Massage And Atsirian Oil Of Kencur (*Kaemferia Galanga*)As Lotion To Treat Muscle Fatigue Of Hoki Atlets

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Abstract. The purpose of this study was to find information about the effect of massage using kencur essential oil (kemferia galanga) as a lotion to overcome muscle fatigue in Hockey athletes. The method used in this study is an experimental method by giving treatment to three experimental groups of 30 people divided into 3 groups. Group A received exercise treatment. Group B received training treatment and massage with regular lotion and Group C received training treatment and massage with kencur essential oil lotion, each of which received treatment 16 times. The results of the study were that there was a significant difference in the average lactic acid levels between the three groups ($p=0.000$; $p<0.05$). It was also found that the average lactic acid level of group C was smaller than the other groups. This means that during the recovery process with massage, exercise treatment and massage with kencur essential oil are better at reducing lactic acid levels in the muscles than other groups.

Keywords: Massage, kencur, hockey

1 Introduction

1.1 Background

One treatment that is often done by athletes is massage which aims to reduce muscle tension due to training or during competition. Massage in the form of sports massage is a massage that is more specialized for athletes or sports activists who have a risk of muscle injury, which has the impact of selling and improving athlete performance both during training and competing, and can also help the recovery process from muscle injury. Training is systematic and continuous, the goals include improving the athlete's physical condition, preventing injury or for health purposes (Bompa & Haff 2009). Training conditions result in muscle contraction. Differences in intensity indicate differences in contraction. with high intensity, the muscles will contract in an anaerobic state and at moderate and low intensities, the muscles will contract aerobically. Such muscle contractions under anaerobic conditions result in the provision of ATP in the muscle being met by the process of anaerobic glycolysis. As a result, muscle glycogen during exercise is reduced, increasing blood lactic acid levels. This increase in lactic acid levels can interfere with the athlete's performance (Powers, such as affecting the maximum work ability of muscle fibers, reducing physical performance and being one of the factors causing fatigue.

Recovery immediately after physical exercise is a crucial factor to improve athlete performance (Pinar et al. 2012). The recovery mechanism in muscles can be done by increasing the elimination of lactic acid through increased microcirculation. Massage can

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facilitate the elimination of lactic acid from tissues by increasing the flow of lymphatic fluid or blood, so that lactic acid can diffuse out of the muscle and into the blood. Massage aims to stretch muscles, prevent injury, and speed up recovery time. Massage performed on the body provides physiological effects in the form of relaxation effects, increased blood flow, lymphatic flow, nervous system stimulation, increased venous return.

Kencur (Kaemferia Galanga) is a plant from the Rutaceae family that has the potential to produce essential oil. Kencur essential oil is obtained by distillation, and the process is easy and inexpensive. The pharmacological effects of Kencur essential oil can cause antimflammatory, analgesic, antioxidant, sedative effects. The sedative effect is a state of physical and psychological relaxation because it contains the bioactive substance linalool.

Antioxidants as one of the contents of kecur have an alkaline effect. Foods or drinks that are alkaline are known to inhibit muscle fatigue (Schwalfenberg, 2012). Based on pharmacology, the alkaline nature of Kencur essential oil when applied through massage or massage can be absorbed through the capillary blood vessels of the skin. so as to neutralize the lactic acid present in the circulation. The acid-base chemical reaction process will produce salt and water so that lactic acid levels in the circulation can be eliminated. Thus, the body needs important substances in the oil used during massage to prevent fatigue and muscle pain (Gomez et al., 2009).

Kencur essential oil applied during massage will accelerate the recovery process. Massage will provide physiological effects in the form of a relaxing effect, increased blood flow, lymphatic flow, stimulation of the nervous system, increasing venous return so as to reduce muscle tension due to spasm, muscle shortening or due to fibrosis (Swarbrick et al.,2015). In some studies for massage, lotion or ordinary oil is usually used for massage. The difference in this study is that the spreadable material for massage uses Kencur essential oil. To scientifically prove the effect of relaxation, further research is needed to apply the application of the pharmacological effects of Kencur essential oil as a spread on massage to overcome fatigue.

