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Effects of Short Sprint Interval Training and Long Sprint Interval Training on Alactic and Lactic Anaerobic Capacities

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Abstract

This research aims to examine the influence of short sprint interval training (SPI) and long sprint interval training (LPI) on anaerobic capacity of Alactase (AA) and Lactase (LA). The subjects were 29 Junior Secondary students Makassar randomly selected from 50 students. They were divided into two groups based on the results of the initial test matching anaerobic capabilities Alactase. The first group was given a short sprint interval training (SPI) and group II were given a long sprint interval training (LPI). A Wingate test was used to measure the response variable. The parameters of the visits are the capacity of Alactase (AA) and capacity Lactase (LA). Results of the analysis that short sprint interval training (SPI) generate greater increase of anaerobic capacity Alactase (AA) than the long sprint interval training (LPI) (MSPI-AA = 18.92 > MLPI-AA = 18:16) ($p < .05$). Whilst, the long sprint interval training (LPI) generate greater increase of anaerobic capacity Lactase (LA) rather than a short sprint interval training (SPI) (MLPI-LA = 76.16 > MSPI-LA = 65.56) ($p < .05$).

INTRODUCTION

One of the body functions is anaerobic capacity. Anaerobic capacity is an exercise performed by an anaerobic energy source at a maximum speed. Anaerobic is one of the energy-producing systems (ATP) for the body. The anaerobic system consists of the ATP-PC system and the anaerobic glycolysis system. This system supports anaerobic capacity. To improve this system, the body needs anaerobic exercises (Hoppe et al., 2020).

Anaerobic exercise is an exercise using energy from the anaerobic system, both the ATP-PC system and the anaerobic glycolysis system. An anaerobic system provides a relatively fast waterwheel (ATP); thus, anaerobic exercises are generally carried out by prioritizing speed and explosive power. To increase the speed and explosive power, exercises involving the anaerobic energy system are needed (Maćkała et al., 2015), (Sole, 2018), (Smajić et al., 2015).

As the anaerobic energy system mechanism is a quick system, anaerobic exercise must be conducted in a short time so that the body can perform the exercise optimally. Muscle activities that involve maximal exercise, such as sprinting, require energy from the ATP-PC system and the muscle glycogen breakdown without the use of oxygen (anaerobic glycolysis) (R. et al. 2017) (Nelson, 2017). According to the process, anaerobic exercise is expected to respond to anaerobic glycolysis in increasing ATP production.

The purpose of anaerobic exercise is to increase anaerobic capacity and anaerobic power. These two aspects are the driving factors for a person's anaerobic capacity. Therefore, a person's anaerobic capacity is good if he has a relatively large anaerobic capacity and anaerobic power.

The exercise intensity mainly determines the use of energy generated from the anaerobic system in practice. High-intensity exercise is a common practice used in anaerobic exercises. Sooner or later, high intensity can be maintained, depending on the amount of ATP provided by the ATP-PC system and the anaerobic glycolysis system (P., 2001), (R. et al., 2017). The higher the amount of ATP produced, the longer the intensity can be maintained (Spriet et al., 2008), (Innis et al., 1988).

The concept of anaerobic exercise is the basis for

creating and implementing training methods. The training methods commonly used in anaerobic exercise are sprinting, interval training, and short-distance running (Stork et al., 2015), (J. et al., 2018), (Talanian, 2015). Sprint is a commonly used method in training methods. Richmond emphasizes several exercises that can improve anaerobic capacity, including interval running interspersed with short breaks (Richmond, 2013). The elaboration of this interval training is realized in sprint interval training.

Interval running is a form of physical condition exercise often used in the field (Antony & Palanisamy, 2016). This exercise is a running exercise interspersed with rest periods. A short break can be conducted based on the goal achieved through the exercise, such as through low, medium, or high-intensity exercises. (R. et al., 2017) suggest several factors to be considered in making a running interval training program, including work intervals, relief intervals, sets, repetitions, exercise time, distance training, and frequency. For example, (Hoppe et al., 2020) explain interval training in tennis. More specifically, Hoppe et al. explain that interval training helps increase athletes' aerobic and anaerobic capacity.

Based on the problems, this study used two anaerobic exercises, including short sprint interval training with an energy focus and sprint interval training using ATP-PC dominant terms with an energy focus, especially anaerobic glycolysis. Rest intervals for short sprint interval training are based on ATP-PC recovery, while rest intervals for long sprint interval training are based on the state of lactic acid that is still accumulating in body fluids. This study aimed to determine the difference in the Effect of short sprint interval training and long sprint interval training on lactic and alactic anaerobic capacity. It is hoped that this research will contribute to scientific support and strengthen the findings related to the physiological characteristics of athletes, both aerobically and anaerobically.

