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The Effect of a 12-Minute Aerobic Running Program on the Endurance of Adolescent Football Players at Bhatara Football School Sumedang

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Abstract

This study aimed to determine the effect of a 12-minute aerobic exercise program on improving the aerobic endurance of adolescent football students at SSB Bhatara Sumedang. The study employed an experimental method using a one-group pretest-posttest design. The research sample consisted of 30 adolescent football students. The Cooper Test was used as the research instrument to measure participants' aerobic endurance. The training program was conducted over 10 sessions. Data were analyzed using descriptive statistics, the Shapiro–Wilk normality test, and a paired sample t-test. The results showed an increase in the average endurance score from 37.33 in the pretest to 77.33 in the posttest. The hypothesis test results indicated a significance value of 0.000 < 0.05, meaning that the 12-minute aerobic exercise program had a significant effect on improving the aerobic endurance of adolescent football students. Therefore, the 12-minute aerobic exercise program can be considered an effective alternative physical training method in youth football development.

Keywords: exercise aerobics, power hold, VO_2Max, football

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A. Introduction

Football is one of the most popular sports worldwide and plays an important role in physical, social, and psychological development. In football, players are required to master various basic techniques such as passing, dribbling, shooting, and ball control to achieve optimal performance during matches. Besides technical skills, football performance is also strongly influenced by physical condition, tactical understanding, and mental readiness. As a high-performance sport, football requires players to maintain consistency, movement intensity, and physical endurance throughout the game (Sukmana et al., 2024).

In addition, football has broader social and educational values. Football activities contribute not only to physical fitness improvement but also to the development of discipline, teamwork, sportsmanship, and social interaction among athletes. Sarifudin et al. (2023) explained that football plays an important role in strengthening social solidarity and shaping collective identity within society. Therefore, football can be viewed not only as a competitive sport but also as a medium for character building and social development.

One of the most important physical components in football is endurance. Endurance is defined as the ability of the body to perform physical activity continuously over a prolonged period without experiencing excessive fatigue. In football, aerobic endurance is essential because players are required to run, move actively, and adapt to changing game intensity throughout the match. Good endurance allows players to maintain performance, concentration, and movement effectiveness during competition. Therefore, endurance training becomes a fundamental aspect of football conditioning programs.

Aerobic exercise is one of the most effective training methods for improving endurance and cardiovascular fitness. Aerobic training involves continuous low-to-moderate intensity physical activity that increases oxygen utilization efficiency and cardiovascular function. One commonly used aerobic training and testing method is the 12-minute run, also known as the Cooper Test. This test is widely used to measure aerobic capacity and estimate VO_2Max through the maximum distance covered within 12 minutes. The 12-minute aerobic exercise was selected in this study because it is practical, simple to implement, does not require expensive equipment, and is suitable for adolescent football training programs. Furthermore, the method can easily be integrated into regular football practice sessions.

Several previous studies have reported that aerobic and interval training positively influence endurance and VO_2Max improvement in athletes. Mubarok and Kharisma (2021) found that both extensive and intensive interval training significantly improved aerobic endurance. Yunus et al. (2022) also reported that moderate-intensity aerobic exercise increased erythrocyte resistance and oxygen distribution capacity during physical activity. In addition, Amory and Haris Satria (2025) demonstrated that interval running training significantly improved VO_2Max in football players. These findings indicate that aerobic exercise contributes positively to athletes' physical performance and endurance development.

However, previous studies have primarily focused on interval training and VO_2Max improvement in professional or adult athletes. Limited studies have specifically examined the effectiveness of a simple 12-minute aerobic exercise program among adolescent football students in local football schools, particularly in the context of youth football

development in Indonesia. In addition, few studies have investigated the practical implementation of this training method in football schools with limited facilities and training resources. This gap indicates the need for further research regarding the effectiveness of a 12-minute aerobic exercise program for improving endurance among adolescent football players.

The novelty of this study lies in the implementation of a simple and structured 12-minute aerobic exercise program specifically designed for adolescent football students at SSB Bhatara Sumedang. Unlike previous studies that mainly focused on interval training or elite athlete populations, this study emphasizes practical aerobic training that can be easily applied in local football coaching programs. This study also provides empirical evidence regarding the effectiveness of the 12-minute aerobic exercise method in improving endurance among adolescent football students.

Based on the background above, this study aims to analyze the effect of a 12-minute aerobic exercise program on improving the endurance of adolescent football students at SSB Bhatara Sumedang. The findings of this study are expected to contribute theoretically to sports training science and practically to the development of effective physical conditioning programs for youth football athletes.

B. Methods

This study employed a quantitative approach using an experimental method with a one-group pretest-posttest design. This design was selected to determine the effect of a 12-minute aerobic exercise program on improving the aerobic endurance of adolescent football students at SSB Bhatara Sumedang. In this design, one group of participants was given a pretest before receiving the treatment and a posttest after the completion of the training program. The difference between pretest and posttest scores was used to evaluate the effectiveness of the aerobic exercise intervention (Adiprasetio, 2022).

