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The Effect of Extensive Interval Training Methods and Fartlek Training Methods on Increasing Cardiovascular Endurance in Football Athletes

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Abstract

This study aims to determine the effect of extensive interval training and fartlek training methods on improving the cardiovascular endurance of soccer athletes. Cardiovascular endurance, as measured by VO_2max, is a fundamental physical component in soccer because it determines an athlete's ability to maintain optimal performance throughout a 2 x 45-minute match. Good endurance allows players to perform repeated high-intensity activities, such as sprinting, pressing, and rapid changes of direction, while maintaining concentration until the end of the match. This study used an experimental method with a two-group pretest-posttest design. The study sample consisted of 22 U-16 soccer athletes who were divided ordinally into two groups: an extensive interval training group and a fartlek training group, each consisting of 11 athletes. The test instrument used to measure cardiovascular endurance was the Yo-Yo Intermittent Recovery Test Level 1 (YYIR1). Data analysis was carried out through normality tests, homogeneity tests, paired sample t-tests, and independent sample t-tests to determine differences in effects between groups. The results of the study showed that: (1) The extensive interval training method had a significant effect on increasing VO_2max in soccer athletes, (2) The fartlek training method also had a significant effect on increasing cardiovascular endurance, and (3) There was a significant difference in the effect between the two methods, where extensive interval training showed a greater increase in VO_2max than fartlek. Based on these findings, the extensive interval method is recommended as a more effective alternative in increasing cardiovascular endurance in soccer athletes aged 16 years.

How to Cite

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INTRODUCTION

Footballis a very popular sport throughout the world which is played by teams using all parts of the body except the hands, except for the goalkeeper.Football is played on a larger field than other sports fields (Handoko, 2018). The size of an international standard soccer field is 100-110 m long and 65-75 m wide with a normal game time of 2 x 45 minutes, if the game is a draw then there is an additional 2 x 15 minutes and if it is still a draw then a penalty kick will be carried out with 5 players from each team taking the initial kick (Rebelo et al., 2014). With a large field and long hours, players must be smart about managing their energy expenditure and capitalizing on every opportunity to score. To maintain consistent performance and ensure team success, players must work together (Goodman et al., 2018).

From my experience as an endurance athlete, I›ve found that many endurance exercises aren›t specific to soccer, but in practice, the training used is still general and doesn›t meet the demands of the sport. Endurance issues are still common among many soccer athletes, both amateur and professional.Factors such as inappropriate training programs, lack of adequate recovery, inappropriate diet, and lack of physical condition monitoring are the main causes of a decline in a player›s physical endurance (Bahtra et al., 2023).This has a direct impact on the quality of play, the risk of injury, and the overall outcome of the competition. Through a deeper understanding of the endurance aspect of soccer and the identification of the factors that influence it, it is hoped that more effective training and physical management strategies can be developed (Ardiansyah et al., 2025). Therefore, studying endurance issues is crucial for supporting optimal and sustainable athlete performance.

Endurance is one of several physical elements that need to be trained and developed as a factor that greatly supports technical and tactical abilities in playing football. The role of aerobic endurance (VO_2max) as an energy source is very important because the total distance covered by a football player in one match can reach 8-11 kilometers (Warni et al., 2017).Football is a sport that really requires high cardiovascular endurance or VO_2max for its athletes to be able to play during the match (Ardiansyah et al., 2025). These requirements are adjusted to the length of a football match, which is 2 x 45 minutes. in a match. Good endurance will improve the performance of soccer athletes because when a player has a sufficient VO_2max that can support his body›s movements during the match, it can maximize the strategy that has been prepared by the coach and the player›s focus is maintained throughout the match. VO_2max is one of the main variables in the field of exercise physiology, and is often used to indicate aerobic endurance and to determine training programs for athletes and non-athletes (Ozmen et al., 2017).

