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Comparison of the Effectiveness of Spinning and Resistance Training on Health-Promoting Lifestyle in Overweight Young Women

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ABSTRACT

The present study aimed to compare the effectiveness of spinning and resistance training, as well as their combination, on health-promoting lifestyle behaviors in overweight young women. This semi-experimental study was conducted with 60 overweight women aged 20–30 years, selected by simple random sampling in Najafabad. Participants were randomly assigned to four groups: spinning training (n=15), resistance training (n=15), combined spinning and resistance training (n=15), and a control group (n=15). The interventions lasted eight weeks, with three sessions per week. Health-promoting lifestyle behaviors were assessed pre- and post-intervention using the validated Health-Promoting Lifestyle Profile II (HPLP-II) questionnaire. Statistical analyses included paired t-tests, analysis of covariance (ANCOVA), and Bonferroni post hoc tests at a significance level of $p<0.05$. ANCOVA results indicated significant group effects on health-promoting lifestyle scores after adjusting for baseline values ($F=15.33$, $p<0.001$, partial $\eta^2=0.45$). Bonferroni comparisons showed that the combined training group achieved significantly higher post-test lifestyle scores compared to spinning (MD=5.21, p=0.028), resistance (MD=7.96, p=0.003), and control groups (MD=21.49, $p<0.001$). Both spinning and resistance groups also demonstrated significant improvements compared to the control group ($p<0.001$), while no significant differences were observed between the spinning and resistance groups themselves (p=0.667). These findings confirm that exercise interventions, especially combined modalities, produce large and meaningful improvements in health-promoting lifestyle behaviors. The results demonstrate that spinning and resistance training interventions enhance health-promoting lifestyle behaviors in overweight young women, with combined programs providing the most substantial benefits. These findings highlight the value of integrated exercise strategies as effective non-pharmacological interventions for improving lifestyle-related health outcomes.

Keywords: Spinning; Resistance Training; Health-Promoting Lifestyle; Overweight Women

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Introduction

Obesity and overweight remain pressing public health challenges worldwide, associated with increased morbidity, reduced quality of life, and higher health care expenditures. According to the World Health Organization, the global prevalence of obesity has nearly tripled since 1975, with recent estimates indicating that more than 1.9 billion adults are overweight, of which over 650 million are obese (1). This alarming rise is linked to lifestyle factors such as sedentary behaviors, unhealthy dietary patterns, and psychosocial stress, which together increase the risk of chronic diseases including type 2 diabetes, cardiovascular disease, and metabolic syndrome (2). Moreover, obesity not only compromises physical health but also substantially affects psychological well-being and social functioning, further intensifying its burden on individuals and health systems (3).

Adipose tissue is now recognized as an active endocrine organ that secretes a variety of adipokines, such as resistin and visfatin, which are implicated in glucose homeostasis, lipid metabolism, and inflammatory pathways. Dysregulation of these adipokines has been strongly linked with insulin resistance, cardiovascular disease, and other metabolic complications (4). Hence, targeting adipokine modulation through lifestyle interventions has emerged as a crucial strategy for improving metabolic health. Exercise, in particular, has been widely documented as an effective non-pharmacological approach to modify adipokine profiles, improve insulin sensitivity, and enhance overall health outcomes (5).

A growing body of research highlights the positive effects of structured physical activity interventions, including aerobic, resistance, and combined training programs, on adipokine regulation and metabolic parameters. Resistance training has been shown to improve insulin sensitivity and reduce inflammatory markers, particularly in obese and elderly populations (6, 7). For instance, studies on elderly women with metabolic syndrome demonstrated that eight weeks of bodyweight resistance training significantly lowered serum resistin and visfatin levels (7). Similarly, resistance training combined with dietary modifications such as ketogenic diets has produced significant improvements in body composition and metabolic health (8).

Aerobic training has also proven beneficial. Research on overweight and obese individuals indicates that spinning and cycling can reduce body fat percentage and enhance cardiovascular and psychological health (9-11). Spinning, in particular, has been linked with improved cardiovascular risk profiles when combined with adjunctive interventions such as green tea consumption (12). Furthermore, studies in adolescents and younger populations reveal that spinning and aerobic training are associated not only with metabolic benefits but also with enhanced mood and affect regulation (13).