METHODS

Participants

The research variables consisted of short sprint interval training (SPI) and long sprint interval training (LPI) as treatment variables, while the response variables were anaerobic alactic capacity (AA) and anaero-

bic lactic capacity (LA). This research employed experimental research. The research subjects consisted of 28 men who were randomly selected. They were randomly divided into two groups based on the anaerobic lactic capacity (the initial test before the treatment). To determine the treatment of each group, a sortition process was conducted. One group received short sprint interval training, and one received long sprint interval training. The characteristics of the sample can be seen in Table 1. The design of the training program group division is shown in figure 1.

Table 1. Anthropometric characteristics of the participants

Height (meters)	Weight (Kg)	BMI (Kg/m ²)
167.8 ± 8.9	67.41 ± 11.2	22.4 ± 2.3

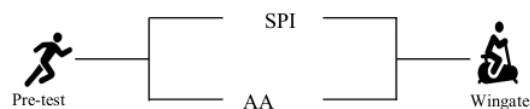


Figure 1. Design of Training Program Group Division

(LA) anaerobic capacities were measured based on the initial test and the final test using the Wingate test (Bar-Or, 1987) (Benke et al., 2002).

The test protocol instructed the sample to cycle the ergo cycle in a constant motion for two or three minutes to match the workload. When the load was appropriate, the sample was instructed to row the ergo cycle as quickly as possible for 30 seconds. When they started pedaling quickly, the stopwatch and electronic counter were activated. Anaerobic lactic capacity data were taken from the number of ergo cycles every five seconds. The lactic anaerobic capacity data were taken from the total work performed on an ergo cycle for 30 seconds. Short sprint interval training ranged from 6 to 10 seconds in practice, and long sprint and interval training ranged from 30 to 60 seconds. Determining the underlying working time was associated with anaerobic ATP-PC and anaerobic glycolysis (lactic acid).

Instrument and Procedure

The Wingate Anaerobic Test is arguably one of the most well-known laboratory fitness tests. The test is usually performed on an ergometer cycle to measure individual anaerobic capacity and anaerobic power output. The test can be performed using only a Monark or

Table 2. 9-Week SPI and LPI Program

Group	Set	Week			Rest Interval/ Reps'	Volume (Second)
		1-3 (Reps`xSet)	4-6 (Reps`xSet)	7-9 (Reps`xSet)		
SPI	1	10x1 (1set = max 6")	12x1 (1set = max 6")	14x1 (1set = max 6")	50"	1548
	2	8x1 (1set = max 10")	10x1 (1set = max 10")	12x1 (1set = max 10")	60"	
LPI	1	5x1 (1set = max 30")	6x1 (1set = max 30")	7x1 (1set = max 30")	15"	3060
	2	3x1 (1set = max 40")	4x1 (1set = max 40")	5x1 (1set = max 40")	20"	

*Note: Short Sprint Interval Training (SPI) – Long Sprint Interval Training (LPI)

Sampling Procedure

The samples of this study were male high school students who aimed to equalize fitness levels based on their anaerobic capacities. This study did not involve athletes to avoid a risk of bias regarding the anaerobic performance of each trained athlete, which could affect the homogeneity of the group. Alactic (AA) and lactic

Bodyguard cycle ergometer and a stopwatch in its simplest form. The test of this study required participants to cycle on an ergometer cycle for 30 seconds maximally. Its simplicity and effectiveness make it a popular testing protocol.

After taking the initial data (pre-test), the follow-

ing week is treated in the short sprint interval (SPI) and the long sprint interval (LPI) training program. The short sprint interval training (SPI) and the long sprint interval training (LPI) in this study were carried out for 9 (nine) weeks. More details on the SPI and LPI training programs are shown in table 2. After the training program was completed for nine weeks, then continued with the post-test.

Data Analysis

The Statistical analysis was performed using SPSS (version 20.0) statistical software package. Data were presented as the mean of standard deviation ($M \pm SD$). The Shapiro-Wilk W test was used for testing the normality of the data, while the Levene test was used to see the homogeneity of the two treatment groups. In addition, a paired t-test was used for in-group comparisons. Meanwhile, to compare the Effect of SPI and LPI exercises on the post-test scores, an unpaired t-test was used. For all analyses, the statistical significance level was set at 0.05.

