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Differences of Athletes' Blood Lactic Acid Levels Before and After 1500 M Run

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ABSTRACT
The high intensity of training and competitions that athletes in various branches undergo exercise often carries a high risk of injury and fatigue. Efforts to recover from fatigue are required after athletes undergo training and competitions so that the athlete's body is back to normal. This study aimed to analyze the differences in blood lactic acid levels before and after the 1500 M run. This study used a quantitative method with a cross-sectional design. The research subjects were soccer athletes who were actively exercising. The variables to be studied were blood lactic acid levels and the identity data of the research subjects. This study included all soccer athletes in the FIK UNP Soccer Activity Unit, totaling 51 people. The sample is part of the population, namely 12 people taken purposively. The subject's identity data were collected using a questionnaire and data measurement of lactic acid levels using Accutrend Lactacid. Measurement of lactic acid levels was carried out before running 1500 meters and after resting for one hour. The results showed that the lactic acid levels after running the 1500 m run increased five times than the lactic acid levels before doing the 1500 m run. However, statistical analysis test results after measuring the lactic acid levels after an hour of rest, the lactic acid levels returned to normal conditions. The results of statistical tests showed that there were differences in blood lactic acid levels before and after running 1500 meters in athletes ($\alpha < 0.05$).

Keyword: *Lactic Acid Levels, Running 1500 m*

1. INTRODUCTION

Achievement of optimal sports performance is supported by many factors, both internal and external factors. Internal factors that have contributed significantly, among others, physiological factors.

Physiological factors in the form of high levels of athlete fatigue during the competition trigger a lack of score or the best points in the process of a match. Football is an achievement sport that is currently favored by the public. Many football clubs and organizations arise. However, from the other side, the achievements of the sports branch have not made many significant achievements, let alone the fostering of regional football. Many factors make a sports achievement reach an optimal level, including optimal physical condition coupled with coaching the lowest to top levels, health conditions and dietary arrangements, competent trainers, and good support for facilities and infrastructure. In terms of health promotion and food regulation, many regional football organizations have not taken it seriously. Moreover, health and nutrition regulation problems involve a large amount of funding, becoming an increasingly careful consideration to becoming a significant concern in achieving achievements in sports.

In football, athletes often experience injuries and fatigue, which are very significant in every match and training. Movements that require much running, kicking and swinging leg movements are high opportunities for athletes' injury and fatigue. Strengthened again, many athletes have not realized the high risk of fatigue in football, so they have not anticipated the arrangement of food and drinks and good match preparation. The fatigue factor is a physiological condition that an athlete often experiences and affects the achievement to be achieved.

The impact of high training intensity for soccer is many athletes experience excessive injury and fatigue. There are various ways to prevent fatigue during matches and training and reduce the risk of injury caused by the high intensity of soccer training. One way that is often done to overcome the fatigue that occurs is through sports massage treatments applied to athletes.

The factors causing fatigue are very complex, both from the physiological condition and the psychological condition of the athlete. Many things can cause the onset of muscle fatigue during exercise, including depletion of energy reserves from ATP, creatine phosphate, glycogen, or glucose; accumulation of lactate in muscles; homeostatic disorders, e.g., disturbances in plasma osmolarity, plasma volume, decreased pH of body fluids, and decreased electrolyte levels of body fluids; fatigue due to neuromuscular or

central disorders; fatigue caused by environmental conditions, both temperature and humidity; and due to the accumulation of lactic acid in muscles as a result of anaerobic glycolysis (Novita Intan Arovah, et al: 2010).

Lactic acid is a byproduct of the anaerobic glycolysis process. Nearly 80% of the lactate produced in anaerobic glycolysis is carried outside the muscles into the blood circulation. Farenia et al. (2010) explained that lactic acid is the end product of the anaerobic glycolysis process produced by active red blood cells and muscle cells. In a resting state, lactic acid is produced by red blood cells, white blood cells, brain, muscle cells, liver cells, intestinal mucosa, and skin.