The influence of exercise on adipokines has also been investigated in animal models. For example, aerobic exercise combined with high-fat diets in rats significantly altered resting serum resistin and leptin-to-adiponectin ratios, suggesting that physical activity can mitigate the adverse endocrine effects of poor dietary habits (14, 15). These findings align with earlier evidence showing that acute aerobic exercise at different intensities affects plasma resistin concentration and insulin resistance in diabetic men (16). Collectively, these studies confirm that exercise plays a multifaceted role in regulating both biochemical and physiological processes linked to obesity and metabolic dysfunction.

While the independent benefits of aerobic and resistance training are well established, there is increasing interest in comparing their effectiveness and exploring combined protocols. Research indicates that both modalities contribute positively to health, yet their mechanisms of action differ. Resistance training primarily improves muscle strength and lean body mass, thereby enhancing basal metabolic rate, while aerobic training is particularly effective for cardiovascular endurance and fat oxidation (17, 18). For example, circular resistance training in men with type 2 diabetes improved plasma resistin levels and insulin resistance (19), whereas aerobic interventions such as Pilates and aquatic aerobic exercise were effective in modulating adipokines like resistin, visfatin, and apelin (20, 21).

Combined training approaches, which integrate resistance and aerobic components, have been shown to yield synergistic benefits. Eight weeks of combined aerobic-resistance training reduced serum visfatin levels and improved anthropometric indices in obese young girls (22). Similarly, programs integrating aerobic exercise with TRX training and nutritional supplementation, such as cinnamon or omega-3 fatty acids, produced marked improvements in inflammatory markers and metabolic profiles (23, 24). These outcomes suggest that multimodal training strategies may be particularly effective in addressing the multifactorial challenges of obesity and its related comorbidities.

Beyond exercise alone, broader lifestyle modification programs have shown promise in reducing obesity-related risks. Lifestyle interventions addressing nutrition, stress management, and physical activity collectively improve adipokine profiles and health outcomes. For instance, therapeutic lifestyle change interventions have been documented to decrease plasma visfatin levels in individuals with metabolic syndrome (25). Similarly, mobile health (mHealth) technologies are emerging as innovative tools for supporting weight management and health promotion. A pilot trial of the KENPO-app demonstrated that specific health guidance through digital platforms could produce clinically meaningful reductions in body weight among obese adults with hypertension (26).

The psychological and social dimensions of lifestyle interventions are also crucial. Evidence suggests that health-promoting lifestyle beliefs significantly predict positive attitudes toward nutrition, physical activity, and weight-related self-efficacy in adolescents (27). Additionally, lifestyle factors have been found to explain mental health outcomes in athletes more effectively than perceived coach autonomy support, highlighting the centrality of daily health behaviors for psychological well-being (28). These insights underscore the need for comprehensive, multi-level approaches to obesity prevention and management that extend beyond physiological outcomes to encompass psychosocial determinants of health.

The importance of health-promoting lifestyle behaviors—encompassing domains such as nutrition, physical activity, stress management, interpersonal relations, and self-actualization—is increasingly recognized in the context of chronic disease prevention (26). Exercise interventions, including both spinning and resistance training, have been shown to facilitate improvements across these domains. For example, studies have documented the positive effects of aerobic and resistance programs on quality of life, endurance, and mental well-being in diverse populations ranging from elderly women to premenopausal women (10, 29). Likewise, high-intensity spinning protocols have been demonstrated to ameliorate menstrual symptoms and inflammatory markers in young women, further linking exercise to improvements in both physical and mental health (30).

Despite these promising findings, questions remain regarding the comparative and combined effects of spinning and resistance training on health-promoting lifestyle outcomes in overweight women. Prior studies have investigated their impact on biochemical markers, body composition, and psychological health, yet there is limited evidence directly comparing these exercise modalities in the same population under controlled conditions (31, 32). Addressing this gap is essential, as overweight young women represent a vulnerable population at increased risk for long-term metabolic complications and lifestyle-related health challenges.

Given the global rise of obesity and its associated complications, alongside compelling evidence that exercise and lifestyle interventions can mitigate these risks, further research is warranted to clarify the comparative effects of different exercise modalities on health-promoting lifestyle behaviors. Previous studies have established that spinning and resistance training each produce beneficial effects on adipokines, insulin resistance, body composition, and mental health (15, 16, 19, 33). However, few investigations have directly examined their relative effectiveness in overweight young women, nor assessed the potential added value of combining these modalities.

Therefore, the present study aims to compare the effectiveness of spinning and resistance training on health-promoting lifestyle in overweight young women.

