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Antioxidant Potential of Virgin Coconut Oil Reduced Creatine Kinase Levels in Non-Athlete Students receiving Submaximal Physical Exercise

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Abstract. Damage to the muscle cell acute and chronic can be caused by strenuous physical exercise. Oxidative stress that occurs during strenuous exercise contributes to muscle cell damage. One indicator of muscle cell damage is creatine kinase in the blood serum. Natural antioxidant can be given to counteract the free radicals and reduce oxidative stress. Virgin coconut oil is a natural plant that has potential as an antioxidant. The purpose of this study was to determine the effect of virgin coconut oil on muscle damage by looking at the creatine kinase activity during submaximal exercise in non-athlete students. This is an experimental study with a randomized control group pretest-posttest design. The sample in this study were ten people who were divided into two groups. The control group was given a placebo while the experimental group was given virgin coconut oil at a dose of 15 ml. All groups received submaximal physical exercise with an intensity of 80-90%, a frequency of 3 times a week for one month. Creatine kinase was measured before and after treatment. The creatine kinase activity in the control group increased significantly while the experimental group decreased insignificantly. Virgin coconut oil in this study significantly reduced creatine kinase activity. The antioxidant potential of virgin coconut oil can repair muscle damage in non-athlete students receiving submaximal physical exercise.

1. Introduction

Physical exercise is a series of structured and rhythmic physical activities that have an intensity and within a certain period of time aimed at improving physical fitness [1]. Increased metabolism in the body due to physical exercise will increase oxygen consumption including muscle cells and this can have an adverse effect [2]. Maximum physical exercise can cause fatigue and even injury to muscles. When the skeletal muscle contracts, reactive oxygen species (ROS) are produced which can cause oxidative stress due to an imbalance between reactive oxygen species (ROS) and body antioxidants [3]. This situation will trigger damage to muscle cells. To prevent this situation there are physiological indicators that are considered important parameters for monitoring the volume and intensity of exercise such as plasma creatine kinase concentration.

According to [4] exercise resistance increases creatine kinase levels significantly, exercise power resistance in a higher total creatine kinase (CK) level than hypertrophy and strength types. Resistance training can also induce an increase in circulating creatine kinase [5]. The concentration of Creatine Kinase nonsignificant increase in runners who run a distance of 6 kilometers [6]. However, [7] found



different results where the creatine kinase level decreased not significantly in subjects receiving eccentric and concentric exercise.

Much research has been done to address the state of oxidative stress caused by exercise, one of them by giving antioxidants either synthetic or natural. Several studies have found that taking supplements can help reduce states of oxidative stress [8,9,3]. On the other hand, the use of natural antioxidants to treat oxidative stress due to exercise has been found, such as anthocyanins from purple sweet potatoes [10], red dragon fruit extract [11], red-fleshed pitaya (*Hylocereus polyrhizus*) [12] and red fruit oil [13].

One of the natural ingredients that contains antioxidants is virgin coconut oil (VCO), which is an oil derived from fresh old coconut (*Cocos nucifera*) which is processed at low temperature [14]. The active compounds contained in VCO include tocopherols, tocotrienols, phytosterols, phytostanol, flavonoids and several polyphenol compounds, phospholipids, and medium chain triglycerides [15].

Research on the effect of VCO on the production of free radicals that can cause oxidative stress is currently limited. Results of research have shown that administration of the VCO can increase the content of Cu, Zn-SOD in the kidneys of mice with diabetes mellitus [16]. Meanwhile, the results of a study on the effect of VCO administration for 30 days on the hematological parameters of mice showed an increase in SOD enzyme levels [17]. VCO at a dose of 6.7 ml / kgBW can reduce testicular MDA levels in rats induced by giving alcohol a dose of 7 ml / kgBW [18]. The results of the study reported that VCO given acutely can increase endurance rats at maximal physical activity [19].

Based on the background above, it is necessary to conduct research to see the effect of giving Virgin Coconut Oil on muscle damage by looking at creatine kinase levels during submaximal exercise in non-athletic students.

2. Materials and Methods

This research was conducted in the physical laboratory of the Faculty of Sports Science, Universitas Negeri Medan. Examination of creatinine kinase levels was carried out at the regional health laboratory, North Sumatra. Samples are non-athlete students as many as 10 people were divided into 2 groups: control (5) and experimental (5) group. The sample in the study had the criteria of men, aged 21-24 years, physically healthy and did not smoke. During physical exercise the sample should not take other antioxidant supplements and 72 hours before exercise should not do any other physical exercise. The sample who participated in this study had obtained an explanation of the approved research procedure by filling in the informed consent.

