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Application of Interval Training Method to Improve Anaerobic Alactacid Capacity

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Abstract

This study aims to examine the effect of the application of the interval training method on increasing anaerobic alactitic capacity in female futsal athletes. Anaerobic alactitic capacity is one of the components of physical condition that is very important in supporting futsal performance, especially in short-duration explosive activities such as sprints, accelerations, and rapid changes of direction that occur repeatedly during the match. The research method used is an experimental method with a one-group pre-test post-test design. The research subjects were 21 female futsal athletes selected using a purposive sampling technique from a total population of 24 athletes, with the criteria of actively participating in training and being in healthy physical condition. The instrument used to measure anaerobic alactitic capacity was the Shuttle Run Test. The interval training program was implemented in a structured manner for 16 meetings with high intensity and controlled recovery time. Data analysis was carried out through descriptive tests to see the data overview, normality tests as a prerequisite for analysis, and paired sample t-tests to test differences in pre-test and post-test values. The results showed a significant improvement in anaerobic alactitic capacity, indicated by a decrease in the mean Shuttle Run Test time from 6.75 seconds in the pre-test to 6.46 seconds in the post-test. The paired sample t-test analysis revealed a significant difference between pre-test and post-test scores ($p < 0.05$), confirming that the application of the interval training method had a significant effect on increasing anaerobic alactacid capacity in female futsal athletes.

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INTRODUCTION

In the context of competitive sports, anaerobic alactic acid capacity is a physical component that greatly determines an athlete's performance, especially in sports that require speed and explosive strength in a short period of time.

The anaerobic alactacid energy system works through the adenosine triphosphate–phosphocreatine (ATP-PC) mechanism without involving oxygen and without producing lactic acid, so it plays an important role in physical activities lasting 0–10 seconds such as sprints, rapid changes of direction, and explosive movements (A. Bompa T, O & Buzzichieli, 2019; Rosdiana et al., 2019).

This ATP-PC system can only operate for a short period of time, no more than 10 seconds. It doesn't use O2 and doesn't produce lactic acid (D. Zafar Sidik et al., 2019). Athletes who have good anaerobic alkalosis capacity tend to be able to maintain maximum performance in high-intensity game situations.

One training method widely used to improve athletes' physical capacity is interval training. Interval training is a form of exercise that uses high intensity for a specific period of time, generally at the same intensity as anaerobic training, interspersed with recovery periods.

A lower intensity exercise activity, interval training can strengthen the body's physiology in many ways (Yue et al., 2025). Intervals also use the principle of increasing the load in each exercise (Suryanto, 2018). Interval training is characterized by variations between work and exercise. The interval training method is the most appropriate method for improving the physical qualities of athletes (Triardhana et al., 2021).

This method has been shown to be effective in increasing physiological adaptations in both aerobic and anaerobic energy systems, including increasing muscle work efficiency and phosphocreatine energy recovery (Zakky Mubarok, 2022). Therefore, interval training is a relevant method to study in efforts to increase athletes' anaerobic alkalosis capacity.

A number of previous studies have shown that the application of interval training, including high-intensity interval training in Thai national wushu martial arts athletes and interval-based small-sided games in 17-18 year old soccer athletes, can significantly increase anaerobic alactacid capacity in various sports (Chanlaya & Kaithongsuk, 2024; Khairurrijal et al., 2025).

However, this research specifically examines the application of the interval training method to increase anaerobic alactacid capacity, which is still relatively limited, especially in female futsal athletes at university level.

Based on this description, this study aims to examine the effect of interval training on increasing anaerobic alactacid capacity. The results are expected to contribute scientifically to the development of evidence-based training methods and serve as a practical reference for trainers in developing more effective and targeted training programs.

METHOD

This study employed an experimental method with a one-group pretest-posttest design. The subjects were 21 female futsal athletes selected from a total population of 24 athletes. The sample was selected using a purposive sampling technique, ensuring that the selected athletes met certain criteria, such as actively participating in regular training, being in good physical condition, and not experiencing any injuries during the study. This technique was used to ensure that the sample met the research objectives and was able to optimally undergo the entire treatment series.

The instrument used to measure anaerobic alactic acid capacity is the shuttle run test. The 4x5 Meter Shuttle Run Test measures participants' agility and anaerobic endurance by running back and forth over a distance of 5 meters four times. Total run time is recorded using a stopwatch (Aandstad et al., 2011; DZ Sidik et al., 2025).

The research procedure consisted of several stages: the initial stage involved all selected athletes undergoing a pre-test using the Shuttle Run Test; the second stage involved administering treatment; and the final stage was a post-test using the Shuttle Run Test. These stages were conducted to determine whether there were any changes in speed after the treatment. The study was conducted over 16 sessions.

