

Effect Of Giving Virgin Coconut Oil And Physical Exercise On Leukocyte Levels In Non-Athlete Students

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Abstract.

In recent years there has been an increase in the prevalence of viral infections worldwide with the outbreak of the Coronavirus Disease. Various attempts have been made to find new drugs and vaccines against the viruses that cause it, but there are no effective preventive and curative drugs yet, so boosting the immune system is one of the most important things to do. One of the natural ingredients that are believed to increase the body's immunity is Virgin Coconut Oil (VCO), but it still needs more intense research. In addition to the use of natural ingredients, exercise is also important to maintain and increase immunity. One indicator that is sensitive to impaired immune response is leukocytes. This study aims to see the effect of giving VCO and physical exercise on immune function by measuring leukocyte levels. This is an experimental study with a randomized control group pretest-posttest design. The sample in this study were 12 people who were divided into two groups. During the exercise with an intensity of 70-80% in two weeks with a frequency of three times a week, the experimental group was given 15 ml of VCO every day while the control group was given a placebo. Leukocyte levels were measured before and after treatment. Leukocyte levels in the control group increased significantly while the experimental group decreased insignificantly. Giving virgin coconut oil in this study significantly reduced leukocyte levels.

Keywords: *Virgin Coconut Oil, Physical Exercise and Leukocyte.*

I. INTRODUCTION

In recent years there has been an increase in the prevalence of viral infections worldwide. At the beginning of 2020, the world was shocked by the outbreak of a new virus, namely a new type of corona virus (SAR-CoV-2) and the disease is called Coronavirus Disease 2019 (COVID-2019) [1]. More than 150 countries have confirmed the findings of positive cases of Covid-2019 and more than two million people have died, so efforts are being made to find new drugs and vaccines against the virus that causes it. During this pandemic, there are no available preventive and curative drugs that are effective, healthy and boosting the immune system is one of the most important weapons [2]. The results show that some herbs and probiotics have also shown effectiveness for the treatment and prevention of viral infections [3]. In addition, several nutraceuticals and probiotics have also shown a supportive role in enhancing the immune response, including against coronavirus [4]. One of the natural ingredients that are believed to increase the body's immunity is Virgin Coconut Oil (VCO). The active compounds contained in VCO include tocopherols, tocotrienols, phytosterols, phytosterols, phytosterols, flavonoids and several polyphenol compounds, phospholipids, and medium chain triglycerides [5,6].

The results showed that VCO has pharmacological effects including functioning as an antioxidant [7,8,9,10,11], anti-inflammatory [12,13,14] and enhance immunity by increasing the ability of macrophage cells to perform phagocytes. Studies on the effect of VCO on the immune system are still limited so they still need to be developed. In addition to the use of natural ingredients, exercise is also important to maintain and increase immunity [15,16,17]. Several different studies have shown that regular physical exercise is directly related to reduced mortality from pneumonia and influenza, improved cardiorespiratory function, glucose, lipid, and insulin metabolism [18,19]. Physical exercise can also reduce the concentration of various inflammatory cytokines and reduce the secretion of proinflammatory cytokines, and can increase the number of natural killer cells so that the body's immunity also increases [20,21,22]. On the other hand, excessive exercise (overtraining) can lower the immune system [23]. One indicator that is sensitive to impaired immune response is leukocytes. Physical exercise can change the number and function of leukocytes and the degree of leukocyte trafficking depends on the intensity and duration of exercise [24,25]. This study aims to see the effect of giving VCO and physical exercise on immune function by measuring leukocyte levels.

II. METHODS

This research was conducted in the physical laboratory of the Faculty of Sports Science, State University of Medan. The examination of leukocyte levels was carried out at a regional health laboratory, North Sumatra. The sample in this study were 12 non-athlete students who were divided into 2 groups, namely the control group 6 people and the experimental group 6 people. The sample in this study must meet the criteria for being healthy, having a good VO₂max level, male, aged 20-22 years, having a good BMI, not smoking, not taking antioxidant supplements 2 weeks before and during the study and willing to be a research subject. The sample who took part in this study had received an explanation of the approved research procedure by filling out an informed consent. This study is an experimental study with a pre-test post-test design, control group design and has received "Ethical clearance" from the ethical committee of the Faculty of Medicine, University of North Sumatra (approval number 593/KEP/USU/2021).

