

The Effect of Sport Massage and Thai Massage to Lactic acid and Pulse Decreased

Yuni Fitriyah Ningsih¹, Fitria Kurniasih², Dyah Ayu Puspitaningrum³, Kendid Mahmudi⁴, Arik Aguk Wardoyo⁵

Primary Teacher Education - FKIP UNEJ
Email: kendidmahmudi.fkip@unej.ac.id

Abstract— Sport massage has the purpose of fostering physical conditions, and avoids things that can harm and alleviate suffering as minimize as possible due to sports injuries (Sulistiyorini, dkk 2013:12). Sport massage has the effect of relieving stress, improving tissue elasticity, and eliminating the buildup of lactic acid. In the general population of Indonesia, Sport massage is considered as the most powerful means for stimulating the decrease of lactic acid inside the muscle. Sport massage with Swedish techniques has major applications in the form of Eflleurage, Petrissage, Vibration, Tapotement, Friction, Shaking in accordance with anatomical of the athlete's body. The type of research used in this study is quantitative research with experimental method that is quasi experiment. Experimental method is a way to express the relationship between two or more variables to understand the influence of a variable on other variables. Based on these methods, the design research used nonequivalent control group design. In the design of this study, the experimental group and the control group were not chosen randomly, thus the subject division in this study using ordinal pairing technique. So from the design can be known correctly the difference from the treatment result given. Author is using E-Views 5 software to test the correlation between the dependent variable and the independent variable. In lowering the levels of lactic acid and pulse after exercise activities need to be considered. It is expected that trainers and implementers of sports activities can make Sport and Thai Massage as a reference in an effort to reduce lactic acid levels and pulse after doing heavy physical activity.

Keywords— Sport Massage, Thai Massage, Lactic Acid, Pulse.

I. INTRODUCTION

Everyone needs exercise to maintain physical fitness and keep their body healthy in addition to consuming healthy food and adequate rest. Exercise is important for the human body either from students, adolescents, adults to the elderly at least once a week they do sports both at school, home, gym and company where they work. Please

note the ability and intensity before doing the exercise, do not force the movement that could be fatal for our bodies. People who are rarely doing exercise sometimes force the movement without stretching at the beginning of the exercise so the possibilities of sports injury can occur. Instead of being healthy and fit they gained the other way around. However, sport injury can be prevented by taking these things into consideration: (1) stretching, if stretching is done carelessly then our body has not been able to work hard so the risk of injury is very high. (2) cooling down, after doing physical activity it is recommended to cool down for 5-10 minutes to decrease the pulse.

Sports not only functioned as a physical activity, but also as an industry that can provide job vacancies. In Indonesia, the types of sports are adjusted to its functions and roles. The types of sports are: (1) Education sports, is an educational sport that we are very familiar with the term "Pendidikan Jasmani", (2) Recreation sports, is a sports to achieve the objectives of its nature on recreation, (3) Health sports, is a sports that have a function for health, (4) Dissability sport, is a sport that is provided for people with special needs, (5) Healing sports, is a sport that function ad a therapy or rehabilitation of injury to the sport, and (6) Achievement sports (competition), is a sport that aim to get the highest level of achievement.

Exercise involves the whole organs of the human body and one of them is muscle. Muscles are very influential in performance at the time of exercise. Muscle fatigue will be felt when doing very heavy exercise. However muscle fatigue has varies degrees. Another definition of fatigue is the inability to maintain muscle power output. Fatigue can be restored with rest or doing treatment in the form of active and passive stretching, massage, as well as the latest trend among athletes such as cupping/cup. Muscle fatigue occurs after a strong and long muscle contraction in which the muscle is unable to contract in a certain period of time. Muscle fatigue can occur due to accumulation of lactic acid in the muscle contained in blood plasma. Besides being produced in muscle, lactic

acid is also produced in other organs including heart muscle, liver and other body tissues.

