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Sport Massage and Lactic Acid Recovery Time in Softball Athletes

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Abstract

Various factors could cause fatigue in athletes, including increased lactic acid levels in muscles. According to the movement patterns of softball athletes, the energy source comes from the lactacid anaerobic metabolism. Therefore, it is necessary to know the elimination of lactic acid in muscles, reflecting the decrease of lactic acid in the blood. The purpose of this study was to determine the recovery time of lactic acid levels after exercise (at recovery minutes 0, 5, 10, and 20) through sports massage treatment for 10 minutes. Accutrend Lactacid measured softball athlete lactic acid levels. The method used in this study was an experimental method with a One-Shot Case Study research design, while the research subjects were randomly assigned from the feasible softball athlete population in the Student Activity Unit. The samples included 12 athletes. Data analysis employed paired t-test with significance $p \leq 0.05$ using SPSS V. 20.0 software. The results showed that the lactic acid levels returned to normal (2.79 mMol/L) at 20 minutes of rest. It concludes that that lactic acid levels of softball athletes increased after the start of training, decreased after 5 minutes of rest, and returned to normal at 20 minutes of rest.

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INTRODUCTION

In a softball game, every basic movement requires explosive muscle power. Observing the softball athlete movement patterns, the energy source comes from the lactacids anaerobic metabolism (Szymanski, 2009). This is why it is possible that there are increased lactic acid levels in the blood while playing softball sports. Increased lactic acid levels in the blood will accumulate and affect the muscle contraction inhibition causing pain in the muscles (Cairns, 2006). Therefore, the athletes will quickly experience fatigue, which results in decreased movements during softball practice affecting the performance quality and quantity in performing the next movement (Arren et al., 2011). Fatigue arises due to the lactic acid buildup in muscle tissue. It occurs because the body's ability to neutralize the lactic acid is not proportional to the speed of the acid-forming lactic process due to the heavy exercise activity. If it lasts for a long time, it will significantly interfere with a person's performance. Each of the basic softball game movements is expected to have different lactic acid levels because each movement is different.

In anaerobic exercise, lactic acid levels will increase rapidly. Therefore, it is pertinent to a person's fitness level and can measure a person's fitness level. Submaximal blood lactate assessment is useful for detecting fitness endurance changes (McMillan et al., 2005). It concludes that lactic acid in the body while performing a movement can measure a person's fitness level. For this reason, in softball training, it is necessary to pay attention to the athlete's recovery to restore their normal body conditions. Recovery gains less consideration after softball practices, even though it needs attention to show a person's fitness (Szymanski, 2009) (Arren et al., 2011). Recovery in a relatively short time shows a person good physical fitness. The recovery position is important as a support for the success of a programmed, planned, progressive, and systematic exercise that leads to a successful exercise.

There are various efforts to eliminate lactic acid levels in the blood and muscles, including sports massage. Sports massage can supply oxygen through the bloodstream into the muscles and ATP formation due to changes in lactic acid metabolism. To increase the athlete's physical condition, the lactate level in the blood and muscles must be at the normal threshold. Previous research has shown that sports massage can eliminate lactic acid. Sports massage can be in the form of a general sports massage and a partial sports massage. Partial sports massage is a massage on specific body parts experiencing fatigue by giving manipulation massages, such as squeezing, scouring, shaking, and folding the skin to eliminate lactic acid. The partial massage lasts for 20-30 minutes and is conducted 10-13 minutes after exercise.

Another study revealed that sports massage was proven to eliminate lactic acid more effectively, reaching 62%. However, studies on recovery time in every minute have not been widely studied, especially in softball athletes. Therefore, the purpose of this study was to determine the recovery time of lactic acid levels after exercise using sports massage treatment in softball athletes (McMillan et al., 2005) (Ismanda et al., 2019) (Davis et al., 2020)

METHODS

The purpose of this study was to determine the lactic acid recovery time in softball athletes. To find out the lactic acid recovery time in softball athletes, the descriptive-analytic method, as a research method that can be used to describe an event or phenomenon in relation to other phenomena, was used.

Participants

The population of the research was softball athletes who were members of the sports club, totaling 36 athletes. To determine the number of research samples, systematic sampling was used. The systematic sampling is carried out based on a serial number determined by the researcher, a certain identity number, space with a uniform order, or other systematic considerations. With a sampling interval of 3, researchers got 12 samples. The minimum sample criteria included one-year participation in a softball sports club, in good health, and not under any treatment.

