



The Effect of Fartlek Training on Increasing VO₂max in Extracurricular Futsal Students

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ABSTRACT

Futsal places considerable demands on cardiorespiratory endurance due to the varying intensities of physical activity during matches. However, studies on the use of Fartlek training to improve VO₂Max among junior high school students engaged in futsal extracurricular activities remain limited, particularly at SMPN 1 Sukamulia. This study aimed to identify changes in VO₂Max after participation in a Fartlek training program. The study adopted a quantitative experimental approach using a One Group Pretest-Posttest design. The sample consisted of 20 students selected through total sampling. VO₂Max was assessed using the Multistage Fitness Test (MFT) before and after the training intervention. Data analysis included descriptive statistics, the Shapiro-Wilk normality test, Levene's Test as an additional analysis, and the Paired Sample t-Test with a significance level of 0.05. The mean VO₂Max score increased from 31.800 at pretest to 35.810 at posttest, showing an average gain of 4.010 points. The Paired Sample t-Test revealed a statistically significant difference between the two measurements ($p < 0.001$), while Cohen's d_z of 1.05 indicated a large effect size. These results demonstrate an improvement in VO₂Max following the Fartlek training program. Nevertheless, the improvement cannot be conclusively attributed solely to Fartlek training because the study did not include a control group.

Keywords: Fartlek; VO₂Max; futsal; extracurricular students



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INTRODUCTION

Futsal is a sport that requires good physical condition because the characteristics of the game require players to carry out activities with varying intensity repeatedly. The ability to run, accelerate, decelerate, change direction, and maintain activity during a game is greatly influenced by cardiorespiratory endurance (Rizky et al., 2025). One indicator that can be used to determine cardiorespiratory endurance is VO₂Max. A good VO₂Max allows individuals to maintain physical activity for longer periods and reduces fatigue during high-

intensity activities (Fatoni, 2025). Therefore, increasing $VO_2\text{Max}$ is an important aspect in developing the physical condition of students participating in futsal extracurricular activities.

One training method that can be used to improve cardiorespiratory endurance is Fartlek training. Fartlek training is a form of exercise that combines variations in speed and intensity in a continuous activity. These variations in intensity stimulate the cardiorespiratory system, potentially improving the body's ability to utilize oxygen optimally (Manggala et al., 2023). The characteristics of Fartlek training also align with futsal, which requires dynamic changes in activity intensity (Gunawan et al., 2026). Therefore, implementing Fartlek training can be an alternative training program to improve $VO_2\text{Max}$ for extracurricular futsal students (Divo Azzurio, 2025).

Various types of training can help increase $VO_2\text{Max}$, such as circuit training, interval training, continuous sprinting, hollow sprints, and fartlek (Amal, 2024). However, regardless of the type of training chosen, the most important thing is that it reaches the $VO_2\text{Max}$ threshold (Rahmat et al., 2025). All training methods must be performed consistently and aligned with our desired training goals.

Fartlek training, also known as "Speed Play," was created by Gosta Holmer of Sweden. It is designed to increase endurance, improve, or maintain physical fitness. States that low-intensity Fartlek training consists of a mix of jogging, walking, jogging, sprinting, and continuous walking (Iskandar, 2023). On the other hand, high-intensity Fartlek training involves a combination of jogging and sprinting. This activity is a type of training method that can be applied to all types of sports to improve physical endurance (Wiguna, 2023). By applying training principles in a specific way, we can develop the aerobic system, which is the main source of energy, as well as the anaerobic system so that both develop in balance for gradual physical improvement (Fajar et al., 2026). There are many sports that can be chosen to achieve success, one of which is futsal.

Several previous studies have explored the effect of Fartlek training on increasing $VO_2\text{Max}$, especially in the context of team sports, such as futsal. For example, a study conducted by (Al Fayed et al., 2022), "The Effect of Fartlek Training on Increasing $VO_2\text{Max}$ in the Men's Futsal Team of As-Shofa Islamic High School

Pekanbaru," found that athletes who underwent training using Fartlek experienced an increase in VO₂Max compared to before undergoing training using Fartlek. In addition, a study conducted by (Pranata, 2020), entitled "Fartlek Training to Increase VO₂Max in BBG Futsal Players," Fartlek training can increase VO₂Max in BBG futsal players, this is because Fartlek training has components of activities that maximize movements such as walking, jogging, and sprinting, where these movements are dominant in playing futsal. Overall, this study provides a basis that Fartlek can be applied to increase aerobic capacity, but its implementation needs to be adapted to the local context.

