

# Sports Massage: How does it Affect Reducing Lactic Acid Levels in Athletes?

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**Abstract** Increased lactic acid levels in the blood and muscles during high-intensity training and sports competitions cause muscles to get fatigued, which affects physical performance and is made worse by a greater risk of injury. Therefore, a solution is needed. The purpose of this study was to analyze the effect of sports massage on reducing lactic acid levels in athletes. This research is a true-experimental design with a pretest-post-test control group design. A total of 24 football athletes from the Faculty of Sports Science, Padang State University, Indonesia were used as research samples. Sports massage treatment was given after the athlete did a 1.500 meter run (experimental) and without sports massage (control). Sports massage is given to the back, back of the neck, shoulders, upper extremities, and lower extremities. The techniques used include effleurage, petrissage, shaking, tapotement, walken, vibration, and skin-rolling. Each was given 6 repetitions. Then, accutrendlactacid was used to measure lactic acid levels. Data were analyzed using a t-test. The results showed that lactic acid levels in both groups increased after running 1500 meters. However, after being given a sports massage in the experimental group, lactic acid levels decreased by 1.94 mmol/L. Meanwhile, the lactic acid level in the control group was 5.43 mmol/L. The difference in mean lactic acid levels from the post-test data of the two groups showed a significant result of 6.16 mmol/L ( $p < 0.05$ ). In conclusion, giving sports massage after exercise and sports competition (high intensity) is very effective in reducing lactic acid

levels in athletes. The results of this study are expected to be useful for coaches, sports health teams, and athletes to reduce lactic acid levels so that they can improve performance during exercise (sports competition), and minimize the occurrence of a high risk of injury.

**Keywords** Sport Massage, Lactic Acid, Football, 1.500 Meter Run

## 1. Introduction

A distinction between anaerobic and aerobic energy systems is made based on the frequency, degree of intensity and kind of muscle fibers used [1]. Lactic acid levels in muscle cells can rise as a result of anaerobic exercise. Adenosine triphosphate generation and metabolic capacity are both reduced as a result of the rise in lactic acid, which also lowers cell pH and slows the pace of the catalytic process [2]. Lactic acid is produced during anaerobic glycolysis as a result of incomplete glucose breakdown [3]. Anaerobic tiredness can develop during high-intensity exercise as a result of the buildup of lactic acid [4,5]. The neuromuscular junction prevents nerve stimulation to muscle fibers as a result of lactic acidosis, which is caused by lactic acid in muscle cells. The muscles are unable to contract as a result [6,7].

Recovery after training and sports competitions is an

important component to support better performance to prepare for the next training or competition [8]. Increased recovery time can help athletes maintain their health and improve their performance [9]. Rapid recovery from muscle fatigue is very important in sports performance, especially when athletes need maximum energy to promote better performance during competition. Therefore, athletes need to be given treatment that has a direct impact on muscle recovery, in addition to fulfillment and adequate nutritional intake [38-41]. If muscle care is applied incorrectly, it can lead to decreased physical performance and an increased risk of injury during competition [10]. Several muscle recovery methods have been suggested for professional athletes, including the use of heat/cold therapy, stretching techniques, and sports massage. Of this type of recovery method, sports massage has been considered the most natural technique, which is directly applied to the area/body part to increase the elasticity of muscles and joints [11]. Sports massage is one of the most widely used tools, both in the field of rehabilitation therapy and in sports. This is because, muscle fatigue in athletes often occurs during and after training (sports competition) [12].

