

Effects of a 3-Month Combined Training Program (Endurance, Strength, and Flexibility) on Physical Fitness Levels and Students' Attitudes Toward Exercise

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ABSTRACT

Promoting and sustaining physical fitness can be effectively achieved through regular complementary exercise routines. This study aimed to evaluate the impact of a 3-month combined training program, implemented over an academic semester, on selected physical fitness components and students' attitudes toward physical activity and training modalities. A total of 263 students (mean age: 20 ± 2.8 years) participated and were assessed pre- and post-intervention, with results compared to a control group that did not perform regular physical activity. Data were analyzed using paired t-tests. The results revealed significant improvements ($P < 0.05$) in cardiovascular endurance, muscular strength, and endurance of the abdominal and shoulder girdle muscles following the intervention. However, no significant changes were observed in the explosive strength of the calf muscles ($P > 0.05$). Two training approaches were employed: (1) combined aerobic, strength, and flexibility exercises; and (2) the same protocol supplemented with rhythmic sports music. At the semester's end, students' attitudes were assessed via a questionnaire covering five domains: sports performance, program content, exercise attractiveness, exercise variety, and appropriateness of exercise intensity. Significant positive differences ($P < 0.05$) were found in sports performance, program content, variety, and intensity appropriateness, whereas no significant difference was noted in exercise attractiveness ($P > 0.05$). In conclusion, the combined training program positively enhanced participants' physical fitness levels, supporting its recommendation for improving fitness among young women. Additionally, students exhibited particularly favorable attitudes toward aerobic exercises incorporating sports music, especially regarding program content.

Keywords: Physical fitness, exercise attractiveness, program content, aerobic training, students' attitudes.

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Introduction

Regular physical activity is widely recognized as a cornerstone of physical health, psychological well-being, and social functioning across the lifespan. Over recent decades, however, rapid technological advancement, urbanization, and changes in lifestyle patterns have contributed to a marked decline in daily movement and an increase in sedentary behaviors, particularly among adolescents and young adults. University students constitute a population that is especially vulnerable to physical inactivity due to academic workload, screen-based learning, and reduced opportunities for structured exercise. Empirical evidence consistently shows that insufficient physical activity during young adulthood is associated with

adverse outcomes such as increased body fat, reduced cardiovascular fitness, musculoskeletal ضعف, and compromised mental health (1-3). These concerns have intensified global interest in identifying effective, sustainable, and context-appropriate exercise programs within educational settings.

Physical fitness is a multidimensional construct encompassing cardiorespiratory endurance, muscular strength and endurance, flexibility, agility, and body composition. Participation in structured exercise programs has been shown to improve multiple components of fitness in children, adolescents, and university students (1, 2, 4). Regular engagement in sports and exercise not only enhances physiological capacity but also contributes to psychological outcomes such as vitality, reduced fatigue, emotional balance, and overall well-being (3, 5, 6). These benefits underscore the importance of integrating effective physical activity interventions into school and university curricula.

Despite the well-documented benefits of physical activity, participation rates among students remain suboptimal in many countries. Studies from diverse cultural contexts reveal that a substantial proportion of young people fail to meet recommended levels of moderate-to-vigorous physical activity. This decline has been attributed to environmental barriers, lack of motivation, insufficient social support, and negative or ambivalent attitudes toward exercise (7, 8). Consequently, contemporary research has increasingly focused not only on the physiological effects of exercise but also on psychological and social determinants that shape individuals' engagement in physical activity.

Among these determinants, attitude toward exercise occupies a central role. Attitude reflects an individual's cognitive evaluations, emotional responses, and behavioral tendencies toward a specific behavior. According to the Theory of Planned Behavior, attitudes, along with subjective norms and perceived behavioral control, directly influence behavioral intentions and, ultimately, actual behavior (9). Empirical research supports the predictive power of attitudes in explaining exercise participation and adherence, particularly among adolescents and young adults (9, 10). Positive attitudes toward physical activity are associated with higher levels of participation, greater persistence, and more favorable health outcomes, whereas negative attitudes often act as barriers to sustained engagement.

University physical education courses represent a critical context for shaping students' attitudes toward exercise. Well-designed programs can provide not only structured opportunities for physical activity but also meaningful experiences that foster enjoyment, perceived competence, and intrinsic motivation (11, 12). Conversely, poorly designed or monotonous programs may reinforce negative perceptions and reduce students' willingness to remain physically active beyond compulsory coursework. Therefore, the quality, variety, and perceived relevance of exercise programs are essential considerations in promoting long-term active lifestyles.