The study was conducted at SSB Bhatara Sumedang, West Java, Indonesia. The participants consisted of 30 adolescent football students who actively participated in regular football training programs. The sample was selected using purposive sampling based on the criteria that participants were actively involved in training activities, physically healthy, and willing to participate throughout the research process.

The research design can be illustrated as follows:

$$O_1 \; X \; O_2$$

Information:
O_1 : Pretest (before treatment)
X : 12-minute aerobic exercise treatment
O_2 : Posttest (after treatment)

The research procedure consisted of 12 meetings. The first meeting was conducted for the pretest, meetings 2–11 were used for the implementation of the 12-minute aerobic exercise program, and the final meeting was conducted for the posttest. Each training session lasted approximately 30–40 minutes, consisting of:

1. Warm-up: 10 minutes
2. Core aerobic exercise: 12 minutes of continuous running
3. Cooling-down: 8–10 minutes

The aerobic exercise program was performed at moderate intensity, approximately 70–85% of maximum heart rate (HRmax), adjusted to the participants' age and physical condition. The exercise intensity was controlled through observation of running pace and participant physical responses during training sessions.

The research instrument used in this study was the Cooper Test (12-minute run test) to measure aerobic endurance and estimate participants' VO_2Max levels. The Cooper Test is widely recognized as a valid and reliable instrument for measuring aerobic endurance and estimating VO_2Max.

The test was conducted on a standard football field under the same environmental and operational conditions during both the pretest and posttest.

To minimize the influence of external factors, participants were instructed to maintain their regular daily activities, avoid excessive physical exercise outside the research program, and maintain adequate rest and hydration before testing sessions. All tests and training sessions were conducted at the same location and within similar time schedules to maintain data consistency.

The data obtained from the pretest and posttest were analyzed using descriptive statistics, the Shapiro–Wilk normality test, and a paired sample t-test with the assistance of IBM SPSS Statistics software. The significance level used in this study was 0.05.

C. Results and Discussion

Table 2 . Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
PRETEST	30	10	60	37.33	14.606	-.967	.833
POSTEST	30	50	100	77.33	12.847	-.436	.833
Valid N (listwise)	30						

Based on Table 2, the descriptive statistical analysis showed that students' aerobic endurance improved after participating in the 12-minute aerobic exercise program. The mean pretest score was 37.33 with a standard deviation of 14.606, while the mean posttest score increased to 77.33 with a standard deviation of 12.847. These findings demonstrated a substantial improvement in students' aerobic endurance following the training program.

The minimum and maximum scores also increased considerably. In the pretest, the minimum score was 10 and the maximum score was 60, whereas in the posttest the minimum score increased to 50 and the maximum score reached 100. This increase indicated that almost all participants experienced improvement after the treatment was administered.

In addition, the lower standard deviation in the posttest suggested that students' endurance performance became more consistent after the training intervention. This finding indicated that, besides improving the average endurance score, the exercise program also contributed to reducing performance variability among participants. Overall, the results demonstrated that the 12-minute aerobic exercise program was effective in improving the aerobic endurance of adolescent football students at SSB Bhatara Sumedang.

Table 3 Normality Test

Tests of Normality

	Kolmogorov-Smirnov a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PRETEST	.159	30	.052	.923	30	.032
POSTEST	.151	30	.078	.943	30	.107

Based on the normality test results using the Shapiro–Wilk test, the significance value for the pretest was 0.032, while the posttest significance value was 0.107. Data are considered normally distributed when the significance value is greater than 0.05. The results indicated that the posttest data were normally distributed, whereas the pretest data did not fully meet the normality assumption because the significance value was below 0.05.

Furthermore, the Kolmogorov–Smirnov test showed significance values of 0.052 for the pretest and 0.078 for the posttest, both of which were greater than 0.05. These results suggested that the data distribution tended to be normal. However, because the sample size consisted of fewer than 50 participants (N = 30), the Shapiro–Wilk test was considered more appropriate for determining data normality.

Overall, the normality test findings indicated that most of the research data fulfilled the assumptions required for parametric statistical analysis. The normality test was conducted to ensure the validity and accuracy of the subsequent hypothesis testing process.

TABLE 4. Paired Sample Test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest Daya Tahan - Posttest Daya Tahan	-40.000	21.009	3.836	-47.845	-32.155	-10.428	29	.000

Based on Table 4, the paired sample t-test results showed a significance value (Sig. 2-tailed) of 0.000, which was lower than 0.05. These findings indicated a statistically significant difference between the pretest and posttest endurance scores. The mean difference value of -40.000 demonstrated a considerable improvement in students' aerobic endurance after participating in the 12-minute aerobic exercise program.

In addition, the t-value obtained was -10.428 with 29 degrees of freedom (df = 29). The 95% confidence interval ranged from -47.845 to -32.155, indicating that the improvement in endurance performance occurred consistently among most participants. The standard deviation value of 21.009 also showed some variation in improvement levels among students; however, the overall results demonstrated positive development after the intervention.