Sports massage is very well known in Indonesia, and almost all massage therapists for national athletes have practiced, where the manipulation techniques used are effleurage, petrissage, shaking, friction, tapotemen, walken, vibration, stroking, and skin-rolling [13]. The purpose of sports massage before and after competition is to improve athlete performance and reduce the risk of injury. Previous studies examined sports massage in increasing immunoglobulin-A (IgA) [13], acceleration and sprint performance in athletes [14], knowledge and perceptions of athletes about Sport Massage Therapy (SMT) [15], pain relief, ROM, and pelvic function in chronic pelvic injuries [16], the effect of sports massage and cold water immersion for recovery from the match [17], depression, anxiety and stress [18], performance, muscle recovery and injury prevention [19], treat myofascial syndrome [20], the effectiveness of Chinese cupping massage during the early stages of lipodystrophy [21], different order of changes in the level of blood circulation in the upper extremities [22], roentgenometric parameters of sagittal spinopelvic balance in patients with sacroiliac joint dysfunction [23], electromyogram, muscle tension, and pain [11], the benefits of the mechanism of massage [24], and the effectiveness of massage therapy for back pain [25]. However, there are only a few studies that discuss how sports massage can help athletes' lactic acid levels.

This study aims to analyze the effectiveness of sports massage on reducing lactic acid levels in athletes, with the hope that it can be useful for coaches, sports health teams, athletes, and athletes an effort to reduce lactic acid levels, so as to improve performance during exercise (sports competition), and minimize the risk of high injury.

## 2. Materials and Methods

### 2.1. Study Design

This research is true-experimental using a pretest-post-test control group design (Figure 1). The group in this study consisted of an experimental group and a control group. The experimental group was the group that was given a sports massage after running 1.500 meters, while the control group is the group without being given a sports massage after running 1.500 meters. The control group was intended as a comparison group so that the experimental results were purely based on the effect of the treatment, namely sports massage.

R	O <sub>1</sub>	X	O <sub>2</sub>
R	O <sub>3</sub>		O <sub>4</sub>

Figure 1. Experimental design

Note:

- R = Random
- X = Sports massage treatment
- O<sub>1</sub> = Pretest data on lactic acid levels in the experimental group
- O<sub>2</sub> = Post-test data on lactic acid levels in the experimental group after being given a sports massage
- O<sub>3</sub> = Pretest data on lactic acid levels in the control group
- O<sub>4</sub> = Post-test data on lactic acid levels without being given a sports massage

### 2.2. Participant

This study involved 24 athletes from the Faculty of Sports Science, Padang State University, Indonesia, who were randomly recruited. The average age of the sample was 21.6 years, weight 62.1 kg, and height 169.2 cm. The sample was recruited based on considerations, namely athletes who were actively participating in training and had competed in student sports events at the provincial level. Then, written consent was carried out so that the sample's involvement in the study was voluntary.

### 2.3. Procedure

The procedure in this study consisted of several stages.

#### 2.3.1. Stage 1 (pretest)

At this stage, pretest data were collected on lactic acid levels in the sample. Then, the sample was divided into two groups, namely the experimental group (n = 12) and the control group (n = 12), with the aim that the pretest data of the two groups did not have a significant average difference.

### 2.3.2. Stage 2 (treatment)

This stage includes: (1) both groups run 1.500 meters, (2) after running 1.500 meters, both groups are given a 30-minute rest period, (3) the experimental group is given a sports massage for 60 minutes, while the control group is not given a sports massage. The sports massage given is the back, back of the neck, shoulders, and upper and lower extremities. The sports massage techniques used include effleurage, petrissage, shaking, tapotement, walken, vibration, and skin-rolling [26]. The implementation of each movement technique was repeated 6 times.

### 2.3.3. Stage 3 (post-test)

At this stage, post-test data were collected on lactic acid levels in the sample after running 1.500 meters, so that it was known that the increase in lactic acid levels after 1.500 runs, and a decrease in lactic acid levels after sports massage treatment.

### 2.4. Instrument

Lactic acid levels in the blood were measured using accutrendlactacid with units of mmol/L [27]. Measurements were taken 2 times, namely before and after running 1.500 meters. The equipment needed is cotton, alcohol, betadine, and lancet's blood. Blood samples from respondents were taken using BM-Lactate/lactic acid strip, which aims to store blood after the fingertip of the sample is pricked using lancets blood. Then, the lactate strip was inserted and checked using accutrend lactate.

