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The Impact of Fartlek Training on Endurance and Speed Development in Amateur Futsal Players

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ABSTRACTS

Purpose: This study aims to evaluate the impact of the fartlek training program on improving endurance and speed in futsal players.

Materials and Methods: This quasi-experimental study involved 13 male futsal players (ages 18–25) from the Elano Futsal Team, selected through purposive sampling. Participants underwent a six-week Fartlek training program with three sessions per week. Endurance was assessed using the Multi-Stage Fitness Test (MFT), while speed was measured with a 20-meter sprint test. A paired sample t-test ($p < 0.05$) was used to analyze pre-test and post-test differences, with descriptive statistics (mean and standard deviation) summarizing the results.

Result: The one-sample t-test results indicate a significant improvement in both endurance and speed following the six-week Fartlek training program. The post-test VO_2max scores ($M = 40.46$, $p < 0.05$) showed a statistically meaningful increase compared to pre-test scores ($M = 35.29$). Similarly, sprint speed improved, with post-test times ($M = 2.03$, $p < 0.05$) demonstrating a significant reduction from pre-test values ($M = 2.05$).

Conclusion: In conclusion, Fartlek training is an effective method for improving the physical condition of futsal players, particularly their endurance and speed.

Keywords: Fartlek training; Endurance; Speed; Futsal.

INTRODUCTION

This research investigates the impact of the Fartlek training program on improving endurance and speed in futsal players. The study aims to explore effective training methods that can enhance the physical performance of athletes, particularly in high-intensity sports like futsal (Barbero-Alvarez et al., 2008), where endurance and sprint speed play a crucial role (Widodo, 2020). Given the demands of the game, players must develop optimal aerobic capacity (VO2 max) (Kurniawan & Roepajadi, 2022) and rapid acceleration to sustain their performance throughout matches (Barasakti & Faruk, 2019). Fartlek training, which integrates elements of continuous and interval training, is examined for its potential to enhance these physical attributes. Through this analysis, the study seeks to provide valuable insights into training approaches that can support futsal players in achieving peak fitness and maximizing their competitive abilities.

Fartlek training is a workout method incorporating variations in running intensity to enhance aerobic and anaerobic capacity in athletes (Cao et al., 2024). In futsal, endurance and

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speed are essential factors that significantly impact a player's performance on the field (Kurniawan & Roepajadi, 2022). The fundamental concept of Fartlek training is based on improving cardiovascular efficiency and enabling muscle adaptation to shift in movement intensity (Pranata, 2020). This research plays a crucial role as endurance and speed are key elements that determine futsal players' performance. The right training strategy is essential in improving athletes' physical condition, especially in sports that demand high speed and endurance, such as futsal. Therefore, an in-depth study is needed to further investigate the effectiveness of the Fartlek training method as an approach that has the potential to enhance both aspects. Fartlek is described as a training method that combines endurance and speed because it is designed to train both physical aspects simultaneously. Fartlek is a form of interval training that combines high-intensity sessions (such as sprints) with low-intensity sessions (such as jogging or walking), low- to moderate-intensity sessions help train the aerobic system to improve endurance, enabling the heart, lungs, and muscles to function efficiently over extended periods by producing energy sustainably. High-intensity sessions (sprints) that are repeated in fartlek train speed and endurance. When athletes do repeat sprints, their bodies are forced to adapt to a high workload. Fartlek training, which combines variations in intensity and speed within a single session, is believed to improve players' aerobic and anaerobic capacity (Cao et al., 2024). This method allows for better physiological adaptation to changes in game tempo, enabling players to maintain optimal performance throughout the match (Grove, 2017). By scientifically understanding the impact of Fartlek training on endurance and speed (Romadona & Faruk, 2021; Tandek Sulingallo, 2022), this study is expected to serve as a reference for coaches in designing more effective and evidence-based training programs. Additionally, the findings of this research have the potential to contribute to the development of futsal athlete training strategies, both at the regional and national levels.

Unlike previous studies that primarily focused on interval training or other conventional methods to enhance athletes' performance, this research specifically examines the effects of fartlek training on the endurance and speed of futsal player. This study provides new insights into how training with varying intensities can more effectively optimize the physical performance of futsal players (Al Fayed et al., 2023; Criya Permana & Sugiyanto, 2019; Haryanto et al., 2024). The main objective of this research is to analyze the impact of the Fartlek training program on improving endurance (VO2 max) and sprint speed of futsal players. The evidence-based recommendations on implementing Fartlek training in futsal training programs, derived from the rigorous analysis of the study's findings, are expected to provide coaches and athletes with a high level of confidence in the effectiveness of these training methods. Conceptually, this study contributes to the advancement of sports science by providing deeper insights into the effectiveness of Fartlek training in enhancing athletes' physical capacity. From a practical standpoint, the research findings can guide coaches and athletes in designing more optimal training programs, empowering them to make informed decisions about their training regimes. Furthermore, in the policy domain, this study can be a reference for academics and sports practitioners in developing scientifically based training modules to improve futsal players' performance, thereby enhancing the quality and effectiveness of futsal training programs.

