The Effect of Red Ginger Essential Oil Used for Massage After Exercise on Leukocyte Value in Athletes

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Abstract. Athletes who train with maximum and tiring training intensity to face a match are often unable to continue to the next match due to illness or injury. Extended and rigorous training might lead to a functional deterioration in immune cells' ability to react to elevated infection risk. Physical exercise will cause changes in homeostasis in the body which will affect the immune system. The tolerance limit for changes in homeostasis in the body is narrow, therefore giving heavy intensity physical training loads, both during training and during heavy competitions can cause interference with the immune system. This can affect the athlete's performance, and ultimately cause the athlete to fail to achieve peak performance. The research subjects were cricket athletes, Twenty to twenty-two years old, with a healthy VO_2 max level, were not smokers and were willing to be research subjects by signing a consent form. Approximately twenty athletes were split up into two groups. Group P1: athletes after training were given sports massage therapy and lotion without red ginger essential oil; group P2: athletes after training were given sports massage therapy and red ginger essential oil as an oil for topical use. The physical exercise and massage treatment was carried out for 2 weeks, the frequency was 3 times a week and the duration of the physical exercise was 60 minutes and the duration of the massage was 15 minutes. Examinations of leukocytes were done both before and after treatment. The results of the study showed that athletes who exercised and then had a massage with ginger essential oil had increased immunity as indicated by the average leukocyte value within normal limits.

Keywords: athlete, leukocytes, massage, red ginger essential oil, training

1 Introduction

Athletes who train with heavy training intensity in preparation for a competition are often unable to continue to the next competition due to illness or injury. The body's response to heavy exercise can result in a decrease in the functioning capacity of immune cells. Exercise

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will cause changes in homeostasis in the body which will affect the immune system. Therefore, heavy intensity physical exercise, both during training and during tough competitions, can cause interference with the immune system. This can affect the athlete's performance, and can cause the athlete to fail to achieve achievements [1].

In several studies regarding giving maximum loads during physical training or heavy fatigue, changes in leukocyte values were found. The change in leukocyte values is the cause of the An rise in respiratory tract infection cases, because there is suppression of immune function, resulting in a decrease in athlete performance. Leukocyte values can be a source of information for diagnostics and prognosis, reflecting the suppression of the immune system after maximum physical activity [2].

Exercise is a stressor that has the potential to alter the haematological system's physiological biological functions, including leukocyte counts. Leukocyte levels change based on the frequency, intensity, type, and duration of exercise [3,4]. Blood is divided into blood cells, namely, erythrocytes, leukocytes and platelets. Leukocytes are white blood cells that function as the body's defense, containing a nucleus [5].

exhaustion brought on by intense exercise will cause changes in the cellular components of immunity which can be seen in an increase in leukocyte values of more than 10,000 cells/µl. Increased leukocyte values are a protective response to stress such as microbial invasion and heavy physical training [6]. Previous studies' findings indicate that following physical activity, the number of leukocytes increases [7,8].

The negative effects of heavy physical training can be prevented by massage therapy with red ginger (*Zingiber officinale var. rubrum*) essential oil as a complementary treatment for athletes. Massage is a recovery effort that involves artificially activating the venous pump and lymph pump mechanisms, the aim of which is to speed up recuperation through accelerating circulation. Massage therapy is one intervention that is widely used to treat athletes [9]. Ginger (Zingiber officinale) is a herbal plant that comes from the Zingiberaceae family. The dominant bioactive compounds contained in red ginger are gingerol and shogaol [10].

2 Methode

2.1 Ethical Approval

The research was carried out after obtaining approval from the USU Health Research Implementation Ethics Commission No.654/KEPK/USU/2024.

2.2 Design of study

The experimental design in this study is a pretest-posttest group design. The research was carried out at Universitas Negeri Medan's Faculty of Sports Sciences.

