THE INFLUENCE OF 8-WEEK AEROBIC EXERCISE ON ANTIOXIDANT ENZYM ON YOUNG MEN

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PAPER INFO ABSTRACT

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Background: Aerobic exercise is indicated to be able to trigger an increase in antioxidant enzyme activity in the human body, which is one indicator of an increase in antioxidant enzyme activity marked by an increase in blood plasma Superoxide dismutase (SOD).

Aim: This study aims to examine and analyze the magnitude of the increase in SOD due to aerobic exercise for 8 weeks.

Methods: This research is a quasi-experimental research with a quantitative approach and a one group pretest and posttest design. The population in this study were students of the Department of Sports Coaching, State University of Malang, aged 19-20 years, with a normal Body Mass Index (BMI). The sampling technique used purposive sampling, with a total sample of 20 students. Data was collected by measuring blood plasma SOD activity as an indicator of antioxidant enzyme. SOD measurements were carried out before and after the aerobic exercise treatment. Aerobic exercise is carried out with a frequency of 3 times per week, with moderate intensity, for 8 weeks. Data Analysis using t-test in pairs (α = 0.05).

Findings: The results showed that the mean and standard deviation of the SOD pretest were 22.68 ± 2.62 U/ml and posttest 29.05 ± 1.44 U/ml, there is an average increase in SOD activity plasma by 21.9% (p=0.021 <0.05).

KEYWORDS aerobic exercise, antioxidant enzyme, young men

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INTRODUCTION

The increasing incidence of various non-communicable diseases and metabolic syndrome today is closely related to the increase in free radicals in the body. The occurrence of oxidative stress shows that free radicals cause cells and tissues to experience an imbalance and in the end the cells are damaged. Under normal circumstances, there is usually an equilibrium between antioxidants, oxidants, and biomolecules. Excessive production of free radicals, usually triggered by increased consumption or pollution, causes natural cellular antioxidants to be overwhelmed, resulting in increased oxidation and cellular functional defects (Wang et al., 2013).

Reactive Oxygen Species (ROS) under normal conditions function as a “redox messenger” in the control of intercellular pathways. Natural ROS production that is not balanced with the antioxidant capacity of tissues causes oxidative stress, in which this condition triggers permanent damage to cellular components and results in cell destruction through the mechanism of intrinsic apoptosis through mitochondria. Damage to the respiratory chain in mitochondria can lead to overproduction of ROS, which can increase the disruption of oxidative processes not only in mitochondria but also in other cellular parts (Schöttker et al., 2015). Conditions of oxidative stress can be reduced by: reducing exposure to environmental pollutants, increasing antioxidants sourced from within the body and exogenous antioxidants,
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and minimizing oxidative stress (stabilizing the production and efficiency of mitochondrial oxidation) (Poljsak, 2011).

Antioxidants can be interpreted as molecules that can balance or neutralize free radicals before they attack cells by holding back the oxidation process. Endogenous antioxidants can be distinguished as non-enzymatic endogenous antioxidants (uric acid, albumin, glutathione, bilirubin, thiols, vitamins, and phenols), and enzymatic endogenous antioxidants (superoxide dismutase (SOD), glutathione peroxidase, and catalase). Under normal conditions endogenous antioxidants will balance ROS production. Endogenous antioxidants function to maintain optimal cellular balance and systemic homeostasis in general, so that antioxidants have the function of prevention and protection against age-related diseases (Erejuwa et al., 2012; Rahman, 2007; Zalukhu et al., 2016).

One way to increase antioxidants is with exercise. It is known that exercise with submaximal intensity can improve health status and maintain cardiorespiratory fitness (Hottenrott et al., 2012). Physiologically, sports training places physical stress on the body which can produce an adaptation response. The recommended exercise is that as long as the body is able to adapt to excessive loads on the body (overload principle), training at a sufficiently high intensity can induce specific adaptations that allow the body to function more efficiently (Katch et al., 2013). Adaptation of sports training is also known to increase the production of antioxidants, such as catalase (CAT), Superoxide Dismutase (SOD), and Hydroxyl Sulfur Glutathione (GSH) (de Araujo et al., 2016; Mayorga-Vega et al., 2013). Antioxidant defense is very necessary for a cell, because cells will continue to form reactive oxygen species (ROS) free radicals during respiration and inflammatory conditions. Adaptation of sports training can increase the production of endogenous antioxidants, these conditions can prevent the occurrence of oxidative stress which can cause damage to cells and their components (Putri, 2019).