METHODS

***Study Participants*:** This study involved 13 male futsal players from the Elano Futsal Team in Tuban Regency, selected through purposive sampling. The participants were between 18 and 25 years old and had at least one year of experience in competitive futsal. The inclusion criteria

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required players to be in good health and actively participate in regular training sessions, while those with injuries or medical conditions affecting performance were excluded.

***Study Organization*:** This study uses a quantitative approach and an experimental method, namely the treatment, namely fartlek training on the independent variable, with a quasi-experimental research design. The data collection techniques, namely the initial test (pre-test) and final test (post-test), were carried out to determine the extent of the increase due to the training program. The training program was carried out for six weeks with a frequency of three weekly sessions. The test instruments used were to measure endurance using the MFT (multi-stage fitness test) and speed measurement using the 20-meter sprint test.

***Statistical Analysis*:** The data were analyzed using paired sample t-tests to compare the pre-test and post-test results and identify significant endurance and sprint speed improvements. The level of significance used was $p < 0.05$. In addition, descriptive statistics such as mean and standard deviation were used to summarize the data.

***Training Program*:** The Fartlek training program was designed to improve aerobic and anaerobic capacity. The training program was conducted over six weeks, with a frequency of three training sessions per week. Each training session consisted of: Warm-up (10 minutes): Dynamic stretching and light jogging. Primary training (25–40 minutes): Alternating between high-intensity sprints, moderate jogging, and easy walking for recovery, with structured intervals (e.g., 30 seconds of sprinting followed by 1 minute of jogging). The cool-down phase lasts 10 minutes and includes static stretching and slow jogging to aid recovery. The program aimed to improve VO2 max (endurance) and sprint speed, ensuring players were better prepared for competitive futsal matches.

Table 1. Programs of fartlek training

No	Training Component	Duration	Description
1.	Warm-up	10 min	Dynamic stretching and light jogging
2.	Main Training	30-40 min	Primary training (25–40 minutes): Alternating between high-intensity sprints, moderate jogging, and easy walking for recovery, with structured intervals (e.g., 60 seconds of sprinting followed by 3 minutes of jogging).
3.	Cool-down	10 min	Static stretching and slow jogging to aid recovery.

Table 1 presents the structure of the Fartlek training program used in this study. The program has three main components: warm-up, primary training, and cool-down. The warm-up phase lasts 10 minutes and includes dynamic stretching and light jogging to prepare the body for intense activity. The main training session lasts 30 to 40 minutes. It involves alternating high-intensity sprints, moderate jogging, and easy walking for recovery, following structured intervals (e.g., 60 seconds of sprinting followed by 3 minutes). Finally, the cool-down phase, lasting 10 minutes, consists of static stretching and slow jogging to facilitate recovery and reduce muscle stiffness. This structured program improves endurance and speed through varied intensity levels.

RESULT

After undergoing the Fartlek training program, Elano Tuban futsal players significantly improved in endurance and speed. To illustrate this improvement, the measurement data before and after the training program are presented in tables.

Table 2. Physical measurement

No	Sample	Vo2max		Speed	
		Pretest	Posttest	Pretest	Posttest
1.	FA	43.6	44.6	2.05	2.03
2.	JA	33.2	39.6	2.08	2.05
3.	MU	42.2	43.6	2.12	2.10

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No	Sample	Vo2max		Speed	
		Pretest	Posttest	Pretest	Posttest
4.	SA	41.1	43.6	2.07	2.03
5.	AR	38.5	41.8	2.06	2.02
6.	F	38.5	41.5	1.99	1.95
7.	N	33.2	39.2	2.09	2.09
8.	NA	30.6	36.0	2.07	2.07
9.	RLT	30.6	41.5	2.0	1.98
10.	SP	30.2	39.2	1.99	1.98
11.	S	29.8	36.8	2.05	2.01
12.	A	30.2	37.1	2.10	2.07
13.	PI	37.1	41.5	2.03	2.00
	Mean	35.29	40.46	2.05	2.03
	SD	5.08	2.74	0.04	0.046

Table 2 presents the VO_2max values (ml/kg/min) and speed measurements (seconds) before and after the Fartlek training program for 13 futsal players. VO_2max was measured to assess aerobic endurance, while the speed test was conducted using a 20-meter sprint test. The results indicate an increase in the mean VO_2max from 35.29 ± 5.08 to 40.46 ± 2.74, suggesting an improvement in cardiovascular fitness following the training intervention. Additionally, the reduction in standard deviation reflects more consistent performance among participants after the training program. Regarding speed, the average 20-meter sprint time decreased from 2.05 ± 0.04 seconds to 2.03 ± 0.046 seconds, a significant improvement in the players' speed performance after undergoing Fartlek training.