Procedure

Lactic acid sampling was administered after carrying out a basic softball game skill test consisting of 7 test items, namely 1) speed throw, 2) fielding fly ball, 3) throw and catch, 4) repeated throws, 5) fungo batting, 6) overhand accuracy throw, and 7) sprint home to home. The samples who had carried out the softball skill test then sat on a chair. The blood sample was tak-

en from a finger that had been cleaned with cotton soaked in alcohol, then pricked with a needle. About 2-3 drops of blood were taken from each sample and dripped onto the accurate stick. After 60 seconds, the measurement results were displayed on the lactate accurate digital screen. Lactic acid recovery was measured four times at recovery minutes 0, 5, 10, and 20 after performing the skill test. Sports massage was conducted in the general sports massage form. The general sports massage lasted for 10 minutes with effleurage massage techniques on hands, back, and feet.

Data Analysis

The data analysis was administered using SPSS V. 20.0 software. The lactic acid recovery time test after training for softball athletes used the paired t-test at the significance level of $p \leq 0,05$.

RESULT

After the data from all tests were collected, the next step was to process and analyze the data. The first data processing was to calculate the mean and standard deviation of each group of data. The calculation results are listed in Table 1.

Table 1. Physiological and Physical Characteristics of Softball Athletes

Physiological and Physical Characteristics			
	Mean	±	SD
Age (year)	20,73	±	0,88
Height (cm)	59,00	±	4,39
Weight (kg)	167,13	±	3,77
VO_2max (ml/kg/min)	41,46	±	6,17

Table 1 describes the physiological and physical characteristics of softball athletes who participated in the study to examine the recovery time after 20 minutes of training.

Table 2. Lactic Acid Levels after Softball Training

Recovery	$\bar{x}$	**SD**
0 minute	9,45	3.34
5 minutes	8.96	2.49
10 minutes	7.75	2,33

Table 2 shows the mean and standard deviation of the difference of decrease at minute 0 (9.45±3.34), minute 5 (8.96 ± 2.49), minute 10 (7.75 ± 2.33), and minute 20 (2.79 ± 0.11).

Table 3. Lactic Acid Levels after Sport Massage

Recovery	$\bar{x}$	**SD**
20 menit	2.79	0.11

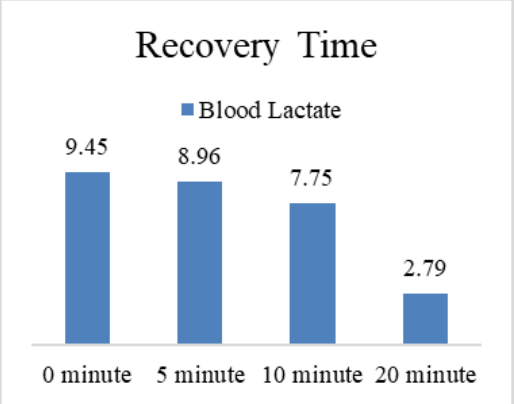

Figure 1. Lactic Acid Recovery Time after Exercise

Table 3 presents that there was a significant lactic acid decrease after sport massage. From Figure 1, it can be seen that there was a significant result at minute 20 after sport massage treatment for 10 minutes.

DISCUSSION

This study determined the percentage of lactic acid level recovery through sports massage treatment in 20-minute recovery after a softball skill test. The 20-minute recovery was divided into several periods to determine the decrease of lactic acid levels, namely minutes 0, 5, 10, and 20.

The amount of lactic acid in the blood of a person in good health ranges from 2.5 mmol/l. When the blood lactic acid level at rest is above the average normal blood lactic acid level, fatigue is indicated. The condition will limit physical performance. Even achieving a person's anaerobic threshold tends to take place quickly. After doing a softball skill test using the o'donell test, there was a difference in the lactate decrease every minute (0, 5, 10, and 20 minutes). At minutes 0-5, some

samples experienced an increase in lactate, but overall experienced lactate decrease, and there was no significant effect. At minutes 0-5, the lactate level decreased from 9.45 mmol/l to 8.96 mol/l at minute 5, showing a 0.49 mmol/l decrease difference. At minute 5 and minute 10, the lactate level decreased from 8.96 mmol/l to 7.75 mmol/l, showing 1.20 mmol/l decrease difference. The average decrease difference (minute 0-5 and minute 5-10) shows that the decrease percentage was 144% (0.49 ± 2.89 vs. 1.20 ± 2.15), and there was no significant decrease.