RESULT

Tables 3 and 4 showed a significant difference between SPI and LPI on the AA capacity ($t=2.3055$; $p<.05$). In addition, the increase of the mean score in short sprint interval training on anaerobic alactic capacity was higher than in the long sprint interval training, where MSPI-AA was 18.92, and MLPI-AA was 18.16. Statistical analysis also showed a significant difference between SPI and LPI on LA capacity ($t= -5.9827$; $p<.05$). The mean score in long sprint interval training on lactic anaerobic capacity was higher than in the short sprint interval training (SPI), where MLPI-LA was 76.16 and MSPI-LA was 65.56.

Table 3. The Effect of 9-Week of SPI and LPI Programs on Alactic Anaerobic Capacity (AA) and Lactic Anaerobic Capacity (LA)

Variable	Group	Pre-test (M±SD)	Post-test (M±SD)
AA	SPI	15.15±1.179	18.92±1.115
	LP	15.00±1.155	18.16±1.429
AL	SPI	51.96±4.614	65.56±5.575
	LPI	52.48±4.6289	76.16±5.737

Table 4. T-Test of SPI and LPI Differences on Alactic Anaerobic Capacity (AA) and Lactic Anaerobic

Variable	Group	Pre-Post Mean Difference	t	p
AA	SPI	18.92	2.3055*	0.05
	LP	18.16		
AL	SPI	65.56	-5.9827*	0.05
	LPI	76.16		

DISCUSSION

This study aimed to determine the difference in the Effect of short sprint interval training and long sprint interval training on the alactic and lactic anaerobic capacity. This study revealed several results to answer the hypothesis based on these objectives. The different test results between the initial and final tests for both AA and LA indicated a significant difference due to the impact of SPI and LPI. Furthermore, the Effect of a treatment variable on a response variable is mostly related to the use of the type of sport (de la Cruz-Sánchez et al., 2011) designed in such a way to increase each energy source's capacity.

SPI increases alactic capacity (AA), while LPI increases lactic capacity (LA). SPI is a practice of utilizing the main ATP-PC energy source. On the other hand, LPI used the main energy source using anaerobic glycolysis (lactic). For SPI, the use of rest intervals is based on ATP-P recovery (Sheykhlovand et al., 2018) (Richardson & Gibson, 2015) (R. et al., 2017), (Gibala et al., 2014), while LPI uses the resistance of lactate concentration in body fluids (Wahl, 2013) (Masuda et al., 1999). In other words, it is to examine to what extent the body can adapt to a high activity when the lactic deposits are still high.

This study investigated the difference between LPI and SPI to examine a better exercise to increase lactic capacity (LA) and whether LPI was better at increasing lactic capacity than SPI. To increase lactic capacity, everything related to practice must be guided by the characteristics contained in the energy system dominated by anaerobic glycolysis (lactic).

For increasing alactic capacity (AA), short sprint interval training is believed to have a greater alactic anaerobic capacity than long sprint interval training (R. et al., 2017). On the other hand, long sprint interval training uses anaerobic glycolysis as the primary energy

source to increase lactic capacity, which is not its primary goal (Bappsc et al., 2002), (Kirsten A Burgomaster et al., 2006). The interval training applied in this study was sprinting for 30 to 40 seconds with a rest interval of 15 to 20 seconds. Although it is known that resting for 15 and 20 seconds is considered to have a high lactate concentration in body fluids, it is suspected that ATP-PC has been restored during rest. This condition allows the lactic capacity to adapt and increase. Despite the results of data analysis showing that there was a significant difference between SPI and LPI in increasing lactic capacity (LA), the results indicated that, on average, long sprint interval training still had a higher lactic increase than short sprint interval training (Hill-Haas et al., 2007), (Lee et al., 2017), (Saraslanidis et al., 2011), (K A Burgomaster et al., 2003).

CONCLUSION

This study found that SPI increased lactic capacity (AA) higher than LPI, while LPI had a greater capacity to increase lactic capacity (LA) than SPI. According to the findings of this study, we encourage coaches to consider the SPI method as a method to increase anaerobic capacity, specifically to increase the lactic acid capacity. Meanwhile, LPI is suggested as a method to train or measure anaerobic capacity based on lactic acid. Anaerobic sports, such as sprints, can use this exercise. We recognize that this study has limitations. For example, the participant's circadian cycle may affect the findings; thus, it should be considered in future research.

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CONFLICT OF INTEREST

The authors declared no conflict of interest.

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