After implementing the training program according to each group, the data from the anaerobic alactacid capacity measurements were analyzed statistically. The data analysis technique used was a descriptive test. Descriptive tests are used to summarize, present, and describe data in an easy-to-read format, thus providing more complete information. Furthermore, a normality test aims to determine whether the research subjects are normally distributed or not. To test the hypothesis, a paired-sample t-test was used. The entire data analysis process was carried out using

SPSS version 31 software with a predetermined significance level (Fadluloh et al., 2024).

RESULTS AND DISCUSSION

Table 1. Descriptive Test

	N	Min	Max	Mean	Standard Deviation
Pretest	21	6.20	7.46	6.7467	.30395
Post Test	21	5.86	6.87	6.4629	.29599

Table 1. The descriptive test results showed that in the pretest, the minimum value of the Shuttle Run Test was 6.20 seconds and the maximum was 7.46 seconds, with an average value (mean) of 6.75 seconds. Meanwhile, in the posttest, the minimum value decreased to 5.86 seconds and the maximum to 6.87 seconds, with a mean of 6.46 seconds. The decrease in the minimum, maximum, and mean values indicates an increase in the athletes' anaerobic alactate capacity after being given interval training.

The results of normality tests using the Kolmogorov–Smirnov and Shapiro–Wilk tests showed that the pretest and posttest data had a significance value greater than 0.05, thus concluding that the data were normally distributed. With the normality assumption met, further analysis can be conducted using parametric statistical tests.

The results of the paired t-test showed a significant difference between the pretest and posttest scores of the Shuttle Run Test, with a t-value of 6.012 and a significance level of 0.000 ($p < 0.05$). These results indicate that the application of the interval training method has a significant effect on increasing the anaerobic capacity of female futsal athletes.

This discussion focuses on interpreting research results related to the application of interval training methods to increase anaerobic alactate capacity in female futsal athletes. Theoretically, anaerobic alactate capacity plays a crucial role in supporting sports performance that require short-duration explosive activity, such as sprinting, acceleration, and rapid changes of direction, which frequently occur in futsal (Bompa & Buzzichelli, 2019). Therefore, the interval training method is assumed to be able to provide optimal stimulus for the ATP-PC energy system.

The results of this study indicate that the application of the interval training method has a significant effect on increasing anaerobic alactacid capacity. These findings indicate that high-intensity interval training can increase the capacity of the non-lactacid energy system by increasing the rate of phosphocreatine recovery and the efficiency of muscle contraction during repeated explosive activity (Bishop et al., 2023). This adaptation is highly relevant to the characteristics of futsal, which demands sprinting and acceleration performance in short bursts throughout the game.

In addition, recent research also reports that interval training contributes to improved neuromuscular function, particularly in terms of increased recruitment of type II muscle fibers and increased muscle activation velocity. Experimental studies in competitive athletes have shown that high-intensity interval training can significantly improve explosive power and anaerobic capacity (Taylor et al., 2022). This improvement in neuromuscular ability plays a direct role in supporting the athletic performance of female futsal athletes.

The results of this study are in line with the findings of a recent meta-analysis which concluded that interval training is an effective training method for increasing anaerobic capacity in intermittent sports, especially those that require repeated explosive activity with short recovery times (Hammami et al., 2023). These findings strengthen the results of this study that interval training stimuli are capable of producing specific and meaningful physiological adaptations to the ATP-PC energy system.

In the context of women's university-level futsal, the results of this study provide practical implications that the implementation of structured and progressive interval training can be a primary strategy in a physical conditioning program. This training approach is not only theoretically relevant but also supported by recent scientific evidence confirming the effectiveness of interval training in increasing anaerobic alactic acid capacity in modern game athletes. In addition to the main findings, field observations showed individual differences in training responses, which may be influenced by initial fitness levels and recovery capacity, although these variations did not deviate from the study objectives. This study has limitations, including the absence of a control group, a relatively small sample size, and the use of a single measurement instrument. Therefore, future research is recommended to apply comparative experimental designs, involve larger and more diverse samples, and utilize additional physiological indicators to strengthen the evidence regarding the effectiveness of interval training on anaerobic alactacid capacity.

CONCLUSION

Based on the research results, it can be concluded that the application of the interval training method effectively enhances anaerobic alactic capacity in female futsal athletes, as evidenced by a meaningful improvement in Shuttle Run Test performance following the training intervention. These findings indicate that structured, high-intensity interval training with controlled recovery effectively supports the ATP-PC energy system, which is essential for repeated short-duration explosive activities such as sprinting and rapid directional changes in futsal. Therefore, the interval training method can be strongly recommended as an effective, practical, and evidence-based component of physical conditioning programs aimed at optimizing performance in female futsal athletes.

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