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THE EFFECTIVENESS OF THE RECOVERY METHOD FOR MALUKU U-16 SOCCER PLAYER MSA THORANA ARU

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Abstract

This study aims to determine the effectiveness of several recovery methods to reduce the fatigue level of soccer players. The sample of this study was Thorana Aru, Maluku U-16 soccer player, aged 16.26 ± 2.5 years, with a body weight of 56.13 ± 11.84 kg, consisting of 32 people. The sample was divided into four groups using random sampling, namely the control group, active recovery, massage, and combined recovery, with a total sample of 8 people for each group. The instrument used to measure the fatigue index is the RAST method. The MANOVA test was used to see if there was a significant difference between the data of the control group and the active recovery, massage and combined recovery groups to see the effect of the recovery technique. The normality test used the Kolmogorov-Smirnov test and the variance homogeneity test used the Levene test. The objects in this study were the fatigue index and lactic acid levels in the blood, which were carried out by the initial test before recovery and the final test after recovery. The results showed that analysis of the fatigue index in the active recovery, massage, and combined recovery sample groups ($p<0.05$) could reduce the fatigue index of soccer players. Testing lactic acid levels that occurred during active recovery and combined recovery ($p<0.05$) showed that the two sample groups were effective in reducing lactic acid levels, whereas testing lactic acid levels in the massage sample group ($p>0.05$) showed a decrease in lactic acid levels. Based on the results of the data analysis, it can be concluded that active recovery and combined recovery are effective in reducing the level of fatigue in soccer players.

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INTRODUCTION

Football is one of the most popular sports in Indonesia. This popularity shows that many people are fond of football from all regions, from cities to rural areas (Millah, Mulyana, & Zimarna, 2022). Football is a team game consisting of eleven people each and can serve as defenders, midfielders, attackers, and goalkeepers (Jia, Abdullah, Dev, & Samsudin, 2021). In soccer, almost all foot skills are used, except for the goalkeeper, who can use all limbs (Putra, 2018).

Football has crucial aspects, like sports in general. Football is a complex game that requires special training. Soccer players must understand the basic tactics and strategies for playing soccer and have good skills, speed, strength, and aerobic fitness to maintain physical fitness during matches (Dahlan, Hidayat, & Syahruddin, 2020). Football sport requires a very high level of physical condition. Football players are required to have more fitness than other sports. The physical components needed in this sport are not only limited to cardiovascular endurance but muscular endurance and strength are also very important for soccer players (Kurniawan & Elfarabi, 2018).

In addition to high physical performance, soccer players face a busy match schedule, where players must repeatedly practice in a short time (Akbar, Marhaendro, Agus, Hita, & Ariestika, 2021). The amount of training that is carried out intensively will expend excessive energy, causing fatigue in soccer players during matches. Fatigue is a process of decreased physical work endurance due to reduced oxygen supply to muscle cells (Fondy, 2016). In addition, according to (Brilian, Ugelta, & Pitriani, 2021) it is a mechanism that protects the body so that the body avoids further damage, and recovery occurs after rest. The maximum strength limit of the body is not only in activities that involve physical activities but also affect the body's performance. Fatigue is caused by an imbalance in the body's physiological state (Triansyah & Kushartanti, 2015).

According to (Andriani & Rasto, 2019), the body's physiological factors are 1) problems with the energy system, 2) lactic acid accumulation, 3) muscles failing to contract mechanically, and 4) changes in the nervous system. One indicator of fatigue in soccer players is the high concentration of lactic acid in the tissues. Lactic acid levels in the body can increase when a person exercises too hard (Todd, 2014). In addition, a person's physical condition has a lactate threshold when carrying out physical activity. If you do low-intensity exercise, less lactic acid is produced (Haetami & Triansyah, 2021). However, when the intensity of exercise increases, lactic acid production increases, causing a buildup of lactic acid in the blood (Aspar, Ghani, Gery, & Mulyanto, 2022). Accumulation of lactate in the blood is a fundamental problem in physical activity because it causes fatigue and reduces physical performance (Aguiar et al., 2017). Slow disposal of lactate can reduce energy metabolism, which causes acidosis in and around muscle cells, inhibits coordination, and increases the risk of injury, which can cause temporary or permanent disability (Purnomo, 2015). Therefore, to minimize the risk of injury due to fatigue, the recovery period can be optimized, ultimately restoring the homeostatic condition of the football player's body (Haryono, Darajat, Rusdiana, Salman, & Gumilar, 2021).

