

## **Development of A Model of Recovery Origin of Modification of Exercise Massage and Muscle Strength on Reducing Lactic Acid in Blood for Partner Football Players Surabaya**

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**Abstract:** Football is a high-intensity game of long duration, so in addition to technical, tactical, strategic and mental factors, there is one more determining factor, namely muscle fatigue, this factor which is often forgotten by coaches and players. The cause of player fatigue is due to heavy training or a tight competition schedule, there is a metabolic waste in the blood called lactic acid, this buildup of lactic acid causes fatigue but actually some of the lactic acid can be converted back into energy. The research objective to be achieved in this study was to determine the effect of exercise massage and muscle stretching in reducing lactic acid levels in the blood after a 45-minute round 1 soccer match. The type of research used is the type of research used is descriptive research. The population in this study, namely the population in this study were all football players in one team, namely 22 players from the Surabaya partner club. The data collection method used in this study is the measurement of blood lactic acid levels. The instrument used in this study was a blood lactic acid test using a blood lactic acid level measuring device. The data obtained will be analyzed using inferential statistics, namely the independent T test. Based on the results obtained, it can be concluded that the provision of sports massage and muscle stretching can reduce levels of lactic acid in the blood after the first half of the soccer match for 45 minutes. Based on the findings of the research on the first and second treatments, some suggestions are given, including; (1) for soccer players after training or matches, it is better to give sports massages and muscle stretching to maintain stamina in the next round, so that they can be maximized in training and matches; and (2) players who will be doing training or matches should stretch or warm up before being deployed to the field to avoid injury.

**Keywords:** Lactic acid, exercise massage, muscle stretching

**Abstrak:** Sepak bola merupakan permainan dengan intensitas tinggi durasi waktu lama maka selain faktor teknik, taktik, strategi dan mental, ada satu lagi faktor prenentu yaitu faktor kelelahan otot, faktor ini yang sering terlupakan oleh pelatih dan pemain. Penyebab terjadinya kelelahan pemain yaitu akibat latihan yang berat atau padatnya jadwal kompetisi maka terjadilah sisa metabolisme dalam darah yang disebut asam laktat, penumpukan asam laktat inilah penyebab kelelahan namun sebetulnya sebagian dari asam laktat tersebut bisa diubah lagi menjadi energi. Tujuan penelitian yang ingin dicapai dalam penelitian ini yakni mengetahui pengaruh masase olahraga dan peregangan otot dalam menurunkan kadar asam laktat dalam darah setelah pertandingan sepakbola babak 1 selama 45 menit. Jenis penelitian yang digunakan adalah Jenis penelitian yang digunakan adalah penelitian deskriptif. Adapun populasi dalam penelitian ini yaitu Populasi dalam penelitian ini adalah semua pemain sepakbola dalam satu tim yaitu 22 pemain club mitra surabaya. Metode pengumpulan data yang digunakan dalam penelitian ini yakni pengukuran kadar asam laktat darah. Instrumen yang digunakan dalam penelitian ini yakni tes asam laktat darah dengan menggunakan alat pengukur kadar asam laktat darah. Data yang diperoleh akan dianalisis menggunakan statistik inferensial yakni uji T independent test. Berdasarkan hasil yang diperoleh dapat disimpulkan bahwa pemberian masase olahraga dan penguluran otot dapat menurunkan kadar asam laktat dalam darah setelah pertandingan sepakbola babak 1 selama 45 menit. Berdasarkan temuan-temuan hasil penelitian pada perlakuan pertama dan kedua, maka diberikan saran diantaranya; (1) untuk pemain sepak bola setelah latihan atau pertandingan, sebaiknya diberikan masase olahraga dan penguluran otot untuk menjaga stamina pada babak selanjutnya, sehingga dapat maksimal dalam latihan maupun pertandingan; dan (2) pemain yang akan melakukan latihan maupun pertandingan sebaiknya melakukan perengangan atau pemanasan sebelum diterjunkan ke lapangan untuk menghindari cedera.