1.2 Problem Formulation

Based on the facts above, the problem formulation of this research can be arranged, namely how the potential of Kencur essential oil can be applied as a lotion in massage which has a natural sedative effect to overcome muscle fatigue in athletes.

2 Literature Review

2.1 Massage

Massage is the mechanical manipulation of soft body parts with rhythmic pressure with the aim of producing physiological and medicinal effects on the body and can calm and reduce psychological stress by increasing endogenous morphin hormones such as endorphin, enkephalin and dinorphine while reducing stress hormone levels such as cortisol, norepinephrine and dopamine (Best et al, 2008). Massage is a recovery effort that is engineering activation of the venous pump mechanism and artificial lymph pump whose purpose is to accelerate the recovery through accelerated circulation in a state of complete rest (lying down withrelaxation). Recovery is the regaining of normal homeostasis conditions, which is the best physiological condition for body cells (Giriwijoyo and Sidik, 2012). Massage is a physical manipulation consisting of body rubbing (effleurage), squeezing (petrissage),

scouring (friction) on soft tissue throughout the body, which is carried out on the face, body, upper and lower limbs.

Physiologically, massage is proven to reduce heart rate, improve blood and lymph circulation, reduce muscle tension, increase joint range of motion and reduce pain. These physiological benefits have been widely used by athletes both to support physical performance and for other purposes such as prevention, therapy and rehabilitation of injuries and negative effects of exercise (Wiltshire, 2009).

2.2.Lactic Acid Formation Process in Exercise

Lactic acid is the metabolic product of glucose through anaerobic lactacid glycolysis reaction. The chemical name of lactic acid is Lactic Acid, 2-hydroxypropanoic acid, with the chemical formula C3H6O3. Lactic acid is produced from the reduction of pyruvic acid, this process occurs in muscle tissue that is deprived of oxygen, for example during exercise with relatively heavy intensity (Guyton & Hall, 2008). The occurrence of increased lactic acid in muscle is due to hypoxia of muscle tissue (Farenia et al, 2010).

In hypoxia, the process of cellular respiration increases because Adenosine Triphosphate (ATP) is reduced and the number of free radicals formed increases. In hypoxia mitochondria are more vulnerable, unable to maintain the Krebs cycle and oxidative phosphorylation process. The respiration chain that resides in the mitochondrial membrane will is also damaged, so no ATP is produced. Energy source is only obtained from anaerobic glycolysis metabolism. Anaerobic glycolysis metabolism results in very rapid lactate accumulation. The accumulation of lactate in the blood is a fundamental problem in physical performance (Rosidi et al., 2013). Exercise causes the formation of high amounts of lactic acid. Furthermore, lactic acid in the muscle dissociates into H+ ions and lactate ions. The increase in H+ ions causes a decrease in pH in extra- and intracellular fluid. This decrease in pH will inhibit the binding of oxygen by Hemoglobin in the lungs, and can inhibit the activity of phosphofructokinase enzymes and myofibril ATP-ase enzymes in muscles that play a role in ATP synthesis, so that energy provision is disrupted. This disruption of energy supply will reduce the ability of muscle contraction. (Guyton & Hall, 2019; Farenia et al, 2010).

2.3.Effect of Massage on Muscle Fatigue

Research conducted by Bahartresna (2005) on untrained individuals concluded that massage during the recovery period reduces fatigue better than passive rest after 200 meters running activity. Similarly, research conducted by Jones and Mondero proved that massage can increase lactic acid elimination during the recovery period after high-intensity exercise. Similarly, the results of research by David, et al. massage for 20 minutes caused a decrease in blood lactic acid by 36, 21%, and according to David, et al. Massage for 45 minutes causes a decrease in blood lactic acid by 72.4% (David et al., 2005).

