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The Effect Of Fartlek Training on the Increase of Cardiorespiratory Endurance in Kumite Karateka

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Abstract

Cardiovascular endurance is a crucial component for karate athletes, especially in kumite, where matches require high aerobic and anaerobic capacity. However, the lack of consistent physical training programs often leads to suboptimal performance in student athletes. This study aimed to determine the effect of Fartlek training on improving cardiorespiratory endurance in karate athletes of the Gokasi Student Activity Unit, Universitas Jenderal Soedirman. This research employed a quasi-experimental design with a nonequivalent control group. The population consisted of 32 athletes, from which 20 samples (12 males and 8 females) were selected using purposive sampling. The treatment group underwent Fartlek training for 16 sessions over 4–5 weeks, while the control group continued routine practice without intervention. Cardiorespiratory endurance was measured using the Multistage Fitness Test (MFT) to obtain VO_2max values. Data analysis used paired sample t-test and independent sample t-test with a significance level of 0.05. Result: The paired sample t-test showed a significant increase in VO_2max in the treatment group ($p = 0.000$), while no significant change was observed in the control group ($p = 0.651$). The independent t-test revealed a significant difference between the treatment and control groups in post-test results ($p = 0.047$). Conclusion: Fartlek training has a significant effect on improving cardiorespiratory endurance (VO_2max) in karate athletes. Therefore, it can be considered an effective training method to enhance performance in kumite athletes.

Keywords: *Cardiorespiratory endurance, Fartlek training, Karate, Kumite, VO_2max*

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INTRODUCTION

Exercise is a physical activity performed regularly to maintain physical and mental health (Gäbler et al. 2021; Zakky 2023). One form of sport that is developing within the campus environment is the Student Activity Unit (UKM), which serves as a platform for students to explore and enhance their interests and talents, including in martial arts such as karate. Karate is a martial art originating from Okinawa, Japan, which emphasizes techniques of striking, kicking, and self-defense (Ansyah 2023). In karate, there are three main components: *kihon* (basic techniques), *kumite* (sparring), and *kata* (a sequence of movements). Karate athletes, especially in the kumite category, require excellent physical condition to compete optimally (Hindiari and Wismanadi 2022; Kamnuron et al. 2020).

Key factors that support karate athletes' performance include physical condition, technique, strategy, and mental strength (Hindiari and Wismanadi 2022; Noviary 2020). One crucial physical component is cardiorespiratory endurance, which refers to the capacity of the heart and lungs to support prolonged physical activity (Aliffudin et al. 2022). In this context, VO2MAX is an important indicator for determining an athlete's endurance level, as it is directly related to the body's ability to distribute oxygen efficiently (Noviary 2020). Athletes with high VO2MAX tend to have better endurance and are less likely to experience excessive fatigue during matches. Therefore, effective training methods are needed to increase cardiorespiratory endurance, particularly among *kumite* athletes.

One such training method is *fartlek* training. *Fartlek* training combines varying running speeds to improve aerobic endurance and muscle strength (Aliffudin et al. 2022; Pranata 2020). This method has been proven to enhance VO2MAX and endurance in athletes across various sports, including karate (Manggala et al. 2023; Ryzki et al. 2021). By applying *fartlek* training, it is expected that *kumite* athletes will achieve better endurance, enabling them to perform optimally in every match round.

At the GOKASI Karate Student Activity Unit of Jenderal Soedirman University (UNSOED), there are indications that the physical condition of *kumite* athletes is still suboptimal, which has led to decreased performance in championships. Athletes often experience early fatigue during matches, causing them to play defensively and lose points. Additionally, the lack of certified coaches poses a challenge to athlete development. Based on these issues, this study aims to analyze the effect of *fartlek* training on the increase of cardiorespiratory endurance in *kumite* athletes of the GOKASI Karate UKM at UNSOED.

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Previous studies have shown that *fartlek* training can increase cardiorespiratory endurance and VO2MAX (Manggala et al. 2023). Thus, this research is expected to contribute to improving *kumite* athletes' performance through the application of effective training methods.

METHOD

This study used a quantitative approach with a Quasi-Experimental Nonequivalent Control Group Design (Sugiyono 2018). The participants consisted of 20 *kumite* karateka (12 males and 8 females) from the Gokasi Student Activity Unit at Jenderal Soedirman University. They were selected using purposive sampling based on specific inclusion criteria from a total population of 32 students. Participants were divided into treatment and control groups through an ordinal pairing method (A-B-B-A). The treatment group received a *fartlek* training intervention conducted over 16 sessions within a period of 4–5 weeks, while the control group continued with their regular physical training routines. Cardiorespiratory endurance (VO2MAX) was measured using the Multistage Fitness Test (MFT) through pretest and posttest procedures.