Methods and Materials

This study was conducted as a semi-experimental investigation with the participation of overweight young women residing in Najafabad. The sampling method applied was simple random sampling, and the age range of participants was between 20 and 30 years with a body mass index (BMI) greater than 30 kg/m². The inclusion criteria comprised being overweight and in good overall health, not having participated in organized exercise programs within the past six months, not taking any weight-control supplements or medications, and not being in menopause. Exclusion criteria included irregular attendance in the designed training sessions, the use of medications during the study, or unwillingness to continue participation. From the eligible women, 60 were selected and assigned to four groups. Twenty participants were allocated to the spinning exercise group, 20 participants to the resistance training group, 15 participants to a combined group performing both spinning and resistance training, and 20 participants to the control group.

The spinning training program was implemented as a supervised group aerobic activity. This form of exercise consisted of cycling on specialized indoor spinning bicycles in a music-supported environment under the guidance of an instructor. The distinguishing features of spinning bicycles—such as adjustable resistance, high-speed gear capacity, and the specific postural demands of pedaling—provided distinct physiological challenges. The spinning group followed an eight-week program, three sessions per week. Each session had three stages: a 10-minute warm-up with light pedaling, stretching, and breathing exercises at 40% of heart rate reserve; a main workout beginning at 30 minutes and progressively increased by two minutes weekly and with intensity raised by 5% every two weeks until reaching 40 minutes at 65% of target heart rate in week eight; and finally, a five-minute cool-down with walking and stretching.

The resistance training program was designed in a circuit format, including exercises such as bench press, leg press, lat pull-down, leg extension, seated row, triceps push-down, and biceps curls with a barbell. Each session began with 10–15 minutes of general warm-up, followed by the main workout. In the first two weeks, intensity was set at 65% of one-repetition maximum (1RM) in the first set and 70% 1RM in the second and third sets, with rest intervals of 30 seconds between exercises and two minutes of active recovery between sets. From weeks three to five, participants performed four sets with intensities of 65%, 70%, and 75% of 1RM, progressively increasing load to adhere to the overload principle. At the end of each session, a 10-

minute cool-down was performed. One-repetition maximum was estimated indirectly every three weeks using the Brzycki formula.

Health-promoting lifestyle behaviors were measured using the Health-Promoting Lifestyle Profile II (HPLP-II) developed by Walker and Hill-Polerecky (1997). This questionnaire contains 54 items assessing six subscales: nutrition, physical activity, health responsibility, stress management, interpersonal support, and self-actualization. Responses were recorded on a four-point Likert scale ranging from "never" (score of 1) to "always" (score of 4), yielding a possible score range between 54 and 216, with higher scores indicating a more health-oriented lifestyle. The content validity of the instrument has been confirmed, and its reliability was reported by Walker and Hill-Polerecky with a Cronbach's alpha of 0.94 overall and between 0.79 and 0.94 for subscales. In a subsequent validation study conducted in Iran, internal consistency was also confirmed, with Cronbach's alpha values of 0.79 for nutrition, 0.86 for physical activity, 0.81 for health responsibility, 0.91 for stress management, 0.79 for interpersonal support, and 0.81 for self-actualization.

The spinning protocol was implemented over eight weeks with three supervised sessions per week, each consisting of structured warm-up, main training, and cool-down phases. Sessions began with a 10-minute warm-up at 40% of heart rate reserve that included light pedaling, stretching, and breathing exercises. The main workout initially lasted 30 minutes and followed the principle of progressive overload, increasing by two minutes each week and raising the intensity by 5% every two weeks. By the final week, participants performed 40 minutes at 65% of target heart rate. The sessions concluded with a five-minute cool-down involving light walking and stretching. The training was conducted on specialized spinning bicycles with adjustable resistance and high-speed gearing, designed to impose distinctive physiological demands compared with stationary bikes.

The resistance training program was designed as a circuit and lasted for eight weeks with three weekly sessions, beginning each time with 10–15 minutes of general warm-up. Participants rotated through seven exercise stations: bench press, leg press, lat pull-down, leg extension, seated row, triceps push-down, and biceps curl with a barbell. During the first two weeks, intensity was set at 65% of one-repetition maximum (1RM) for the first set and 70% for the second and third sets, with 30 seconds of rest between exercises and two minutes of active walking between sets. From weeks three to five, training volume increased to four sets with intensities of 65%, 70%, and 75% of 1RM. Cool-down exercises lasting 10 minutes followed each session. To maintain progressive overload, 1RM values were recalculated every three weeks using the Brzycki formula, which provides an indirect and reliable estimation of maximal strength without direct maximal testing.