In practice, many coaches still use general stamina training (long-distance running) that is not specific to the characteristics of soccer, resulting in suboptimal endurance improvement, as experienced and observed by researchers. There are few studies directly comparing the effectiveness of extensive interval training and fartlek training in soccer athletes. Most studies only examine the effects of interval training in general or fartlek training separately. Direct comparisons of the two methods within a single experimental design are still limited. There is a lack of research conducted at the club or school level with training conditions that mimic real-world training situations. There is still a gap in the effectiveness of extensive interval training and fartlek training, especially when using instruments appropriate to soccer, such as the Yo-Yo IR Test. Therefore, this research is necessary to provide concrete and useful evidence for coaches and athletes. Previous research using or comparing intensive and extensive interval training to improve endurance, «Intensive and Extensive Interval Training; Which is Better Against VO2max in Football Athletes?»(Ramadhan et al., 2022).

Cardiovascular endurance is the body›s ability to maximally store oxygen. Good cardiovascular endurance is characterized by the ability to continue activities in leisure time after completing daily activities without feeling excessively tired. Cardiovascular endurance, here referred to as VO_2max, is influenced by several factors, including physical activity, exercise habits, and body mass index (BMI) (Kalmira et al., 2023). This study will focus on two endurance training methods, namely extensive intervals and fartlek.

Extensive interval training is a form of exercise used to improve aerobic endurance. In extensive interval training, exercises are performed in multiple repetitions and series. Each repetition and series is always followed by a timed interval. In the extensive interval method, the duration of the load is also crucial, depending on the desired goal of the exercise (Suhdy, 2018).

The fartlek training system created by

Gosta Holemer from Sweden is an endurance training system which means building, restoring or maintaining a person›s body condition. In this training, athletes can determine the type, intensity and duration of training or depending on the athlete›s circumstances and condition at that time (Budiman, 2017).

Data analysis showed significant improvements in selected criterion variables as a result of the experimental treatment. Intensive interval training significantly increased speed, while extensive interval training significantly improved cardiorespiratory endurance. These results indicate that interval training with varying intensities can be performed according to the player›s needsm (Elamaran, 2014).

Both training models, high-intensity interval training and fartlek, both resulted in an increase in VO_2max for players. High-intensity interval training increased VO_2max for players under 15 years old by 32%, fartlek for players under 15 years old by 32%, high-intensity interval training for players under 23 years old by 29%, and fartlek for players under 23 years old by 29%. Therefore, there is no difference between high-intensity interval training and fartlek training in increasing VO_2max for players at the Pamoso football school in Majene Regency (Sopyan et al., 2023).

The results of this study demonstrate an effort to introduce fartlek and interval training to improve cardiovascular endurance, which is crucial in all sports, especially futsal. There was an increase in cardiovascular endurance among futsal extracurricular players at SMK Muhammadiyah 03 Weleri who used the Fartlek and Interval Training treatments. This can be seen from the average pretest and posttest scores (Romadona & Faruk, 2021).

Compared to previous studies, the novelty of this study lies in the effort to replace general endurance training, namely long-distance running, which is often used by coaches while the training is not suitable for the characteristics of the game of soccer, replacing it with training methods that are more suitable for the characteristics of soccer training, namely the extensive interval training method and the fartlek training method. The study not only compares the effectiveness of the two methods directly, but also develops a measurable and structured training model according to the physiological needs of soccer athletes. In addition, this study uses more relevant endurance measurement instruments such as the yo-yo intermittent test, thus producing findings that are more appropriate for coaches in determining the right training program. This novelty fills the gap in local research that is still minimal in conducting comparative studies between the two methods of intensive interval training and fartlek in soccer athletes.

METHOD

The method used in this study was an experimental method with a population approach in this study of 48 athletes from the SSB Ranggawulung football school. The sampling technique used was random assignment, a technique in experimental design in which selected research participants are placed into treatment groups randomly (Gravetter & Forzano, 2018).The total sample used was 22 Football School Ranggawulung U16 athletes.The instrument in this study, the researcher used the yo-yo intermittent recovery test level 1 as an instrument to collect data., a reliable and valid measure of aerobic fitness. Briefly, the test consists of two 20-meter back-and-forth runs repeated until a beep is heard, interspersed with 10-second periods of active rest. The time allotted for each 20-meter section decreases as the test progresses, resulting in a faster required running speed; this speed begins at 10 km/h, and increases by 2 and then 1 km/h for each of the next two speed levels. After this, the speed increases by 0.5 km/h for each additional level. The test is stopped when the subject fails to cover the distance in the allotted time on two consecutive occasions, indicating that fatigue has set in.(Pickering et al., 2018).The validity of the Yo-Yo IR1 is very high, with correlations between test results and VO_2max ranging from $r = 0.70 – 0.92$. Furthermore, there is a strong correlation with total distance covered during the match ($r \approx 0.74$) (2015) also shows that the IR1 YoYo Test has a reliability coefficient value (Intraclass Correlation Coefficient) between 0.91 and 0.95, which means it is included in the very high reliability category (Bangsbo, 2015). The analysis was conducted using SPSS version 24 to ensure more accurate and objective results.

