

# Effect of aerobic exercise and supplementation virgin coconut oil on lipid profile

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## 1 Effect of aerobic exercise and supplementation virgin coconut oil on lipid profile

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**Abstract.** Dyslipidemia and sedentary lifestyle are risk factors for atherosclerotic heart disease. The research objective was to determine the effect of aerobic exercise and virgin coconut oil supplementation on the lipid profile of obese women. The research subjects were 20 women with obesity, divided into two groups, namely the experimental group (doing aerobic exercise and VCO supplementation) and the control group (only doing aerobic exercise) with the 43.55±2.21 age, 154.75±0.05 height, 75.75±1.44 weight and 31.69±1.63 BMI. The experimental group did aerobic exercise and VCO supplementation for 8 weeks, while the control group did aerobic exercise without VCO supplementation. Total cholesterol and triglyceride levels were measured before and after aerobic exercise. Using the t test, statistical analysis was conducted and the significance level of the test was considered to be p<0.05. The results showed that the combination of aerobic exercise with VCO supplementation resulted in a more significant reduction in triglyceride levels and cholesterol compared to aerobic exercise (p = 0.001). The conclusion is that the combination of aerobic exercise with VCO supplementation can reduce triglyceride levels and total cholesterol, thus preventing cardiovascular disease.

### 1. Introduction

The prevalence of obesity around the world is increasing, from 1975 to 2016 an estimated increase of almost three times. The number of adults aged>18 years who are obese is 650 million of the total>1.9 billion adults who are overweight in 2016. Overall, about 13% of the world's adult population includes 11% of the male population and 15% of the female population was obese in 2016[1]. In general, women have a higher percentage of body fat than men[2]. Fat is useful for the body, but in excess, it tends to cause disease[3]. Fat content in the body is closely related to nutritional status. If the levels are excessive (women more than 30% and men more than 25%) then this indicates that he is overweight (obesity) and is at risk for various chronic diseases[4].

Obesity can cause an increase in cholesterol and trigger narrowing of the blood vessels in the heart which can lead to cardiovascular disease[5][6]. The results of the study reported that weight gain was accompanied by an increase in serum cholesterol. Each increase in body mass index (BMI) was associated with an increase in total plasma cholesterol and a decrease in HDL. In addition, obesity leads to an endogenous cholesterol synthesis rate of 20 mg per day for every kilogram of excess body weight, increased VLDL synthesis and triglyceride production[7].

In order to maintain a person's body weight so that it is ideal, the energy consumed must be the same as the energy expended where when it is the same, there is an energy balance. So in order to lose



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weight, this energy balance needs to be adjusted, where physical exercise plays a role [8]. Things that need to be considered in losing weight through physical exercise are the duration, intensity, and type of exercise where intervention through aerobic exercise is an important component for weight loss, and is usually included as part of a management program for weight loss [9].

Apart from doing aerobic exercise, natural ingredients can be used as an alternative for hypercholesterolemia, one of which is using virgin coconut oil (VCO). VCO is known to have many health benefits including preventing cardiovascular disease. It is known, VCO can increase HDL cholesterol levels. HDL cholesterol functions to prevent atheroma or narrowing of blood vessels due to fat. VCO also functions to reduce LDL cholesterol and triglyceride levels. LDL is one of the main causes of atheroma formation. Atheroma itself is a trigger for heart disease, also known as atherosclerosis or hardening of the arteries[10][11]. The active compounds found in VCO include tocopherols, tocotrienols, phytosterols, phytostanol, flavonoids and several polyphenol compounds, phospholipids, and medium chain triglycerides (MCT)[12][13][14]. MCT are rapidly oxidized at rest and during physical activity, in contrast to long-chain triglycerides (LCT)[15]MCTs are metabolized in the body in a different way to LCT. MCTs are metabolized just like carbohydrates. MCTs hydrolyze faster, are more complete than LCTs, and are absorbed more quickly[16].In addition, several studies have shown that MCTs can support metabolic rates and energy expenditure in the body[17]. Thus, these MCTs may provide health benefits in reducing cardiovascular risk factors. In addition, MCTs have very high water solubility and less need for digestive enzymes, making it easy for them to enter the liver through the veins without having to go through the spleen and systemic circulation and quickly burn into energy[18]through increased biogenesis and mitochondrial metabolism[19].

