



Effects of a 10-week fitness training program on muscular strength, body composition and exercise motivation among university students

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Abstract

This study investigated the effects of a 10-week fitness training program on muscular strength, body composition, and exercise motivation among undergraduate students at the University of Finance - Marketing, Vietnam. A randomized controlled pretest-posttest design was employed involving 40 students (25 females and 15 males), who were randomly assigned to an experimental group ($n = 20$) and a control group ($n = 20$). The experimental group participated in supervised fitness training three times per week for 10 weeks, whereas the control group maintained their usual daily activities. Muscular strength was assessed using the handgrip strength test, body composition was measured using a bioelectrical impedance analyzer, and exercise motivation was evaluated using the Behavioral Regulation in Exercise Questionnaire-3 (BREQ-3). Statistical analyses included descriptive statistics, paired- and independent-samples t -tests, ANCOVA, and Cohen's d effect sizes. The results showed that the experimental group achieved significant improvements in muscular strength, skeletal muscle mass, and exercise motivation, together with significant reductions in body fat percentage ($p < .001$), while no significant changes were observed in the control group. These findings suggest that a structured 10-week fitness training program is an effective strategy for improving physical fitness and promoting exercise motivation among university students and may be integrated into university physical education curricula.

Keywords: Fitness training, muscular strength, body composition, exercise motivation, university students, physical education

Introduction

Regular physical activity plays a fundamental role in maintaining physical health, preventing chronic diseases, and improving psychological well-being throughout the lifespan. However, physical inactivity has become increasingly prevalent among university students because of academic demands, prolonged screen time, and sedentary lifestyles. According to the World Health Organization (WHO, 2020) [14], insufficient physical activity is a major modifiable risk factor for cardiovascular disease, obesity, diabetes, and premature mortality. University students are particularly vulnerable to declining physical fitness because many reduce their participation in organized sports and recreational activities after entering higher education (Lavie *et al.*, 2019) [6]. Consequently, promoting effective exercise interventions within university settings has become an important public health priority.

Among the components of health-related physical fitness, muscular strength and body composition are recognized as important indicators of overall health and functional capacity. Adequate muscular strength contributes to improved physical performance, injury prevention, and better quality of life, while healthy body composition - characterized by lower body fat percentage and higher skeletal muscle mass - is associated with reduced risks of metabolic and cardiovascular diseases (Westcott, 2012; Schoenfeld, 2020) [10, 12]. Unlike body mass index (BMI), body composition provides a more accurate assessment of physiological adaptations resulting from exercise and has therefore become a widely accepted outcome measure in exercise science research.

Fitness training, particularly resistance-based exercise, has gained considerable popularity among university students

due to its effectiveness in improving muscular fitness and physical appearance. A structured fitness training program typically combines machine-based exercises, free weights, bodyweight movements, and functional training following the principle of progressive overload (American College of Sports Medicine [ACSM], 2022) [1]. Numerous studies have demonstrated that regular fitness training enhances muscular strength, increases skeletal muscle mass, reduces body fat percentage, and improves metabolic efficiency (Grgic *et al.*, 2020; Schoenfeld *et al.*, 2019) [11]. In addition to its physiological benefits, resistance training has also been shown to positively influence self-confidence, perceived competence, and adherence to regular physical activity. Exercise motivation is another critical factor influencing participation in physical activity. According to Self-Determination Theory, individuals are more likely to maintain regular exercise when they experience intrinsic motivation and perceive themselves as competent and capable (Ryan & Deci, 2020) [9]. Participation in structured fitness training enables individuals to observe gradual improvements in physical performance and body composition, which may strengthen their confidence and enjoyment of exercise. Consequently, improvements in physical fitness may also enhance exercise motivation, thereby increasing the likelihood of sustained participation in physical activity beyond the intervention period. The Behavioral Regulation in Exercise Questionnaire is one of the most widely used instruments for assessing exercise motivation within the Self-Determination Theory framework (Markland & Tobin, 2004; Wilson *et al.*, 2006) [7, 13]. Recent validation studies have continued to support the reliability and construct validity of the BREQ-3 across different populations.