The results of previous studies related to the effect of exercise on endogenous antioxidant capacity, among others, were produced by Park and Kwak (2016) explaining the results of research that sports activity resulted in a response of increasing oxidative stress and reducing antioxidant capacity. These results are different from research by Ismaeel et al. (2019) which found that the resistance training model was able to significantly increase antioxidant status. Likewise, de Souza et al. (2019) concluded that high-intensity interval training (HIIT) exercises were able to increase antioxidant capacity in rats. Vatani and Gholzar (2012) presented the results of his research that although exercise can lead to an increase in the antioxidant system and reduce some cardiovascular risk factors among overweight subjects, the combination of resistance training and whey consumption is more effective.

Other studies related to increased antioxidant capacity due to exercise were also presented by Vieira Junior et al. (2013) which resulted in an increase in antioxidant capacity (SOD) of 36.83%. Likewise, the research Azizbeigi et al. (2014), there was an increase in antioxidant capacity due to exercise training, but the results obtained varied greatly depending on the exercise model. In the concurrent training (CT) model, there was an increase of 14.5%, endurance training (ET) increased by 21.8%, while the resistance training (RT) method experienced an increase of 9.5%.

From this exposure, it was found that research related to the effect of exercise on increasing antioxidant capacity, the results varied widely. This is greatly influenced by many factors of
sports training methods, for example differences in exercise doses related to frequency, intensity and duration of exercise, exercise programs and measurement methods. With this description, this research was conducted with the aim of knowing and analyzing increased antioxidant capacity due to moderate intensity aerobic exercise, with a frequency of 3 times per week for 8 weeks. The research is expected to give readers more insight into the discussed topic in hopes for widening the range of knowledge and interest in it.

METHODS

This is quasi-experimental research with quantitative approach, using a one group pre-test and post-test design. The population of this study were all students of the Sports Coaching Education Department, Faculty of Sports Science, Malang State University who were male and aged 19-20 years, with a normal BMI of 164 people. The research sample was taken using purposive sampling technique so that a sample size of 20 people was obtained. The inclusion criteria in this study were: 1) Body Mass Index 19-24 Kg/m²; 2) Hemoglobin level 12–17 g/dL; 3) Not smoking; and 4) and informed consent.

Variable Free from this study was moderate intensity aerobic exercise with a frequency of 3 times/week and a duration of 30 minutes for one exercise, which was carried out for 8 weeks. While the dependent variable is antioxidant capacity with an indicator of blood plasma SOD effectiveness. Data were collected by measuring blood plasma SOD activity before and after an 8-week aerobic exercise program. The data were then analyzed by paired t-test using the SPSS program with a significance level of \( \alpha = 0.05 \). Technical analysis requirements -t test includes data normality test using the Shapiro–Wilk test technique.

RESULTS AND DISCUSSION

Table 1. Description of Antioxidant Capacity Variable Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>Means</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOD (U/ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>20</td>
<td>22.68</td>
<td>2.62</td>
<td>18.67</td>
<td>27.31</td>
</tr>
<tr>
<td>Posttest</td>
<td>20</td>
<td>29.05</td>
<td>1.44</td>
<td>26.00</td>
<td>32.34</td>
</tr>
</tbody>
</table>

Table 1 shows an increase in the average posttest SOD, which reflects an increase in antioxidant enzyme activity after an 8-week aerobic exercise program. Furthermore, prior to analysis using the paired t-test, a normality test was carried out which is summarized in table 2 below.

Table 2. Results of Normality Test Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistics</th>
<th>Sig.</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>0.951</td>
<td>0.741</td>
<td>Normal</td>
</tr>
<tr>
<td>Postest</td>
<td>0.930</td>
<td>0.821</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Based on table 2, it was found that Sig > 0.05 in both the pretest and posttest. This shows that the data is normally distributed.
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Table 3. Results of t-test analysis of dependent variable antioxidant capacity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sig. (2-tailed)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair SOD Pre-Post</td>
<td>.02 1</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Based on table 3, it shows the results of Sig <0.05, which means there is a difference between the average pretest and posttest SOD.

Table 4. Results of the Effectiveness Analysis of the Dependent Variable Antioxidant Capacity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre - test</th>
<th>Post - test</th>
<th>Delta</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOD (u/ml )</td>
<td>22.68±2.62</td>
<td>29.05±1.44</td>
<td>6.37 ± 3.00</td>
<td>↑ 21.927 %</td>
</tr>
</tbody>
</table>

Based on table 4, the difference in SOD between pretest and posttest was obtained with a percentage of 21.927%.