It is known that triglycerides are the main energy source for aerobic physical activity [20]. The use of fatty acids as an energy source requires hydrolysis (lipolysis) of triglycerides (fat) from fat tissue, muscle, and plasma to release fatty acids to be oxidized in muscle mitochondria [21]. When viewed from the energy use system in sports, the potential use of VCO which is rich in MCT is very potential to be used as a source of quickly available energy, especially for aerobic exercise that uses fatty acids as an energy source. Research on the effect of aerobic exercise and supplementation of natural ingredients is still limited, so it is necessary to conduct research on the effect of aerobic exercise and supplementation of virgin coconut oil on the percentage reduction in triglyceride levels and total cholesterol in obese women.

## 2. Methods

Using a control sample, the study design used a quasi-experimental design with a pretest-posttest design.

### 2.1. Subjects

Twenty obese women ( $43.55 \pm 2.21$  age,  $154.75 \pm 0.05$  height,  $75.75 \pm 1.44$  weight and  $31.69 \pm 1.63$  BMI) participated in the study. Before participating, all participants read and signed an informed consent form. The exclusion criteria included asthma, heart disease or conditions that could harm the research subject while conducting the experiment. All participants did not smoke, were not taking antioxidants and caffeine-free two weeks before the study and during the study process.

### 2.2. Exercise Program

Participants were divided into 2 groups, Participants were divided into 2 groups, consisting of an experimental group of 10 people and a control group of 10 people. The experimental group did aerobic exercise and VCO supplementation (AE-VCO), while the control group only did aerobic exercise (AE). Aerobic exercise is carried out for 8 weeks, the frequency is three times a week, the intensity of the exercise is 60-65%, the maximum pulse is for 40 minutes per session. The dose of VCO is 15ml, taken 3 times a day for 2 months.

### 2.3. Collection Blood Samples

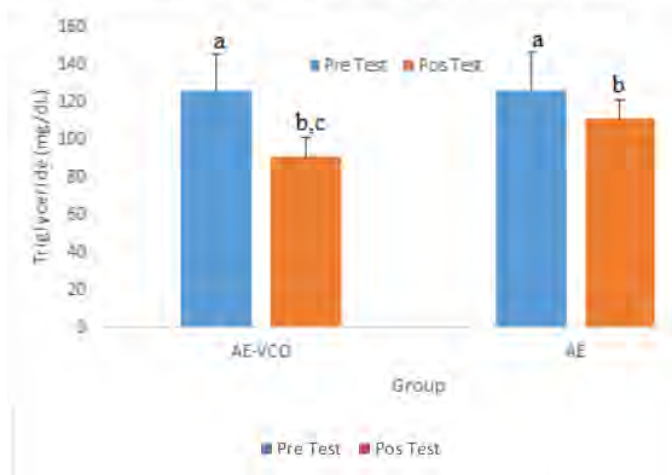
Blood samples (fasting) of 5 ml were taken from the forearm veins of the research subjects before and after completing the exercise program. Blood samples were centrifuged at 3000 rotations for 10 minutes to separate the serum, then stored at  $-80^{\circ}\text{C}$  until analysis of the research variables was carried out.

### 2.4. Statistical analysis

All data were analyzed using SPSS (version 25). Independent sample t-test and paired t-test were used to evaluate changes between study variables.