This lactic acid system requires 12 kinds of chemical reactions in sequence. The energy generated through this energy system takes place slower than the Adenosine Tri-Phosphate Phospho-Creatine (ATP-PC) system, which only requires two chemical reactions. ATP-PC is used for speedy muscle contraction, while for rapid muscle contraction, the anaerobic system is used. This process takes place in the absence of oxygen. So, that lactic acid is the end product of glucose metabolism with an anaerobic metabolism system. The characteristics of the anaerobic glycolysis system are that it causes the formation of lactic acid, which can cause fatigue, does not need oxygen, only uses carbohydrate energy sources (glycogen and glucose), and the energy released is only sufficient for ATP synthesis in small amounts (Widiyanto,

Lactic acid buildup inhibits action potentials in the neuromuscular junction. As a result, muscle contraction becomes weak. This disruption of muscle contraction is due to reduced ATP and increased lactic acid buildup. The buildup of lactic acid in muscles results in increased hydrogen ion concentration and decreased pH in cells. From the explanation above, it can be said that muscle fatigue is caused by a buildup of lactic acid and reduced ATP. Reduced ATP leads to reduced muscle strength and increased lactic acid concentrations and can interfere with transmission in the neuro muscular juntion. The benefits of massage can reduce blood pressure have been studied in 2019 (Darni, 2019). The purpose of this paper is to analyze the differences in lactate levels before and after running 1500 meters.

2. RESEARCH METHODS

This study is part of a study entitled "The Effect of Sports Massage on Perceptions of Fatigue and Blood Lactic Acid Levels in Athletes." This study used quantitative methods with pre-experimental designs with one group pretest - post-test design. There is an initial test in this study before being given treatment and a final test after treatment. Thus, the treatment results can be more accurate because they can compare with the situation before being given treatment (Sugiyono, 2015: 74). This study was conducted to see the differences in lactic acid levels before and after running 1500 meters in athletes. This study uses only one sample group without using a control group.

This study included all soccer athletes in the Faculty of Sport Science Universitas Negeri Padang Soccer Activity Unit, totaling 51 people. The sample is part of the population, namely 12 people taken purposively. The subject's identity data were collected using a questionnaire and data measurement of lactic acid levels using Accutrend Lactacid. Measurement of lactic acid levels was carried out before running and after running 1500 meters. Before running activities, the subject's blood pressure and body weight, and height profiles were checked first

The t-test is used to analyze the differences in lactic acid levels before and after the 1500 m run. The data obtained from the measurement results were analyzed using paired t-test (paired t-test) with a significance level of 5%. The t-test produces a t-value and a probability value (p), which can prove the hypothesis that there is or is no difference significant with a significance level of 5%. The way to determine whether it is significant is if the value ($p < 0.05$) is a significant difference, if ($p > 0.05$) there is no significant difference.

3. RESULTS AND DISCUSSION

The subjects in this study were athletes of the Sports Activity Unit (UKO) who train regularly. The research results indicate the age of the subjects ranged from 23 to 25 years, with an average age of 23.5 years. The mean subject body weight was 59.8 kg, and the mean subject's height was 165.5 cm. The results of measuring lactic acid levels from processing and research data collection can be seen in table 1.

Table 1. Subjects' Lactic Acid Levels Before and After Running 1500 m

No.	Lactate levels Before Running (mmol / L)	Lactate Levels After Running (mmol / L)	After Lactate Levels 1-hour rest (mmol / L)	Difference (D)
1	2.5	4,2	1.90	1.7
2	2,3	9.4	2.10	7,1
3	2.7	5.7	1.10	3.0
4	2,2	7,1	2.60	4,9
5	3,2	6.2	2.80	3.0
6	0.8	5.7	5.40	4,9
7	0.1	4.5	1.80	4,4
8	1.9	2,4	4.00	0.5
9	2,4	19.2	2.10	16.8
10	1.5	12.6	3.70	11.1
11	1.0	3,4	1.30	2,4
12	0.8	3.8	1.50	3.0

The results of data collection and data processing for measuring lactic acid levels show that the average level of lactic acid before the 1500 m run was 1.8 mmol / L with a standard deviation of 0.9 mmol / L. The levels of lactic acid in the blood of respondents before the activity found in this study were not much different from the theory put forward by Janssen (1987), namely the levels of lactic acid in the blood when the resting state in healthy people ranges from 1–2 mmol / l. Tanaka et al. (1983) stated that the threshold for lactic acid under normal conditions is 2 mmol / l. Blood lactic acid levels that exceed the threshold value (greater than 2 mmol / l) indicate fatigue (Mattner, 1988). It shows that the initial conditions of most of the subjects before running were normal or not tired. When referring to Janssen (1987), it can be seen that there are still many athletes who show conditions above the typical lactic acid level threshold. The subject has not been in optimal resting condition from previous training activities or matches.