Everyone has their own risk of injury and how to recover or the recovery process, so it is crucial for players to take advantage of the recovery period to return the body to its initial state or condition before training (Rey, Casais, & Ballesteros, 2014). Recovery is restoring muscles and other body parts to pre-training conditions (Romadhona, Sari, & Utomo, 2019). Recovery aims to give the body time to rest. Tired muscles need to regain their strength and recovery aims to regenerate muscle cells damaged during exercise to form new, higher-quality muscle cells (Lesmana, Padlib, & Endang Pati Broto, 2017). Recovery duration depends on the level of fatigue experienced by athletes due to previous training stimuli (Kellmann et al., 2018). The less fatigue he experiences, the less time it takes to recover. Conversely, the higher the fatigue level of an athlete, the longer the rest time needed for recovery (Burhan & Vandita, 2021).

Athletes can apply two types of recovery: active recovery and passive recovery. Active recovery is carried out by physical activity with a light intensity of 20-50% of the maximum heart rate (Fitria, 2022). Passive recovery is a training method by resting completely or not doing any activity other than sitting and sitting sleeping (Mulyawan, 2020). Of the two types of recovery, active recovery is more profitable than passive recovery. This is by the research of (Fitrianto & Maari, 2020) that to accelerate the decrease in lactic acid levels, the body needs oxygen to oxidize lactic acid, which is carried out through active recovery. Other research has also found that active recovery helps rid muscles of the lactic acid that causes pain and fatigue. Active recovery or reducing heat with light exercise is more efficient in increasing recovery after exercise (Wilson & Kemi, 2010).

Apart from using active recovery and passive recovery, other recovery techniques are carried out with the help of others through a massage or sequencing technique that is carried out to restore the limbs of a person who has been injured while exercising, which is known as sports massage (Kozier et al., 2018). The results of (Sa'roni & Graha, 2019) revealed that sports massage could increase the effectiveness and efficiency of the recovery process. Sports massage can destroy lactic acid accumulations that accumulate during exercise so that the muscles become relaxed (Bervoets, Aj, Jn, Buijs, & Verhagen, 2015) increase blood and lymph circulation, stretch joints, and relieve pain (Burr, Slysz, Boulter, & Warburton, 2015). Massage can also reduce lactic acid levels as an indicator of fatigue in athletes after training and matches (Kurniawan & Elfarabi, 2018).

As a consideration in this study, previous researchers have examined the effectiveness of active recovery and massage effectiveness, but what differs from previous research is that few studies have combined the two recovery methods to minimize fatigue in soccer players.

Based on the background of the problems described above, this study aims to determine the effectiveness of several recovery methods to reduce fatigue in soccer players. The results of this study can be used as a reference for athletes and coaches to minimize fatigue during training and matches.

METHODOLOGY

The type of research used in this study is a type of quantitative research, where quantitative is a research model that emphasizes the analysis on the processed numerical data using statistical means in each result obtained.

The sample of this study was Thorana Aru, a Maluku U-16 soccer player, aged 16.26 ± 2.5 years and weighing 56.13 ± 11.84 kg, as many as 32 soccer players. The sample will be divided into four groups using random sampling: the control group, active recovery, massage, and combined recovery (massage and jogging) with a total sample of 8 people for each group. The instrument used to measure the fatigue index is the Running-based Anaerobic Sprint Test (RAST) method. Each sample did small-sided games (4vs4) for 45 minutes to get tired.