**Kata kunci:** Asam laktat, masase olahraga, peregangan otot

## INTRODUCTION

Football is a game played by both teams with 11 players vs. 11 players each, for 45 minutes in the first half and 45 minutes in the second half, a total of 90 minutes with a 15-minute rest period between halves. The energy system used in soccer games is anaerobic, anaerobic exercise is an exercise that is carried out with high intensity in a short time using energy from the anaerobic system, both from the ATP-PCr system and anaerobic glycolysis. The ability of anaerobic encourage maximum body motion until a certain time, so that the lungs are not able to supply O<sub>2</sub> to the muscles that need. In other words, the body movement - a movement without O<sub>2</sub> carried out in a short time (Sidik, et al, 2012: 126). Anaerobic glycolysis process will produce the final product in the form of lactic acid (Sudargo., et al, 2012: 11). Lactic acid is an indicator of fatigue where the body is no longer able to supply or provide energy for further activities.

The increased content of lactic acid in the blood and muscles will cause pain that can interfere with the training process and subsequent matches which are very detrimental to athletes. Increased lactic acid will cause a decrease in pH and a decrease in pH will cause enzyme work to be slow so that ATP formation will be slow too, this condition will cause fatigue which will eventually hinder achievement (Hartono, et al, 2012: 204).

Fatigue or *fatigue* is a condition in which muscles experience a decrease in contraction, because the oxygen supply in muscle cells decreases (Afriwadi and Rizki, 2008: 192). Fatigue is a decrease in muscle performance accompanied by a sensation of fatigue (Kusnanik, 2011: 71), Meanwhile, according to Wiltshire (2010: 107) that fatigue is the inability to maintain muscle power output and will return to normal after rest. Fatigue in sports occurs in athletes or athletes during training and competing because of the tight schedule of training and matches and lack of rest time for recovery (*recovery*). Fatigue is an internal problem experienced by athletes during training and during matches, this can prevent athletes from achieving the highest achievements. Therefore, it is necessary to perform optimal recovery to accelerate the metabolism of lactic acid to be recycled as energy again.

Stretching is a physical exercise that stretches a group of muscles to get elastic and comfortable which is usually done before and after exercise. There are four types of stretching according to Meva Nareza (2021), namely:

1. Static *stretching* (*static stretching*) is done by stretching the targeted muscle group until you feel the muscle tighten and hold it for 15-60 seconds and this stretch is suitable to be done after finishing the exercise.
2. Dynamic stretching (*dynamic stretching*) is the twist shoulders and arms to get wider coverage and repeated 10-12 times.
3. PNF (*proprioceptive neuromuscular facilitation*) is to start by stretching the muscles as usual then tighten and hold for 6-10 seconds and then relax, repeat again by increasing the range of each movement, this is to increase flexibility and range of motion of the body more maximally.
4. Ballistic stretching (*Balistic Stretching*) are bouncing and jerking movements to encourage muscle exceeded normal-range of motion to improve performance in jumping and kicking.

Benefits of Stretching for the body:

1. Increasing flexibility is if done regularly can increase flexibility in carrying out daily activities will feel comfortable and easy and can reduce the risk of difficulty moving due to aging.
2. Reducing stress is a muscle that is rarely moved, there will be stiffness or spasm, so it needs to be stretched regularly so that the tense muscle becomes more relaxed and the circulation becomes smooth so that it can reduce stress levels.
3. Improving posture is by stretching muscles can restore muscle tension that is not balanced because if left unchecked it will happen such as scoliosis.

4. Increasing blood flow to the muscles is if the blood flow to the muscles is getting smoother, the muscle recovery after sports training will be normal faster and will reduce muscle pain. In this study, the focus is on using *static stretching*.

Recovery is the return of homeostatic conditions to normal conditions (Firdaus, 2011:201). The mechanism of lactic acid recovery from muscle and blood is strongly influenced by the form of subsequent activity after maximal or anaerobic activity. This will affect the mechanism of lactate release from the muscles into the blood, increased blood flow, lactate uptake by the liver, heart and skeletal muscles (Hartono, et al, 2012: 204). Blood flow will speed up the metabolism in the body so that the supply of oxygen O<sub>2</sub> into the muscle will be more so that it will speed up the metabolism of lactic acid and lactic acid is converted into the energy returned by the liver through the Krebs cycle.