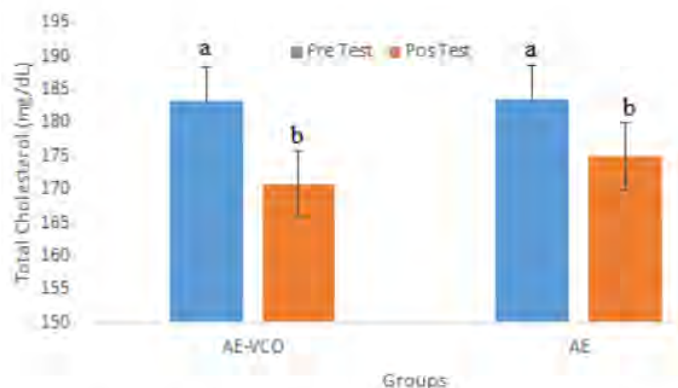
## 3. Results

The results showed that the pre-test triglyceride level in the experimental group (AE-VCO) was 126.20 mg/dL while in the control group (AE) the triglyceride level was obtained 126.30 mg/dL. The results of the independent sample t-test statistic showed no difference in triglyceride levels between the two groups. After doing aerobic exercise and VCO supplementation for 8 weeks, there was a significant decrease in triglyceride levels in the experimental group (AE-VCO) and also in the control group (AE) as shown in Figure 1. The results of statistical tests show that there are differences in triglyceride levels posttest between the experimental group and the control group.



**Figure 1.** Effect of aerobic exercise and supplementation virgin coconut oil on triglyceride level. Data are mean  $\pm$  SD for  $n = 10$  in each group.  $P < 0.05$  by paired samples t-test and independent sample t-test. bsignificantly ( $P < 0.05$ ) different from a values. csignificantly ( $p < 0.05$ ) different from AEgroup

The results of measuring the total pre-test cholesterol levels in the experimental group (AE-VCO) were 183.20 mg/dL while the control group obtained the levels of 183.50 mg/dL. The results of statistical tests using independent samples t-test showed that there was no difference in total cholesterol levels between the two groups. After doing aerobic exercise and VCO supplementation for 8 weeks, the total cholesterol level in the experimental group (AE-VCO) was 170.80 mg/dL, while the control group (AE) was 175.00 mg/dL. The results of statistical tests using paired sample t-test showed a decrease in total cholesterol levels in the experimental group and the control group.



**Figure 2.** Effect of Aerobic Exercise and Supplementation Virgin Coconut Oil on total cholesterol level. Data are mean  $\pm$  SD for  $n = 10$  in each group.  $P < 0.05$  by paired samples t-test and independent sample t-test. bsignificantly ( $p < 0.05$ ) different from a values.

When compared with post-test total cholesterol levels between the experimental group (AE-VCO) and the control group (AE), there was no significant difference ( $p > 0.05$ ) (Figure-2).

#### 1 Discussion

The results showed that aerobic exercise with virgin coconut oil supplementation could reduce triglyceride levels and total cholesterol levels. Decreased levels of triglycerides and cholesterol also occurred in study subjects who only did aerobic exercise. When compared to the decrease in triglyceride and total cholesterol levels between the AE-VCO and AE groups, the largest decrease occurred in the AE-VCO group. The decrease in triglyceride and total cholesterol levels in aerobic exercise is caused by an increase in the lipolysis process. Increasing the lipolysis process due to aerobic exercise will also increase the use of fatty acids as an energy source, thereby reducing the occurrence of sterol formation. The reduction in the process of sterol formation will result in a decrease in cholesterol formation[22]. Aerobic exercise will result in an increase in the release of epinephrine and norepinephrine by the adrenal medulla during aerobic activity. It is known, epinephrine and norepinephrine will activate the lipase enzyme, an enzyme that plays a role in the process of breaking down triglycerides into free fatty acids and glycerol (lipolysis process). The free fatty acids that are formed will be used as a source of energy in aerobic exercise[23].

The results of the study reported that the concentration of free fatty acids in the blood of a person who is doing aerobic activity can increase up to eight times. The free fatty acids will then be used by the muscles as an energy source so that the low-density lipoprotein (LDL) will decrease. It is known, the raw material for the formation of LDL is derived from triglycerides[24]. The decrease in total cholesterol and triglyceride levels in the study is in accordance with the results of research by Sadeghi et al, who reported aerobic exercise training can reduce total cholesterol and triglyceride levels[25].