The objects in this study were the fatigue index and blood lactic acid levels. The initial test was carried out by measuring the fatigue index using the RAST method and then continued by measuring the level of lactic acid in the blood. Then each sample will recover for 15 minutes in their respective groups with the following provisions:

1. The control group performs passive recovery by completing rest or not doing any activity other than sitting.
2. The active recovery group jogged with an intensity of 50% - 60% HRmac.
3. The massage group performs recovery assisted by a masseur.
4. Furthermore, the combined recovery group recovered by jogging for 3.80 minutes, then massage for 8 minutes assisted by a masseur, and ending jogging for 3.80 minutes.

Manipulation of the massage movements are effleurage, tapotement, stroking, and shaking which are given to the most active muscles during activity. Eufleurage (rubbing) is movement rhythmically performed lightly throughout the body surface. Effleurage uses the entire surface of the palm and fingers to rub certain areas of the body. The objective of this application is to improve blood circulation and lymph fluid (lymph). Tapotement is a light rhythmic punching movement that is applied to the fleshy part. The goal is to encourage or accelerate blood flow and push out the burning remains from their hiding place. Tapotement (hitting) is with a fist, straight fingers, half straight, or with a concave palm, by being hit to the large muscles such as the back muscles. The aim is to stimulate the peripheral nerve fibers and stimulate the internal organs of the body. Stroking is a massage manipulation technique that is done by pressing in all directions on the body segment to be manipulated using the palms of the hands and fingers pressed together. The purpose of using the stroking technique is to relax the tissue so that blood circulation becomes better. Shaking is a massage technique by shaking the body segment to be manipulated. The shaking or shaking technique can be done with the palms of the hands, either with one palm or with two palms.

After recovering, the samples underwent a final RAST test and blood lactic acid levels. The MANOVA (Multivariate Analysis of Variance) test was used to see if there was a significant difference between the data of the control group and the active recovery, massage and combined recovery groups to see the effect of the recovery technique. The normality test used the Kolmogorov-Smirnov test and the variance homogeneity test used the Levene test with a significance level of $\alpha = 0.05$.

RESULTS

In this study, the researcher will present several data results that have been obtained

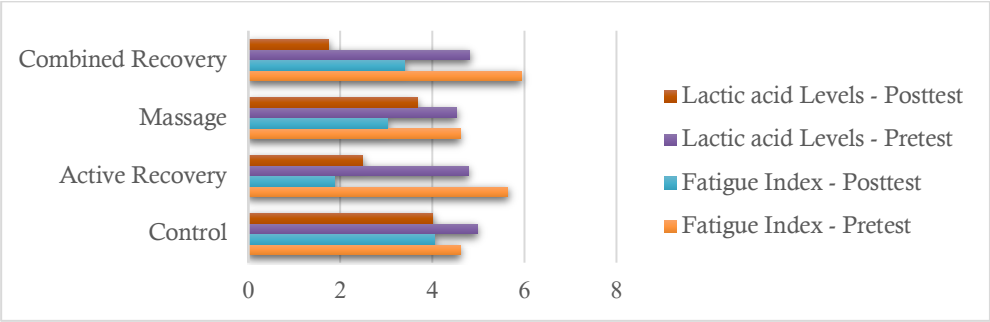
from the researcher based on the observation results, where the data results will be presented in the form of a table as follows. The data on the measurement results of the fatigue index and lactic acid levels in soccer players was described twice, namely the pretest (before recovery) and a posttest (after recovery). The results of measuring the fatigue index and lactic acid levels in the control, active recovery, massage, and combined recovery groups can be seen in Table1.