Recovery must be done quickly and appropriately to help athletes overcome fatigue, after the first round of matches is over, so that athletes do not feel tired and can play optimally in the second round of matches. Therefore, it is necessary to find a solution that can speed up the fatigue recovery time obtained in the first round, so that athletes are still able to perform to maximum performance. One method that needs to be done to overcome this problem is during a 15 minute break all players, namely 22 players are divided into 3 groups, group 1 is given exercise massage manipulation treatment, group 2 is given muscle stretching treatment, group 3 is given no treatment or passive rest.

Sports massage is a touching technique by tapping body parts to affect the nerves and muscles to relax so that they can work optimally according to their functions, with sports massage the blood circulation in muscles and organs becomes smooth and the spleen flow becomes regular (Roepajadi, 2015: 1 ). The purpose of people doing sports massage is to restore body fitness or restore the body's condition as usual or in a normal state (*homeostasis*).

Based on the explanation above, exercise performed with high intensity and tight schedule of matches can cause fatigue due to the accumulation of lactic acid in muscles and high blood pressure. This is an internal problem experienced by athletes in dealing with the fatigue they experience. Athletes must struggle to overcome fatigue with the lack of time to recover from the original (*recovery*). If this is not immediately addressed, it will have an impact on the athlete's achievement in achieving maximum performance. For this reason, it is necessary to find a method that can speed up recovery, so that it can help athletes fight fatigue, one of which is by manipulation of sports massage. Based on the description of the background above, general problems can be formulated, namely how the influence of sports massage and muscle stretching in reducing lactic acid levels in the blood after a 45-minute round 1 soccer match . The research objective to be achieved in this study was to determine the effect of exercise massage and muscle stretching in reducing lactic acid levels in the blood after a 45-minute round 1 soccer match .

Anaerobic exercise is a high-intensity exercise that requires energy quickly in a short time, but cannot be done continuously for a long duration. Anaerobic capability is the ability of the body where the maximum movement up time, such that the lungs are not able to enter the O<sub>2</sub> to the muscles - the muscles need oxygen. Anaerobic means working without using oxygen and this happens when the body's need for energy suddenly increases according to Purwanto (2004: 40) in Akbar (2013; 13). According to Sukadiyanto (2011: 61) in Akbar (2013; 13) anaerobic is an activity that does not require oxygen assistance. Anaerobic endurance is divided into two, namely: (a) lactate anaerobic endurance is a person's ability to cope with training loads with maximum intensity in a period of 10 seconds to 120 seconds; and (b) alactic anaerobic endurance is a person's ability to cope with a maximum intensity of exercise in a period of less than 10 seconds.

In the energy metabolism of the body's cells, a chemical reaction known as metabolism occurs, from this chemical reaction energy will be formed, the energy produced will be used for muscle performance (Afriwardi, 2010: 52). Energy metabolism is a chemical reaction process to synthesize ATP. According to Sukadiyanto (2005: 34) anaerobic metabolism is a series of

chemical reactions that do not require the presence of oxygen. A *adenosine tri phosphate* (ATP) is an energizing phosphate compound that stores energy for the body. ATP acts as an energy donor in various body cells by removing one of the phosphate groups (Sloane, 2003: 45 and 300). For that ATP must always be there for the muscles to use in contracting.

Anaerobic metabolism is the process of forming ATP to fuel muscle contraction without the help of oxygen. ATP in the anaerobic process will be obtained through two sources, namely through the ATP-PCr (phosphagen system) and the glycolysis system (lactic acid system). According to Irianto, et al. (2007: 7) in Akbar (2013: 14) anaerobic endurance is a process of producing energy in the absence of oxygen, this system is divided into two, namely:

1. Alactite anaerobic system: energy source is obtained from the breakdown of ATP and PCr available in the body without causing the formation of lactic acid. The process of energy formation is very fast, but is only able to provide very little for very short activities.
2. Lactite anaerobic energy system: source of energy is obtained through the breakdown of muscle glycogen via anaerobic glycolysis. This system in addition to producing energy also causes the formation of lactic acid. The energy formation process runs fast, can be used for short activities.