Previous studies have demonstrated that Fartlek training may improve endurance capacity and VO₂Max. However, research focusing on its use among junior high school students participating in futsal extracurricular activities is still limited. In particular, limited evidence is available regarding the application of Fartlek training to improve VO₂Max among students at SMPN 1 Sukamulia. Differences in students' physical characteristics and training environments may also influence the outcomes of training (Sandi et al., 2021). Therefore, further research is needed to examine the effectiveness of Fartlek training in this specific context. This study aims to fill this gap by investigating the effect of Fartlek training on the VO₂Max of futsal extracurricular students at SMPN 1 Sukamulia.

This study differs from previous studies in that it focused on a group of junior high school students within a specific extracurricular context and context. Furthermore, it used the Multistage Fitness Test (MFT) to measure VO₂Max, allowing for changes in cardiorespiratory endurance through pre- and post-exercise measurements.

This research is still limited to a study that specifically examines the effect of Fartlek training on increasing VO₂Max in junior high school extracurricular futsal students in a specific school context. Previous research has provided evidence of the effectiveness of Fartlek in both students and futsal players, but the characteristics of the participants, the training environment, and the physical condition of each group can differ. Therefore, research that provides empirical evidence on different subject characteristics is needed to broaden our understanding of the application of Fartlek training in school-age groups.

This study offers new empirical insight into the implementation of Fartlek training as an approach to improving VO₂Max among junior high school students involved in futsal extracurricular activities. The study specifically examines the changes in students' VO₂Max following a structured Fartlek training program, with the Multistage Fitness Test (MFT) employed to measure VO₂Max. By focusing on the application of Fartlek training within a junior high school futsal extracurricular setting, this research adds empirical evidence concerning endurance training among students at SMPN 1 Sukamulia. The findings are expected to contribute to the existing evidence on the application of Fartlek training for developing endurance in junior high school futsal extracurricular activities.

RESEARCH METHODS

This study uses quantitative research. Quantitative research is a research method used to process data in the form of numbers, both in the form of measurements and conversion results (Sugiyono, 2022). The approach used in this study is an experimental approach aimed at observing the impact of one independent variable on one dependent variable.

The design used in this study is one-group pre-test and post-test without a control group. (Ismayani, 2019) Experiments with non-separate samples use only one sample group measured twice. The following is a research design:

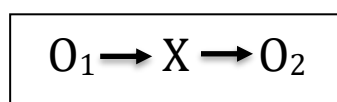


Figure 1. Research design

Note:

O₁ : Pre Test (VO₂Max)

X : Exercise Treatment *Fartlek*

O₂ : Post Test (VO₂Max)

The Fartlek training program was implemented at SMPN 1 Sukamulia over a total of 24 meetings, with three training sessions conducted each week. The study involved 20 students participating in the futsal extracurricular program and comprised a pre-test, 22 Fartlek training sessions, and a post-test. Each training session consisted of a 10-minute warm-up, the main Fartlek exercise, and a 10-minute cool-down. The main exercise included 5 minutes of jogging, 10 seconds of

sprinting, 1 minute of walking as a recovery interval, and 2 minutes of stride running. Each repetition lasted 8 minutes and 10 seconds, followed by a 2-minute recovery period. The number of repetitions was adjusted across the training phases, ranging from one to five repetitions, with the training volume periodically increased and decreased. The total duration of each training session ranged from 36 minutes and 20 seconds to 60 minutes and 50 seconds. $VO_2\text{Max}$ was assessed before and after the intervention using the Multistage Fitness Test (MFT/Bleep Test).