A growing body of research suggests that combined training programs, integrating aerobic endurance, muscular strength, and flexibility exercises, may offer superior benefits compared to single-mode training. Combined training has been shown to produce greater improvements in cardiovascular fitness, body composition, and functional capacity in different populations, including youth, adults, and older individuals (4, 13). Such programs may also enhance perceived exercise variety and reduce boredom, factors that are particularly salient for sustaining motivation among students.

In addition to the physical structure of exercise programs, contextual and environmental elements—such as the use of music, social interaction, and goal setting—play a significant role in shaping exercise

experiences. Music-accompanied physical activity has been associated with improved mood, reduced perceived exertion, enhanced enjoyment, and better cognitive outcomes across age groups (14-16). These effects appear to be mediated by psychophysiological mechanisms that synchronize movement, attention, and affective responses. Similarly, interventions grounded in behavioral theories, including goal-setting and competence support, have demonstrated positive effects on both fitness outcomes and exercise attitudes (11, 17).

Social support constitutes another critical factor influencing physical activity behavior. Adolescents and university students who perceive higher levels of support from peers, family members, and instructors are more likely to engage in regular exercise and maintain participation over time (7, 18). Educational environments that encourage cooperation, inclusivity, and positive feedback can therefore amplify the effectiveness of physical education interventions.

Recent research has further expanded the scope of physical activity studies by examining links between exercise and mental health outcomes such as depression, loneliness, emotional regulation, and cognitive functioning. Systematic reviews and meta-analyses indicate that regular physical activity contributes to neuroplasticity, improved cognitive performance, and emotional well-being across different age groups (19-21). Among university students, physical exercise has been shown to moderate relationships between sleep quality, depressive symptoms, and suicidal ideation, highlighting its protective role in mental health (22). These findings reinforce the argument that physical education programs should be evaluated not only in terms of physical fitness but also in relation to broader psychosocial outcomes.

Despite substantial evidence supporting the benefits of exercise, inconsistencies remain regarding the optimal duration, intensity, and composition of training programs required to elicit meaningful physical and psychological changes. Some studies report significant improvements in endurance, strength, and agility following short-term interventions, whereas others find limited or no effects on specific components such as flexibility or explosive power (2, 23). These discrepancies may be attributable to differences in program design, participant characteristics, measurement methods, and contextual factors.

Gender-specific considerations further complicate this landscape. Cultural norms, social expectations, and perceived barriers often shape female students' engagement with physical activity, influencing both participation levels and attitudes toward exercise. Research conducted in Middle Eastern and Asian contexts suggests that tailored programs sensitive to cultural and psychosocial factors may be particularly important for promoting physical activity among female students (24-26). Understanding how different training modalities are perceived by female students can therefore inform the design of more effective and acceptable physical education curricula.

In parallel with traditional exercise research, contemporary studies have begun to explore innovative approaches such as mindful movement practices, virtual reality-based exercise, and technology-assisted interventions. These emerging modalities have demonstrated potential in enhancing engagement, social presence, and emotional outcomes among adolescents and young adults (21, 27). Although such approaches are promising, foundational evidence on conventional, resource-efficient programs—such as combined endurance, strength, and flexibility training—remains essential, particularly in contexts where advanced technologies may not be readily accessible.

Taken together, the existing literature highlights the multifaceted benefits of physical activity and underscores the importance of program design, psychological determinants, and contextual factors in shaping both fitness outcomes and exercise attitudes. Nevertheless, there remains a need for empirical studies that simultaneously examine objective physical fitness indicators and subjective attitudes toward different training methods within real-world university settings. Such research is crucial for bridging the gap between theoretical models of behavior change and practical implementation in physical education courses.

Moreover, few studies have directly compared students' attitudes toward distinct yet commonly used training approaches—such as combined training versus aerobic training with rhythmic or musical components—over the course of an academic semester. Given the central role of attitude in predicting exercise adherence (9, 10), understanding these perceptions is vital for developing interventions that not only improve fitness but also foster positive, lasting relationships with physical activity.

In light of these considerations, the present study draws upon established theoretical frameworks, empirical findings on physical fitness and exercise psychology, and recent advances in physical activity research to investigate the effects of a structured combined training program on female university students. By integrating endurance, strength, and flexibility exercises within a semester-long intervention and assessing both physical fitness components and students' attitudes toward different training modalities, this study seeks to contribute to a more comprehensive understanding of how physical education programs can be optimized for effectiveness and acceptability in higher education contexts (12, 17, 28-33).