Despite the growing popularity of fitness training, most previous intervention studies have focused primarily on physiological outcomes such as muscular strength, muscle hypertrophy, or body composition. Comparatively fewer studies have simultaneously examined both physical adaptations and psychological outcomes, particularly exercise motivation, among university students. Furthermore, empirical evidence from Vietnam remains limited, as existing research has mainly investigated general physical education or aerobic exercise interventions. Therefore, the effectiveness of structured fitness training within Vietnamese university physical education programs has not been sufficiently explored.

At the University of Finance – Marketing, fitness training has recently been introduced as one of the practical modules within the physical education curriculum to promote students' health and encourage active lifestyles. Nevertheless, no controlled experimental study has evaluated whether participation in this program leads to meaningful improvements in muscular strength, body composition, and exercise motivation. Generating scientific evidence from the UFM context will contribute to improving curriculum design and provide practical recommendations for implementing evidence-based physical education programs in Vietnamese universities. Therefore, the present study aimed to investigate the effects of a 10-week fitness training program on muscular strength, body composition, and exercise motivation among undergraduate students at the University of Finance – Marketing, Vietnam. It was hypothesized that students participating in the fitness training program would demonstrate significantly greater improvements in muscular strength, healthier body composition, and higher exercise motivation than students in the control group following the 10-week intervention.

Materials and Methods

Participants

This study employed a randomized controlled pretest-posttest experimental design involving undergraduate students from the University of Finance - Marketing (UFM), Ho Chi Minh City, Vietnam. A total of 40 healthy undergraduate students (25 females and 15 males), aged 18-22 years, voluntarily participated in the study. The higher proportion of female participants reflects the actual gender distribution of the student population at UFM.

Participants were randomly assigned to either an experimental group (n = 20) or a control group (n = 20). All participants were informed about the study procedures and provided written informed consent before data collection. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (World Medical Association, 2013)^[15].

Inclusion Criteria

Participants were eligible if they:

- Were full-time undergraduate students at UFM;
- Were aged between 18 and 22 years;
- Had not participated in regular fitness or resistance training during the previous six months;
- Had no cardiovascular, respiratory, neurological, or musculoskeletal disorders;
- Voluntarily agreed to participate in the study.

Exclusion Criteria

- Participants were excluded if they:
- Had any medical condition contraindicating resistance exercise;
- Sustained injuries during the intervention period;
- Attended fewer than 80% of the training sessions;
- Withdrew from the study before completion.

Research Design

A randomized controlled pretest–posttest design was used to evaluate the effectiveness of the intervention. Baseline measurements were collected one week before the intervention, and post-intervention measurements were conducted immediately after the completion of the 10-week fitness training program.

The independent variable was participation in the fitness training program, while the dependent variables included muscular strength, body composition, and exercise motivation.

Fitness Training Program

The intervention consisted of a supervised 10-week fitness training program, conducted three sessions per week on non-consecutive days. Each session lasted approximately 60 - 70 minutes and was supervised by qualified physical education instructors.

Training intensity followed the recommendations of the American College of Sports Medicine (ACSM, 2022)^[1], progressing from moderate to vigorous intensity according to the principle of progressive overload.

Each session consisted of:

- 10 minutes of warm-up;
- 45-50 minutes of resistance-based fitness training;
- 5-10 minutes of cool-down and stretching.

The training program was organized according to major muscle groups:

Weeks	Training Focus
Weeks 1–2	Chest muscles
Weeks 3–4	Shoulder muscles
Weeks 5–6	Lower-body (Legs)
Weeks 7–8	Biceps and Triceps
Weeks 9–10	Whole-body integrated training

Outcome Measurements

Muscular Strength

Muscular strength was assessed using the Handgrip Strength Test, a reliable indicator of overall muscular strength (Roberts *et al.*, 2011)^[8]. Two trials were performed for each participant, and the highest value was recorded.

Body Composition

Body composition was measured using the InBody 270 Bioelectrical Impedance Analyzer, following standardized testing procedures. The recorded variables included:

- Body Weight (kg)
- Body Mass Index (BMI)
- Body Fat Percentage (%)
- Skeletal Muscle Mass (kg)

Participants were instructed to avoid vigorous exercise, alcohol, caffeine, and large meals for at least 12 hours before testing (Kyle *et al.*, 2004) [5].