RESULTS AND DISCUSSION

The data obtained through the research was then collected and analyzed to reach conclusions that were understandable to all parties. Based on this, the data obtained from the research was then analyzed using SPSS 24.

Based on **Table 1** it is known that the Extensive Interval group had an average pretest score of 15.86 with a standard deviation of 1.091, while the average posttest score was 16.91 with a

standard deviation of 1.070. There was an average increase of 1.04 after being given extensive interval training treatment. This increase indicates that extensive interval training has a positive effect on increasing the cardiorespiratory endurance of soccer athletes. Fartlek Group The average pretest score was 15.82 with a standard deviation of 0.984, and the average posttest score was 16.41 with a standard deviation of 0.903. There was an average increase of 0.59 after being given fartlek training treatment. This increase also indicates a positive effect, although not as large as in the extensive interval training group.

Table 1. Descriptive Statistics Test

	N	Min	Max	Mean	Standard Deviation	Gain score
Extensive PreTest_Interval_	11	14.5	17.5	15.86	1,091	1.04
PostTest_Interval_Extensive	11	15.4	18.5	16.91	1,070	
PreTest_Fartlek	11	14.5	17.4	15.82	.9837	0.59
PostTest_Fartlek	11	15.8	18.1	16.41	.9027	
Valid N (listwise)	11					

Table 2. Data Normality Test

	Types of Exercise	Shapiro-Wilk			Result
		Statistics	df	Sig.	
pre-training level	Extensive Interval	.92	11	.31	Normal
	Fartlek	.94	11	.53	
post-training level	Extensive Interval	.95	11	.62	
	Fartlek	.95	11	.61	

Table 3. Homogeneity Test

Group	Levene test	df1	df2	Sig.	Result
Interval Ekstensif Fartlek	0.48	1	20	0.50	Homogeneity

Table 4. Paired Test Results

Group	Mean Pre	Mean post	Gain	t	sig.	Result
Extensive Interval	15.86	16.91	1.04	7.56	0.00	Significant
Fartlek	15.82	16.41	0.59	7.82	0.00	

Table 5. Independent Samples Test

	Levene's Test for Equality of Variances Sig. (2-tailed)	t-test for Equality of Means Mean Difference	Result
Equal variances assumed	.00	.46	Significant
Equal variances not assumed	.00	.46	

Based on the descriptive analysis, the extensive interval training group experienced an increase in average VO_2max from 15.86 in the pretest to 16,909 in the posttest. This average increase of 1.04 indicates a significant improvement in cardiovascular endurance after participating in the extensive interval training program.

The results of the Paired Sample T-Test showed a t value of 9.66 with a significance of p = 0.00 ($p < 0.05$), which means there is a significant difference between the pretest and posttest scores in this group. This indicates that an extensive interval training program used regularly and measurably has a positive impact on increasing VO_2max.

The extensive interval training method is a form of interval training that is carried out continuously and systematically, where there are settings for intensity, repetitions, number of sets, and rest periods between intervals (Sulastio, 2016). Extensive interval training emphasizes repeated moderate-to-high-intensity activity with adequate rest periods, allowing the cardiovascular system to optimally adapt. Interval training makes muscles more efficient at using oxygen. This, in turn, makes the body more energy efficient and better prepared for exercise or physical activity. Therefore, this significant improvement aligns with the theory that extensive interval training is effective in developing aerobic endurance in soccer athletes (Gibala & McGee, 2008).