Wiltshire, et.al (2010: 107) concluded that the effect of massage decreased 25% lactic acid levels after 10 minutes of recovery. So it is expected from the treatment provided through this massage can reduce lactic acid levels in the athlete's body so that athletes can recover after doing the exercise with anaerobic dominant energy system. Sport and Thai massage done for passive recovery. Sport massage is expected to improve blood circulation as to accelerate the decrease of lactic acid. Giving sport massage has the purpose of fostering physical conditions, and avoids things that can harm and alleviate suffering as little as possible due to muscle fatigue. Thai Yoga Massage or Thai Yoga therapy commonly known as Thai Massage is one type of therapy that uses movement manipulation originating from the country of Thailand. In western medicine, Thai massage is much influenced by the treatment of China, India and ancient Thailand.

According to Sutaji (in Sulistyorini, 2013: 35) the influence of sports massage on the physiology that affects all the network without exception although located deeper within the body, such as skin, muscles, peripheral nerves, central nervous, as well as circulation and also blood circulation and lymph, can further effect on cardiac activity, help food assimilation and influence on metabolism extensively. Sport massage has the effect of relieving stress, improving tissue elasticity, and eliminating the buildup of lactic acid. In the general population in Indonesia, sport massage is considered the most powerful in stimulating the decrease of lactic acid in muscle

Sport Massage is a complex of motion manipulation on its application by hand on the athlete/sportsman's body or all healthy persons in a passive state, with the aim of fostering physical conditions, and avoiding the things that can harm and alleviate suffering as little as possible due to physical activity and sports injuries. Unlike sports massage that uses oil, this Thai massage does not have to undress and use oil. With the Thai massage movement is expected to flow energy structured from the patient's body as to make the patient back to recover and make the whole organs become healthy.

Based on preliminary observations conducted at the Faculty of Health and Sports PGRI University Banyuwangi to reduce lactic acid levels and decrease the pulse rate the researchers want to give sport massage and Thai massage as a treatment. Before performing a running activity, a lactate test on blood with a blood sample is taken to find out the patient's initial test. After exercise, treatment of Sport and Thai massage massage is given on the most dominant body parts used at the time of athletes

do the exercises. The exercise is a running exercise with the intensity of a submaximal exercise.

In previous research there was similar research on sports massage and jogging against athletic recovery. From the above problems concluded that authors want to do research influence of Sport and Thai massage massage to the decrease of lactic acid and pulse on the students of the Physical Education Health and Recreation year 2015 Faculty of Sports Health PGRI University Banyuwangi.

II. LITERATURE REVIEW

The amount of energy spent on different activities will vary according to the intensity and type of exercise. During exercise the body needs energy and physiological adjustment. The speed of energy production must be increased, and the metabolic product must be overcome. The internal environment inside a human body is very influential on changes in the state of the human body. The high activity performed during exercise will complicate our body to maintain homeostasis. During physical activity or exercise not only the nervous system that works but also other systems that affect the body's cells such as the endocrine system in charge of regulating metabolism in the athlete's body through hormones.

According to Kusnanik, Dkk (2011: 14) the adenosine triphosphate molecule (ATP) consists of adenosine with an inorganic three phosphate group (Pi). Adenosine is a combination of adenine molecules and ribose molecules. Adenine is a group containing nitrogen and ribose is a five-carbon group (including the type of sugar). When the ATP molecule reacts with water (hydrolysed) with the ATP-ase enzyme, the latter group phosphate is released, and releases a large free energy (about 7.3 kcal / molecule ATP, under standard conditions but can reach 10 kcal or more / ATP molecules). This turns ATP into ADP (adenosine diphosphate) and Pi.

The provision of energy in muscle can be done through three energy supply systems. The system of energy supply in the muscle depends on the type of physical activity performed. The three systems of energy supply are: (1) ATP-PC system (phosphagen system); (2) lactic acid system (lactic acid system / glycolysis anaerobic); and (3) aerobic system (oxygen system / aerobic glycolysis). Meanwhile, Badriah (2009: 60) states that the energy supply system that there are three kinds of outline that is anaerobic pre-dominant energy system, aerobic pre-dominant energy system, and a combination of both.