Accordingly, the aim of this study was to examine the effects of a 12-week combined training program on selected physical fitness components and to evaluate female university students' attitudes toward different exercise training methods over an academic semester.

Methods and Materials

The research sample consisted of 262 students who participated in a physical education course during an academic semester. Initially, several indicators of physical fitness were assessed through physical fitness tests. The participants engaged in a combined exercise program for 12 weeks, with 3 sessions per week, each lasting 1.5 hours. Subsequently, after the sixteenth week, they were retested in the same physical fitness assessments.

Additionally, a control group of 30 students who did not take this course and did not engage in any physical exercise participated in both pre-tests and post-tests, allowing for a comparison of the experimental group's results with those of the control group.

At the start of the first training session, the desired variables were measured. For assessing cardiorespiratory endurance, the 540m run test was utilized; for agility, the 9×4 m run test was employed; for explosive power, the long jump test was implemented; and for abdominal muscle endurance, a 1-minute sit-up test was conducted. To evaluate the strength and endurance of the shoulder girdle muscles, a 30-second push-up test was used. Additionally, body fat percentage was estimated using the Harpenden skinfold caliper method, combining it with the following formula:

Fat % (women) = $0.00043 \times (\text{Sum of 4 skinfold sites}) - 0.29669 \times (\text{Sum of 4 skinfold sites}) - 1.2963 \times (\text{Age})$

Where the four skinfold measurement sites included: quadriceps, suprailiac, abdominal, and triceps

All measurements were taken on the right side of the participants' bodies, and all tests and body fat percentage measurements for the subjects were conducted during the final training session. (24)

Furthermore, a questionnaire was developed to assess students' attitudes toward the exercise program throughout the semester and was distributed among the same 262 students. This questionnaire included 42 questions on a 5-point Likert scale and was evaluated for reliability and validity. Subsequently, the normality of the sample was verified using descriptive statistical methods, and for data analysis, the paired T-test statistical method was employed. This study is descriptive in nature, and its execution method is an analytical intervention.

To familiarize students with two training methods, the physical education class sessions throughout the semester were divided into two segments. Half of the sessions were dedicated to a mixed training approach, which included warm-up, aerobic and anaerobic exercises, strength training, speed, agility, flexibility exercises, and concluded with a cool-down period. The other half of the sessions employed an aerobic method, featuring rhythmic warm-ups followed by endurance running, strength, and flexibility exercises; agility and speed drills were also incorporated into several sessions. At the end of the semester, students' attitudes toward the two training methods were evaluated.

In this study, descriptive statistics were utilized to calculate averages and perform numerical comparisons of the raw data, while inferential statistics were employed for hypothesis testing. The paired t-test was conducted at a significance level of 5% ($\alpha > 0.05$), and the statistical software used for this research was SPSS-26.

Findings and Results

Statistical analysis of the research findings revealed that the exercises performed over the 12-week period had a significant impact on the fitness factors of the female students. The fitness components assessed in this study included cardiorespiratory endurance, agility, explosive power, abdominal muscle endurance, and shoulder girdle muscle endurance and strength.

The descriptive characteristics of the participants included an average age of 20.8 ± 2 years, a height of 163 ± 10 cm, and a weight of 65.5 ± 8 kg.

According to the research findings, the exercises conducted with the experimental group over one semester significantly improved the variables of cardiorespiratory endurance, agility, abdominal muscle endurance, and shoulder girdle muscle endurance and strength in comparison to the control group. A significant difference was observed in the pre-test and post-test results within the experimental group ($\alpha < 0.05$) (see Table 1).

However, the evaluation revealed that these exercises did not have a significant effect on the explosive power variable, which was assessed using the standing long jump test ($\alpha < 0.05$) (see Table 1).

Additionally, the exercises conducted had a significant effect on the body fat percentage of the students, showing noteworthy changes in the experimental group samples after 12 weeks of training compared to the control group ($\alpha < 0.05$) (see Table 1).