This is an experimental study with a randomized control group pretest-posttest design and has received "Ethical clearance" from the ethical committee of the Faculty of Medicine, Universitas Sumatera Utara (approval number 276/KEP/USU/2020). The control group was the group that received placebo in the form of mineral water and submaximal physical exercise, while the experimental group was the group that received virgin coconut oil and submaximal physical exercise. VCO was given as much as 15 ml one hour before training. Sub-maximal physical exercise in this study is exercise using a treadmill with a slope of 0° and a speed level of 10-12, for one month with a frequency of 3 times a week with an intensity of 80-90% of the maximum pulse. The creatine kinase examination in this study was carried out before (pretest) and after (posttest) treatment. Examination of creatine kinase levels was carried out using the IFCC (International Federation of Clinical Chemistry) method. This method is the standard method used to measure the catalytic concentration of enzymes.

Statistical test was performed using SPSS software version 22. Paired and unpaired t-tests are performed when the data are normally distributed, nonparametric tests are performed if the data are not normally distributed. In this study, the value of $p < 0.05$ were classified as significant results.

5 Result and Discussion

The purpose of this study was to see how the effect of VCO administration on creatine kinase levels in non-athlete students who received submaximal training. The results of this study showed that the creatine kinase level in the control group had a significant increase ($p < 0.05$), while in the treatment

group there was an insignificant decrease ($p > 0.05$) in the creatine kinase level. Virgin coconut oil in this study had an effect on creatine kinase levels, where creatine kinase levels decreased significantly ($p < 0.05$). The results of the study can be seen in tables 1 and 2.

Table 1. Differences in levels of creatine kinase before and after physical exercise on student

Parameter	Group	Average \pm SD	p value
CK (U/L)	Pretest P1	34.40 \pm 6.22	0.046*
	Posttest P1	56.60 \pm 18.79	
	Pretest P2	40.40 \pm 13.44	0.520
	Posttest P2	32.80 \pm 11.34	

P1 (Control); P2 (Treatment); * $p < 0.05$.

Table 2. Effect of VCO administration on creatine kinase levels

Parameter	Group		p value
	P1 (Average \pm SD)	P2 (Average \pm SD)	
CK (U/L)	56.60 \pm 18.79	32.80 \pm 11.34	0.029*

P1 (Control); P2 (Treatment); * $p < 0.05$.

Submaximal physical exercise in this study can increase the levels of creatine kinase significantly. Several previous studies have found that there is an effect of exercise training on creatine kinase levels. Swimming until exhaustion in mice could increase the activity of creatine kinase in the serum of these mice [20]. Creatine Kinase is a marker that indicates muscle damage [21]. Resistance training can cause damage to muscle tissue and this condition is known as rhabdomyolysis [5,22]. This damage is characterized by an increase in muscle proteins in circulation such as Creatine Kinase, Lactate Dehydrogenase and Myoglobin [23].

The provision of VCO in this study had an effect on creatine kinase levels. Creatine kinase levels had a significant reduction in non-athlete students who received the VCO and submaximal exercise. The use of natural plants to reduce exercise-induced muscle damage has been studied before. Curcumin administration and exercise were effective in reducing CK-MB levels [24]. There was a decrease in the activity of CK, CK-MB serum in mice given *Lycium barbarum* and received swimming exercises until fatigue [25-26]. Red fruit oil can reduce creatine kinase levels in mice that get maximum physical activity from swimming to fatigue [27].

One of the natural ingredients that contain antioxidants is virgin coconut oil (VCO). In addition to fatty acids, some other known chemical components contained in coconut oil are sterols, vitamin E, and the fraction of polyphenols (phenolic acids). The main phenolic acids detected were ferulic acid and p-coumaric acid, these phenolic compounds which contribute to the antioxidant capacity of VCO [28]. VCO has the potential to prevent exercise-induced damage and restore antioxidant balance [29].

4. Conclusion

The conclusion of our study is creatine kinase level in the control group had a significant increase and the treatment group there was an insignificant decrease. Virgin coconut oil in this study had an effect on creatine kinase levels, where creatine kinase levels decreased significantly.

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