Table 1. Results of measurements of fatigue index and lactic acid levels in the sample group

		Control	**Active Recovery**	**Massage**	**Combined Recovery**
Fatigue Index (watt/s)	*Pretest*	4.61 ± 0.81	5.64 ± 1.10	4.60 ± 0.93	5.93 ± 0.92
	Posttest	4.04 ± 0.70	1.88 ± 0.93	3.02 ± 0.86	3.40 ± 0.72
Lactic acid Levels (mmol/L)	*Pretest*	4.97 ± 0.50	4.79 ± 0.46	4.53 ± 0.32	4.81 ± 0.30
	Posttest	4.01 ± 0.40	2.49 ± 0.59	3.68 ± 0.27	*1.75 ± 0.16*

The data in Table 1. shows that the fatigue index at the time of the pretest in each group has almost the same value, namely the range between 4.60 watts/s to 5.93 watts/s. The lowest fatigue index during the Pretest was 4.60 watts/s in the group that applied massage movement manipulation. The highest was in the combined recovery group between active recovery and massage. The same thing happened in the pretest blood lactic acid levels in each group, which had almost the same value, between 4.53 mmol/L to 4.97 mmol/L. The results of the fatigue index measurement (posttest) were 4.04 watts/s. The result of this measurement is the highest fatigue index during the posttest. While the lowest fatigue index (posttest) is 1.88 watts/s which implements active recovery in jogging. The highest measurement of lactic acid levels during the posttest was 4.01 ± 0.40 mmol/L in the control group, while the lowest was 1.75 ± 0.16 mmol/L in the combined recovery group.

To further clarify the results of measuring the fatigue index and lactic acid levels in the control, active recovery, massage, and combined recovery sample groups, it can be described in the form of diagram 1 as follows:



Picture 1. Comparison of fatigue index and lactic acid levels in the sample groups

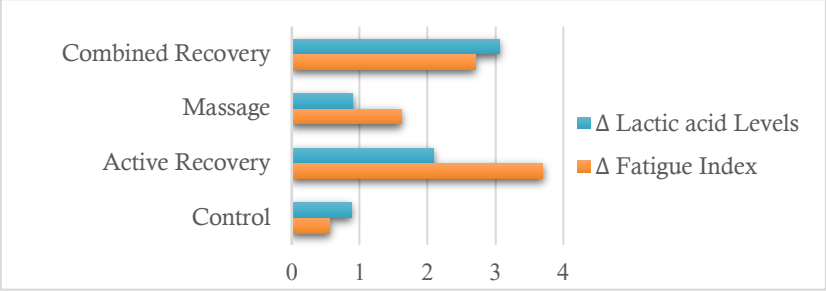
Table 2. Average Changes in Fatigue Index and Lactic Acid Levels

	Control	Active Recovery	Massage	Combined Recovery
Δ Fatigue Index (watt/s)	0.56 ± 0.15	3.70 ± 0.44	1.61 ± 0.23	2.70 ± 0.45
Δ Lactic acid Levels (mmol/L)	0.88 ± 0.10	2.09 ± 0.24	0.90 ± 0.12	3.06 ± 0.21

The data in Table 2 shows that the average decrease in the fatigue index has the smallest value, namely in the control sample group 0.56 ± 0.15 watts/s. In contrast, the average decrease in the index has the highest value, namely in the active recovery sample group 3.70 ± 0.44 watts/s s. The average change in lactic acid levels had the smallest value, also in the control sample group, which was 0.88 ± 0.10 mmol/L. In contrast, the average change in lactic acid levels had the highest value in the combined recovery sample group, 3.06 ± 0.21 mmol/L.

The results of the fatigue index analysis in the active recovery, massage, and combined recovery sample groups obtained a value of 0.00 ($p < 0.05$). This shows that the sample group effectively reduces the fatigue index in soccer players. In comparison, the analysis of lactic acid levels obtained a value of 0.00 in the active recovery and combined recovery sample groups and 0.961 in the massage sample group so that it can be stated that the active recovery and combined recovery sample groups ($p < 0.05$) can reduce lactic acid levels in the body of soccer players.