According to Kusnanik, et al (2011: 66) At rest, normal people consume oxygen about 0.3 L / men, when the diet is mixed then RER = 0.8 or 4.8 kcal / 1 O₂ then this individual expenditure energy = L O₂ consumed 1 day x 4.8 Kcal / l. This value is in accordance with the energy

expenditure of a person weighing 70 kg (154 lbs). Basal metabolic rate (BMR) is the speed of energy use for a person during supine rest, measured directly after at least 8 hours of sleep and at least 12 hours of fasting. The value of BMR shows the minimum amount of energy needed to live.

Factors that affect BMR include:

1. Age, BMR decreases with age.
2. Body temperature, BMR increases with increasing body temperature.
3. Psychological stress, BMR is increasing with increasing stress.
4. Hormone, thyroxin, adrenaline increase BMR.

Many researchers use RMR (resting metabolic rate), where subjects do not need long sleep.

According to Kusnanik, et al (2011: 67, metabolism increases proportionally in accordance with the increased intensity of exercise. Subjects who performed ergocycle for 5 minutes with loads of 50 W, 100 W, 150 W, 200 W, and 250 W, were examined by Astrand in 1986 (in Wilmore et al., 2008). But there seems to be a revision with respect to loads that have crossed the anaerobic threshold, needing extra metabolism to reach steady state or stability. Oxygen consumption continues to rise beyond the so-called slow component of oxygen Kinetic.

As a living creature the body always needs energy to run their activities, activities that require energy referred to as work. Work can be viewed as creation or work sports. Fulfillment of energy during physical activity is obtained through metabolic processes. Metabolism is a series of various chemical reactions that occur in the body, or changes that involve all chemical transformations and energy that occurs in the body (Sukadiyanto & Muluk, 2011: 37).

2.1 Muscle Fatigue

According Kusnanik, Dkk (2011: 71) Fatigue is reduced muscle performance coupled with the sensation of fatigue. Another definition of fatigue is the inability to maintain muscle power output. Fatigue can be restored with rest. In the Wiltshire study, et.al (2010: 107) concluded that the effect of massage decreased 25% lactic acid levels after 10 minutes of recovery.

Fatigue is a complex phenomenon; the cause can be caused by:

1. There is a problem with the provision of energy; ATP_PC, anaerobic glycolysis,
2. Accumulation of product yields such as H⁺, lactic acid
3. Muscle mechanic failure to perform contractions

2.2 Sport Massage

Sport massage is a massage, effleurage and so on certain parts by hand or special tools to smoothen out blood circulation as a way of treatment or to relieve fatigue. Karfawi (2001: 20) massage in general can be divided

into four namely Therapiutis Massage, Beauty Massage, Hygiene Massage, and Sport Massage. The focus on this research is Sport massage and Thai massage.

Sports Massage is provided to achieve preparative, preventive, and curative goals. The purpose of preparative is to prepare the physical condition of the athlete before performing motion activity so that the muscles used before doing the physical activity relax and reduce muscle tension; preventive purposes is the goal for prevention by maintaining and restoring the function of the motion device (recovered origin) and can function well as well as the curative purpose of improving the physical condition of the athlete after doing sports activities. Of course at the time of physical activity the athlete will experience some problems on certain body parts.

2.3 Thai Massage

Thai massage uses several techniques of manipulation: leaning pressure, reflexology, energy line work, blood stopping, stretching, and yoga. To maximize the movement and manipulation, the therapist uses some of their limbs to accommodate the massage manipulation as follows: palms, thumbs, legs, elbows, forearms, and knees. In Thai massage, therapy is performed on a floor mattress. Manipulation is done in 5 positions of the patient body: 1. Supine; 2. Side lying (lying on one side of the body); 3. Prone; 4. Inverted; 5. Seated.