2.4 Kencur (Kaemferia Galanga))

Kencur is a plant that has benefits as an antioxidant, essential oil, bioflavonoids, polyphenols, coumarins, flavonoids, α-terpinen, α-pinen, β-pinen, and coumarins, and polyphenols (Nizhar, 2012). Muscle fatigue can be prevented by administering ergogenic substances. Ergogenic is a substance that increases energy production, energy control or

energy efficiency during an exercise performance that provides greater additional ability than normal training when training normally. Ergogenic nutrients are classified into 4 categories namely, substances that improve anabolism and body composition (e.g., dietary amino acids), substances that provide fast-acting energy (dietary carbohydrates), substances that facilitate recovery from physical fatigue (e.g., antioxidants) and substances that fill an important role in exercise physiologically (e.g., vitamins, sodium bicarbonate). Kencur has an alkaline effect. This is because the citric acid contained in lemons will be metabolized into HCO3- (Rhoades & Tanner, 2003). One of the causes of muscle fatigue is the accumulation of lactic acid, which causes the accumulation of H+ ions, resulting in a decrease in intracellular pH. In addition, the accumulation of H+ ions is known to stimulate pain receptors, thus inhibiting muscle contraction (Guyton & Hall, 2019). Alkaline foods or drinks are known to inhibit muscle fatigue (Schwalfenberg, 2012).

Figure 1. Kencur Plant

Figure 2. Kencur essential oil

2.5 How Kencur Essential Oil Works

Based on their nature, compounds that are lipophilic (fat soluble, e.g. essential oils) are easily absorbed. When essential oils penetrate the epidermis, essential oil molecules can easily spread to other parts of the body, such as lymph channels, blood vessels, nerves, fibroblasts and mast cells. These molecules will circulate and be carried by the blood circulation system and lymphatic circulation through capillary blood vessels. Furthermore, the capillaries deliver them to the central nervous system and the brain will send messages to the organs that are experiencing an imbalance. Molecules that reach each brain cell are converted into an action with the release of neurochemical substances in the form of feelings of pleasure, relaxation, and calm. Essential oils applied with massage will further stimulate the circulation system.

3 Research Methodology

3.1 Research Methods

The method used in this research is the experimental method

3.2 Research Design

This research design is pre and post test control group.

3.3 Place and Time of Research

This research was conducted at the Chemistry Laboratory of FMIPA UNIMED, North Sumatra Hockey Education and Training Center. The research time has been carried out in May - August 2023.

3.4 Research Subject

The research subjects used female hockey athletes aged 19-20 years, have good fitness, actively training at least 6 times a week.

3.5 Materials and Tools

The basic material of this research is Kencur (Kaemferia Galanga). Isolation of Kencur essential oil using steam and water distillation distillation, and the research tools used are accutrend lactate and lactic acid strips.

3.6 Research Stages

The research was conducted in stages:

a. Raw Material Preparation
b. The galangal ingredients are collected as needed, then pulverized into a powder-like consistency.
c. The powder-like material was then isolated using steam and water distillation distillation in the Chemistry laboratory of FMIPA UNIMED Medan to produce essential oil.
d. Furthermore, essential oils were tested on the subjects, by carrying out sports massage treatment after the exercise.
e. After undergoing 16 treatments, routine blood tests and lactic acid measurements were conducted.

3.6 Data Analysis

Data were analyzed by Anava using SPSS application.

