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Original Research Article

Exercise System for Enhancing Endurance in Physical Education Students

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Abstract

The purpose of this study is to improve general endurance of students, by selecting and implementing appropriate exercises. All participants were the freshman majoring in physical education in Vinh University, Vietnam. Participants were randomly assigned to either a experiment group (MG) or a Control Group (CG). Fifty students were randomly assigned to an experimental (n=25) or control group (n=25) for a sixteen-week study. Both groups had regular physical education twice weekly. The experimental group received extra athletic training twice weekly, while the control group followed the standard curriculum. Physical fitness tests, including 5-minute running, 800m running, and 1-minute rope jumping, were used as outcome measures. After sixteen weeks, the experimental group showed significantly improved performance in all tests ($p < 0.05$) compared to the control group, demonstrating the effectiveness of the exercise program in enhancing student endurance.

Keywords: Exercise, endurance, physical education, student.

1. INTRODUCTION

Physical education plays a vital role in every school's curriculum, offering students opportunities to improve their physical fitness, overall health, and social interaction skills [1]. Endurance is one of the fundamental aspects of human movement and a key indicator of overall health. Endurance activity is an innate form of movement that relies on aerobic metabolism and repeated isotonic contractions of large skeletal muscles [2, 3]. Endurance training, a structured and systematic approach to endurance activity, is well known for its health benefits, as it enhances or restores physical fitness. As a result, it is utilized not only in sports but also in the rehabilitation of patients with neuromuscular [4], cardiovascular [5], and metabolic disorders [6]. Endurance training is well-documented to enhance athletes' physical fitness, boosting performance and ability [7], while also reducing the risk of cardiovascular diseases, preventing heart complications, and improving cardiac function [8].

Regular physical activity greatly lowers the risk of chronic diseases like heart disease and diabetes while also alleviating symptoms of mental health disorders such as depression and anxiety [9]. Encouraging physical activity is essential in combating sedentary lifestyles and enhancing community fitness [10]. Research highlights the benefits of endurance training in improving various aspects of physical health [11]. including increased capillary density in muscle fibres and enhanced blood flow to active muscles [12]. Additionally, endurance exercise boosts maximal oxygen uptake [13].

Recognizing the significance of physical exercise and endurance training, a structured system of suitable exercises was chosen to enhance the overall endurance of Physical Education students through experimentation.

2. MATERIALS AND METHODS

2.1. Participants

Participants for this study were recruited from the Physical Education Department at Vinh University, consisting of 50 freshmen majoring in physical education. They were randomly assigned to an experimental group (EG) or a control group (CG), with 25 students in each group. All participants signed informed consent forms before the intervention began, and were informed they could withdraw from the study at any point.

2.2. Design

The pedagogical experiment lasted for sixteen

weeks, with both groups attending physical education and sports classes twice a week. The control group followed the standard educational curriculum, while the experimental group engaged in structured athletic exercise complexes twice a week outside of regular class time in the form of sport club to enhance natural physical qualities. These exercises were implemented according to a predefined plan. To evaluate general endurance in both groups, the 5-minute running test, 800m running test, and 1-minute rope jumping test were used. Both groups underwent pre- and post-intervention assessments conducted by the same instructors to ensure consistency. Testing followed identical protocols, using the same equipment and measurement criteria. The specific physical exercises incorporated in the study, including their types, durations, and intensity levels, are detailed in Table 1.

Table 1: Selected physical exercises

Exercises	Dosage, intensity and methods
400m repeat running	1 set, intensity of 80-85% of maximum speed
800m repeat running	1 set, intensity of 80-85% of maximum speed
1000m repeat running	1 set, intensity of 80-85% of maximum speed
Continuous steady-paced running at a low speed	10-12 min, uniform running at low speed (heart beat 120-160 beats/min
Running distances of 20 to 60 m from high start	Intensity is 90 – 95% of maximum speed; Rest between distances is 1 min and 3 min between series
Continuous running over a long distance without altering speed	10-12 min, alternating long slow running and 20m last running
Running at variable intensity	2sets x 5 min, variable running at middle speed, 3-4 min rest
Running at intervals	2 series, 2-3x50m, the intensity is 70-80% of of maximum speed, 30s rest between distances ad 3 min rest between series
Repeat running	3 sets x 80m or 2x120m, intensity 80-90% of maximum speed, 3-4 min rest
Relay games	3 sets x 30m, using competitive method
Movement games	10 min, using playing method
Jumping in place	40cm for 40s
Jumping rope	3 sets x 1 min

min: minute; s: second

2.3. Outcomes Measurements

- 5-minute running test (m): To assess maximal aerobic speed.
- 800m running test (minute): To assess anaerobic capacity.
- 1-minute rope jumping test (times): To assess cardiorespiratory endurance

2.4. Data Analysis

Statistical analyses were conducted using the SPSS software package. A significance level of $p \leq 0.05$ was applied. Data are presented as means with standard deviations. A t-test was used to assess between-group differences in pre-test and post-test results.

3. RESULTS

Assess the effectiveness of exercises through tests

Table 2: Result of tests for overall endurance of students between EG and CG at pre-test

Tests	EG		CG		P*
	M	SD	M	SD	
5-minute running (m)	860	45.2	855	46.4	>0.05
800m running (minute)	4.54	0.23	4.57	0.26	>0.05
1-minute rope jumping (times)	92.6	7.3	93,5	7.5	>0.05

**t- test; SD: Standard Deviation*

The table 2 reveals that there were no statistically significant differences in performance between the experimental Group (EG) and the control Group (CG) (>0.05) across all three physical tests (5-minute running, 800m running, and 1-minute rope jumping). While there were slight variations in the mean scores, these differences were not large enough to be considered statistically meaningful.

