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**EFFECT OF RED FRUIT OIL ON HEMATOLOGICAL PARAMETERS AND ENDURANCE PERFORMANCE
AT MAXIMAL PHYSICAL ACTIVITY**



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Effect of red fruit oil on malondialdehyde level at maximal physical activity

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Abstract

Background. Maximal physical activity can produce an imbalance between reactive oxygen species (ROS) and antioxidants which is possibly related to fatigue and tissue injury. Red fruit oil contains high betacarotene and tocopherol. This study investigated the effect of red fruit oil on malondialdehyde level in maximal physical activity.

Methods. This study used pretest-posttest control group design. Thirty athletes are used as samples were divided into two groups. While undergoing the training program, the experimental group consumed the red fruit oil 5 ml every day. After undergoing the training program, all athletes perform maximum physical activity by doing a bleep test. Blood samples were collected before and after the test to measure the levels of malondialdehyde (MDA).

Results. Analysis showed that MDA level obtained was decreasing significantly ($P=0.000$) and endurance athletes was increasing significantly ($P= 0.001$) in the intervention groups.

Conclusion. The results conclude that red fruit oil can obviously to reduce MDA level and increase endurance and delay fatigue induced by maximal physical activity in athletes.

Key words: red fruit oil, antioxidant, malondialdehyde, maximal physical activity.

INTRODUCTION

Strenuous physical activity can lead to oxidative stress occurs due to the production of free radicals exceeds the amount of antioxidants in the body [1-2]. Under conditions of oxidative stress, free radicals cause lipid peroxidation of cell membranes [3]. Malondialdehyde (MDA) is one of the results of lipid peroxidation [4-6], so that the MDA is a common indicator used to determine the amount of free radicals and indirectly assess body antioxidant capacity.

Some studies claim that oxidative stress may result in a decrease in the amount of antioxidants [7], decreased immunity [8], sport anemia [9], damage to the muscle tissue [10] which is thought to be involved in the process of fatigue, causing muscle pain [11], changes in the value of hematocrit, erythrocytes and leukocytes [12], decreased hemoglobin levels and morphological changes in the cells of erythrocytes [13], which in turn can affect performance.

In the body there is a mechanism of antioxidant or anti-free radicals are endogenous. Free radicals are formed will be neutralized by the antioxidant defense system elaboration of the enzymes and a number of non-anti-oxidant enzymes [14]. The results of the study reported that the administration of antioxidants derived from natural or synthetic sources from outside the body is required to neutralize the free radicals formed during physical activity, especially strenuous physical activity [15-18].

One of the known natural sources of antioxidants is red fruit (*Pandanus conoideus* Lam) contained in Papua. Red fruit contains beneficial nutrients or active compounds in high levels, such as beta carotene, tocopherol, as well as fatty acids [19-20]. In many research activities tocopherol and beta carotene as an antioxidant believed to be its ability to prevent chronic diseases such as cardiovascular disease, atherosclerosis, and cancer. In addition, the Papuan people believe that red fruit can improve physical performance, but it still needs to be proven scientifically.

The specialty of the red fruit that contains high antioxidant makes researchers feel interested and need to examine the antioxidant effects of red fruit oil at maximum physical activity.

The purpose of this study was to determine the antioxidant effect of red fruit oil to the MDA at maximum physical activity. The results are expected to contribute to the development of science and technology, especially as a basis for further research and development phytopharmaca for the improvement of public health, especially for the health of athletes. The results could be applied to athletes during training programs or during the competition so as to support program development, especially the development in the field of sports achievement and health. In terms of the development of science and technology, this research is a form of contribution to disciplines other than sports disciplines to support the athlete's performance.

METHOD

Subject

Subjects of research using trained athlete. The number of athletes as many as 30 people with the criteria of having a good level of VO₂max, male gender, age 20-22 years old, have a BMI that is good, not smokers, not taking supplements and antioxidants 2 weeks before and during the study

Treatment

Before starting an exercise program all samples measured levels of MDA, and VO₂max. During the training programs for 3 months, group I (treatment group) consume red fruit oil once a day after meals, while the second group (control group). After the training programs, re-measured levels of MDA and VO₂max. While undergoing training program, all athletes undergoing the same diet to maintain homogeneity of the samples during the study.