Activities carried out with an anaerobic energy system will stimulate the production of lactic acid, so that lactic acid increases both in the muscles and in the blood. Increased lactic acid will cause a decrease in pH and a decrease in pH will cause enzyme work to be slow so that ATP formation will be slow too, this condition will cause fatigue which will eventually hinder achievement (Hartono, et al, 2012: 203-204).

Lactic acid levels in the blood can be measured and expressed in units of millimoles per liter (mM/l). Healthy people at rest have lactate levels of 1-2 mM/l and according to practitioners the lactate threshold is at a level of 4 mM/mol with the belief that this level is close to the true limit (Jenssen, 1993:51-52). ). Exercise at high levels can increase lactate concentrations. An increase of between 6 mM/mol to 8 Mm/mol can have a negative effect on coordination, this situation has a detrimental effect in a match. According to Peter GJM Janssen (1993: 57), high lactate levels can be caused by a heavy workload, this can have detrimental effects, including:

- 1) High lactate concentrations cause metabolic acidosis in and around muscle cells.
- 2) High lactate levels impair coordination.
- 3) High lactate content increases the risk of injury.
- 4) The creatine phosphate system is compromised by high lactate levels.
- 5) Fat oxidation at high lactate levels stagnates

According to Danardono (2013), a feeling of tension or tiredness in the body is an indication of the accumulation of lactic acid or milk acid in the muscles. This lactic acid arises in the burning process in active muscles. In this state, apart from producing energy, combustion residues are also obtained, namely in the form of lactic acid. The longer the activity is carried out, the less energy is produced, while the rest of the combustion in the form of lactic acid actually accumulates. Lactic acid buildup is what causes fatigue or tiredness. Physically, the muscles will feel stiffer and harder. If held does not feel elastic and does not relax. Muscles that do not relax will interfere with the body's organs, for example, veins or arteries.

The accumulation of lactic acid can cause fatigue in the muscle contraction mechanism . Lactic acid is an indicator of fatigue where the body is no longer able to supply or provide energy for further activities. The increased content of lactic acid in the blood and muscles will cause pain that can interfere with the next training process and the next match which is very detrimental to athletes.

Recovery is the process of returning to physical condition as before physical activity (exercise and competition). The essence of recovery is the return of homeostatic conditions to normal conditions (Firdaus, 2011:201). With this it can be interpreted that the recovery of lactic acid is a process of returning the conditions of acidity (lactic acid) that are too high in the muscles and blood to normal conditions. The recovery process (*recovery*) after exercise is very important

and it is advisable to reduce fatigue and exercise-induced imbalance of body functions according to Castro, *at el* (2011) in Ilmi (2014). The mechanism of lactic acid recovery from muscle and blood is strongly influenced by the form of subsequent activity after anaerobic exercise or maximal activity. This will affect the mechanism of lactate release from the muscles into the blood, increased blood flow, lactate uptake by the liver, heart and skeletal muscles (Hartono., et al, 2012: 204). Blood flow will speed up the metabolism in the body so that the supply of oxygen O<sub>2</sub> into the muscle will be more so that it will speed up the metabolism of lactate and lactate will be converted into energy returned by the liver through *the Krebs Cycle*.

Sports massage is a type of massage used by athletes in an effort to maintain physical fitness, reduce the risk of injury, as a recovery from fatigue after training or competition and as post-injury rehabilitation. According to Graha and Priyonoadi (2012) Sports massage is a type of massage that has been adopted for the needs of athletes and consists of two categories, namely maintenance (as part of the training rules) and competition (before the competition or after the competition). Sports massage is also used to promote healing from injuries. According to Roepajadi (2015: 23) sports massage is an act with the hands (manipulation) on the soft parts of the body with manual or mechanical procedures that have an influence in eliminating the remnants of burning in the muscles, for example lactic acid or milk acid.