Exercise Motivation

Exercise motivation was evaluated using the Behavioral Regulation in Exercise Questionnaire-3 (BREQ-3), which is based on Self-Determination Theory and has demonstrated satisfactory validity and reliability in exercise settings (Ryan & Deci, 2020; Wilson *et al.*, 2006) [9, 13].

Power Analysis

An a priori power analysis was conducted using G*Power 3.1 (Faul *et al.*, 2009) [3]. Assuming a medium effect size ($f = 0.30$), a significance level of $\alpha = .05$, statistical power of .80, two groups, and two measurement occasions, a minimum sample size of 36 participants was required. To compensate for potential attrition, 40 students were recruited.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics Version 29.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics are presented as mean $\pm$ standard deviation (Mean $\pm$ SD).

The Shapiro–Wilk test was used to assess normality. Independent-samples t-tests were used to compare baseline characteristics between groups, while paired-samples t-tests evaluated within-group changes. Analysis of covariance (ANCOVA) was applied to compare posttest outcomes between groups after controlling for baseline values. Effect sizes were calculated using Cohen's d (Cohen, 1988) [2]. Statistical significance was set at $p < .05$.

Results

Baseline Characteristics of Participants

Forty undergraduate students (25 females and 15 males) completed the study. No participants withdrew during the intervention. Baseline comparisons revealed no statistically significant differences between the experimental and control groups in age, anthropometric characteristics, muscular strength, body composition, or exercise motivation (all $p > .05$), indicating that the two groups were comparable before the intervention (Table 2).

Table 2: Baseline Characteristics of Participants

Variable	Experimental Group (n = 20) Mean $\pm$ SD	Control Group (n = 20) Mean $\pm$ SD	p
Age (years)	20.31 $\pm$ 1.22	20.46 $\pm$ 1.18	.681
Height (cm)	165.62 $\pm$ 8.15	164.91 $\pm$ 7.94	.782
Body Weight (kg)	59.84 $\pm$ 9.31	60.15 $\pm$ 8.86	.914
BMI (kg/m ²)	21.84 $\pm$ 2.47	22.01 $\pm$ 2.55	.823
Handgrip Strength (kg)	30.12 $\pm$ 7.43	29.81 $\pm$ 7.15	.891
Body Fat (%)	24.56 $\pm$ 5.81	24.92 $\pm$ 5.46	.844
Skeletal Muscle Mass (kg)	24.62 $\pm$ 5.18	24.39 $\pm$ 5.06	.876
Exercise Motivation	3.42 $\pm$ 0.52	3.39 $\pm$ 0.49	.853

Changes in Muscular Strength

Table 3 presents the pretest and posttest results for muscular strength. The experimental group demonstrated a significant increase in handgrip strength after the 10-week fitness training program ($p < .001$), with a large effect size ($d =$

1.18). No significant improvement was observed in the control group.

Table 3: Changes in Muscular Strength

Group	Pretest	Posttest	Mean Change	p	Cohen's d
Experimental	30.12 $\pm$ 7.43	35.84 $\pm$ 7.21	+5.72	<.001	1.18
Control	29.81 $\pm$ 7.15	30.21 $\pm$ 7.11	+0.40	.641	0.08

Changes in Body Composition

Changes in body composition are presented in Table 4. Following the intervention, the experimental group showed a significant reduction in body fat percentage and a significant increase in skeletal muscle mass ($p < .001$). No statistically significant changes were observed in the control group.

Table 4: Changes in Body Composition

Variable	Experimental Pretest	Experimental Posttest	Control Pretest	Control Posttest	p
Body Fat (%)	24.56 $\pm$ 5.81	21.83 $\pm$ 5.04	24.92 $\pm$ 5.46	24.65 $\pm$ 5.33	<.001
Skeletal Muscle Mass (kg)	24.62 $\pm$ 5.18	26.31 $\pm$ 5.22	24.39 $\pm$ 5.06	24.46 $\pm$ 5.09	<.001

Changes in Exercise Motivation

Exercise motivation scores before and after the intervention are presented in Table 5. The experimental group demonstrated a significant increase in exercise motivation after completing the fitness training program ($p < .001$), whereas no significant changes were observed in the control group.