An Ayurvedic doctor named Jivaka Kumar Bhacca finds a Thai massage that includes a phaen Thai or a phaen boran. Traditional Thai massage is known by several different names: Ancient Massage, Passive Yoga, and Yoga Massage Therapy and the last name is more descriptive and illustrate the real is a traditional Thai massage. According to Gall, Simon (2008: 17) services offered by Thai massage are divided into three main areas, namely:

1. Medicines, including herbal remedies and traditional medicines.
2. Massage (Nuad), including Thai Foot Massage, Thai traditional massage, self-employed herbal compress or in massage, and herbal steam bath.
3. Meditation (dhamma namai), which includes Buddhist rituals and meditation such as those living in the "middle way" of Buddhism to avoid excessive joy or under control.

III. METHODOLOGY

The type of research used in this study is quantitative research with experimental method that is quasi experiment. Experimental method is a way to express the relationship between two or more variables to understand the influence of a variable on other variables. Based on these methods, the design research used nonequivalent control group design. In the design of this study, the

experimental group and the control group were not chosen randomly, thus the subject division in this study using ordinal pairing technique. So from the design can be known correctly the difference from the treatment result given.

The study design is described as follows:

Table.3.1: Nonivalent Control Group Design

Group	Pretest 1	Sprint	Pretest 2	Treatment	Posttest
Experiment 1	T11	O1	T12	X1	T13
Experiment 2	T21	O1	T22	X2	T23
Experiment 3	T31	O1	T32	-	T33

(Sugiyono, 2011:116)

Description:

- T11 : Group 1 pretest before exercise
 T12 : Group 1 pretest after exercise
 T13 : Group 1 posttest
 T21 : Group 2 pretest before exercise
 T22 : Group 2 pretest after exercise
 T23 : Group 2 posttest
 T31 : Group 3 pretest before exercise
 T32 : Group 3 pretest after exercise
 T33 : Group 3 posttest
 O1 : Sprint with the intensity of submaximal exercise
 X1 : Sport Massage Treatment
 X2 : Thai Massage Treatment

3.1 Research Variable

Variables are the object of research, or the point of attention in a study. In this study there are two variables underlying this research which are two independent variables and dependent variable.

3.2 Independent Variable

Independent variable is a variable that are suspected as the cause of the emergence of dependent variables. Independent variables are the variables that influence or the cause of the change or the emergence of dependent variable (bound). Independent variables in this study, is Sport massage and Thai massage.

3.3 Dependent Variable

Dependent variable is the response or output variable. The dependent variable is also a variable that is influenced or which becomes a result, because of the independent variables. The dependent variables in this study are blood lactic acid and pulse rate.

IV. RESULT AND DISCUSSION

Sport is closely related to the energy system. The bond is how the energy system is formed when doing sports activities. Sources and literaries on energy sources

suggest that the adenosine triphosphate (ATP) molecule comprising adenosine with an inorganic three-phosphate group (Pi) is the primary source of energy. There is a possibility during sports activities we will also experience fatigue.

According to Setiadi (2007: 252) muscle fatigue occurs due to the imbalance of energy requirements (ATP) for muscle (contraction) activity with the supply of O₂ and glucose by the bloodstream for the aerobic glycolysis process in the mitochondria of muscle cells. The muscle is forced to use anaerobic glycolysis to meet the demands of its activity and lactate acid is left out which is toxic to the muscles causing fatigue. Fatigue is not the only factor; it is the pulse that is also part of the sport activity.

Pulse, in other word, heartbeat, is the pulsation of the arteries of the blood waves that flow through the blood vessels as a result of the pulsation of the heart. According to Sukadianto and Muluk (2011: 26) for people in general who are trained tends to have less heartbeat. It can be interpreted that if someone who is highly trained is able to restore the heartbeat back to original after doing heavy physical activity.

Based on the result, researchers are looking for methods or ways to restore lactic acid levels and pulse after doing a strenuous exercise activity. From various literatures, researchers decided to take the method of Sport and Thai massage which then made a research to determine the impact of Sport and Thai massage therapy against decreased levels of lactic acid and pulse. Here are the results.