Statistical analysis

All collected data were in average \pm SD manner for the athletes in each group. The data normality was tested using Kolmogorov-Smirnov test. Data homogeneity was tested using Levene test. The normal and homogenous data were then analyzed using t-paired with $\alpha = 0.05$ in SPSS version 23.0 program to determine the difference among groups.

RESULT AND DISCUSSION

Result

Based on the results of research conducted MDA levels before and after administration of red fruit oil at the time of maximum physical activity are shown in Table 1

Table 1. Analysis results of plasma MDA level (nmol/ml)

Parameter	Group	
	Exsperiment	Control
MDA (nmol/ml)		
Before supplementation	1,571 ± 0,123	1,521 ± 0,063
After Supplementation	1,114 ± 0,023	1,641 ± 0,111

The normality and homogenous tests showed that the data were normally and homogenously distributed ($p > 0.050$). The result of statistic analysis using t test showed that there was no difference in MDA level among groups before treatment ($p > 0.050$). The t-paired test result showed that the MDA level was significantly increasing in control group while it is significantly decreasing in treatment groups ($p < 0.05$).



Fig.1. The Malondialdehyde level in blood of each group before and after treatment. Data were given in average \pm SD manner of 15 athletes in each group. Statistical analysis was done by t-test

The results of studies that reported the effect of red fruit oil against VO_{2max} is shown in figure 2



Fig 2. Effects of red fruit oil on VO_{2max} in athletes. Data were given in average \pm SD manner of 15 athletes in each group. t-test result showed the significantly increasing VO_{2max} in treatment groups compare to control group ($p < 0.05$).

Discussion

The effect of Red Fruit Oil on the Malondialdehyde level

Malondialdehyde (MDA) is a main product in lipid peroxidation of cells and the MDA content in tissue is a common indicator reflected in the number of free radicals [21]. During strenuous exercise or high-intensity endurance exercise, the generation of oxygen free radicals increased heavily, while the MDA is one of the main products of lipid peroxidation induced by the free radicals. Therefore, determining the MDA content in tissue can evaluate the degree of lipid peroxidation and indirectly assessed the body's antioxidant capacity [4-6].

The result showed the increasing level of MDA in control group after treatment. The increasing level of MDA in control group was due to the high free radicals production in maximal physical activity condition. The higher level of MDA compare to the level of defending cellular antioxidant will generate the oxidative stress condition. As mentioned above, the MDA is one of the oxidized lipids formed by free radical during maximal physical and high intensity endurance exercises [4-6].

Statistically, the MDA levels in all treatment groups were remaining low after treatment compared with the control group. This result was due to the antioxidants in red fruit oil that bind to the free radicals. Red fruit contains beneficial nutrients or active compounds in high levels, such as beta carotene, tocopherol, as well as fatty acids [19-20]. Results of research conducted by Rohman et al [22] reported that red fruit has antioxidant activity that can be used as free radical scavengers. Results of research conducted by Sandhiutami reported administration of red fruit oil for 10 days can increase levels of tocopherol [23].

The effect of red fruit oil on endurance

The results showed that administration of red fruit oil can improve VO_{2max} athlete during training programs.. Several theories are supporting this result, namely the high antioxidant content in red fruit oil. Antioxidants in red fruit oil were considered to prevent lipid oxidation in cellular membrane especially in erythrocyte cells. Several researches showed that physical activities were able to induced the formation of oxidized lipid and generate the oxidative stress condition. Oxidized lipid are able to cause erythrocyte cell damage and thus caused the "sport anemia" [9], and muscle tissues damage [10] The damage of muscle and blood cells were considered to be involved in exhaustion processes or the disability to generate energy and therefore decrease the endurance. Several researches about the effect of antioxidant on the endurance have been conducted Ozaslan et al reported that vitamin C was able to increase endurance in rat model [24]. Bing and Wang reported that Ginkgo biloba extract was able to increase the activities of antioxidant enzymes in rat liver tissues, reduce the level of oxidized lipid generated by free radicals and increase endurance and healing processes after maximal physical activities [25]. Similar result was also reported by Miao et al using corn peptide [26].

CONCLUSION AND SUGGESTION

Conclusion

1. Red fruit oil supplementation was significantly decreasing the rat MDA level in maximal physical activity condition.
2. Red fruit oil supplementation was significantly increasing the rat endurance in maximal physical activity condition.

Suggestion

This research will be better when done measuring antioxidant status as measured levels of concentration betacaroten, tocopherol, glutathione peroxidase, superoxide dismutase and catalase.

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