4.1 Research results

Table 1. Lactic acid test results Group A

Name	Lactic acid (mmol/L)		LDH (IU/)		HB (g/dl)		Erythrocy tes		Leukocyte s		Platelets		Lymph ocytes (%)	
	Pre	The post	Pre	The post	Pre	The post	Pre	The post	Pre	The post	Pre	The post	Pre	The post
A1	7.8	5.8	168	159	12.8	12.4	5.0	4.93	6.61	7.04	301	301	34	36
A2	5.8	5.6	215	157	12	12.5	4.43	4.55	11.65	11.09	387	3.98	44	43
A3	5.6	3.8	186	186	12.6	12.7	4.56	4.79	11.06	11.25	392	423	40	30
A4	11.0	7.8	215	193	11.4	12.1	4.28	4.45	7.18	6.58	332	364	37	42
A5	7.8	5.3	179	165	11.8	11.4	5.06	5.16	7.21	7.53	323	347	38	35
A6	6.2	3.8	163	171	10.7	11.5	4.37	4.45	6.67	6.32	394	340	35	37
A7	5.7	5.6	200	163	12.8	13.3	4.33	4.47	6.87	6.99	274	286	34	34
A8	4.8	5.2	203	160	11.6	12.5	4.35	4.45	7.18	7.45	274	283	28	27
A9	8.0	4.8	228	218	10.8	12.0	4.44	4.44	7.82	9.45	328	369	32	28
A10	8.8	5.8	218	167	12.4	13.2	4.18	5.15	8.12	7.35	322	357	33	36

Table 2. Results of Routine Blood Table Examination of Group B

Name	Lactic acid (mmol/L)		LD H (IU/ L)		HB (g/d l)		Erythroc ytes		Leukocyte s		Platelets		Lymp hoc ytes (%)	
	Pre	The post	Pre	The post	Pre	The pos t	Pre	The post	Pre	The post	Pre	The post	Pre	The pos t
B1	4.1	3.9	173	165	12.3	12.0	4.77	4.71	7.78	7.57	313	386	30	33
B2	6.6	1.7	223	200	11.3	11.6	3.63	4.20	8.64	8.77	376	388	35	36
B3	8.8	4.7	251	160	11.5	12.1	4.66	4.20	7.93	6.56	355	350	38	40
B4	5.2	3.8	179	165	11.7	12.8	4.76	4.8	7.96	7.52	355	358	38	39
B5	5.8	4.0	163	160	12.2	11.4	4.16	4.29	8.14	7.82	363	358	33	32
B6	5.2	5.2	209	168	11.2	12.6	4.11	5.13	9.30	9.97	334	360	31	33

B7	5.4	2.2	214	135	11.0	11.6	4.03	4.94	8.52	7.39	424	387	34	36
B8	5.2	3.1	214	161	12.6	12.5	4.44	5.14	7.32	8.18	326	398	28	30
B9	10.9	2.0	173	180	12.1	12.6	5.00	5.15	8.24	8.22	398	375	25	30
B10	6.2	3.7	168	207	12.3	12.6	4.51	4.67	6.30	6.61	395	394	33	34

Table 3 Routine blood test results of Group C

Name	Lactic acid (mmol/L)		LDH (IU/L		HB (g/dl		Erythrocytes		Leukocytes		Platelets		lymphocytes	
	Pre	The post	Pre	The post	Pre	The post	Pre	The post	Pre	The post	Pre	The post	Pre	The post
C1	4.8	2.2	239	154	11.0	12.5	4.52	5.05	10.24	9.52	349	322	28	27
C2	3.8	2.1	206	200	13.3	12.6	4.19	4.60	9.25	9.50	354	373	28	24
C3	3.2	1.8	176	150	13.1	12.4	4.59	5.00	8.21	8.54	320	340	37	40
C4	5.4	1.7	174	138	12.4	13.0	4.59	5.10	10.87	10.6	280	340	29	32
C5	4.3	1.5	214	228	11.4	11.6	4.09	4.05	7.68	7.12	323	430	20	23
C6	5.1	1.9	208	205	12.4	12.4	4.24	5.25	7.38	7.78	349	365	37	35
C7	4.2	2.8	168	195	11.6	12.7	4.62	4,60	8.39	7.81	330	382	27	29
C8	4.5	1.7	214	163	12.4	12.4	4.66	4.68	7.38	7.40	341	345	31	30
C9	4.6	2.0	215	251	11.9	11.5	4.12	4.61	8.61	9.28	366	390	29	27
C10	4.4	1.8	190	156	12.8	12.0	4.3	4.09	6.57	6.77	396	395	34	35