The characteristics of this method moderate intensity (e.g., 60-80% of maximal capacity), high repetition volume, and relatively short rest periods between intervals facilitate cardiovascular and metabolic adaptations essential for endurance. This is supported by literature suggesting that the extensive interval method is more effective than the intensive method for improving aerobic capacity under certain training conditions (Ulandari et al., 2023). Physiologically, repeated stimulation with medium-high intensity and limited recovery results in adaptations such as increased heart stroke, muscle fiber capillarization, and better oxygen efficiency, which then increases VO_2max values and the athlete's ability to maintain work speed for longer durations. For example, in the study Intensive and Extensive Interval Training (2022), it was stated that extensive interval training increased VO_2max by 12.54% in soccer athletes, while the intensive method "only" increased 5.07% (Wright et al., 2016).

In the fartlek training group, the average VO2max value increased from 15.82 in the pretest to 16.41 in the posttest, with an increase of 0.59. Although the increase was not as large as the extensive interval group, the results of the Paired Sample t-Test showed a value of t = 5.70 and a significance of p = 0.00 ($p < 0.05$), which means there was a significant increase after being

given fartlek training treatment.

Fartlek training is a variation of running training that involves spontaneous changes in speed and intensity. This method trains the body's ability to adapt to changes in intensity, which is beneficial for soccer athletes because the game is dynamic and requires rapid tempo changes. This increase in VO_2max indicates that fartlek is also effective in improving aerobic endurance, although not as intensely as interval training in stimulating the cardiovascular system (Desai & Poovishnudevi, 2024).

Fartlek has a positive effect on VO_2max, the maximum volume of oxygen that can be used during intense activity. Fartlek forces the body to work harder spontaneously, thereby increasing the aerobic threshold and improving the efficiency of the heart and lungs (Kalimasada et al., 2025). Because fartlek involves alternating exercise intensity, the body continually adapts from aerobic to anaerobic conditions. This alternating energy use results in: Increased oxygen-carrying capacity of the lungs and heart. Muscle adaptation to metabolic fatigue. Gradual increases in endurance (Ali Hameed Ali Al-Zubaidi, 2025). Based on the results of the Independent Sample t-Test, the t value was obtained = 3.46 with a significance of $p = 0.00$ ($p < 0.05$). This indicates that there is a significant difference between the increase in VO2max in the extensive interval training group and the fartlek training group. The average value of the increase in VO_2max in the extensive interval group (1.04) was higher than that in the fartlek group (0.59).

These findings indicate that extensive interval training is more effective in improving cardiovascular endurance compared to fartlek training. This is because extensive interval training provides a more structured and systematic training load, with appropriate work and rest timing to maximize physiological adaptations. Therefore, in this study, increasing players' physical endurance is expected to not only improve their overall work capacity but also positively impact motor skills through physiological adaptations such as increased VO_2max, muscle capillarization, and motor unit efficiency, which then contribute to technical and tactical performance on the field (Hoff & Helgerud, 2004). Continuity of motor skills is also very important in increasing endurance with the efficiency of movement resulting from good motor skills, this is reinforced by the statement that motor skills are the quality of a person's ability that can make it easier to perform motor skills, besides that motor skills are also the foundation for future success in performing sports skill tasks (Febrianty, 2020).

CONCLUSION

Based on the results of research conducted regarding "The Effect of Extensive Interval Training Methods and Fartlek Training Methods on Increasing Cardiovascular Endurance in Football Athletes", several things can be concluded as follows:

The extensive interval training method has a effective effect on increasing VO_2max in soccer athletes.

The fartlek training method also has a effective influence on increasing cardiovascular endurance, and

There was a subtancial difference in effect between the two methods, where extensive interval training showed an increase

Thus, it can be concluded that the extensive interval method is more recommended for use in cardiovascular endurance training programs, especially for soccer athletes. This training has been proven to significantly and efficiently increase VO_2max. The results of this study also support the theory of physical training, which states that interval training with the appropriate volume and intensity can provide optimal cardiovascular adaptations, such as increased cardiac capacity, oxygen efficiency, and muscle resistance to fatigue. Therefore, the application of the extensive interval method can be an effective strategy in planning physical training programs to improve athletes' overall performance (Gibala & McGee, 2008).

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