2.3 Research Procedure

The research subjects were cricket athletes,Twenty to twenty-two years old, with a healthy VO2 max level, were not smokers and were willing to be research subjects by signing a consent form. Approximately twenty athletes were split up into two groups. Group P1: athletes after training were given sports massage therapy and lotion without red ginger essential oil;

group P2: athletes after training were given sports massage therapy and red gingr essential oil as an oil for topical use. The physical exercise and massage treatment was carried out for 2 weekes, the frequency was 3 times a week and the duration of the physical exercise was 60 minutes and the duration of the massage was 15 minutes. Leukocyte examination was carried out before and after treatment. Examination of leukocyte values was carried out at the North Sumatra Regional Health Laboratory using a Haematology Analyzer.

3 Result

The study's findings indicated that there was a decrease in the leukocyte value of athletes after training who were given sports massage therapy with cream containing red ginger essential oil as massage oil (7,460 ± 0.58) compared to the group after training given sports massage therapy with cream without red ginger essential oil as massage oil (9,640 ± 1.22). The statistical results of the independent *t*-test show that there is a significant effect of giving cream containing red ginger essential oil as a massage oil on reducing leukocyte values ($p=0.000$; $p<0.05$), as seen in table 1.

Table 1. The difference in mean leukocyte value between two groups.

Groups	Mean	sd	p
P1	9.640	0.58	0.000*
P2	7.460	1.22	

Note : *=significant ($p<0.05$)

4 Discussion

The findings of the investigation revealed that using cream containing red ginger essential oil as a massage oil for athletes had the effect of reducing leukocyte values significantly ($p<0.05$) compared to using cream without red ginger essential oil. This decrease in leukocyte values was influenced by red ginger essential oil it has an antioxidant source that helps to counteract the formation of free radicals when athletes exercise.

Huang et al. (2008) discovered that Zingiber officinale var. rubrum, often known as red ginger, is a rhizome plant that has immunostimulatory properties which have an effect on numerous aspects of the immune system at the cellular and molecular level, such as T cells, cytokines, synthesis antibody [11].

In the group of athletes who after training, the massage oil did not contain red ginger essential oil, there was an increase in leukocyte values. This can happen because during exercise there is an increase in oxygen consumption. Excessive oxygen utilisation can cause the generation of free radicals in numerous bodily tissues and weaken the immune system, specifically leukocyte. During exercise, the formation of free radicals, especially superoxide, can increase

in mitochondria, or energy centers in cells, as well as the mobilisation of bone marrow will cause an increase in the quantity of leukocytes [12].

Frequent massage therapy will aid in blood vessel smoothing, allowing the blood to gradually return to normal. Massage will have the effect of restoring the antibody system in the body after exercise. The mechanism of action is by encouraging lymphocyte activity, boosting NK (Natural Killer) cell activity, producing interferon, or boosting macrophage phagocytosis resulting in increased immunity [13].

Massage therapy can cause biochemical and cellular changes in the body that affect inflammation and skeletal muscle function. Previous research stated that massage therapy carried out for 30 minutes, every day for 4 consecutive days can reduce the amount of cellular infiltration and tissue necrosis compared to those without massage therapy. Massage therapy has an important physiological role in encouraging the changeover to the phase of repair and regeneration [14].

Massage treatment can help muscles heal more quickly, lessen pain from injuries, and slow down the inflammatory process. The mechanism of massage therapy is to change the signaling pathways involved in the inflammatory process and reduce nerve sensitization and the mechanism of massage therapy is to potentially activate beneficial immunostimulatory pathways [15].

Another advantage is eliminating muscle pain by increasing the pain threshold, due to increased production of endorphin hormones [16]. The results of research by Harahap (2017) stated that physical exercise combined with sports massage was better at reducing muscle pain compared to physical exercise without sports massage in athletes [17].

5 Conclusion

This study's conclusion stated that it was found that red ginger essential oil used in massage therapy had a significant effect on reducing leukocyte values. Massage therapy has an important role in physiological recovery and regeneration.