Table 4.Average lactic acid levels

Variables		**A group**	**B group**	**C group**	**Anova**
					P
Lactic acid (mmol/L)	Pre test	5.260	5.84	5.600	0,000*
	sd	0.231	0.374	0.466	
	Post test	6.100	5.340	4.290	
	Sd	0.455	0.462	0.546	
	t-dependent	0.000	0.003*	0.000*	

Notes: * = significant (p<0.05).

The results of statistical analysis of Anova test found a significant difference in the average lactic acid levels (p=0.000). In all 3 groups, namely the exercise group (A), the exercise and massage lotion group (B), and the exercise and massage group with Kencur essential oil (C). the average lactic acid level of group C is smaller than the other groups. This means that during the recovery process with massage, the exercise and massage treatment with

Kencur essential oil is better at reducing lactic acid levels in the muscles compared to other groups.

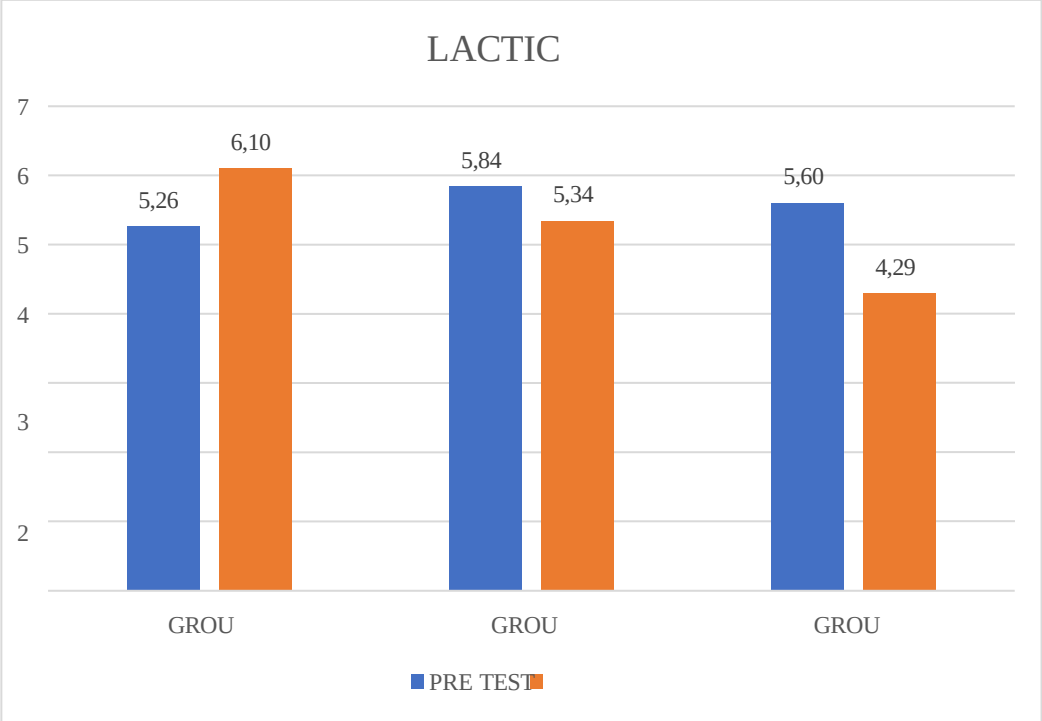

Figure 3. Average pre and post test lactic acid levels of each treatment group

4. Conclusion and Suggestions

The conclusion in this study is that essential oils have the potential as lotions, it is proven that in the exercise and massage group with kencur essential oil is better in reducing lactic acid levels than other groups. Thus when undergoing a recovery process such as massage to overcome muscle fatigue from exercise, it is recommended to use kencur essential oil as a lotion.

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