Table 1: The results of Comparing the experimental and control groups in the pretest and posttest

Variable		Pretest M \pm SD	Posttest M \pm SD	Sig Intragroup	Sig Out-group
Run	Control	2.50 \pm 0.199	2.63 \pm 0.331	0.09	0.009
(s)	Experimental	2.43 \pm 0.303	2.32 \pm 0.264	0.001 *	
Sit up	Control	26.58 \pm 6.302	26.17 \pm 7.234	0.53	0.011
(R)	Experimental	29.88 \pm 8.625	32.87 \pm 7.979	0.001 *	
Push up	Control	17.83 \pm 5.937	18 \pm 6.030	0.61	0.53
(R)	Experimental	18.53 \pm 5.911	19.22 \pm 5.981	0.001 *	
Long jump	Control	142.08 \pm 20.611	141.25 \pm 20.164	0.26	0.20
(cm)	Experimental	154.96 \pm 17.875	152.51 \pm 28.285	0.44	
Agility	Control	10.97 \pm 0.766	11 \pm 0.801	0.34	0.08
(S)	Experimental	11.56 \pm 0.775	11.44 \pm 0.773	0.002 *	
Fat	Control	11.47 \pm 1.843	11.53 \pm 1.819	0.60	0.81
(Percent)	Experimental	12.02 \pm 2.293	11.71 \pm 2.312	0.001 *	

The questionnaire assessed students' attitudes across five domains: sports performance, program content, exercise appeal, exercise variety, and exercise intensity in two different training methods, yielding the following results (see Table 2).

Table 2. Results of the paired T-test in the five domains of performance, training content, appeal, variety, and exercise intensity.

Subscale	mean difference	standard deviation	df	T	sig
Functions	0.26	0.65	116	4.369	0.001
content	0.17	0.63	116	3.008	0.003
attractiveness	0.11	0.8	116	1.542	0.126
Variety	0.27	0.98	116	2.954	0.004
Proportion of intensity	0.2	0.64	116	3.340	0.001

According to the information in Table 2, there is a significant difference in students' attitudes regarding sports performance between the two training methods ($P < 0.05$). Additionally, in the domain of program content, the differences in means indicate significant values ($P < 0.05$). Furthermore, in the area of exercise variety, students show a significant difference in attitudes towards the two training methods ($P < 0.05$). In terms of exercise intensity, students' attitudes towards the combined and aerobic training methods also display significant differences ($P < 0.05$). However, in the domain of exercise appeal, no significant difference was observed between the two training methods ($P > 0.05$).

According to the graph, students had a more positive attitude towards aerobic exercises compared to combined exercises and traditional training methods. Although a difference in attitudes was noted between the two training methods in terms of exercise appeal, this difference was not significant ($P > 0.05$).

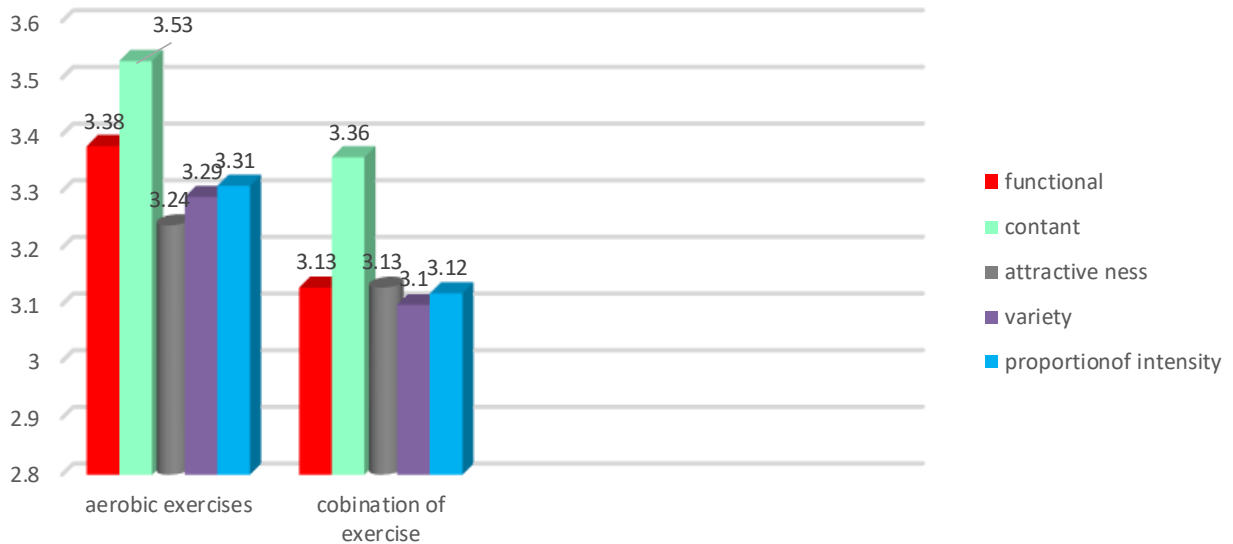


Figure 1. Comparison of means in the five domains of performance, program content, appeal, variety, and exercise intensity