From the results, the average recovery difference at minute 0-5 and minute 5-10 was 1.20 mmol/l, showing a slight lactate decrease. Passive recovery causes the heart rate to decrease; thus, lactic acid and products, including h+, are not effectively removed (özsu, gurol, and kurt 2018). During exercise or high-intensity exercise in a short time, muscles produce lactate rapidly (warren, Szymanski, and landers 2015).

From the average results of this study, the 0-5 minute recovery was 7.75 mMol/L, so the anaerobic threshold level had been exceeded. Lactic acid occurs when the number of H+ atoms exceeds the body buffering system, or in other words, a decrease in body pH causes muscle pain and reduces performance (Garbouj et al., 2016) (McMillan et al., 2005) (Kim & Park, 2020). Decreased performance can be caused by two factors, namely metabolic factor, and muscle fatigue. Metabolically, the decrease in pH causes inactivation of several enzymes and inefficiency of nutrient membrane transport mechanism so that glycogen catabolism is slowed by the inactivation of the glycogen phosphorylase enzyme. Lactic acid also inhibits the use of fatty acids as energy fuels (Yano et al., 2012) (Monedero & Donne, 2000)(Rey et al., 2012). Because of these effects, carbohydrates are used at high rates, and phosphocreatine catabolism increases, further inhibiting ATP formation. These factors reduce the ATP production so that the athlete performance would decrease.

Furthermore, the muscle contraction strength can decrease because of high lactic acid concentrations. It is due to the decreased binding capacity of Ca++ ions to troponin and increased binding capacity of sarcoplasmic reticulum to Ca++ ions. Both of these mechanisms will reduce calcium ions bound to troponin during the muscle contraction process so that it will be detrimental to activities that require high performance (Garnacho-Castaño et al., 2015) (Garnacho-Castaño et al., 2015) (Ramadan, 2017) (Seyedi et al., 2019). From the average decrease difference (minute 0-5 and minute 10-20), the decrease percentage was 506% (2.97 ± 1.10 vs. 0.49 ± 2.89), and there was a significant decrease with a p-value of 0.01. The value was obtained from paired t-test. It shows that there is a decrease in blood lactic acid levels after performing a softball skill test.

The lactic acid level can be quickly reduced by doing aerobics activities, not by complete rest. It is relevant to the research from Jansenn that recovery after anaerobic activity can be carried out in three ways, including by a complete rest (passive recovery), walking for 20 minutes, and running slowly or jogging for 20 minutes (Cooper, 2005)(Seyedi et al., 2019). Sports massage can be carried out in the form of general massage or partial sports massage. Partial sports massage is massage on specific body parts experiencing fatigue through manipulation massage to eliminate lactic acid. The partial massage lasts for 20-30 minutes and is done 10-13 minutes after exercise (Jang & Lee, 2019) (Kaur & Singh, 2019). Based on previous research, there are various efforts to eliminate lactate levels, including sports massage. Carrying out sports massage on the muscles will increase blood flow to the muscles so that lactic acid is channeled to the liver and becomes the raw material for glycogen formation through the gluconeogenesis process. In addition, the blood flow bringing O2 will convert lactic acid into pyruvic acid, which is then converted into acetyl CoA for energy formation (ATP). It is the process of how sports massage is beneficial for eliminating fatigue (Garbouj et al., 2016) (Rodas et al., 2000) (Jang & Lee, 2019). The 2.79 mMol/L average lactic acid level has not become a normal condition. The lowest blood lactic acid level at rest reaches 2.5 mMol/L; thus, it takes longer to return to normal conditions. It proved that to return the blood lactic acid level to the initial condition before submaximal exercise requires 60 minutes of recovery. Cleaning blood lactic acid in the body will be faster by doing light activities than not doing any activity at all (Ramadan, 2017) (Cairns, 2006) (Arren et al., 2011) (Zinoubi et al., 2018).

CONCLUSION

The study concludes that the lactic acid level of softball athletes increased and returned to the normal level (2.79 mMol/L) 20 minutes after 10 minutes of sports massage treatment.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

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