$VO_2\text{Max}$ was assessed using the 20-meter Multistage Fitness Test MFT/Bleep Test (Yuliawan, 2022). The test was performed on a 20-meter track marked with cones, while an audio signal was used to control the running pace. Participants ran continuously back and forth between the two lines and were required to reach each line in accordance with the beep signals. The running speed increased progressively at each stage until the participants were no longer able to maintain the required pace. The highest level and number of shuttles completed were recorded as the MFT score. The corresponding $VO_2\text{Max}$ value was subsequently determined by referring to the $VO_2\text{Max}$ conversion table (Yasso, 2020:1), based on the participants' age and sex. The same testing and scoring procedures were applied during both the pre-test and post-test.

In quantitative research, data analysis is an activity after data from all respondents or other data sources are collected. Before hypothesis testing, a normality test using Shapiro-Wilk is conducted to determine the distribution of the difference data between the pre-test and post-test. Data is declared normal if the Sig. value is > 0.05 (Hariadi et al., 2025). A homogeneity test using Levene's Test is conducted as an additional analysis, with the data declared homogeneous if the Sig. value is > 0.05 . Furthermore, hypothesis testing is conducted using a Paired Sample t-Test to determine the difference in $VO_2\text{Max}$ before and after Fartlek training. Decision making is carried out at a significance level of 0.05, namely if the Sig. value is < 0.05 , then H_0 is rejected, and H_a is accepted, which indicates the effect of Fartlek training on increasing $VO_2\text{Max}$.

RESULTS AND DISCUSSION

Results

The results of VO2Max measurements of futsal extracurricular students at SMPN 1 Sukamulia are based on data obtained in the form of Pre-Test and Post-Test results after Fartlek training. Before conducting the hypothesis test, a descriptive test was first conducted to determine the average value, standard deviation, minimum value, maximum value, and number of samples, which can be seen and explained in the following table:

Table 1. Description of VO2Max of futsal extracurricular students at SMPN 1 Sukamulia

Information	Average	sd	Variants	Min score	Max score	N
<i>Pre-test</i>	31,800	5.22937	27,346	22.40	40.50	20
<i>Post-test</i>	35,810	5.85787	34,315	24.80	48.70	

The initial test (Pre-test) in this study did not include fartlek training treatment for futsal extracurricular students at SMPN 1 Sukamulia. In this initial test, the highest score was 40.50, and the lowest score was 22.40, with an overall score of 636 and a standard deviation of 5.22937. Thus, the average VO2Max of futsal extracurricular students at SMPN 1 Sukamulia was 31.800.

The final test (Post-test) in this study is a test conducted after the futsal extracurricular students of SMPN 1 Sukamulia were given Fartlek treatment or training. In the final test, the highest score was 48.70, and the lowest score was 24.80, with an overall score of 716.2 and a standard deviation of 5.85787. Thus, the average VO2Max of futsal extracurricular students of SMPN 1 Sukamulia was 35.810.

Before hypothesis testing, the normality of the data was assessed using the Shapiro-Wilk test (Sianturi, 2025). In accordance with the paired-samples t-test procedure, the analysis focused on the difference scores between the post-test and pre-test measurements. The results of the normality analysis are presented in Table 2.

Table 2. Normality Test

No	Test form	N	Shapiro-Wilk Statistics	sig	information
1	Difference (Post-Test - Pre-Test)	20	0.936	0.204	Normal

The Shapiro-Wilk normality test indicated that the difference scores between the post-test and pre-test results had a significance value of 0.204. As this value exceeded the 0.05 threshold, the difference scores were considered normally distributed. Thus, the normality assumption required for the Paired Sample t-Test was satisfied

A homogeneity test was conducted to determine whether the variance of the pre-test and post-test data was homogeneous (Santoso, 2020). In this study, the homogeneity test was conducted using Levene's Test, the results of which can be seen in the following table 3.

Table3. Homogeneity Test

No	Variables	Levene's Statistics	Df1	Df2	Sig.	Information
1	Pre-Test and Post-Test V02Max	0.045	1	38	0.833	Homogeneous

Based on the results of the homogeneity test using Levene's Test in the table above, it can be concluded that the variance of the Pre-Test and Post-Test data is homogeneous.

