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Research Article

# THE INFLUENCE OF RED FRUIT (*PANDANUS CONOIDEUS* LAM.) OIL ON GLUTATHIONE PEROXIDASE LEVEL AT MAXIMUM PHYSICAL ACTIVITY

**FAJAR APOLLO SINAGA[1]*, NORA SUSANTI[2]**

**[1]Department of Sports Science, Faculty of Sports Sciences, Universitas Negeri Medan, Medan, Indonesia. [2]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Medan, Indonesia. Email: sinaga_fajar@yahoo.com**

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**ABSTRACT**

**Objectives**: This study aims to see the effect of red fruit oil (RFO) on glutathione peroxidase (GPx) level at maximum physical activity.

**Methods:** This study is an experimental research using the design of randomized control group pretest-posttest. This study was using 24 male mice divided into four groups, the control group was given aquadest, the treatment groups P1, P2, and P3 were given the RFO orally of 0.15 ml/kg BW, 0.3 ml/kg BW, and 0.6 ml/kg BW, respectively, for a month. The level of GPx was checked for all groups at the beginning of study and after the maximum physical activity. The obtained data were then tested statistically using t-test and ANOVA.

**Results:** The result shows the RFO supplementation during exercise increased the GPx level in P1, P2, and P3 groups with $p<0.05$, and the higher RFO dosage resulted in higher GPx level at $p<0.05$.

**Conclusion:** The conclusion of this study is the RFO could increase the level of GPx at maximum physical activity.

**Keywords:** Red fruit oil, Maximum physical activity, Glutathione peroxidase.

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## INTRODUCTION

Heavy physical activities can cause the oxidative stress which result in the increasing free radicals production [1,2]. In the oxidative stress condition, free radicals can oxidize lipid in the cell membrane and thus interrupt the cell membrane organization [3]. Malondialdehyde (MDA) is one of the oxidized species of the membrane lipid that can be produced by maximal physical activities or by high intensity endurance exercises. The level of MDA can be used as a general indicator for free radical level and indirectly pointed the oxidant capacity [4,5].

Researchers showed that the maximum activity can cause the lowering level of endogenous antioxidants, namely, superoxide dismutase, catalase (CAT), glutathione peroxidase (GPx), and glutathione-S-transferase on gastrocnemius muscle [6]. Bulduk *et al*. reported the high level of MDA and the lowering level of endogenous antioxidants, CAT, and GPx in volleyball athletes after 20 min of shuttle run [7].

Antioxidant and anti-free radicals mechanism is naturally occur in human body. Free radicals will be neutralized through elaborated system made of enzyme and non-enzyme antioxidants [2,8]. Some researchers reported supplementation of natural or synthetic antioxidants are required for the neutralization of free radicals formed during heavy physical activities [9-12].

Red fruit oil (RFO) (*Pandanus conoideus* Lam.) is one of the natural resources found in Papua Island and known for its high antioxidant contents (beta-carotene, tocopherol, and unsaturated fatty acids) [13,14]. As an antioxidant, the RFO is believed to prevent chronic diseases such as cardiovascular diseases, atherosclerosis, and cancer. In addition, the Papuan believe that this plant can be used to enhance the stamina, but this later property is yet to be proven scientifically.

The result of research conducted by Sinaga stated that RFO can increase the erythrocyte, hematocrit, and hemoglobin level and decrease the leukocyte level in rats during maximal activity. In that research, it is also found that RFO can decrease the MDA level and enhance the rats' stamina during maximal activity [15]. This result is particularly interesting and therefore need further study to discover the effect of RFO on human GPx level at maximal physical activity.

The aim of this study is to find antioxidant compound which has the ability to prevent the formation and decrease the level of free radicals formed during physical activity and therefore enhance the athlete performance and health.

The result of this research is expected to contribute to the body of knowledge, especially as the basic for further research in developing natural medicine for athlete health. The results can be applied during training program and competitions for athlete.

## METHODS

The study was conducted for 6 weeks in Animal Laboratory Unit in Mathematics and Natural Science Faculty of Medan State University. The GPx level was examined in Laboratorium Terpadu (Research Center Lab) in Medical Faculty of North Sumatera University.

This study used 24 healthy male rats. The rats were divided into four groups randomly consisted of six rats in each group. The control group (P0) was given 2 mL water, the treatment groups (P2, P3, and P4) were given RFO 0.15, 0.3, and 0.6 mL, respectively, per day using gavage spuit. The rats were trained to swim for a month, 15 min/day in the 1st week, 20 min/day in the 2nd week, 25 min/day in the 3rd week, and 30 min/day in the 4th week. After 30 days, the rats were forced to perform maximal activity by putting the rats in water with no exit. The GPx level was then measured.

## RESULTS

The GPx level prior and after treatment is presented in Table 1.

The GPx level before and after treatment in each group was subject to Shapiro–Wilk normality test and Levene's homogeneity test. Both tests result showed that the data were normal and homogeneous ($p>0.05$), and therefore, one-way ANOVA and t-paired test were used for parametric test.