Discussion and Conclusion

The present study examined the effects of a 12-week combined training program on selected physical fitness components and students' attitudes toward exercise, comparing outcomes with a control group and contrasting two instructional approaches. Overall, the findings demonstrate that participation in a structured combined exercise program over one academic semester led to significant improvements in several key physical fitness indicators, including cardiorespiratory endurance, muscular endurance of the abdominal and shoulder girdle muscles, agility, and body fat percentage. In parallel, the results revealed meaningful differences in students' attitudes toward exercise, particularly in the domains of sports performance, program content, exercise variety, and perceived appropriateness of exercise intensity. These findings provide empirical support for the effectiveness of combined training interventions in university physical education settings and highlight the importance of psychological factors in shaping students' engagement with physical activity.

From a physiological perspective, the significant improvement observed in cardiorespiratory endurance aligns closely with prior research demonstrating that regular aerobic or mixed-modality exercise enhances cardiovascular efficiency and endurance capacity in young adults and adolescents (1, 2, 13). The structured inclusion of endurance activities within the combined program likely stimulated adaptations in the cardiovascular and respiratory systems, thereby improving oxygen uptake and utilization. Similar improvements have been reported in studies employing 12-week aerobic or combined exercise protocols, which consistently show enhanced endurance performance compared to baseline or control conditions (4, 13). These findings reinforce the notion that even within the constraints of an academic semester, appropriately designed exercise programs can yield meaningful physiological benefits.

The significant gains in muscular endurance of the abdominal and shoulder girdle muscles further support the efficacy of combined training. Strength and endurance exercises incorporated into the program appear to have contributed to neuromuscular adaptations, increased muscle recruitment efficiency, and improved

local muscular endurance. This outcome is consistent with earlier research indicating that mixed aerobic–resistance training produces superior improvements in muscular endurance compared to single-mode training (13, 23). In university populations, such adaptations are particularly relevant, as muscular endurance contributes not only to physical fitness but also to injury prevention and functional performance in daily activities.

Agility also improved significantly following the intervention, suggesting that the inclusion of speed and coordination drills was effective in enhancing neuromotor performance. Previous studies have shown that training programs incorporating multidirectional movement, speed changes, and coordination tasks can improve agility in adolescents and young adults (2, 25). The present findings corroborate these results and underscore the value of integrating diverse movement patterns into physical education curricula to address a broad spectrum of fitness components.

In contrast, no significant improvement was observed in explosive power as measured by the standing long jump test. This finding mirrors results from some earlier studies reporting limited changes in explosive strength following short-term or moderate-intensity training programs (2). Explosive power development typically requires high-intensity, plyometric, or power-specific training stimuli, which may not have been emphasized sufficiently within the combined program. Thus, the absence of significant change in this variable suggests that while combined training is effective for enhancing endurance, agility, and muscular endurance, targeted interventions may be necessary to elicit improvements in explosive strength.

The reduction in body fat percentage observed in the experimental group represents another important outcome of the study. Regular participation in combined aerobic and resistance exercise has been consistently associated with favorable changes in body composition, including reductions in fat mass and improvements in metabolic health (1, 13). The present findings align with these reports and suggest that engaging female university students in structured, moderate-to-vigorous physical activity over a semester can positively influence body composition. Such changes are particularly relevant given concerns about sedentary behavior and weight gain during the university years.

Beyond physiological outcomes, the study's examination of students' attitudes toward exercise provides valuable insights into the psychological impact of different training approaches. Significant differences were found between the two training methods in students' perceptions of sports performance, program content, exercise variety, and exercise intensity. These results are consistent with theoretical and empirical work emphasizing the role of attitudes in shaping exercise intentions and behaviors (9, 10). Positive evaluations of performance and content likely reflect students' perceptions that the training was effective, purposeful, and aligned with their physical capabilities.

The favorable attitudes toward program content and exercise variety suggest that diversity in exercise modalities plays a crucial role in maintaining student interest and engagement. Monotony has been identified as a key barrier to sustained participation in physical activity, particularly in educational settings (11). By incorporating multiple components—endurance, strength, flexibility, speed, and rhythmic elements—the combined program may have mitigated boredom and enhanced perceived enjoyment. Similar conclusions have been drawn in studies demonstrating that varied and well-structured physical education programs foster more positive attitudes and higher levels of participation among students (12, 17).