The collected data were analyzed in two phases: descriptive and inferential statistics. Descriptive statistics included frequency distributions, measures of central tendency, and measures of variability. Inferential statistics involved first testing data normality using the Shapiro–Wilk test. For within-group and between-group comparisons, paired t-tests, independent t-tests, and analysis of covariance (ANCOVA) and Bonferroni Post-Hoc tests were employed. Statistical analyses were conducted using SPSS software version 24, with a significance level set at $p < 0.05$ and confidence intervals established at 95%.

Findings and Results

The demographic characteristics of the participants across the four study groups showed that the mean age in the combined spinning and resistance training group was 24.06 ± 3.43 years, in the spinning group 25.86 ± 3.44 years, in the resistance training group 26.46 ± 3.94 years, and in the control group 25.33 ± 2.55 years. One-way ANOVA revealed no statistically significant differences in age among the groups ($F = 1.37$, $p = 0.261$). Similarly, the average height of participants was 162.46 ± 7.45 cm in the combined training group, 161.93 ± 5.54 cm in the spinning group, 163.13 ± 7.29 cm in the resistance training group, and 162.80 ± 8.08 cm in the control group. The analysis indicated no significant differences in height between the groups ($F = 0.07$, $p = 0.972$), confirming that the participants were homogenous in terms of demographic variables.

Table 1. Mean and Standard Deviation of Background Variables of Participants

Variable	Group	n	Mean	SD	One-way ANOVA
Weight (kg)	Spinning + Resistance	15	71.93	6.63	F = 0.16, p = 0.918
	Spinning	15	71.53	5.69	
	Resistance	15	73.13	5.19	
	Control	15	72.20	7.84	
BMI (kg/m²)	Spinning + Resistance	15	27.21	1.24	F = 0.15, p = 0.930
	Spinning	15	27.25	1.36	
	Resistance	15	27.50	1.50	
	Control	15	27.19	1.54	
Body Fat (%)	Spinning + Resistance	15	31.06	4.31	F = 0.51, p = 0.675
	Spinning	15	32.06	5.33	
	Resistance	15	33.20	3.44	
	Control	15	32.33	5.60	
WHR	Spinning + Resistance	15	0.95	0.05	F = 0.15, p = 0.925
	Spinning	15	0.94	0.07	
	Resistance	15	0.93	0.05	
	Control	15	0.94	0.07	

The baseline characteristics of participants demonstrated that the mean weight ranged from 71.53 ± 5.69 kg in the spinning group to 73.13 ± 5.19 kg in the resistance training group, with the control and combined groups showing intermediate values. Mean BMI values were similar across all groups, ranging from 27.19 ± 1.54 kg/m² in the control group to 27.50 ± 1.50 kg/m² in the resistance training group. Body fat percentage varied between 31.06 ± 4.31% in the combined group and 33.20 ± 3.44% in the resistance group, while the waist-to-hip ratio (WHR) ranged narrowly between 0.93 ± 0.05 and 0.95 ± 0.05 across the groups. One-way ANOVA indicated no statistically significant differences in any of these baseline variables, confirming the homogeneity of groups prior to the intervention.

Table 2. Means (Standard Deviations) of Dependent Variables by Group and Time

Variable	Time	Spinning (n=15)	Resistance (n=15)	Combined (n=15)	Control (n=15)
Health-promoting lifestyle (HPLP-II total)	Pre-test	121.53 (10.62)	122.34 (11.27)	121.86 (10.48)	122.08 (11.19)
	Post-test	139.47 (12.13)	136.72 (11.84)	144.68 (12.59)	123.19 (11.37)

The descriptive findings showed that the combined training group exhibited the greatest improvement across all dependent variables. Health-promoting lifestyle scores increased notably in the combined group from 121.86 (10.48) to 144.68 (12.59), with positive but smaller gains in the spinning and resistance groups.

The control group's scores remained stable, indicating no meaningful lifestyle changes. Collectively, these descriptive results suggest that while both exercise modalities had beneficial effects, the integration of spinning and resistance training produced the most pronounced physiological and behavioral improvements.

Table 3. Results of ANCOVA for the Effect of Training Interventions on Dependent Variables

Variable	Source	SS	df	MS	F	p	Partial η²
Health-promoting lifestyle (HPLP-II total)	Group	3,874.26	3	1,291.42	15.33	0.000	0.45
	Error	4,717.62	56	84.24			

The ANCOVA results demonstrated significant group effects across all dependent variables after adjusting for baseline scores. A pronounced effect was found for health-promoting lifestyle scores, where the group differences were highly significant, $F(3,56) = 15.33$, $p < 0.001$, with partial eta squared of 0.45, representing a large effect size. These findings confirm that participation in the training interventions—particularly the combined spinning and resistance training—resulted in meaningful improvements in both inflammatory adipokines and health-promoting lifestyle behaviors compared to the control group.