Table 3: Result of tests for overall endurance of students between EG and CG at post-

Tests	EG		CG		P*
	M	SD	M	SD	
5-minute running (m)	945	48.7	860	47.5	<0.05
800m running (minute)	3.55	0.25	4.41	0.29	<0.05
1-minute rope jumping (times)	104	8.3	95	7.3	<0.05

** t- test; SD: Standard Deviation*

The result of table 3 demonstrates statistically significant differences between the experimental group (EG) and the control group (CG) across all three tests. The experimental group consistently outperformed the control group. These results suggest that the intervention or factor differentiating the EG from the CG had a measurable and significant impact on the physical abilities assessed (endurance).

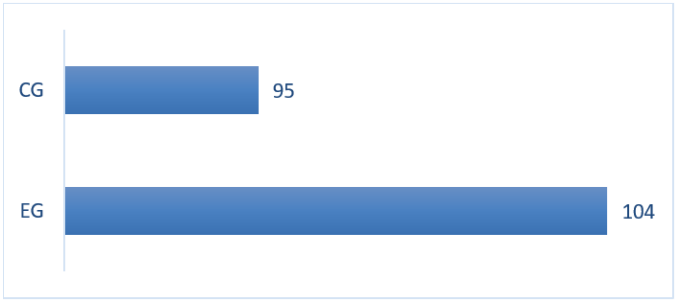

Figure 1: Performance of 5-minute running test (m)

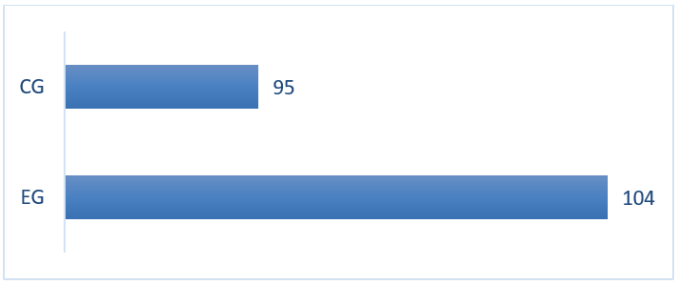

Figure 2: Performance of 800m running test (min)

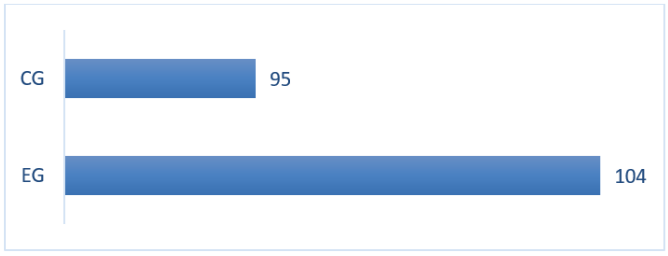

Figure 3: Performance of 1-minute rope jumping (times)

4. DISCUSSION

The purpose of this study was to enhance students' overall endurance through a targeted exercise system. After sixteen weeks of training, test results revealed a significant increase in endurance. The results of this study are in accordance with the results of previous finding that circuit training program involving body weight, resistance bands, and medicine ball exercises suits school-based programs and can improve local muscular endurance in normal weighted primary school boys [14]. Another study also suggested that Exercise can be used to develop speed and endurance of boys [15]. A study of 8-week exercise training revealed that selected exercises had good impacts on improving speed endurance for male students [16]. Some previous findings proved that exercises can increase the indicators of strength endurance and cardiorespiratory fitness of young women [17], improve performance variables that can be obtained with strength and endurance training in long-distance running [18].

Long-distance running performance, a key measure of endurance, can be significantly improved through targeted exercise training. Research consistently demonstrates the effectiveness of such training in enhancing running efficiency. Specifically, study showed that circuit training focusing on speed, agility, and endurance positively impacts physical education students [19], Furthermore, core strength exercises are more effective than traditional strength training for developing myocardial fitness in medium and long-distance runners [20]. Ando et al. found that a six-week sprint training program enhanced both sprint and long-distance running performance in elite athletes, even without changes in aerobic capacity [21] Additionally, a 20-week combined endurance and strength training regimen has been shown to improve performance and physiological markers, while maintaining the runner's biomechanics [22]. These findings collectively reinforce the crucial role of specialized exercise programs in optimizing long-

distance running performance.

Physical training demonstrably enhances both speed and strength in long-distance runners. Incorporating specific protocols into daily training regimens can yield significant improvements [23], Notably, concurrent explosive strength and endurance training is particularly beneficial for competitive performance, especially in races where sprint finishes are crucial [24]. Furthermore, high-load strength training has been shown to improve performance metrics such as time trials and time to exhaustion [25] while endurance-focused drill techniques effectively boost overall endurance capacity [26].

While the study met its objectives, limitations exist. Small sample sizes and potential bias from the control group necessitate further research. Future studies should include larger, more diverse groups and explore various exercise types across different sports.

5. CONCLUSION

This study aimed to enhance student endurance by selecting and implementing a specific exercise program. Fifty students were recruited and assigned to two groups for comparison. Sixteen weeks of targeted exercises led to significantly improved endurance test scores in the experimental group, proving the exercises' effectiveness.

Conflict of Interest Statement: The authors declare no conflicts of interest.

About the author :
Nguyen Manh Hung (PhD) is vice dean of Physical department, Vinh University, Vietnam. His working areas are outdoor activities and physical education.

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