This sports massage is given after a period of competition with the aim of relaxing the muscles and joints that have been working hard. Each type of exercise massage manipulation has a certain effect according to the treatment technique and the expected goals. According to Hadi Basoeki (2009: 15-16) in Roepajadi (2015: 09) in terms of the purpose of sports massage is divided into 3 parts, namely: 1) *preparative* is a sports massage that aims to prepare athletes to have good body condition so that they can face and overcome tensions that arise. occurs in a match, 2) *preventive* is sports massage that aims to maintain and restore the function of the locomotor (recovered from origin) so that it can function properly, 3) *curative* is the purpose of sports massage to improve body condition after doing physical activity to accelerate the loss of substances that cause fatigue in the body so that pain in the muscles can be reduced.

## METHODS

This research uses a quasi-experimental type of research. "Experimental research is research that seeks to find the effect of certain variables on other variables with the aim of knowing the cause and effect between the two variables" (Sujarweni, 2014: 8-9).

The meaning of experimental research is "research conducted strictly to determine the causal relationship between variables. One of the main characteristics of experimental research is the treatment or (*treatment*) imposed on the subject or object of research" (Maksum, 2009:48). In this experimental study, the "*One Group Pretest-Posttest Design*" design is used where this design can distinguish the end caused by the manipulation of exercise massage and muscle stretching.

$$O1 \quad T_{1.1} \quad X \quad T_{1.2}$$

Chart 1. *One Group Pretest-Posttest Design*

Description:

O1 = Group one

T<sub>1.1</sub> = Pretest

T<sub>1.2</sub> = Posttest

X = Treatment

The population in this study, namely the population in this study were all football players in one team, namely 22 players from the Surabaya partner club. The data collection method used in

this study is the measurement of blood lactic acid levels. The instrument used in this study was a blood lactic acid test using a blood lactic acid level measuring device. The data obtained will be analyzed using inferential statistics, namely the independent T test.

## RESULT AND DISCUSSION

In accordance with the type of research conducted by researchers, namely quasi-experimental. In this experimental study, the " *One Group Pretest-Posttest Design* " design is used where this design can distinguish the end caused by the treatment carried out by researchers in the form of manipulation of exercise massage and muscle stretching. The data for the football players used in this study can be seen in the following table:

**Table 1. Research subject data**

NO	FULL NAME OF PLAYER (APPROPRIATE IDENTITY CARD)	NPG	BIRTHDATE	CLUB CERTIFICATE (PLAYER LOAN)	STATUS AMATEUR NON Amateur
1	Achmad Kayyis zalikul Hammud	01	Surabaya 05/03/2007	Surabaya Partner	AMATEUR
2	Mohamad Nurudin	02	Nganjuk 10/10/2007	Surabaya Partner	AMATEUR
3	Mohammad Ridho Awaludin	03	Gresik 06/03/2007	Surabaya Partner	AMATEUR
4	Satryo Galang Budiarto	04	Sidoarjo 21/05/2007	Surabaya Partner	AMATEUR
5	Abi Artha Wijaya	05	Surabaya 16/08/2007	Surabaya Partner	AMATEUR
6	Rafael Banu Septiansyah	06	Surabaya 20/09/2007	Surabaya Partner	AMATEUR
7	Rokhmanda Farel Afrizal	07	Surabaya 20/02/2007	Surabaya Partner	AMATEUR
8	M Fauzi Dwi Riza	08	Gresik 14/03/2007	Surabaya Partner	AMATEUR
9	Samuel Dwell Theoreva Simanungkalit	09	Surabaya 2/02/2007	Surabaya Partner	AMATEUR
10	Fahrel Nova Rahmadani	10	Surabaya 29/09/2007	Surabaya Partner	AMATEUR
11	Mohammad Thoriq Arifyansyah	12	Surabaya 03/02/2007	Surabaya Partner	AMATEUR
12	Qamara Fathoni Cahyo Putro	13	Surabaya 14/12/2007	Surabaya Partner	AMATEUR
13	Levi Fischa Romansyah	14	Surabaya 28/01/2007	Surabaya Partner	AMATEUR
14	ALi Qabidh Ariq Destyawan	15	Bojonegoro 24/12/2007	Surabaya Partner	AMATEUR
15	Nishfu Chandra Alfathan	17	Surabaya 06/09/2007	Surabaya Partner	AMATEUR
16	Andhika Candra Saputra	18	Gresik 12/05/2007	Surabaya Partner	AMATEUR