Table 5: Changes in Exercise Motivation

Group	Pretest	Posttest	Mean Change	p	Cohen's d
Experimental	3.42 $\pm$ 0.52	4.21 $\pm$ 0.48	+0.79	<.001	0.95
Control	3.39 $\pm$ 0.49	3.45 $\pm$ 0.47	+0.06	.571	0.11

Overall Intervention Effects

Analysis of covariance (ANCOVA) revealed significant intervention effects for all outcome variables after controlling for baseline values. Compared with the control group, the experimental group demonstrated significantly greater improvements in muscular strength ($F = 21.64$, $p < .001$), body fat percentage ($F = 18.57$, $p < .001$), skeletal muscle mass ($F = 17.82$, $p < .001$), and exercise motivation ($F = 15.94$, $p < .001$).

Discussion

The present study investigated the effects of a 10-week fitness training program on muscular strength, body composition, and exercise motivation among undergraduate students at the University of Finance – Marketing (UFM), Vietnam. The findings demonstrated that participants in the experimental group showed significant improvements in all measured outcomes compared with the control group, supporting the effectiveness of structured fitness training in promoting both physical and psychological health.

The first major finding was the significant improvement in muscular strength following the intervention. The increase in handgrip strength observed in the experimental group is consistent with previous studies reporting that progressive resistance training enhances neuromuscular function and muscle force production through neural adaptations and muscle hypertrophy (Schoenfeld, 2020; Grgic *et al.*, 2020) ^[10]. These findings suggest that a structured 10-week fitness training program is sufficient to produce meaningful strength gains among university students with limited previous resistance training experience.

The study also found significant improvements in body composition, as indicated by reduced body fat percentage and increased skeletal muscle mass. These results agree with previous evidence showing that regular resistance training promotes favorable changes in body composition by increasing lean muscle mass while reducing fat mass (Westcott, 2012; ACSM, 2022) ^[12]. Such improvements are particularly important for university students, who are increasingly exposed to sedentary behaviors and unhealthy lifestyles.

Another important finding was the significant increase in exercise motivation after participation in the fitness training program. This result supports Self-Determination Theory, which proposes that improvements in perceived competence and physical performance strengthen intrinsic motivation to engage in regular physical activity (Ryan & Deci, 2020) ^[9]. As students experienced visible improvements in strength and body composition, they were likely encouraged to continue exercising, thereby enhancing their motivation toward long-term physical activity.

From a practical perspective, the findings suggest that incorporating structured fitness training into university physical education curricula may be an effective strategy for improving students' physical fitness and encouraging regular participation in exercise. Such programs may contribute to healthier lifestyles and support long-term disease prevention among young adults.

This study has several limitations. First, the sample size was relatively small and was drawn from a single university, which may limit the generalizability of the findings. Second, the intervention lasted only ten weeks, and therefore the long-term effects of the program remain unknown. Finally, dietary intake and physical activity outside the intervention were not controlled. Future studies should include larger samples, longer intervention periods, and additional physiological and psychological variables to further examine the effectiveness of fitness training among university students.

Conclusions

The findings of this study demonstrate that a 10-week fitness training program significantly improved muscular strength, body composition, and exercise motivation among undergraduate students at the University of Finance – Marketing (UFM), Vietnam. Compared with the control group, participants in the experimental group achieved greater gains in muscular strength and skeletal muscle mass, lower body fat percentage, and higher levels of exercise motivation.

These findings indicate that structured fitness training is an effective approach for enhancing both physical fitness and psychological engagement in university students. Integrating fitness training into university physical

education curricula may help promote healthy lifestyles and encourage long-term participation in regular physical activity. Future studies should include larger and more diverse samples, extend the intervention period, and examine additional health-related outcomes to further validate the effectiveness of fitness training in higher education settings.

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