The control group was the group that received a placebo in the form of mineral water and physical exercise, while the experimental group was the group that received virgin coconut oil and physical exercise. VCO was given as much as 15 ml one hour before exercise. Physical exercise in this study is exercise using a treadmill with a slope of 0° and a speed level of 10-12, for 2 weeks with a frequency of 3 times a week with an intensity of 70-80% of the maximum pulse rate. Leukocyte examination in this study was carried out before and after treatment. Examination of leukocyte was carried out using the Hematology Analyzer method. SPSS software version 22 is used to process data in this study. Normality and homogeneity of the data were tested using the Shapiro Wilk test and the Levene's test. Paired and unpaired t tests were performed for data analysis. In this study the p value <0.05 was classified as a significant result.

III. RESULT AND DISCUSSION

The purpose of this study was to see how the effect of VCO on leukocyte levels in non-athlete students who received physical exercise. The results of this study showed that the leukocyte levels in the control group increased significantly while the experimental group experienced an insignificant decrease. The administration of virgin coconut oil in this study significantly reduced leukocyte levels. The results can be seen in tables 1 and 2.

Table 1. Differences in Leukocyte Levels in the treatment group

Parameter	Group	Average ± SD	p value
Leukocyte (10 ⁹ /L)	Pretest P1	6,53± 1,28	0.001*
	Posttest P1	9,02± 1,76	
	Pretest P2	6,45± 0.30	0.632
	Posttest P2	6,20± 1,14	

P1 (Control); P2 (Treatment); * p < 0,05.

Table 2. Effect of VCO on Leukocyte levels in the treatment group

Parameter	Group		p value
	P1 (Average ± SD)	P2 (Average ± SD)	
Leukocyte (10 ⁹ /L)	9,02± 1,76	6,20± 1,14	0.008*

P1 (Control); P2 (Treatment); * p < 0,05.

Immediate leukocytosis of varying degrees may result from exercise, depending on the intensity and duration of the exercise. This will induce physiological stress in the body which causes the release of adrenaline. During exercise catecholamines are produced to increase the ratio of circulating to non-circulating leucocytes [26]. The results of this study are in line with research which found that aerobic exercise caused a significant increase in total leukocytes, absolute lymphocytes and neutrophil counts [27]. Total leukocytes increased significantly after playing football for one hour in Sudanese soccer players [28]. Exercise has an influence on the immune system, exercise is thought to affect not only the number of leukocytes but also their function.

Giving virgin coconut oil in this study was able to significantly reduce leukocyte levels. Several studies that are in line with this found that virgin coconut oil is better at reducing leukocytes than used cooking oil which can increase leukocytes [29]. Consumption of 0.003 mL/35 g of VCO for more than 18 days reduced the percentage of basophiles in ovalbumin-sensitized mice and normalized the percentage of

neutrophils [30]. However, different results were obtained by *Ahmad et al* who found that administration of coconut oil increased total leukocytes in rabbits intoxicated with carbon tetrachloride. [31]. As is well known, Virgin coconut oil (VCO) contains active ingredients that can increase the body's immunity against disease agents. Research conducted by *Widianingrum et al* showed that VCO has the potential as an immunomodulator [32].

IV. CONCLUSION

The conclusion of this study is that giving virgin coconut oil and exercise has a good effect on the body's immune function.