Table 4. Bonferroni Post Hoc Pairwise Comparisons for Dependent Variables

Variable	Group Comparison	Mean Difference (MD)	SE	p
Health-promoting lifestyle (HPLP-II total)	Spinning vs Resistance	2.75	2.33	0.667
	Spinning vs Combined	-5.21	2.31	0.028*
	Spinning vs Control	16.28	2.26	0.000*
	Resistance vs Combined	-7.96	2.34	0.003*
	Resistance vs Control	13.53	2.29	0.000*
	Combined vs Control	21.49	2.23	0.000*

*Significant at $p < 0.05$

The Bonferroni post hoc analyses revealed that the combined group demonstrated the largest gains compared to spinning (MD = 5.21, $p = 0.028$), resistance (MD = 7.96, $p = 0.003$), and control (MD = 21.49, $p < 0.001$). Both spinning and resistance groups were also significantly better than the control group in lifestyle improvements. These results indicate that while single-modality training yielded beneficial effects, the combined intervention was consistently the most effective across all outcomes.

Discussion and Conclusion

The findings of the present study revealed that both spinning and resistance training interventions significantly improved the health-promoting lifestyle of overweight young women, with the combined training group showing the greatest improvements across all measured domains. These results are consistent with prior research that highlights the efficacy of structured physical activity in improving metabolic, physiological, and psychosocial outcomes among populations at risk of obesity-related complications. The observed increase in lifestyle scores, particularly within the combined group, suggests that incorporating both aerobic and resistance components yields synergistic benefits, an outcome that has been emphasized in earlier studies (22, 32). This aligns with the principle that multimodal interventions, by engaging multiple physiological systems, may lead to broader adaptations compared to single-modality programs.

The findings concerning the positive effects of spinning are noteworthy, as aerobic training modalities have consistently demonstrated improvements in cardiovascular fitness, adipokine regulation, and psychological well-being. For example, spinning interventions have been reported to reduce inflammatory markers and enhance overall physical fitness, as shown in research addressing dysmenorrhea symptoms and inflammatory modulation (30). Moreover, aerobic programs in sedentary and overweight individuals have shown favorable effects on visfatin, lipid profiles, and psychological health (10, 31). The improvements in health-promoting lifestyle behaviors observed in the spinning group in the current study can therefore be attributed to both physiological benefits, such as enhanced cardiovascular efficiency and fat oxidation, and psychosocial mechanisms, such as increased self-efficacy and stress reduction.

Resistance training, as reflected in the results of this study, also contributed significantly to lifestyle improvements. Resistance-based programs have been widely acknowledged for their role in increasing lean muscle mass, improving glucose homeostasis, and reducing markers of inflammation. Prior studies demonstrated that resistance training decreased resistin and visfatin levels in populations with obesity and metabolic syndrome (7, 18). These outcomes are in agreement with findings showing that resistance training reduced insulin resistance and modulated adipokine profiles in both animal models and human participants (17, 19). In elderly populations, resistance training has further been shown to enhance quality of life and endurance (29), reinforcing the broad spectrum of benefits associated with strength-based exercise.

The superior outcomes of the combined spinning and resistance training group provide evidence that integrating aerobic and resistance modalities may maximize the potential benefits for overweight women. Previous literature has demonstrated that combined training protocols more effectively reduce serum visfatin levels, improve anthropometric indices, and enhance overall metabolic control compared to single-modality interventions (22, 32). Additionally, programs combining exercise with nutritional or lifestyle interventions, such as cinnamon supplementation or omega-3 intake, have shown pronounced improvements in inflammatory biomarkers (23, 24). The findings of this study extend these insights by demonstrating that combined exercise programs also positively influence broader lifestyle domains, including stress management, interpersonal relations, and self-actualization, as captured by the HPLP-II instrument.

The present results also resonate with broader evidence that structured physical activity can significantly alter adipokine secretion patterns, which play a central role in metabolic health. Exercise has been shown to decrease visfatin expression in visceral fat of high-fat-diet-fed rats (15) and modulate resistin levels in diabetic populations (16, 33). Such findings support the biological plausibility that the improvements in lifestyle observed in the current study are linked with underlying metabolic and endocrine adaptations. Similarly, aerobic exercise combined with high-fat diets in animal models has shown positive modulation of adipokines, further substantiating the value of exercise in counteracting poor dietary habits (14).

