$ ; 95% CI: 1.31 to 3.57).

Between-group comparison of post-intervention body fat percentage revealed a statistically significant difference favoring the Zumba group. The mean between-group difference was -2.02% (95% CI: -3.32 to -0.72;  $p = 0.004$ ), corresponding to a large between-group effect size (Cohen’s  $d = 1.36$ ).

**Table 2.** Changes in body fat percentage within and between groups

Group	Baseline (%) Mean ± SD	Post-intervention (%) Mean ± SD	Mean change (%)	p-value†	Effect size (d)	95% CI
Zumba	33.87 ± 1.02	28.35 ± 1.58	-5.52	<0.001	3.90	2.41 to 5.39
Low-impact aerobic	33.90 ± 1.00	30.40 ± 1.65	-3.50	<0.001	2.44	1.31 to 3.57
Between-group difference	—	—	-2.02	0.004‡	1.36	-3.32 to -0.72

† Paired t-test (within-group comparison).

‡ Independent t-test (between-group comparison).

## Discussion

The present study demonstrated that both Zumba and low-impact aerobic exercise produced significant reductions in body fat percentage among overweight female university students after eight weeks of intervention. However, the magnitude of reduction was significantly greater in the Zumba group compared with the low-impact aerobic exercise group. These findings align with current evidence supporting aerobic exercise as an effective strategy for improving body composition in individuals with overweight.<sup>4,7,8</sup>

The greater reduction in body fat percentage observed in the Zumba group may be attributed to differences in exercise intensity and movement complexity. Zumba is characterized by dynamic, dance-based movements performed at moderate-to-high intensity, engaging multiple large muscle groups simultaneously.<sup>19,20</sup> This exercise profile is associated with higher energy expenditure and greater cardiovascular demand compared with traditional low-impact aerobic routines. Previous experimental studies and systematic reviews have reported that Zumba training elicits significant improvements in body composition, including reductions in body fat percentage and body mass index, particularly among women with overweight or obesity.<sup>10,11</sup>

In contrast, low-impact aerobic exercise, while effective, is typically performed at light-to-moderate intensity with reduced mechanical load. This modality prioritizes safety and accessibility, making it suitable for individuals with lower baseline fitness levels or joint limitations.<sup>20</sup> The significant reduction in body fat percentage observed in the low-impact aerobic group in this study supports earlier findings that steady-state aerobic exercise can facilitate fat loss through sustained energy expenditure and increased reliance on fat oxidation during exercise.<sup>21,22</sup> However, the comparatively smaller reduction relative to Zumba may reflect the lower overall metabolic demand associated with this exercise modality.

Exercise intensity is a critical determinant of adiposity reduction. Higher-intensity aerobic exercise has been shown to promote greater post-exercise energy expenditure through mechanisms such as excess post-exercise oxygen consumption, thereby contributing to additional caloric burn beyond the exercise session itself.<sup>23</sup> This physiological response may partially explain the larger effect size observed in the Zumba group. Furthermore, intermittent intensity fluctuations commonly observed in dance-based exercise may enhance metabolic adaptations that favor fat loss.<sup>24</sup>

Beyond physiological factors, behavioral and psychological components may also influence intervention outcomes. Dance-based exercise programs such as Zumba have been reported to enhance enjoyment, intrinsic motivation, and adherence to physical activity programs, particularly among young women.<sup>25</sup> Improved adherence may lead to greater cumulative training volume and consistency, which are key contributors to favorable changes in body composition.<sup>26</sup> Although exercise adherence was not quantitatively assessed in this study, the structured and engaging nature of Zumba may have supported sustained participant participation throughout the intervention period.<sup>27</sup>

The findings of this study are particularly relevant in the context of university populations, where sedentary behavior and suboptimal physical activity levels are prevalent. University students represent a critical target group for early preventive interventions aimed at reducing cardiometabolic risk. Evidence suggests that unfavorable body composition patterns established during young adulthood may persist into later life, increasing long-term health risks.<sup>28</sup> Therefore, identifying effective and acceptable exercise modalities for this population is of substantial clinical and public health importance.

From a practical perspective, both Zumba and low-impact aerobic exercise are feasible, low-cost interventions that can be readily implemented in campus-based health promotion programs. Zumba may be preferentially recommended for overweight female students seeking greater reductions in body fat percentage, provided they have no contraindications to moderate-to-high intensity exercise. Conversely, low-impact aerobic exercise remains a valuable alternative for individuals who require or prefer lower-intensity activity, emphasizing that exercise prescription should be individualized based on participant capability and preference.

Several limitations of this study should be acknowledged. Dietary intake, sleep quality, and physical activity outside the intervention sessions were not strictly controlled, which may have influenced changes in body fat percentage and introduced potential confounding. Additionally, exercise intensity was not objectively monitored using heart rate or oxygen consumption measurements, limiting the ability to precisely quantify training load. These factors represent potential sources of internal bias. The study sample was restricted to female university students aged 18–21 years, which may limit the generalizability of the findings to other age groups or to male populations, representing a constraint on external validity.

Future research should incorporate objective monitoring of exercise intensity, such as heart rate or wearable activity trackers, and include dietary assessment or control to better isolate the effects of exercise interventions on body composition. Longer intervention durations and inclusion of more diverse populations would further strengthen the evidence base. Additionally, comparative studies examining combined exercise modalities or integrating resistance training may provide further insight into optimizing exercise prescriptions for fat reduction in young adults.

## Conclusion

This randomized trial demonstrated that both Zumba and low-impact aerobic exercise effectively reduced body fat percentage among overweight female university students after an eight-week intervention. Although both exercise modalities produced statistically significant improvements, Zumba resulted in a greater reduction in body fat percentage compared with low-impact aerobic exercise. These findings indicate that aerobic exercise remains an effective non-pharmacological strategy for improving body composition in young women with overweight, with exercise intensity and movement dynamics likely influencing the magnitude of response.

From a clinical and practical perspective, Zumba may be recommended as a more effective aerobic exercise option for overweight female students who are able to tolerate moderate-to-high intensity activity and seek greater improvements in body fat reduction. Nevertheless, low-impact aerobic exercise remains a valuable alternative, particularly for individuals who prefer lower-intensity exercise or have physical limitations that restrict participation in higher-intensity programs. Overall, these results support the implementation of structured, accessible aerobic exercise programs within university and community settings as part of comprehensive strategies to address overweight and promote long-term metabolic health in young adult populations.

## Author Contribution

Putu Ayu Meka Raini: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing Original Draft, Writing Review and Editing.

Ni Luh Made Reny Wahyu Sari: Supervision, Validation, Methodology, Writing Review and Editing.

AA Lanang Dananjaya P D W A: Investigation, Data Interpretation, Validation, Writing Review and Editing.

AA I Ayesa Febrinia Adyasputri: Project Administration, Formal Analysis, Validation, Writing Review and Editing.

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## Conflict of Interest Statement

The authors declare no conflict of interest.

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## Ethics Statement

This study was approved by the Research Ethics Committee of the Faculty of Medicine, Universitas Udayana (Ethical Approval No. 709/UN14.2.2.VII.14/LT/2021). Written informed consent was obtained from all participants prior to participation.

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