The data collection and processing showed that the mean lactic acid level after the 1500 m run was 7.0 mmol / L with a standard deviation of 4.8 mmol / L. There was a high enough increase in lactic acid levels before the 1500 m run compared to after the 1500 m run. The increase in lactic acid levels was five times (500%). From the data, it can be seen that all research subjects experienced an increase in lactic acid after running 1500 m and lactic acid levels after running 1500 m. All subjects were above normal conditions (above 2 mmol / L). Following the theory put forward by Murray (2005), the human body will receive stimulation during physical activity, which causes muscles to contract continuously so that the oxygen supply to the muscles will decrease. This condition results in a shift in the energy source of muscle activity, originally from fatty acids when the oxygen supply was sufficient, then switched to another energy source whose overhaul process does not require oxygen. The energy source for muscle activity when there is insufficient oxygen is in the form of carbohydrates, namely glucose (Matthew, 2003). Glucose will be converted into pyruvic acid through an anaerobic glycolysis reaction. Pyruvic acid will be reduced to lactic acid. Lactic acid is very detrimental because it can cause muscle fatigue (Murray, 2005). Ardle et al. (1981) and Fox et al. (1993) argued that lactic acid formed from anaerobic glycolysis will lower the pH so that the muscle atmosphere becomes acidic. This situation can increase the acidity of the blood if it lasts a long time.

This change in pH in the muscles inhibits the work of the glycolysis enzymes to interfere with the chemical reactions that take place in cells. It will result in a decrease in the energy produced so that the muscle contractions are weakened, and in the end, the muscles will experience fatigue. Fatigue that occurs to the respondent after running 1500 m must be overcome to not develop into chronic fatigue. One of the efforts to overcome fatigue is by resting as recovery. It is following the theory put forward by Janssen (1987), where rest is a restoration effort that can clean or eliminate lactic acid from the body. Other than that, Brooks (1986) and Peterson (2006) also suggest that an essential process in restoring blood lactic acid levels is

the oxidation of lactic acid to pyruvic acid again by cells in muscle tissue or the spleen and liver. Rest plays an essential role in overcoming the fatigue experienced by a small proportion of respondents. By resting, the body can get a supply of oxygen to oxidize lactic acid to pyruvic acid again. Recovery of blood lactic acid levels can take place actively or passively (Janssen, 1987). Afriwardi and Rezki (2008) explain that the active recovery stage occurs when the cessation of activity or exercise occurs slowly by reducing both the quantity and quality of activity until the metabolite results are at normal levels. Recovery is passive if the activity is stopped immediately without going through the stages of reducing the quality or quantity of activity. The recovery stage that is carried out affects the body's ability to eliminate metabolites, including lactic acid. One of the active restorations of blood lactic acid levels that respondents can do is stretching muscles or sitting for a while between work hours. Passively restoring blood lactic acid levels can be done by sleeping. After the subject did a 1500 m run in this research, lactic acid levels were measured after one hour. The results of measurement of lactic acid levels after resting for one hour, most (42%) of the subjects' lactic acid levels had returned to normal.

4. CONCLUSIONS AND SUGGESTIONS

The results showed that the lactic acid levels after running the 1500 m run increased by 5 times than the levels of lactic acid before doing the 1500 m run. However, after measuring the lactic acid levels after an hour of rest, the lactic acid levels returned to normal conditions. The results of statistical tests showed that there were differences in blood lactic acid levels before and after running 1500 meters in athletes ($\alpha < 0.05$).

Fatigue that occurs in athletes after physical activity can be overcome by resting for one hour. Need to do further research on the effectiveness of reducing lactic acid levels with various types of rest.

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