NO	FULL NAME OF PLAYER (APPROPRIATE IDENTITY CARD)	NPG	BIRTHDATE	CLUB CERTIFICATE (PLAYER LOAN)	STATUS AMATEUR NON Amateur
17	Fadhillah Pamungkas	Abdi	19	Surabaya 28/07/2007	Surabaya Partner AMATEUR
18	Fadhil Abi Maulana		20	Surabaya 13/11/2007	Surabaya Partner AMATEUR
19	Marcell Everest	Jordannio	21	Surabaya 21/03/2007	Surabaya Partner AMATEUR
20	Alfonda Shevariano		23	Sidoarjo 07/04/2007	Surabaya Partner AMATEUR
21	M Daffa Artiansyah		24	Gresik 04/08/2007	Surabaya Partner AMATEUR
22	Moch Naufal Ariyanto	Putra	25	11/11/2007	Surabaya Partner AMATEUR

Description: NPG = Player's Back Number

For research subject data, according to table 1, it can be seen that soccer players have similarities in age levels, which are generally born in 2007, the similarity of the player's club and the status carried by soccer players, namely as amateur players. Furthermore, after the researchers got the research subject data to find out sports massage and muscle stretching, the researchers coordinated with the trainer to agree on the time of data collection in the field.

In accordance with the agreement of the researcher and the coach of the Surabaya partner club in collecting data in the field, the researchers carried out a pulse pretest (DNI) before carrying out activities in a soccer game. After completing the pre-test measurement, the players will carry out soccer game training activities in 2 stages, namely stage I, training for 25 minutes (DNL 1) and training for 45 minutes (DNL 2) and measuring lactic acid content. The next step, the researchers conducted a post test on the players through 2 stages to obtain valid data for the research data studied by the researchers, namely after a 5 minute break (DNR 1) and after a 10 minute break (DNR 2). The results of the pre-test, treatment and post-test measurements can be seen in table 2.

**Table 2. The results of the pre-test, treatment and post-test measurements of research subjects**

NO	FULL NAME OF PLAYER (APPROPRIATE IDENTITY CARD)	NPG	BIRTHDATE	CLUB CERTIFICATE (PLAYER LOAN)	DNI	DNL1	DNL2	DNR1	DNR2
1	Achmad Kayyis zalikul Hammud	01	Surabaya 05/03/2007	Surabaya Partner	94-82	94-142	94-171	94-153	94-140
2	Mohamad Nurudin	02	Nganjuk 10/10/2007	Surabaya Partner	95-75	94-119	93-199	95-132	95-76
3	Mohammad Ridho Awaludin	03	Gresik 06/03/2007	Surabaya Partner	93-73	93-129	93-173	94-137	94-100
4	Satryo Galang Budiarmo	04	Sidoarjo 21/05/2007	Surabaya Partner	78-72	79-126	79-176	78-137	79-96