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REFERENCES

- [1] Director-General, W. (2020). WHO Director-General's remarks at the media briefing on 2019-nCoV on 11 February 2020. *World Health Organization (WHO)*.
- [2] Jayawardena, R., Sooriyaarachchi, P., Chourdakis, M., Jeewandara, C., & Ranasinghe, P. (2020). Enhancing immunity in viral infections, with special emphasis on COVID-19: A review. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*. <https://doi.org/10.1016/j.dsx.2020.04.015>
- [3] Mousa, H. A. L. (2017). Prevention and Treatment of Influenza, Influenza-Like Illness, and Common Cold by Herbal, Complementary, and Natural Therapies. *Journal of Evidence-Based Complementary and Alternative Medicine*. <https://doi.org/10.1177/2156587216641831>
- [4] McCarty, M. F., & DiNicolantonio, J. J. (2020). Nutraceuticals have potential for boosting the type 1 interferon response to RNA viruses including influenza and coronavirus. In *Progress in Cardiovascular Diseases*. <https://doi.org/10.1016/j.pcad.2020.02.007>
- [5] Carandang, E. V. (2012). *Health Benefits of Virgin Coconut Oil*. January, 213–264. <https://doi.org/10.1177/0146167201277003>
- [6] da Silva Lima, R., & Block, J. M. (2019). Coconut oil: What do we really know about it so far? In *Food Quality and Safety*. <https://doi.org/10.1093/fqsafe/fyz004>
- [7] Abujazia, M. A., Muhammad, N., Shuid, A. N., & Soelaiman, I. N. (2012). The effects of virgin coconut oil on bone oxidative status in ovariectomised rat. *Evidence-Based Complementary and Alternative Medicine*. <https://doi.org/10.1155/2012/525079>
- [8] Famurewa, A. C., Ekeleme-Egedigwe, C. A., Nwali, S. C., Agbo, N. N., Obi, J. N., & Ezechukwu, G. C. (2018). Dietary Supplementation with Virgin Coconut Oil Improves Lipid Profile and Hepatic Antioxidant Status and Has Potential Benefits on Cardiovascular Risk Indices in Normal Rats. *Journal of Dietary Supplements*. <https://doi.org/10.1080/19390211.2017.1346031>
- [9] Marina, A. M., Che Man, Y. B., Nazimah, S. A. H., & Amin, I. (2009). Antioxidant capacity and phenolic acids of virgin coconut oil. *International Journal of Food Sciences and Nutrition*. <https://doi.org/10.1080/09637480802549127>
- [10] Sinaga, F. A., Harahap, U., Silalahi, J., & Sipahutar, H. (2019b). Antioxidant effect of virgin coconut oil on urea and creatinine levels on maximum physical activity. *Open Access Macedonian Journal of Medical Sciences*. <https://doi.org/10.3889/oamjms.2019.503>
- [11] Yeap, S. K., Beh, B. K., Ali, N. M., Yusof, H. M., Ho, W. Y., Koh, S. P., Alitheen, N. B., & Long, K. (2015). Antistress and antioxidant effects of virgin coconut oil in vivo. *Experimental and Therapeutic Medicine*. <https://doi.org/10.3892/etm.2014.2045>
- [12] Famurewa, A. C., Maduagwuna, E. K., Folawiyo, A. M., Besong, E. E., Eteudo, A. N., Famurewa, O. A., & Ejezie, F. E. (2020). Antioxidant, anti-inflammatory, and antiapoptotic effects of virgin coconut oil against antibiotic drug gentamicin-induced nephrotoxicity via the suppression of oxidative stress and modulation of iNOS/NF- κ B/caspase-3 signaling pathway in Wistar rats. *Journal of Food Biochemistry*. <https://doi.org/10.1111/jfbc.13100>