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References

[1] Morgado JM, Rama L, Silva I, de Jesus Inácio M, Henriques A, Laranjeira P, et al. Cytokine production by monocytes, neutrophils, and dendritic cells is hampered by long-term intensive training in elite swimmers. Eur J Appl Physiol. (2012) 112:471–82. doi: 10.1007/s00421-011-1966-4

[2] Ali, S., Farman, U. & Habib, U. (2008) Effects of Intensity and Duration of Exercise on Total Leukocyte Count in Normal Subjects. In Drfarmanwazir@Hotmail. Com (Ed.), Department of Physiology, Gomal Medical College, DI Khan, Pakistan.
[3] Bhatti, R., & Shaikh, D. M. (2007). The Effect Of Exercise On Blood Parameters. Pakistan Journal of Physiology, 3(2). https://doi.org/10.69656/pjp.v3i2.651
[4] Hazar S, Yilmaz G 2008. Acute Effect of Submaximal Treadmill Exercise on Immune System. Bolu: 10th In-ternational Sports Science Congress Book, pp. 2325.
[5] Guyton & Hall, 2019. Textbook of Medical Physiology 13th edition. Elsevier Saunders, Philadelphia, Pensylvania
[6] Tortora, G. J., and Grabowski, S.R., (2003) Principles Of Anatomy And Physiology Philadelphia, John Willey And Son, Inc
[7] Atan, T., and Alacam H. 2015. The Effects of Acute Aerobic and Anaerobic Exercise on Blood Parameters. Anthropologist, vol.19(1). pp. 87-93.
[8] Isprayoga I. 2015. Efektivitas Latihan Aerobik Pagi dan Malam Hari Terhadap Kadar Hemoglobin dan Kadar Leukosit (Tesis). Universitas Negeri Semarang
[9] Best, T.M., Hunter, R., Wilcox, A., Haq, F. 2008. Critical Review : Effectiveness of Sport Massage for Recovery of Skeletal Muscle From Strenuous Exercise. Clinic Journal Sport Medicine. Vol 18, No 5, pp 446-460.
[10] Ali, B. H., Blunden, G., Tanira, M. O., & Nemmar, A. (2008). Some phytochemical, pharmacological and toxicological properties of ginger (Zingiber officinale Roscoe): a review of recent research. Food and chemical Toxicology, 46(2), 409-420.
[11] Huang, C. F., Lin, S. S., Liao, P. H., Young, S. C., & Yang, C. C. (2008). The immunopharmaceutical effects and mechanisms of herb medicine. Cellular & molecular immunology, 5(1), 23–31. https://doi.org/10.1038/cmi.2008.3
[12] Deminice, R, Rosa, FT, Franco, GS, Jordao, AA, Freitas, EC 2013, 'Effect of creatine supplementation on oxidative stress and inflammatory markers after repeated-sprint exercise in humans', Applied Nutritional Investigation, vol. 29, pp. 1127-1132.
[13] Kumar, D.; Arya, V.; Kaur, R.; Bhat, Z.A.; Gupta, V.K.; Kumar, V. A review of immunomodulators in the Indian traditional health care system. J. Microbiol. Immunol. Infect. 2012, 45, 165–184.
[14] Butterfield TA, Zhao Y, Agarwal S, Haq F, Best TM. Cyclic compressive loading facilitates recovery after eccentric exercise. Med Sci Sports Exerc. 2008;40(7):1289–1296
[15] Waters-Banker, C., Dupont-Versteegden, E. E., Kitzman, P. H., & Butterfield, T. A. (2014). Investigating the mechanisms of massage efficacy: the role of mechanical immunomodulation. Journal of athletic training, 49(2), 266–273. https://doi.org/10.4085/1062-6050-49.2.25
[16] Mika, A., Mika, P., Fernhall, B. 2007. Comparison of Recovery Strategis on Muscle Performance After Fatiquing Exercise. Am.J.Phy.Med.Rehabil; 86 : 474-481
[17] Harahap, NS. 2017. The Effect Of Regular Exercise And Sport Massage on Musculoskeletal Pain In Runner. International Journal of Advanced Research; 5(12) : 1479-1482.