These results confirmed that the 12-minute aerobic exercise program had a significant positive effect on improving the aerobic endurance of adolescent football students at SSB Bhatara Sumedang.

Table 5. Paired Sample Statistics

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest Daya Tahan	37.33	30	14.606	2.667
	Posttest Daya Tahan	77.33	30	12.847	2.346

Based on Table 5, the paired sample statistics demonstrated an increase in students' aerobic endurance following the implementation of the 12-minute aerobic exercise program. The mean pretest score was 37.33 with a sample size of 30 students, while the mean posttest score increased to 77.33 after the treatment. These findings indicated that the exercise program contributed positively to improving students' endurance performance.

The standard deviation value decreased from 14.606 in the pretest to 12.847 in the posttest, indicating that students' endurance performance became more homogeneous after the training program. In addition, the standard error mean values of 2.667 (pretest) and 2.346 (posttest) suggested that the data had relatively small sampling error and adequately represented the study population.

Overall, the findings demonstrated a clear increase in aerobic endurance after students participated in the 12-minute aerobic exercise program. Therefore, the program can be considered an effective training method for improving the endurance capacity of adolescent football students.

Discussion

The results of this study demonstrated that the 12-minute aerobic exercise program had a significant effect on improving the aerobic endurance of adolescent football students at SSB Bhatara Sumedang. This finding was indicated by the increase in the mean endurance score from 37.33 in the pretest to 77.33 in the posttest. Furthermore, the paired sample t-test showed a significance value of 0.000 < 0.05, confirming that there was a statistically significant difference between students' endurance levels before and after the training intervention. These findings suggest that the 12-minute aerobic exercise program was effective in improving students' aerobic endurance.

The improvement in endurance may be associated with cardiovascular adaptations, including increased oxygen delivery efficiency and improved aerobic metabolism during prolonged physical activity. Aerobic exercise stimulates positive adaptations in the cardiorespiratory system, such as increased heart efficiency, improved lung function, and enhanced blood circulation. These physiological adaptations allow the body to transport and utilize oxygen more effectively during physical activity, thereby delaying fatigue and improving endurance performance. As a result, players are able to maintain movement intensity, physical activity, and performance consistency during football matches.

In modern football, endurance is considered one of the most important physical components because players are required to perform continuous high-intensity activities throughout the game. Football players must repeatedly sprint, jog,

change direction, and maintain concentration during both offensive and defensive situations. Therefore, good aerobic endurance is essential to support technical performance, tactical execution, and decision-making ability during competition. Players with higher endurance levels tend to recover faster and maintain performance more consistently throughout the match.

The findings of this study are consistent with previous research regarding the effectiveness of aerobic and interval training in improving endurance and VO_2Max. Zakky Mubarok et al. (2022) reported that structured interval training significantly improved aerobic endurance and VO_2Max in athletes. Similarly, Trioclarise et al. (2022) found that exercise duration, frequency, and intensity positively contributed to improving cardiorespiratory fitness in young football players. These studies support the present findings that regular aerobic exercise can effectively improve endurance performance among adolescent football athletes.

In addition, Arianto et al. (2022) explained that aerobic endurance and VO_2Max have an important contribution to football performance because football requires a combination of aerobic and anaerobic activities during matches. Players with better aerobic capacity are able to maintain energy production and physical performance for a longer duration. Furthermore, Sudrazat and Rustiawan (2020) stated that structured and continuous physical exercise significantly improves VO_2Max and aerobic endurance in football athletes. These findings strengthen the argument that aerobic exercise programs are highly relevant in football conditioning programs, especially for youth athletes.

Another important finding in this study was the decrease in the standard deviation value from the pretest to the posttest. This result indicated that students' endurance abilities became more homogeneous after participating in the training program. In other words, the exercise program not only improved average endurance performance but also produced more consistent physical development among participants. This demonstrates that the 12-minute aerobic exercise program can be effectively implemented in group-based football training sessions.

Overall, this study demonstrated that the 12-minute aerobic exercise program is a simple, practical, and effective training method for improving aerobic endurance in adolescent football students. The program can be recommended as an alternative physical conditioning method for football coaches, particularly in youth football development programs that require efficient and easy-to-implement endurance training methods.

D. Conclusion

This study concludes that the 12-minute aerobic exercise program significantly improves aerobic endurance among adolescent football students at SSB Bhatara Sumedang. The training program contributed positively to students' cardiorespiratory endurance and supported their ability to maintain physical performance during football activities. The findings indicate that the 12-minute aerobic exercise method is simple, practical, and easy to implement in youth football training programs without requiring complex facilities or equipment. Therefore, this training method can be recommended as an effective alternative endurance training program for adolescent football development. For future research, it is recommended to involve larger sample sizes, include control groups, and examine additional physical condition variables such as VO_2Max, agility, and speed to obtain more comprehensive and accurate findings.

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Finally, the authors hope that the findings of this research will contribute to the development of knowledge in the fields of physical education and sports coaching.

F. Conflict of Interest

No there is conflict interest.

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