Discussion

Based on table 1, the results of SOD as an indication of the antioxidant capacity of the enzyme average per test 22.68 ± 2.62 U/ml and posttest 29.05 ± 1.44 U/ml. These data indicate that there is a difference in the capacity of antioxidant enzymes between before aerobic exercise and after aerobic exercise for 8 weeks. Table 3. Paired t-test results of the pretest and posttest antioxidant capacities obtained sig = 0.02 <0.05, meaning that there is a significant difference in the average antioxidant enzyme capacity between the pretest and posttest results. This can be interpreted that there is a significant increase in antioxidant enzyme capacity as a result of moderate intensity aerobic exercise. Research conducted by Escobar et al. (2009) proved that high-intensity interval training in junior soccer players resulted in an increase in the activity of the enzymes SOD and CAT. This shows that high-intensity interval training can significantly increase the capacity of antioxidant substances. The same thing was produced by Poblete Aro et al. (2015), in which moderate intensity continuous exercise can increase antioxidant capacity. Also in line with the results of a study conducted Vieira Junior et al. (2013) stated that aerobic exercise 5x/week for 8 weeks resulted in an increase in the activity of antioxidant enzymes (superoxide dismutase, catalase and glutathione peroxidase), as well as a decrease in MDA levels. The results of the study by Ajabi and Mohammad (2013) showed that with aerobic exercise 3x/week for 12 weeks there was an increase in SOD and CAT antioxidants, as well as a decrease in blood plasma MDA levels. Lambertucci et al. (2007) stated that aerobic exercise can reduce TBARS (81%), increase the activity of antioxidant enzymes such as Cu, Zn-SOD. Research conducted by de Sousa et al. (2017), by examining the effect of exercise on antioxidants with the meta-analysis method and systematic review, showed that regardless of intensity, volume, type of exercise, and the population studied, antioxidant indicators tended to increase and indicators pro-oxidants tend to decrease after training. So the study concluded that exercise induces antioxidant effects. The results of the study de Araujo et al. (2016), with a study that compared the impact of high-intensity interval training (HIIT) with a training duration of 6 weeks and 12 weeks. The results showed that there was a significant increase in antioxidant capacity in both groups, but there was no significant difference in the increase in
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The results of research by Dunggio (2021), with a walking exercise program for 14 days showed an increase in SOD, but it was not statistically significant. It is possible that training for 14 days does not allow the body to adapt to exercise.

In research conducted by researchers, it was shown that there was an increase in the capacity of antioxidant enzymes by 21.9% due to moderate intensity aerobic exercise, with a frequency of exercise 3 times per week, for 8 weeks. The results of this study were supported by the results of research conducted by Vieira Junior et al. (2013), this study conducted research using the aerobic swimming training method, for 8 weeks, with a frequency of 5 times/week, the results showed an increase in antioxidant capacity (SOD) of 36.83%. Likewise Azizbeigi et al. (2014), the results of research using the endurance training (ET) method, in a sample of young men, training duration of 8 weeks with a frequency of 3 times per week showed an increase in antioxidant capacity of 21.85%. The results of research conducted by Azizbeigi et al. (2013) with the progressive resistance training (PRT) method, for 8 weeks, showed that the PRT method significantly increased SOD activity (pretest 1.323 ± 212.52 and posttest 1.449.9 ± 173.8 U/g). This shows that exercise with progressive resistance method can increase antioxidant capacity by 8.75%. Research conducted by de Araujo et al. (2016), with a moderate-intensity exercise program, the frequency of exercise 3 times per week for 8 weeks in a group of healthy and overweight young men obtained SOD results (U/mL) pretest 2.10 ± 0.72 and posttest 2.76 ± 0.58. from these data shows an increase in antioxidant capacity of 23.9%

CONCLUSION
The conclusion of the results of this study is that there is a significant increase in the capacity of antioxidant enzymes due to aerobic exercise for 8 weeks. Increased capacity of antioxidant enzymes by 21.9%. The impact of various exercise modalities on oxidative stress can be the focus of future study on antioxidant capacity due to moderate intensity aerobic exercise. In actuality, consistent exercise has the ability to fundamentally enhance the body's natural antioxidant system.

REFERENCES
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