Students also reported significant differences in their perceptions of exercise intensity between the two methods, indicating that the combined program was viewed as more appropriately matched to their fitness levels. Perceived appropriateness of intensity is a critical determinant of exercise adherence, as overly demanding or insufficiently challenging programs can undermine motivation (9). The present findings suggest that balancing intensity within a combined training framework may enhance students' confidence and willingness to engage fully in physical education classes.

In contrast, no significant difference was observed in the domain of exercise attractiveness. This result may reflect the influence of individual preferences, cultural norms, and prior experiences with physical activity. While rhythmic and music-accompanied exercises have been shown to enhance enjoyment and emotional responses in various populations (14-16), such effects may not always translate into statistically significant differences in perceived attractiveness, particularly when both training methods are generally well accepted. Nonetheless, the overall positive trend observed in attitudes toward aerobic exercises accompanied by music aligns with evidence linking music-based physical activity to improved mood, reduced fatigue, and enhanced vitality (5, 6).

The psychological benefits associated with exercise participation are further supported by broader research demonstrating links between physical activity, emotional regulation, and mental health outcomes. Regular exercise has been shown to reduce symptoms of depression, loneliness, and fatigue, while enhancing resilience and cognitive functioning (3, 28, 29). Although mental health variables were not directly measured in the present study, the positive attitudes reported by students may reflect underlying improvements in psychological well-being, which, in turn, can reinforce continued engagement in physical activity.

Social and contextual factors also warrant consideration in interpreting the findings. Physical education classes provide a social environment in which peer interaction, instructor support, and group dynamics can influence attitudes and behaviors. Previous studies emphasize that social support from peers and educators plays a significant role in sustaining physical activity among adolescents and university students (7, 18). The structured and interactive nature of the combined training sessions may have fostered a supportive atmosphere conducive to positive experiences and attitudes.

The present findings also resonate with emerging research highlighting the broader neurophysiological and cognitive benefits of physical exercise. Systematic reviews and meta-analyses indicate that regular exercise influences neuroplasticity and brain-derived neurotrophic factors, contributing to cognitive and emotional health across the lifespan (19, 20). While such mechanisms were beyond the scope of this study, the observed improvements in fitness and attitudes may represent proximal indicators of these broader benefits.

Taken together, the results of this study reinforce the value of combined training programs in university physical education contexts. By simultaneously addressing multiple components of physical fitness and fostering positive attitudes toward exercise, such programs have the potential to promote both immediate health benefits and longer-term behavioral change. The alignment of the present findings with a wide range of previous studies across physiological, psychological, and social domains strengthens the evidence base supporting integrated exercise interventions in higher education settings.

Despite its contributions, this study has several limitations that should be acknowledged. First, the sample consisted exclusively of female university students, which limits the generalizability of the findings to male

students or mixed-gender populations. Second, the relatively short duration of the intervention, confined to a single academic semester, may not capture long-term adaptations or sustained changes in attitudes and behaviors. Third, the study relied on self-report measures to assess attitudes toward exercise, which may be subject to response bias. Finally, external factors such as participants' extracurricular physical activity, dietary habits, and psychosocial stressors were not controlled, potentially influencing the observed outcomes.

Future research should consider including more diverse samples, encompassing male students and individuals from different academic disciplines and cultural backgrounds, to enhance the generalizability of findings. Longitudinal studies extending beyond a single semester would provide valuable insights into the sustainability of fitness gains and attitude changes over time. Incorporating objective measures of physical activity, alongside qualitative assessments of students' experiences, could enrich understanding of how and why certain training methods are more effective. Additionally, future studies may explore the integration of emerging modalities, such as technology-assisted or mindful exercise programs, in comparison with traditional combined training approaches.

From a practical standpoint, university physical education programs should prioritize the design and implementation of combined training curricula that integrate endurance, strength, flexibility, and coordination exercises. Emphasizing variety, appropriate intensity, and clear program structure may enhance students' perceptions of effectiveness and engagement. Instructors are encouraged to consider incorporating rhythmic or music-based elements where appropriate to support motivation and enjoyment. Finally, fostering a supportive and inclusive class environment can further strengthen positive attitudes toward physical activity and encourage students to adopt active lifestyles beyond the university setting.

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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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