The average change in fatigue index and lactic acid levels in soccer players during the pretest and posttest can be seen in diagram 2 below.



Picture 2. Data for Δ fatigue index and Δ lactic acid levels

DISCUSION

Lactic acid is formed by carbohydrate metabolism that does not involve oxygen and occurs during strenuous physical activity (Cairns, 2016). Lactic acid is a metabolite that causes fatigue and is produced from the lactic acid system or anaerobic glycolysis as a result of the incomplete breakdown of glucose. Accumulation of lactic acid can occur during exercise with high intensity for a short time, this is because the production of lactic acid is higher than its destruction. In the blood, lactic acid is always there, originating from anerobic metabolism in erythrocytes. Even so, the amount of lactic acid in the body is relatively constant. In this case, if an athlete performs physical exercises that exceed the tolerance threshold, lactic acid buildup can occur, which will cause an increase in the acidity of muscle cells along with disturbances of other

metabolites. The same metabolic pathway allows the breakdown of glucose into energy that performs poorly, thereby reducing the ability of the muscles to work (Kellmann et al., 2018).

The lactic acid level in a healthy person at rest is about 1-2 mmol/L. The concentration of lactic acid in blood and muscles after exercise is estimated to be 20 mmol/L of blood. Lactic acid that accumulates in muscle cells will quickly diffuse into the blood and can cause fatigue. This situation can occur because the speed of oxygen supply is lower than the regulation of energy requirements during strenuous exercise. This also means that the speed of ATP resynthesis cannot keep up with the speed of its use. Likewise, hydrogen and NAD+ (nicotinamide adenindinucleotide) cannot be processed through the respiratory chain, whereas oxidation in glycolysis is highly dependent on the presence of this NAD+. The lactic acid system converts glucose or glycogen in the cytoplasm of muscle cells into energy and lactic acid (Candra, Rusip, & Machrina, 2016). Lactic acid produced during metabolism cannot be excreted directly outside the body but is reduced through gluconeogenesis to supply glucose and the oxidation process during recovery (Westerblad, Allen, & Lännergren, 2023).

Active recovery will be more effective in reducing lactic acid levels because by doing light activities, the body will work as a whole (A-E & Dupon, 2018) so that the distribution of oxygen will quickly reach the organs and the distribution of lactic acid to the liver will run smoothly, with sufficient oxygen and fast lactic acid brought In the liver, the oxidation process will run fast when the skeletal muscles work at low intensity so that lactic acid will decrease quickly. Active recovery can also promote slow muscle contractions (slow-twitch fibers). This type of muscle is the slowest to contract but is more resistant to muscle fatigue. There are mitochondria, myoglobin, glycogen, and glycolytic enzymes (Meznaric & Cvetko, 2016). Massage and active recovery during joint recovery are very effective in helping the recovery process and facilitating the process of transporting lactic acid accumulated in the muscles. Blood flow circulation also influences the process of reducing lactic acid (Wiltshire et al., 2010). Blood circulation that carries hemoglobin in red blood cells smoothly transports oxygen, a source of energy and fuel. (Utomo, Wibowo, & Wahyudi, 2022) stated that massage can increase muscle recovery and reduce the risk of DOMS after exercise. Massage can help increase blood flow to the skeletal muscles to accelerate the rate of lactate flow to be eliminated in various places. Thus massage can be used to accelerate lactate clearance (Meyer, Faude, Scharhag, Urhausen, & Kindermann, 2004). According to (Hemmings et al., 2000), massage from a psychological perspective reduces fatigue caused by hormonal mechanisms. Massage can also relax the body and reduce stress (Zadkhosh, Ariaee, Atri, Rashidlamir, & Saadatyar, 2015).

CONCLUSION

Based on the data analysis and discussion results, it can be concluded that active recovery and combined recovery effectively reduce the fatigue index and lactic acid levels in soccer players. Active recovery and combined recovery are effective in reducing the level of fatigue in soccer players.

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