The data were analyzed using SPSS version 25. Statistical tests included the Shapiro-Wilk test for normality, Levene's test for homogeneity, and the Paired Sample T-Test for hypothesis testing. The normality test ensured the data followed a normal distribution, while the homogeneity test evaluated the equality of variance between groups. The hypothesis test assessed the effectiveness of *fartlek* training on improving VO2MAX. A significance level of $p < 0.05$ was used as the threshold; if this criterion was met, the alternative hypothesis was accepted, indicating a significant effect of *fartlek* training on the cardiorespiratory endurance of the participants.

RESULT

The paired sample t-test analysis showed that the treatment group experienced a significant increase in VO_2Max values from 27.07 to 33.52 ml/kg/min ($p = 0.000$). Meanwhile, the control group did not show a significant change, with VO_2Max values from 27.11 to 27.43 ml/kg/min ($p = 0.651$). Furthermore, the independent sample t-test on the posttest results between the two groups indicated a significant difference ($p = 0.047$), confirming that fartlek training had a greater impact on improving cardiorespiratory endurance compared to the control group.

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Hypothesis Testing (Paired Sample T-Test)

Table 1. Results of Paired Sample T-Test

Paired Sample Test					
		Pretest Mean	**Posttest Mean**	***Sig. (p)***	***Conslusion***
VO2MAX	Treatment	27.07	33.52	0.000	Significant
	Control	27.11	27.43	0.651	Not Significant

Table 2 shows the results of the paired sample t-test analysis. The treatment group experienced a significant increase in VO_2Max values, from a mean pretest score of 27.07 to a posttest score of 33.52 ($p = 0.000 < 0.05$). This indicates that Fartlek training significantly improved the cardiorespiratory endurance of karate athletes. On the other hand, the control group did not show a significant change, with a mean pretest score of 27.72 and a posttest score of 27.55 ($p = 0.651 > 0.05$).

Test of Difference in Effects (Independent Sample T-Test)

Table 2. Results Independent Sample T-Test

Independent Samples T-Test			
	Mean Posttest	***Sig. (2-tailed)***	***Conclusion***
Posttest Treatment & Control	33.52 & 27.43	.047	Significant

Furthermore, the independent sample t-test on posttest data (Table 2) revealed a p-value of 0.047 (< 0.05), indicating a significant difference in VO_2Max improvements between the treatment and control groups. These results confirm that the observed improvement was strongly associated with the implementation of Fartlek training.

DISCUSSION

The results of this study show that Fartlek training has a significant effect on improving the cardiorespiratory endurance of karate athletes in the kumite category. This was evidenced by the increase in VO_2Max in the treatment group compared to the control group, with a significant difference. The findings support the assumption that interval-type endurance training, such as Fartlek, is effective in stimulating both aerobic and anaerobic energy systems.

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This is in line with Sukma et al. (2017), who reported that Fartlek training significantly improved cardiovascular endurance in combat sports athletes. Similarly, Ryzki et al. (2021) found that Fartlek training increased VO_2Max levels due to the varied running intensities that enhance oxygen uptake efficiency and accelerate recovery. The mechanism can be explained by the fact that Fartlek training stresses the heart and lungs in a fluctuating manner, which encourages greater adaptation of the cardiovascular and respiratory systems (Bompa and Harf 2019; Galatti 2019).

In the context of karate, especially kumite, athletes are required to perform explosive movements in short durations but repeatedly throughout the bout. This condition requires not only anaerobic power for fast attacks but also aerobic capacity to sustain effort and ensure rapid recovery between exchanges (Chania et al., 2022). The improvement of VO_2Max in the treatment group shows that Fartlek training is highly relevant to the demands of karate kumite competition (Wijaya et al. 2024).

Meanwhile, the control group did not experience a significant improvement in VO_2Max. This may be due to the lack of training frequency and consistency, as their routine only consisted of jogging every two weeks combined with regular practice. According to Harsono (2017), endurance training should ideally be conducted at least three times a week to achieve optimal adaptation. Inconsistent training reduces the stimulus needed for cardiorespiratory improvement (Kenney et al., 2019).

Therefore, the findings of this study emphasize the importance of structured and consistent endurance training programs such as Fartlek in improving the performance capacity of karate athletes. For practical application, coaches and trainers are encouraged to integrate Fartlek training into their athletes' weekly training plans, especially during the preparation phase before competitions.

CONCLUSION

This study concludes that Fartlek training has a significant effect on improving the cardiorespiratory endurance of karate athletes in the kumite category. The treatment group showed a significant increase in VO_2Max, while the control group did not show significant changes. Furthermore, the independent sample t-test demonstrated a significant difference between the treatment and control groups in the posttest results. These findings indicate that the application of Fartlek training can effectively improve athletes' VO_2Max and

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support the physical demands of karate competitions. Coaches are recommended to include Fartlek training in their training programs to enhance cardiorespiratory fitness and optimize performance.

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