NO	FULL NAME OF PLAYER (APPROPRIATE IDENTITY CARD)	NPG	BIRTHDATE	CLUB CERTIFICATE (PLAYER LOAN)	DNI	DNL1	DNL2	DNR1	DNR2
5	Abi Artha Wijaya	05	Surabaya 16/08/2007	Surabaya Partner	88-74	89-168	90-189	89-125	89-75
6	Rafael Banu Septiansyah	06	Surabaya 20/09/2007	Surabaya Partner	85-64	94-160	95-187	96-123	96-65
7	Rokhmanda Farel Afrizal	07	Surabaya 20/02/2007	Surabaya Partner	97-100	98-150	90-175	95-140	96-105
8	M Fauzi Dwi Riza	08	Gresik 14/03/2007	Surabaya Partner	96-85	96-146	95-170	96-152	96-120
9	Samuel Dwell Theoreva Simanungkalit	09	Surabaya 2/02/2007	Surabaya Partner	95-88	95-113	94-158	93-107	95-92
10	Fahrel Nova Rahmadani	10	Surabaya 29/09/2007	Surabaya Partner	97-99	98-150	90-175	95-140	95-103
11	Mohammad Thoriq Arifyansyah	12	Surabaya 03/02/2007	Surabaya Partner	95-96	96-150	91-169	96-138	96-98
12	Qamara Fathoni Cahyo Putro	13	Surabaya 14/12/2007	Surabaya Partner	96-109	96-143	92-185	97-143	97-102
13	Levi Fischa Romansyah	14	Surabaya 28/01/2007	Surabaya Partner	98-121	97-146	98-178	99-151	99-125
14	ALi Qabidh Ariq Destyawan	15	Bojonegoro 24/12/2007	Surabaya Partner	95-85	95-135	94-182	96-137	96-92
15	Nishfu Chandra Alfathan	17	Surabaya 06/09/2007	Surabaya Partner	96-94	96-152	97-186	96-154	96-115
16	Andhika Candra Saputra	18	Gresik 12/05/2007	Surabaya Partner	95-86	96-163	96-184	95-160	95-103
17	Fadhillah Abdi Pamungkas	19	Surabaya 28/07/2007	Surabaya Partner	96-88	96-158	95-186	96-160	96-96
18	Fadhil Abi Maulana	20	Surabaya 13/11/2007	Surabaya Partner	95-83	95-161	94-187	95-158	95-94
19	Marcell Jordannio Everest	21	Surabaya 21/03/2007	Surabaya Partner	95-100	93-120	91-161	93-107	94-95
20	Alfonda Shevariano	23	Sidoarjo 07/04/2007	Surabaya Partner	97-70	97-139	96-177	97-150	97-85
21	M Daffa Artiansyah	24	Gresik 04/08/2007	Surabaya Partner	95-82	95-135	95-174	94-146	95-98
22	Moch Naufal Putra Ariyanto	25	11/11/2007	Surabaya Partner	96-91	95-106	88-165	96-132	96-97



Description: NPG = Player's Back Number

## Discussion

In accordance with the results obtained by researchers in the field in collaboration with the Surabaya partner club, the researchers then conducted an analysis and discussion to determine the effect of sports massage and muscle stretching on soccer players before, during and after training. For data analysis, the researcher used the T test so that it could be seen the significant impact of the treatment given by the researcher on the research subject. For data analysis before players perform training activities, the results are obtained according to table 3 below.

**Table 3. Sports messaging research data Peretest (DNI)**

Maximum Value	9.8
Minimum Value	7.8
Middle value	9.5
Average pre	9.4
Standard Deviation (SD)	0.45

Based on the results of the calculations in table 3 that have been carried out, it can be seen that the average lactic acid level in the players' blood before doing joint exercises was 9.4 mM/l, with a standard deviation of 0.45. The lowest value is 7.8 and the highest value is 9.8 mM/l. This data is used as an initial reference to determine the effect of the treatment given later to players in the form of sports massage and muscle stretching.

This is due to the fatigue experienced by the players. Fatigue is a condition in which the muscles experience a decrease in contraction, because the oxygen supply in the muscle cells is reduced (Afriwadi and Rizki, 2008: 192). Fatigue is a decrease in muscle performance accompanied by a sensation of fatigue (Kusnanik, 2011: 71), Meanwhile, according to Wiltshire (2010: 107) that fatigue is the inability to maintain muscle power output and will return to normal after rest. Fatigue in sports occurs in athletes or athletes during training and competing because of the tight schedule of training and matches and lack of rest time for recovery ( recovery) . Fatigue is an internal problem experienced by athletes during training and during matches, this can prevent athletes from achieving the highest achievement. Therefore, optimal recovery is needed to accelerate the metabolism of lactic acid so that it can be recycled as energy again. After that the players were asked to exercise for 10 minutes and then measured again for the lactic acid content by the researchers, the results obtained can be seen in table 4.