4.1 Effect of Sport Massage against Decreased Lactic Acid Level and Pulse Rate.

From the results of research conducted, there is a significant influence of sports massage on the decrease of lactic acid and pulse rate. The results showed that after doing heavy physical activity, subjects in this study felt comfortable when given the treatment of Sport massage. Tense muscles during physical activity can relax again. Thus relaxed muscles also affect the lactic acid and pulse rate. These results are in line with Wiltshire's theory, et.all (2010: 107) which says that the effect of massage decreases 25% lactic acid levels after 10 minutes of recovery.

Sport massage is a massage, effleurage and so on certain parts by hand or special tools to smoothen out blood circulation as a way of treatment or to relieve fatigue. Sport massage is a massage, effleurage and so on certain parts by hand or special tools to smoothen out blood circulation as a way of treatment or to relieve fatigue. Karfawi (2001: 20) massage in general can be divided into four namely Therapiutis Massage, Beauty Massage, Hygiene Massage, and Sport Massage. The focus on this research is Sport massage and Thai massage. Sport

Massage is provided to achieve preparative, preventive, and curative goals.

The pulse is closely related to the blood vessels. According to Setiadi (2007: 178) Blood vessels are the road infrastructure for blood flow. So it is possible that the influence of Sport massage can also lower the pulse. A decrease in pulse rate may also be due to a relaxed factor in muscle after exercise. Normal heart rate ranges from 60-100 bpm, but the heart rate of trained athletes tends to be lower that is less than 60 bpm.

Researchers observed while sport massage given on the subject, the subject felt a sense of relaxation in the muscle, even the subject were sleepy when given sport massage. Comfort factor that also affect the decrease in lactic acid and pulse rate.

According to Sutaji (in Sulistyorini, 2013: 35) the influence of sports massage on the physiology that affects all the network without exception although located deeper within the body, such as skin, muscles, peripheral nerves, central nervous, as well as circulation and also blood circulation and lymph, can further effect on cardiac activity, assist in assimilation of food and the effect on metabolism extensively. Sport massage has the effect of relieving stress, improving tissue elasticity, and eliminating the buildup of lactic acid. In the general population in Indonesia, sport massage is considered the most powerful in stimulating the decrease in lactic acid in muscle.

Another supporting reason is the effect of Sport massage is able to give stimulation to the nerves and increase muscle activity, blood vessels and glands are regulated muscles. So when given the treatment of Sport massage after strenuous activity then tense muscles will feel relaxed and can stretch the muscles and soft tissues in the body, thereby reducing muscle tension and cramps. Other effects can also be felt on the skeletal system is stronger. Improved circulation of blood and lymph muscle will produce better circulation in the associated bones.

4.2 The Effect of Thai Massage Therapy on Decreasing Lactic Acid Levels and Pulse Rate.

Thai massage is not like in traditional massage in general. This type of massage in Thailand concentrates more on nerve point emphasis and muscle stretching using a Thai-style yoga movement that not only uses the hands, but knees, elbows and foot massagers also participate to get enough emphasis to be able to smooth the bloodstream on the body. Current blood flow will affect the reduction of lactic acid levels in the body that can cause fatigue. In addition to reduced levels of lactic acid, the smooth flow of blood can also launch the body's metabolism, one of which is decreased lactic acid levels and pulse which is one of the chain reactions of the cause of fatigue. So Thai massage can reduced the levels of lactic acid and pulse.

From the results of research conducted, there is a significant effect of Thai Massage on the decrease of lactic acid and pulse rate. From normality test result that is decrease lactic acid 0,58 and pulse 0,02 mean with thai massage better to decrease pulse rate because of movement that exist in thai massage that is yoga and stretching make pulse faster down and better than Group sport massage and control group.

4.3 Differences Effect of Sport Massage and Thai Massage against Decreased Lactic Acid and Pulse Rate.

There are significant differences in the influences of Sport Massage and Thai Massage on decreased levels of lactic acid and pulse referring to the results of the study. When compared, Sport Massage is better at lowering lactic acid levels than Thai Massage and Control group.