To examine the difference in VO₂Max before and after the implementation of Fartlek training, a Paired Sample t-Test was performed. In addition to evaluating statistical significance, Cohen's dz was calculated to determine the magnitude of the effect produced by the training. The results of the statistical analysis are presented in Table 4.

Table 4. Hypothesis Testing

Variables	Mean Difference	Thitung	Df	Sig.	information	Cohen's Dz	Effect
Pre-Test and Post-Test	-4,010	-4,697	19	<0.001	H ₀ is rejected and H _a is accepted	1.05	Large

As shown in Table 4, the Paired Sample t-Test produced a significance value of <0.001 , which is below the 0.05 significance level. Therefore, H_0 was rejected and H_a was accepted, indicating a significant difference in $VO_2\text{Max}$ between the pre-test and post-test measurements. The calculated Cohen's d_z value was 1.05, which represents a large effect size. These findings indicate that Fartlek training resulted in a statistically significant and large improvement in $VO_2\text{Max}$ among the futsal extracurricular students at SMPN 1 Sukamulia.

DISCUSSION

The Shapiro-Wilk normality test indicated that the difference scores between the pre-test and post-test results had a significance value of 0.204. Because this value was higher than the 0.05 significance level, the difference scores were classified as normally distributed. This finding confirms that the normality requirement for conducting the Paired Sample t-Test was satisfied. Meanwhile, Levene's Test obtained a significance value of 0.833, which was also greater than 0.05. This result indicates that the variances of the pre-test and post-test scores were homogeneous. However, the homogeneity test in this study was considered an additional analysis rather than a primary requirement for the paired-samples analysis.

The descriptive results demonstrated an improvement in the students' $VO_2\text{Max}$ following the Fartlek training program. Before receiving the training, the mean $VO_2\text{Max}$ score was 31.800, whereas the mean score increased to 35.810 after the training. The difference between the two measurements was 4.010 points. This increase suggests that the students' cardiorespiratory endurance improved following their participation in the Fartlek training program.

The hypothesis analysis using the Paired Sample t-Test produced a significance value of <0.001 . Since this value was below the predetermined significance level of 0.05, H_0 was rejected, and H_a was accepted. The result demonstrates that there was a statistically significant difference in $VO_2\text{Max}$ scores between the pre-test and post-test. Therefore, the findings provide support for the hypothesis that Fartlek training has a significant effect on improving $VO_2\text{Max}$ among futsal extracurricular students at SMPN 1 Sukamulia.

In addition to statistical significance, the magnitude of the effect was assessed using Cohen's d_z . The analysis resulted in a Cohen's d_z value of 1.05, which is categorized as a large effect. This indicates that the improvement in $VO_2\text{Max}$ was substantial in terms of effect magnitude, rather than being reflected only by statistical significance. Thus, the findings suggest that the Fartlek training program produced a large improvement in $VO_2\text{Max}$ within the participants of this study.

The findings are also in line with previous research reporting that Fartlek training can improve cardiorespiratory endurance and $VO_2\text{Max}$. The use of variations in running speed and exercise intensity in Fartlek training provides a training stimulus that corresponds to the physical characteristics of futsal. Consistent and structured implementation of this type of training may contribute to the development of aerobic capacity and endurance, which are important for maintaining physical performance during futsal activities.

CONCLUSION

Based on the findings and statistical analysis of the study, it can be stated that the students' $VO_2\text{Max}$ scores increased after participating in the Fartlek training intervention. The average $VO_2\text{Max}$ score rose from 31.800 in the pre-test to 35.810 in the post-test, resulting in a mean increase of 4.010 points. The Paired Sample t-Test yielded a significance value of <0.001 ($p < 0.05$), demonstrating a statistically significant difference between the pre-test and post-test $VO_2\text{Max}$ scores. Furthermore, the Cohen's d_z value of 1.05 indicates a large effect size. Therefore, the findings suggest that participation in Fartlek training was associated with a significant improvement in $VO_2\text{Max}$ among futsal extracurricular students at SMPN 1 Sukamulia.

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