Table 3. Normality test

	Statistic	df	Sig.
Endurance_PreTest	.875	13	.060
Speed_Pre_Test	.943	13	.499
Endurance_Post_Test	.944	13	.506
Speed_Post_Test	.952	13	.623

The normality test was conducted using the Shapiro-Wilk test to determine whether the data were normally distributed. The results indicate that the pretest and posttest data for both endurance and speed variables meet the assumption of normality. Specifically, the significance values (Sig.) for Endurance_PreTest (0.060), Speed_PreTest (0.499), Endurance_PostTest (0.506), and Speed_PostTest (0.623) are all greater than 0.05, suggesting that the data are normally distributed. Therefore, parametric statistical tests can be appropriately applied for further analysis.

Table 4. Test the average VO2max for pretest and posttest

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Endurance_PreTest	25.071	12	.000	35.29231	32.2252	38.3594
Endurance_Post_Test	53.155	12	.000	40.46154	38.8030	42.1201

The One-Sample t-test results showed a significance value (p-value) of less than 0.05, indicating a significant difference between the average test results and the reference value used in the study. In other words, after completing the training program, the Bleep Test scores showed a statistically meaningful improvement. These findings suggest that the implemented training program positively impacts participants' cardiovascular endurance. Therefore, this training method can be recommended to enhance athletes' physical performance.

Table 5. Test the average speed for the pretest and post-test

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Speed_Pre_Test	178.264	12	.000	2.05385	2.0287	2.0789
Speed_Post_Test	155.331	12	.000	2.02538	1.9970	2.0538

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The one-sample t-test results show that the endurance and speed data have a calculated value 0.000, below the significance level of $p < 0.05$. This result leads to rejecting the null hypothesis (Ho), indicating a significant difference between the pre-test and post-test values due to the implementation of the Fartlek training program.

DISCUSSION

This research investigates how the Fartlek training program influences the enhancement of endurance and speed among the Elano Futsal Team athletes in the Tuban Regency. Statistical data analysis showed significant improvements in both endurance and speed after the athletes underwent the training program. This study concludes that combining continuous running with speed tempo changes optimizes futsal players' cardiovascular endurance and sprinting ability.

The findings are consistent with previous research that has demonstrated the effectiveness of Fartlek training in improving endurance and speed among athletes. For example, studies conducted by Damarjati and Saputra (2024), Sarmidi (2018), and Sopyan et al. (2023) have also shown similar results. This study demonstrates that Fartlek training can enhance VO2 max and anaerobic capacity, which is essential for futsal performance. A significant measurable increase in endurance tests indicates that the combination of aerobic and anaerobic elements in Fartlek training effectively triggers cardiovascular adjustments and muscle endurance. Similarly, progress in speed performance reinforces the assumption that interval training with intensity variations positively impacts sprinting ability. In this regard, Fartlek's training aligns with the theory of developing endurance and speed. The training method includes movements that engage the aerobic energy system for activities lasting more than three minutes and movements that utilize the anaerobic energy system. Specifically, the anaerobic phosphate or ATP-PC system is activated for 10–30 seconds, while the anaerobic lactate system is engaged for activities lasting between 30 and 90 seconds and up to just under three minutes (McArdle et al., 2014).

Futsal is a sport that combines speed, agility, and endurance (Fahrudin et al., 2024; Wiranata et al., 2023). In futsal, players frequently perform quick and sudden movements, such as short sprints, abrupt changes of direction, and intense acceleration and deceleration (**Kesalahan! Sumber referensi tidak ditemukan.**These movements require the anaerobic energy system, particularly the ATP-PC (adenosine triphosphate-phosphocreatine) system for short and intense activities, as well as the lactic acid system for activities lasting between 30 seconds to 2 minutes (**Kesalahan! Sumber referensi tidak ditemukan.** However, aerobic endurance plays a crucial role in all these rapid movements. Aerobic endurance is necessary to maintain performance throughout a match, which lasts approximately 40 minutes (2 x 20 minutes) without long breaks. Without proper endurance, players can quickly experience fatigue, reducing the effectiveness of their movements and decision-making during the game.

The findings of this research are highly relevant to futsal, considering that its players frequently transition between high-intensity sprints and moderate-speed movements (Naser et al., 2017). These results indicate that Fartlek training not only enhances overall physical fitness but also aligns with the physiological demands of futsal. The progress observed in this study confirms the urgency of incorporating Fartlek training into structured physical conditioning programs for futsal players.

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CONCLUSION

Research shows that futsal athletes who regularly engage in fartlek training experience an improvement in VO2 max (aerobic capacity), which indicates an increase in endurance. Additionally, fartlek training enhances the athletes' ability to perform rapid acceleration and deceleration, which is crucial in the dynamic nature of futsal. Combining high and low-intensity exercises in fartlek also helps athletes recover more quickly after performing intensive movements, allowing them to maintain optimal performance throughout the match.

Thus, fartlek improves the overall physical condition of futsal athletes and helps them develop mental resilience when facing physical pressure during matches. Therefore, fartlek can be considered one of the most effective training methods for enhancing the performance of futsal athletes, both in terms of endurance and speed.

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CONFLICT OF INTEREST

The authors declare no conflict of interest related to this study. No financial, personal, or professional relationships have influenced the research, analysis, or reporting of the findings

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