As for the drop in pulse rate, Thai Massage is better than Sport Massage and Control Group. The Main factor is when given Sport Massage, blood flow containing oxygen directed to the heart so that blood circulation is disrupted during physical activity can become smooth again. With the smooth return of blood flow in the body so that lactate that settes in the blood can be reduced. For the pulse, Thai Masage has a better influence than the sport massage and contol group because there are several breathing movements or manipulation of Thai Yoga that leads to feeling of calm and relaxation in patients who are able to control the pulse so as to recover origin quickly.

V. CONCLUSION

Based on the results of the research and discussion of research results, the research can be concluded as follows.

1. There is a significant influence of sport massage on the decrease of lactic acid levels in the male in students of physical health and recreation education of PGRI University Banyuwangi.
2. There is a significant influence of sport massage on the decrease in pulse in the male students majoring in physical education health and recreation of PGRI University Banyuwangi.
3. There is a significant effect of Thai massage on the decrease of lactic acid levels in the male students majoring in physical education of health and recreation of PGRI University of Banyuwangi.
4. There is a significant effect of Thai massage on the decrease of pulse in in students of physical health and recreation education department of PGRI University of Banyuwangi.
5. There is a significant difference of influence between sport massage and Thai massage to decrease lactic acid level in students of physical health and recreation education of PGRI University of Banyuwangi.
6. There is a significant difference of influence between

sports massage and Thai massage to decrease the pulse in in students of physical health and recreation education of PGRI University of Banyuwangi..