The one-way ANOVA test on GPx level before treatment gave the F value of 0.555 and p=0.651. This result showed that the average Gpx level was not significantly different within and among groups. While the test on GPx level after treatment gave the F value of 28181.122 and p=0.000 which mean that there is statistically significant difference in the GPx level among groups (p<0.05).

The t-paired test result showed that the GPx level was lowering in the control group (P0), while in contrast, it was significantly increasing in the treatment groups of P1, P2, and P3 (p<0.05) (Fig. 1).

## DISCUSSION

The pre-treatment GPx level average in control group was 35.97±0.40 (U/gHb), in P1 group (RFO 0.15 mL/day) was 36.01±0.72 (U/gHb), P2 group (RFO 0.3 mL/day) was 36.26±0.53 (U/gHb), and P3 group (RFO 0.6 mL/day) was 36.33±0.62 (U/gHb). One-way ANOVA test showed that the GPx level pre-treatment among four different groups is not significantly different (p>0.05). After treatment, the average of GPx in control group was 30.37±0.42, in P1 group was 65.96±0.56, in P2 group was 100.26±0.79, and in P3 group was 126.69±0.59. Statistics analysis showed that there is statistically significant difference among all four GPx average level (p<0.05).

In normal condition, free radicals were formed slowly and neutralized by naturally occurring antioxidants. In the case, where the free radicals were formed massively which can be caused by heavy training, the level of free radicals will overcome the level of naturally occurring antioxidant in the body and thus were not be neutralized. This later condition can lead to the damage of cellular membrane, muscles, bones, and other tissues [16]. The lowering level of GPx after maximum physical activity can lead to physical stress. Recovering time is needed to maintain the relax body condition after training activity [17]. The oxygen consumption during heavy training can rise up to 20 times higher or even more than normal oxygen consumption. In stress condition, the muscle fiber consumes oxygen more than it does in normal condition. This extreme oxygen consumption can rise the free radicals production in mitochondria which will lead to high GPx usage and lower the GPx level. In the discontraction muscles, the oxygen level is low and ischemic can occur. To overcome all these unwanted conditions, the antioxidant supplementation is needed [16].

**Table 1: The average of GPx level prior and after RFO supplementation at maximal physical activity**

| Level | Treatment | P0 | P1 | P2 | P3 | F | p |
|---|---|---|---|---|---|---|---|
| GPx | Before | 35.97 | 36.01 | 36.26 | 36.33 | 0.555 | 0.651 |
| | After | 30.37 | 65.96 | 100.26 | 126.69 | 28181.122 | 0.000 |
| t dependent | | 0.000 | 0.000 | 0.000 | 0.000 | | |

GPx: Glutathione peroxidase, RFO: Red fruit oil

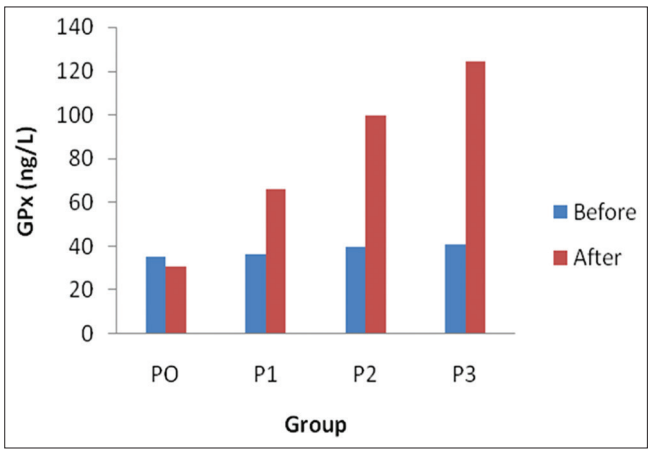


**Fig. 1: The glutathione peroxidase level in control and treatment groups before and after red fruit oil supplementation at maximal activity**

In this study, the supplementation of RFO is found to increase the GPx level. The increasing GPx level was due to the high antioxidant content in RFO such as carotenoids (11.500 ppm), β-carotene (694.80 ppm), tocopherols (11.200 ppm), and α-tocopherol (495.50 ppm) [14].

As one of the natural sources of antioxidant, the antioxidant activity of RFO was studied. Rohman *et al*. reported *in vitro* study showed that the RFO exhibited antioxidant activity with IC50 of 451.51 µg/ml [18]. *In vivo* study, RFO with dosage of 0.15, 0.3, and 0.6 mg/kg BW exhibited the ability to lower the blood MDA level [15,19]. MDA is one of the peroxidized lipids and the level of MDA can be used as the indicator of free radicals level and oxidant capacity [4,5,15].

The result of this research is in line with the research conducted by Sandhiutami *et al*. which studied the level of tocopherol after RFO supplementation on male Wistar rats at maximal activity. They found that the level of tocopherol was increasing as the dosage of RFO is risen [19]. Armiyanti *et al*. reported the lowering level of reactive oxygen intermediate (ROI) on endothelial cell exposed to malaria patient blood serum and normal neutrophil cell after RFO supplementation with concentration of 2.8%, 5.7%, and 11.3%. Higher concentration of RFO decreases ROI level [20].

## CONCLUSION

RFO supplementation during exercise program can increase the level of GPx at maximal physical activity.

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