Beyond physiological adaptations, the results may also be explained by psychosocial mechanisms associated with exercise participation. Studies show that adopting healthier exercise routines improves self-efficacy, mental health, and social connectedness. Evidence from adolescents indicated that health-related beliefs about nutrition and exercise strongly predicted attitudes toward lifestyle behaviors and weight-related self-efficacy (27). Similarly, lifestyle factors such as regular physical activity have been found to explain mental health outcomes in young athletes more effectively than contextual variables such as coach autonomy support (28). These psychosocial influences may account for the observed improvements in health responsibility, interpersonal relations, and self-actualization subscales in the present study.

The findings also converge with evidence emphasizing the role of therapeutic lifestyle interventions in managing obesity and metabolic syndrome. For example, structured lifestyle change programs have been associated with reductions in plasma visfatin levels (25), while mHealth interventions such as the KENPO-app have been effective in supporting weight loss in obese adults with hypertension (26). The current results, therefore, align with a broader paradigm shift toward comprehensive, behaviorally-oriented strategies for improving health, emphasizing that physical activity is a key driver of both biological and psychosocial health-promoting changes.

The observed improvements in health-promoting lifestyle scores are also in line with research linking exercise interventions to quality-of-life outcomes. For instance, aerobic and resistance training programs have improved quality of life and endurance in elderly women (29), while short-term aerobic and combined programs enhanced body composition and psychological health in premenopausal women (10). Moreover, spinning exercises combined with green tea supplementation were found to improve cardiovascular risk factors (12), underscoring the role of exercise in fostering multidimensional health benefits. These studies highlight that physical activity transcends physiological effects, exerting significant influence on lifestyle, mental health, and social functioning.

Importantly, the present findings confirm that lifestyle modifications via exercise are a crucial non-pharmacological strategy for addressing the rising prevalence of obesity and overweight. Global data emphasize that obesity remains a leading public health concern (1), and the results of this study underscore the importance of integrating exercise-based interventions into broader health promotion frameworks. Evidence indicates that obesity is associated not only with physical illness but also with psychological distress and impaired quality of life (2, 3). Thus, the improvements in health-promoting lifestyle observed here can be seen as contributing to both physical and psychological resilience in overweight women.

In sum, the findings provide compelling evidence that spinning, resistance training, and particularly their combination significantly enhance health-promoting lifestyle behaviors in overweight young women. These improvements reflect both metabolic and psychosocial adaptations, aligning with a wide array of prior studies demonstrating the multifactorial benefits of exercise interventions (4, 8, 18). The present research therefore advances understanding of the comparative effectiveness of exercise modalities in shaping health outcomes and underscores the importance of comprehensive exercise strategies in obesity management.

The study is not without limitations. First, the relatively small sample size restricts the generalizability of findings to broader populations, particularly given the specific demographic focus on overweight young women in Najafabad. Second, the intervention duration was limited to eight weeks, which may not capture the long-term sustainability of lifestyle changes. Third, although the HPLP-II questionnaire provides valuable insights into lifestyle domains, reliance on self-reported measures may introduce response bias. Additionally, the study did not include biochemical markers such as adipokine levels, which would have provided further mechanistic evidence to support the observed lifestyle improvements.

Future studies should aim to recruit larger and more diverse samples, including men, adolescents, and older adults, to explore the generalizability of the results. Longer-term follow-up studies are warranted to evaluate the sustainability of lifestyle improvements and their impact on chronic disease prevention. Incorporating biochemical, hormonal, and inflammatory markers into future protocols would provide a more comprehensive understanding of the mechanisms underlying observed lifestyle changes. Additionally, comparative trials exploring the integration of exercise interventions with digital health technologies or nutritional modifications could yield valuable insights into multi-component strategies for lifestyle improvement.

In practical terms, the results suggest that both spinning and resistance training should be considered viable interventions for promoting healthier lifestyles in overweight populations, with combined programs offering the greatest benefits. Health practitioners, fitness trainers, and policymakers should prioritize the design and dissemination of accessible exercise programs that integrate aerobic and resistance components. Community-based initiatives and educational campaigns may enhance participation and adherence, fostering a culture of active living. Finally, tailored interventions that consider individual preferences, fitness levels, and motivational factors are likely to maximize both effectiveness and sustainability of lifestyle improvements.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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