**Table 4. Results of the first post test (DNR 1)**

Maximum Value	9.4
Minimum Value	9
Middle value	9.2
Post average	9.3
Standard Deviation (SD)	0.12

Based on the results of the calculations that have been carried out, the results are shown in table 4 above. Based on table 4, it can be seen that the average level of lactic acid in the blood after receiving treatment is 9.3 mM/l, with a standard deviation of 0.12. The lowest value is 9 and the highest value is 9.4 mM/l. After the measurement from the first treatment, the players continued to practice for 45 minutes and were re-measured regarding the players' lactic acid

content. This is in line with the opinion of Firdaus (2011: 201) which states that recovery is the return of homeostatic conditions to normal conditions. The mechanism of lactic acid recovery from muscle and blood is strongly influenced by the form of subsequent activity after maximal or anaerobic activity. This will affect the mechanism of lactate release from muscles into the blood, increased blood flow, lactate uptake by the liver, heart and skeletal muscles (Hartono, et al, 2012: 204). Blood flow will accelerate metabolism in the body so that the supply of oxygen O<sub>2</sub> into the muscles will be more so that it will accelerate the metabolism of lactic acid and lactic acid is converted into energy which is returned by the liver through the Krebs cycle.

Recovery must be carried out quickly and appropriately to help athletes overcome fatigue, after the first round of matches is over, so that athletes do not feel tired and can play optimally in the second round match. Therefore, it is necessary to find a solution that can speed up the recovery time of fatigue obtained in the first round, so that athletes are still able to perform optimally. One way that needs to be done to overcome this problem is during a 15 minute break all players, namely 22 players are divided into 3 groups, group 1 is given manipulation treatment with massage exercises, group 2 is given muscle stretching treatment, group 3 is given manipulation treatment. no treatment or passive rest.

Measurements after the second treatment, where players exercise 45 minutes DNR 2). Players after 45 minutes of exercise were given a 10 minute rest and then the researchers measured the lactic acid content. Before the measurement the players were given sports massage and muscle stretching after being given treatment, both the first treatment and the second treatment. For the data from the measurement analysis on the post test according to the results obtained, it can be presented in table 5.

**Table 5. Results of the second post test (DNR 2)**

Maximum Value	9
Minimum Value	8
Middle value	8.25
Post average	8.3
Standard Deviation (SD)	0.31

According to table 5, we can see that the average lactic acid level in the blood of players after receiving treatment, namely training for 45 minutes, obtained a result of 8.3 mM/l with a standard deviation of 0.31. The lowest value is 8 and the highest value is 9 mM/l. To determine the effect of exercise massage and muscle stretching on lactic acid content, the researchers conducted an independent T test. For the results obtained by researchers related to the T test, it can be seen in the table 6.

**Table 6. T test results independent test**

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
NAMA_RESPONDEN	Equal variances assumed	13.195	.001	2.083	42	.043	13.13636	6.30780	.40670	25.86602
	Equal variances not assumed			2.083	22.041	.049	13.13636	6.30780	.05620	26.21653

In the T test results, the column with sig 2 tailed shows a p value < 0.05 which means that there is a difference in the decrease in lactic acid. The provision of muscle massage and muscle stretching has an effect on decreasing lactic acid in soccer players, this is reinforced by the results of research by Roepajadi (2015: 08) which states that massage given after a tiring exercise significantly improves the appearance of the quadriceps muscle compared to passive rest. This shows an increase in muscle performance, with the provision of sports massage and muscle stretching can accelerate the recovery process and reduce hand muscle fatigue after exercise (Sitepu, 2007); (Prastyo, 2008); (Purnomo, 2013).

## CONCLUSION AND SUGGESTIONS

Based on the results obtained, it can be concluded that the provision of sports massage and muscle stretching can reduce levels of lactic acid in the blood after the first half of the soccer match for 45 minutes. Based on the research findings in the first and second treatments, some suggestions are given below.

1. For soccer players after training or matches, it is better to give sports massages and muscle stretching to maintain stamina in the next round, so that they can be maximized in training and matches.
2. Players who will be doing training or matches should stretch or warm up before being deployed to the field to avoid injury.
3. To maintain the stamina of the players before the match the players are tested for lactic acid levels in the blood so that it can be seen how long the player can be deployed in the field during the match.

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