### 2.5. Statistic Analysis

Data were analyzed using t-test, namely paired samples t-test and independent samples t-test. Paired samples t-test was used to determine differences in lactic acid levels in pretest and post-test data (experimental and control). Meanwhile, independent samples t-test was used to compare lactic acid levels in post-test data from both groups (experimental and control). Then, testing the normality and homogeneity of the data is a test of

requirements before this test, which aims to determine whether the pretest and post-test data are normally distributed and homogeneous. Each used the Shapiro-wilk test and the F test. All these stages were analyzed using the statistical program IBM SPSS version 24.

## 3. Result

The purpose of the data description is to characterize the lactic acid levels in both the experimental group and the control group. In addition, the data description is to characterize the data form the pretest and post-test.

Table 1 shows that there are variances in the means of each study group, with the experimental group's post-test data showing superior results to the control group in lowering athlete's lactic acid levels.

Figure 2 compares the post-test results from the experimental group with the control group, and displays the average difference in lactic acid levels. The experimental group which was given sports massage treatment after running 1.500 meters, showed a significant decrease in lactic acid levels (post-test mean difference = 6.16 mmol/L).

The analysis requirements test showed that the pretest and post-test data were normally distributed and homogeneous (experimental and control) (Table 2).

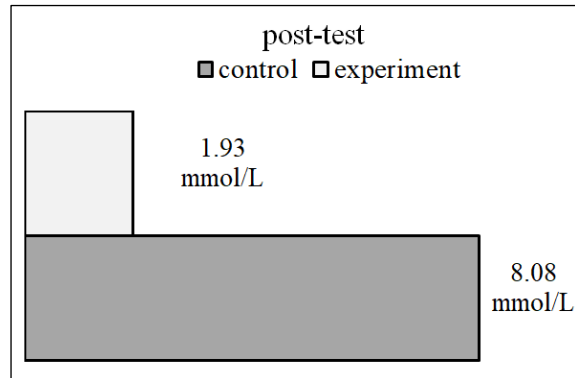


Figure 2. The difference in the average post-test data

Table 1. Descriptive statistics of lactic acid level data

Data	N	Experimental group				Pretest-post-test mean difference*	Post-test mean difference*
		Min*	Max*	$\bar{X}$ *	SD *		
Pretest	12	2.0	5.5	3.87	1.07	1.94	6.16
Post-test	12	.7	3.8	1.93	.93		
Data	N	Control group				Pretest-post-test mean difference*	Post-test mean difference*
Pretest	12	1.5	3.9	2.65	.81		
Post-test	12	6.2	10.2	8.08	1.21	5.43	

Note.\*- data description is translated in mmol/L units

**Table 2.** Summary of normality and homogeneity tests of data

Test	Group	Data	p*
Normality	Experiment	Pretest	.956
		Post-test	.472
	Control	Pretest	.620
		Post-test	.335
Homogeneity	Experiment	Pretest-post-test	.185
	Control	Pretest-post-test	.254
	Experimen-control	Post-test	.568

Note.\*- data is normally distributed and homogeneous ( $p > 0.05$ )

The results of the paired samples t-test showed that there was a significant difference between the pretest and post-test data from the experimental group and the control group, with all values significantly different ( $p < 0.05$ ) (Table 3). Lactic acid levels in the experimental group decreased after being treated with sports massage, namely 1.94 mmol/L (pretest-post-test mean difference) (Table 1). Meanwhile, the level of lactic acid in the control group (without being given a sports massage) was 5.43 mmol/L (pretest-post-test mean difference) (Table 1).

Then, Table 4 also shows that there are significant differences between the two post-test data in the experimental and control groups. After completing 1.500 meters of running, the experimental group's lactic acid levels were 6.16 mmol/L higher than those of the control group (based on the post-test means of the two groups) (Table 1). In other words, it was demonstrated that delivering a sports massage to the experimental group would lower the athletes' lactic acid level.