- [13] Luxminarayan, L., Neha, S., Amit, V., & Khinchi, M. P. (2017). Asian Journal of Pharmaceutical Research and Development. *Asian Journal of Pharmaceutical Research and Development*, 5(2), 1–8.
- [14] Varma, S. R., Sivaprakasam, T. O., Arumugam, I., Dilip, N., Raghuraman, M., Pavan, K. B., Rafiq, M., & Paramesh, R. (2019). In vitro anti-inflammatory and skin protective properties of Virgin coconut oil. *Journal of Traditional and Complementary Medicine*, 9(1), 5–14. <https://doi.org/10.1016/j.jtcme.2017.06.012>
- [15] da Silveira, M. P., da Silva Fagundes, K. K., Bizuti, M. R., Starck, É., Rossi, R. C., & de Resende e Silva, D. T. (2020). Physical exercise as a tool to help the immune system against COVID-19: an integrative review of the current literature. In *Clinical and Experimental Medicine*. <https://doi.org/10.1007/s10238-020-00650-3>
- [16] Pedersen, B. K., & Hoffman-Goetz, L. (2000). Exercise and the immune system: Regulation, integration, and adaptation. In *Physiological Reviews*. <https://doi.org/10.1152/physrev.2000.80.3.1055>
- [17] Leandro, C. G., De Castro, R. M., Nascimento, E., Pithon-Curi, T. C., & Curi, R. (2007). Adaptive mechanisms of the immune system in response to physical training. In *Revista Brasileira de Medicina do Esporte*. <https://doi.org/10.1590/S1517-86922007000500012>
- [18] Laddu, D. R., Lavie, C. J., Phillips, S. A., & Arena, R. (2020). Physical activity for immunity protection: Inoculating populations with healthy living medicine in preparation for the next pandemic. In *Progress in Cardiovascular Diseases*. <https://doi.org/10.1016/j.pcad.2020.04.006>
- [19] Simpson, R. J., & Katsanis, E. (2020). The immunological case for staying active during the COVID-19 pandemic. In *Brain, Behavior, and Immunity*. <https://doi.org/10.1016/j.bbi.2020.04.041>
- [20] Parsons, T. J., Sartini, C., Welsh, P., Sattar, N., Ash, S., Lennon, L. T., Wannamethee, S. G., Lee, I. M., Whincup, P. H., & Jefferis, B. J. (2017). Physical Activity, Sedentary Behavior, and Inflammatory and Hemostatic Markers in Men. *Medicine and Science in Sports and Exercise*. <https://doi.org/10.1249/MSS.0000000000001113>
- [21] Tauler, P., & Aguiló, A. (2010). The anti-inflammatory effects of exercise. In *The Anti-Inflammatory Effects of Exercise*.
- [22] Zimmer, P., Bloch, W., Schenk, A., Zopf, E. M., Hildebrandt, U., Streckmann, F., Beulertz, J., Koliymitra, C., Schollmayer, F., & Baumann, F. (2015). Exercise-induced natural killer cell activation is driven by epigenetic modifications. *International Journal of Sports Medicine*. <https://doi.org/10.1055/s-0034-1398531>
- [23] Gleeson, M. (2002). Biochemical and immunological markers of overtraining. In *Journal of Sports Science and Medicine*.
- [24] Green KJ, Rowbottom DG, Mackinnon LT. Exercise and T-Lymphocyte function: a comparison of proliferation in PBMC and NK cell-depleted PBMC culture. *J Appl Physiol*. 2002;92:2390-2395.
- [25] Edwards KM, Burns VE, Carrol D, et al. The acute stress-induced immunoenhancement hypothesis. *Exerc Sport Sci Rev*. 2007;35:150-155.
- [26] McCarthy DA, Dale MM. The leucocytosis of exercise. A review and model. *Sports Med* 1988; 6:333-363. <https://doi.org/10.2165/00007256-198806060-00002>
- [27] Kristin L Sand , Torun Flatebo , Marian bergeanderrsen , Azzam A Maghazachi , Effects of exercise on leukocytosis and blood hemostasis in 800 healthy young females and males , *world journal of experimental medicine* 2013; 3(1):11 <https://doi.org/10.5493/wjem.v3.i1.11>
- [28] Anwer RM, Babiker NE, The Effect of Exercise on the Total Leukocyte, Absolute Neutrophil, Lymphocyte and Platelet Counts among Sudanese Football Players, *Journal of Drug Delivery and Therapeutics*. 2021; 11(6-S):26-32. DOI: <http://dx.doi.org/10.22270/jddt.v11i6-S.5109>
- [29] Syamsunarno, Mas & Fauziah Agustin, Dinar & Anggraeni, Neni & Kania, Nia. (2020). Effect of Fish Oil, Virgin Coconut Oil, and Used-Cooking Oil Consumption on Hematological Profile in Mice. *Indonesian Journal of Clinical Pharmacy*. 9. 137. 10.15416/ijcp.2020.9.2.137. DOI: [10.15416/ijcp.2020.9.2.137](https://doi.org/10.15416/ijcp.2020.9.2.137).
- [30] Handajani NS, Dharmawan R. Effect of VCO to leucocyte differential count, glucose levels and blood creatinine of hyperglycemic and ovalbumin sensitized Mus musculus Balb/c. *Nusantara Bioscience* 2009; 1(1):1-8.
- [31] Ahmad, B. et al. Beneficial effects of coconut oil (*Cocos nucifera*) on hematobiochemical and histopathological markers in CCL4- intoxicated rabbits. *Brazilian Journal of Biology*, 2024, vol. 84, e252555 | <https://doi.org/10.1590/1519-6984.252555>
- [32] Widianingrum & Salasia. Immunomodulatory effects of virgin coconut oil in wistar rats infected with *Staphylococcus aureus*. *JITV* Vol. 26 No. 1 Th. 2021: 31-38.