The results showed that giving VCO during aerobic exercise had a greater effect on reducing triglyceride levels and total cholesterol. It is known, apart from containing antioxidants, VCO also contains medium chain triglycerides[13]. Medium chain triglycerides are rapidly oxidized at rest and during physical activity, in contrast to long chain triglycerides[15]. MCTs are metabolized in the body in a different way to LCT. MCTs are metabolized just like carbohydrates. MCTs hydrolyze faster, are more complete than LCTs, and are absorbed more quickly[16]. In addition, several studies have shown that MCTs can support metabolic rates and energy expenditure in the body[17]. Thus, MCTs may provide health benefits in reducing cardiovascular risk factors. In addition, MCTs have very high

water solubility and less need for digestive enzymes, making it easy for them to enter the liver through the veins without having to go through the spleen and systemic circulation and quickly burn into energy[18]through increased biogenesis and mitochondrial metabolism[19]. The reduction in triglyceride and cholesterol levels in this study is in accordance with the research conducted by Famurewa et al on the effect of VCO administration for 5 weeks in experimental animals showing a significant reduction in levels of total cholesterol, triglycerides, and low-density lipoproteins; meanwhile high density lipoprotein (HDL) levels increased significantly ( $p < 0.05$ ) compared to controls[10].

## 5. Conclusion

In conclusion, aerobic exercise can reduce triglyceride levels and total cholesterol in obese women. Aerobic exercise and virgin coconut oil supplementation had more effect on reducing triglyceride levels and total cholesterol levels in obese women.

## References

- [1] WHO (World Health Organization) 2013 WHO obesity and overweight fact sheet no 311," *Obes. Overweight Fact Sheet*.
- [2] He X, Li Z, Tang X, Zhang L, Wang L, He Y, et al 2018 Age- and sex-related differences in body composition in healthy subjects aged 18 to 82 years. *Med. (United States)*, doi: 10.1097/MD.00000000000011152.
- [3] Jastreboff AM, Kotz CM, Kahan S, Kelly AS, Heymsfield SB 2019 Obesity as a Disease: The Obesity Society 2018 Position Statement. *Obesity*. 27(1):7–9doi: 10.1002/oby.22378.
- [4] Seidell JC 1997 Assessing obesity: Classification and epidemiology. *British Medical Bulletin*. doi: 10.1093/oxfordjournals.bmb.a011611.
- [5] Csige I, Ujvárosy D, Szabó Z, Lorincz I, Paragh G, Harangi M, et al 2018 The Impact of Obesity on the Cardiovascular System. *J Diabetes Res*. doi: 10.1155/2018/3407306.
- [6] Saeed E, Ali R, Jalal-ud-din M, Saeed A, Jadoon RJ ahangii., Moiz M 2015 Hypercholesterolemia in Patients of Ischemic Stroke. *J Ayub Med Coll Abbottabad*. 27(3):637–9.
- [7] Klop B, Elte JWF, Cabezas MC 2013 Dyslipidemia in Obesity: Mechanisms and Potential Targets. *Nutrients*. (4):1218–40 doi: 10.3390/nu5041218.
- [8] Westerterp KR 2018 Exercise, energy balance and body composition. *Eur J Clin Nutr* [Internet]. 2018;72(9):1246–50. Available from: <http://dx.doi.org/10.1038/s41430-018-0180-4>
- [9] Petridou A, Siopi A, Mougios V 2019 Exercise in the management of obesity. *Metabolism* [Internet]. 92:163–9. Available from: <https://doi.org/10.1016/j.metabol.2018.10.009>.
- [10] Famurewa AC, Ekeleme-Egedigwe CA, Nwali SC, Agbo NN, Obi JN, Ezechukwu GC 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. *J Diet Suppl*. doi: 10.1080/19390211.2017.1346031.
- [11] Chinwong S, Chinwong D, Mangklabruks A 2017 Daily Consumption of Virgin Coconut Oil Increases High-Density Lipoprotein Cholesterol Levels in Healthy Volunteers: A Randomized Crossover Trial. *Evidence-based Complement Altern Med*. doi: 10.1155/2017/7251562.
- [12] Ngampeerapong C, Chavasit V, Durst RW 2018 Bioactive and nutritional compounds in virgin coconut oils. *Malays J Nutr*.
- [13] Carandang EV 2012 Health Benefits of Virgin Coconut Oil. 213–64 doi: 10.1177/0146167201277003.
- [14] Sinaga FA, Harahap U, Silalahi J, Sipahutar H 2019 Antioxidant effect of virgin coconut oil on urea and creatinine levels on maximum physical activity. *Open Access Maced J Med Sci*. doi: 10.3889/oamjms.2019.503.