REFERENCES

- [1] Arikunto, 2015. *Prosedur Penelitian: Suatu Pendekatan Praktek*. Jakarta: Rineka Cipta.
- [2] Arovah, Novita I. 2011. *Massase dan Prestasi Atlet Pendidikan Kesehatan dan Rekreasi*. (online) <http://staff.uny.ac.id> diakses 17 November 2017.
- [3] Badriah, Dewi Laelatul. 2011. *Fisiologi Olahraga Edisi II*. Bandung: Multazam Bandung.
- [4] Bompa, T & Buzzichelli, C. 2015. *Periodization Training for Sports, (Third Edition,)*. New York: Human Kinetics.
- [5] C. Pierce Salguero and David Roylance. 2011. *Encyclopedia of Thai Massage (A Complete Guide to Traditional Thai Massage Therapy and Acupresure)*. Findborn Press
- [6] Coelho, L.F. Et. All . 2011. *Lactic Acid Production by New Lactobacillus Plantarum LMISM6 Grown In Molasses: Optimization Of Medium Composition*. Department of Biochemistry and Microbiology, Institute of Biological Sciences. Brazil. 28 (1): 27-36. Diunduh dari www.abeq.org.br/bjche
- [7] EFSA Panel on Dietetic Product, Nutrition and Allergies. 2014. *Scientific Opinion on The Substantion of A Helath Claim Related to Citrullin-Malate and Faster Recovery From Muscle Fatigue After Exercise Pursuant to Article 13(5) of Regulation (EC) No 1924/2006*. Italy: European Food Safety Authority (EFSA).
- [8] Emma, Bridges & Katie, Roos. 2014. *The Impact of Massage on Athletic Performance and Runners*. CWHP Health & Fitness Journal. Western State Colorado University. www.western.edu
- [9] Joy, Seville. 2012. *The Use Of Cupping As A Therapy for Post Stroke*. Artichel. A Science of Medicine The Art of Care. The Criterion. Diunduh dari www.tibb.co.za
- [10] Kaplan, A.S. Et. All. 2014. *Effect of Sport Massage on Pressure pain threshold and tolerance in athletes under eccentric exercise*. *International Journal of Science Culture and Sport*. School of Physical Education and Sports, Akdeniz University, Antalya, TURKEY. <http://www.icsjournal.com>
- [11] Kurniawan, Rubbi. 2013. *Tesis. Pengaruh massage dan jogging terhadap Recovery Pemain Bulutangkis*. Universitas Negeri Surabaya, Surabaya.
- [12] Kusnanik, Nining W. Dkk. 2011. *Dasar-Dasar Fisiologi Olahraga*. Surabaya: Unesa University Press.
- [13] Liang, M.A. et all. 2010. *A New Muscle Fatigue and Recovery Model and Its Ergonomics Application in Human Simulation*. France: Virtual and Physical Prototype. Vol. 5(3).
- [14] National Holistic Institute. *Massage Therapy Training Program (Sports Massage)*. A College of Massage Therapy. Los Angels. nhi.edu
- [15] Natthakarn Chiranthanut et. all. 2014. *Thai Massage And Thai Herbal Compress Versus Oral Ibuprofen In Symptomatic Treatment Of Osteoarthritis Of The Knee: A Randomized Controlled Trial*. Hindawi Publishing Cooperation.
- [16] Program Pascasarjana. 2015/2016. *Pedoman Penulisan Tesis dan Disertasi*. Surabaya: Unesa.
- [17] Purnomo, M. 2011. *Asam laktat dan aktivitas SOD eritrosit pada fase pemulihan setelah latihan maksimal*. *Jurnal media ilmu keolahragaan Indonesia*, VOL I, 155-170 download by: <http://Fjournal.unnes.ac.id>
- [18] Ralph, Beneke, Renate M. Leithäuser, and Oliver Ochentel. *Blood Lactate Diagnostics in Exercise Testing and Training*. *International Journal of Sports Physiology and Performance*. Human Kinetics, Inc. 2011; 6
- [19] Rebecca, M.S. 2010. *The Effects Of Sports Massage On Mood State, Range Of Motion, Sports Performance, And Perceived Performance*. Thesis: The University of Montana.
- [20] Salinee, Rattnaphan and Panya, Srichandr. 2015. *Mechanical Model of Traditional Thai Massage for Integrated Healthcare*. *Journal of Helathcare Engineering* page 193-212.
- [21] Sifaq, Agus. 2012. *Tesis. Pengaruh Massage Lokal Terhadap Peregangan Aktif dan Pasif Terhadap Kelentukan Otot Pada Perenang Gaya Crawl 50 Meter*. Universitas Negeri Surabaya, Surabaya.
- [22] Sugiyono. 2011. *Metode Penelitian Kuantitatif, Kualitatif dan R & D*. Penerbit Alfabeta, Bandung.
- [23] Suharjana. 2013. *Kebugaran Jasmani*. Yogyakarta: Jogja Global Media
- [24] Sulistyorini dan Basoeki, Hadi. 2013. *Sport Massage Seni Pijat untuk Atlet/ Olahragawan dan Umum*. Malang: Wineka Media.
- [25] Surussawadi Mackawan. et. all. 2007. *Effect of Traditional Thai Massage Versus Joint Mobilization on substance P And Pain Perception In Patients With Non-Specific Low Back Pain*. *Journal of Bodywork and Movement Therapies*.
- [26] Tim Penyusun, 2013. *Buku Ajar kelas VII Pendidikan Jasmani, Olahraga, dan Kesehatan*. Jakarta
- [27] Trisnowiyanto, Bambang. 2012. *Keterampilan Dasar Massage (Panduan Keterampilan Dasar Pijat bagi*

- Fisioterapis, Praktisi, dan Instruktur*). Yogyakarta: Nuhamedika.
- [28] Wiarto, G. 2013. *Fisiologi Olahraga*: Yogyakarta. Graha Ilmu.
- [29] Widiyanto. 2008. Tesis. *Perubahan Kadar Asam Laktat darah Akibat Manipulasi Sport Massage dan Circulo Massage Setelah Latihan Fisik*. Universitas Airlangga, Surabaya.
- [30] Wiltshire, V., Et.all. 2010. *Massage Impairs Post Exercise Muscle Blood Flow and "Lactit Acid" removal*. *Medicine & Science in Sport & Exercise*. Vol. 10. 1062-4206. Diunduh dari <http://www.emto.com/emto-wordpress/assets/Wiltshire-and-Tschakovsky-article-publication.pdf>
- [31] Winarno, M.E. 2011. *Metodologi Penelitian Dalam Pendidikan Jasmani*. Malang: Media Cakrawala Utama Press.