**Table 3.** Paired samples t-test for pretest-post-test data for the experimental group and the control group

Pretest-post-test	Paired differences					t	df	p*
	X̄	SD	SE	95% Confidence				
				Lower	Upper			
Experiment	1.9417	.6960	.2009	1.4994	2.3839	9.663	11	.000
Control	5.4333	.8172	.2359	5.9526	4.9141	23.031	11	.000

Note.\*- the difference is significant ( $p < 0.05$ )

**Table 4.** Independent samples t-test for the post-test data of the experimental group and the control group

		t-test for Em						
		t	df	p*	X̄1-X̄2	SED	95% Confidence	
							Lower	Upper
lactate level	Equal variances assumed	13.96	22	.000	6.16	.44	7.07	5.24
		13.96	20.71	.000	6.16	.44	7.07	5.23

Note.\*- the difference is significant ( $p < 0.05$ )

## 4. Discussion

Based on the results of our research, lactic acid levels in both groups (experimental and control) increased after running 1.500 meters. However, after being given a sports massage in the experimental group, lactic acid levels decreased by 1.94 mmol/L. Meanwhile, the lactic acid level in the control group was 5.43 mmol/L. The difference in mean lactic acid levels from the post-test data of the two groups showed a significant result of 6.16 mmol/L ( $p < 0.05$ ). The findings of this study are consistent with those of other studies that suggested sports massage may be a significant treatment for muscular exhaustion because it can influence fluid mobility in muscle tissue, boost

nutrition flow, and remove waste to encourage muscle repair [12]. Previous studies have reported that sports massage is widely used to minimize injury, recovery, relaxation, and increase sports performance [25], and recovery after intense training [15]. The findings of this study are also consistent with those of other investigations. These investigations have shown that sports massage can improve blood flow and peripheral perfusion to the nearby limbs [28], sports massage can provide an increase in body temperature to help stimulate blood flow [29–31], and reduce muscle pain [32].

Sports massage can have a positive influence on athletes' performance when competing [33]. Previous studies have reported that massage and physiotherapy exercises are an

effective part of improving body health [34]. Many coaches, athletes and other professionals state that sports massage has several benefits. Sports massage is beneficial for athletes for improved sports performance and recovery [24]. Previous studies reported that athletes believed that sports massage can aid in recovery, due to the various physiological, neurological, and other systems that sports massage activates [17]. Various studies show that sports massage can increase the range of movement [14]. The results of this study are consistent with other research that suggested athletes perform better after receiving a sports massage [35]. It is regarded as one of the most widely utilized methods to speed recovery following demanding training sessions [36]. Thus, sports massage plays an important role in the performance and physical health of athletes, possible disease prevention, and rehabilitation [37].

Based on the data we obtained while in the field, we believe that giving sports massage after exercise, and high-intensity sports competitions are very effective in reducing lactic acid levels in athletes. However, we recognize some limitations that need to be validated for future research. These limitations include, the size of the sample used, so it is necessary to involve a wider sample size. The athletes who were sampled were only in football, so it was necessary to involve athletes in other sports. In the post-test data collection, lactic acid levels were measured after a 1.500 meter run, with a 30-minute rest interval. Then, it is necessary to involve other treatment groups as comparison groups, so that the effectiveness of giving sports massage can be known.

## 5. Conclusions

The conclusion from the results of this study, giving sports massages after exercise and high-intensity sports competitions are very effective in reducing lactic acid levels in athletes. The experimental group which was given sports massage treatment after running 1,500 meters, showed a significant decrease in lactic acid levels (post-test mean the difference = 6.16 mmol/L). Lactic acid levels in the pretest and post-test data of the experimental group decreased after being given a sports massage, which was 1.94 mmol/L. Meanwhile, the levels of lactic acid in the pretest and post-test data in the control group were higher, namely 5.43 mmol/L. In other words, giving sports massage is very effective in reducing lactic acid levels in athletes. The results of this study are expected to be useful for coaches, sports health teams, athletes, and athletes in an effort to reduce lactic acid levels, to improve performance and minimize the risk of high injury. In addition, we believe that this study will give the way for other researchers to prove the effectiveness of sports massage in sports performance, by involving other treatment groups as comparisons.

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## Conflict of Interest

The authors declare no potential conflicts of interest.

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