- [15] Metges CC, Wolfram G 1991 Medium- and long-chain triglycerides labeled with  $^{13}\text{C}$ : A comparison of oxidation after oral or parenteral administration in humans. *J Nutr.*
- [16] Costa ACR, Rosado EL 2012 Influencia de la ingesta dietética de los triglicéridos de cadena media sobre la composición corporal, el gasto energético y la saciedad: una revisión sistemática. *Influ Diet intake Mediu Chain triglycerides body Compos energy Expend satiety a Syst Rev.* 27(1):103–8 doi: 10.3305/nh.2012.27.1.5369.
- [17] Bueno NB, de Melo I V., Florêncio TT, Sawaya AL 2015 Dietary Medium-Chain Triacylglycerols versus Long-Chain Triacylglycerols for Body Composition in Adults: Systematic Review and Meta-analysis of Randomized Controlled Trials. *Journal of the American College of Nutrition.* doi: 10.1080/07315724.2013.879844.
- [18] St-Onge MP, Bourque C, Jones PJH, Ross R, Parsons WE 2003 Medium- versus long-chain triglycerides for 27 days increases fat oxidation and energy expenditure without resulting in changes in body composition in overweight women. *Int J Obes.* doi: 10.1038/sj.ijo.0802169.
- [19] Wang Y, Liu Z, Han Y, Xu J, Huang W, Li Z 2018 Medium Chain Triglycerides enhances exercise endurance through the increased mitochondrial biogenesis and metabolism. *PLoS One.* 13(2):1–11 doi: 10.1371/journal.pone.0191182.
- [20] Melzer K 2011 Carbohydrate and fat utilization during rest and physical activity. *e-SPEN* [Internet]. 6(2):e45–52. Available from: <http://dx.doi.org/10.1016/j.eclnm.2011.01.005>.
- [21] J. F. Horowitz, "Fatty acid mobilization from adipose tissue during exercise," *Trends in Endocrinology and Metabolism.* 2003, doi: 10.1016/S1043-2760(03)00143-7.
- [22] Park K-M, Lim S-T, Sung K-Y, Kang S 2020 Effects of regulatory exercise on lipolysis pathway in obese pre and postmenopausal women. 1–22 doi: 10.21203/rs.3.rs-35034/v1.
- [23] Polak J, Bajzova M, Stich V 2008 Effect of exercise on lipolysis in adipose tissue. *Future Lipidol.* 3(5):557–72 doi: 10.2217/17460875.3.5.557.
- [24] Feingold KR, Grunfeld C 2000 Introduction to lipids and lipoproteins. [Updated 2018 Feb 2]. In: *Endotext* [Internet].
- [25] Sadeghi M, Mohammadi A, Khajehlandi A 2019 The Effect of Aerobic Exercise Training on Ox-LDL Levels and Some Cardiovascular Risk Factors in Women with Obesity. *Jundishapur J Heal Sci.* In Press(In Press)doi: 10.5812/jjhs.87511.



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