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Effect of Regular Exercise and Antioxidant on Superoxide Dismutase (SOD)

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Abstract

The components of phenolic compounds contained in antioxidant function antidote to the free radicals that are inevitably generated by physical exertion.Exercise of a moderate level, on a regular basis will increase the sensitivity of endogenous antioxidants so that it can increase the immune system against influenza virus infection. This study aims to prove that regular exercise and antioxidant supplements can prevent oxidative stress which is characterized by increased levels of Superoxide Dismutase (SOD). This study uses an experimental pre and post-test design. Twenty men participated in the study, aged 20-22 years who had a good level of physical fitness, did not smoke, and did not consume supplements and other antioxidants within 2 weeks before and during the study. Participants in the study were randomly assigned to one of two groups, namely group A: regular exercise without antioxidants; group B: regular exercise and antioxidants. Regular exercise is done with a duration of half an hour,the duration of 4 weeks, and the frequency of 3x/week. Before and after treatment, SOD antioxidant levels were measured in both groups. Then the measurement data are tabulated and analyzed. The results showed that there was an increase in SOD levels in the regular exercise and antioxidant groups.

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INTRODUCTION

Various facets of life, including psychological, social, economic, cultural, political, and biological functions, can be affected by physical activity. Working out is a modulator that can take place on many different levels and has many different effects. The effect of exercise on bodily processes can be a positive influence that increases fitness and health and factors that are detrimental to health (Foss, 2006).

High-intensity physical exercise tends to produce excessive free radicals where endogenous antioxidants are unable to neutralize oxidative stress and trigger infection with viruses such as influenza viruses. Through inflammatory responses, oxidative stress promotes viral pathogenesis. Cytokine storm is the activation of a kappa B nuclear factor (NF-B) transcription pathway that may result in impaired immune response and enhanced virus multiplication (Camini et al., 2017).

One of the roles of vitamins and minerals is as an antioxidant that is able to strengthen the immune system (immune system). Antioxidants like vitamin C help get rid of harmful free radicals in the body. Vitamin C has a role as an electron donor so that it quickly breaks the ros reaction chain (Reactive Oxygen Species) (Gomez et al., 2013). Antioxidants are needed to neutralize free radicals and have an effect on inflammatory cytokines so that they can be used to strengthen the immune system so as to avoid being infected with viruses (Gomez et al., 2009: Sahlin et al., 2010; El Abed et al., 2014).

Furthermore, if moderate-intensity physical exercise is done regularly (Regular exercise) will increase the sensitivity of endogenous antioxidants so as to boost the immune system against attacks of viral infections such as influenza virus (Camphell et al., 2018; Samadi et al., 2020).

This study aims to prove that regular exercise and antioxidant supplements can prevent oxidative stress which is characterized by increased levels of Superoxide Dismutase (SOD).

METHODS

Participants

Twenty men participated in the study, aged 20-22 years, had a good level of physical fitness, did not smoke, did not consume supplements and other antioxidants within 2 weeks before and during the study. The participants were randomly divided into 2 groups, namely group A: regular exercise and and to get a placebo that is of the same shape and color as vitamin C; group B: regular exercise and getting vitamin C. Blood from the vena is collected for the assessment of SOD levels before and after the procedure.

Design study

This study employs a group experimental design pretest-posttest design. The investigation was carried out at Medan State University's Faculty of Sports Sciences.

Procedures

Participants warm up in 3 to 5 minutes. Participate in physical activity by running on a treadmill at 70-75% of your maximal heart rate. Regular exercise is done with a duration of half an hour,the duration of 4 weeks, and the frequency of 3x/week. The treadmills are made at the physical laboratory Universitas Negeri Medan. Vitamin C is administered at a level of 500 mg each day at breakfast for 4 weeks.

SOD level determination using Quantitative Colorimetric with Superoxide Dismutase Assay Kit (ESOD-

100) by Bioassay Systems. Both groups had their blood tested before and after treatment to determine superoxide dismutase levels.

RESULT

Average SOD concentrations were 0.4480.151 U/ml in the routine exercise group prior to the treatment, and the average levels of SOD after the treatment were 0.5700.502 U/ml. Before the treatment, the average SOD levels in the regular exercise and antioxidant groups were 0.2900.217 U/ml, and after the treatment, the average superoxide dismutase levels were 0.7370.763 U/ml, as shown in Table 1.

Table 1. The Difference mean Superoxide Dismutase (SOD) levels

	Group A (mean±sd)	**Group B (mean±sd)**
Pre-Test	0.448±0.151	0.290±0.217
Post-Test	0.570±0.502	0.727±0.763
% Increased	21.40	60.11

DISCUSSION

Average levels of superoxide dismutase (sod) were found to have increased in this investigation after the intervention in the regular exercise group that was given antioxidants compared to the regular exercise group without getting antioxidants. This happens because antioxidants can neutralize free radicals that are produced when doing exercises.

By having one or more unpaired electrons in their outer orbitals, free radicals are highly reactive to neighboring cells and cellular components. Because there are electrons in the compound that are not linked up, the compound is highly reactive as it searches for a compatible partner. It does this by attacking and affiliating with the electrons in the molecules that are surrounding it (sousa et al., 2017) .

This compound if it meets a new radical will form new radicals again and so on which eventually the number continues to grow, so that there will be a chain reaction and can damage mitochondria, cells and tissues (cuzzocrea et al. 2001; fisher & bloomer 2009; sahlin et al. 2010).

Actually, free radicals, including ros, are important for the health and normal functioning of the body in combating inflammation, killing bacteria, and controlling the tone of the smooth muscle that can be found in our blood vessels and organs. However, if it is produced beyond the limit of cellular antioxidant protection ability, it will damage the mitochondria of cells and tissues. The altered cell structure also changes its function, which will lead to the process of the emergence of the disease (marciniak et al. 2009; cartrogiovanni & imbesi 2012).

The formation of free radicals during exercise is closely related to the process of ischemia-perfusion. During exercise, for example, when doing weight training (weight training) there is relative hypoxia while in the muscle tissue because when the muscles contract strongly, squeezing the intramuscular blood vessels in the active muscle area, as a result of which there is a temporary decrease in blood flow to the active muscles. After completing the exercise, the blood quickly returns to various organs that lack blood flow, resulting in perfusion that can cause many free radicals to participate in circulation (belviranli & gokbel 2006; simioni et al., 2018). Because of the rise in the body's generation of free radicals, it is necessary for the body to consume anything that contains a chemical, namely antioxidants that may scavenge these free radicals and neutralize them, preventing further oxidative stress and cell damage (thirumalai et al., 2011; ugusman et al., 2012; urso and clarkson, 2003).

Antioxidants are compounds at low levels capable of inhibiting the oxidation of target molecules so that they can fight or neutralize free radicals (finaud 2006; david, 2011). Antioxidants are able to perform their function by giving oxidant compounds one of their electrons in exchange for the ability to hinder the oxidant compounds' activity. The defensive system is bestowed against each cell in the form of an enzymatic antioxidant device. Such as sod (cooper et al. 2002; gomes et al., 2012). Enzymes such as superoxide dismutase, catalase, and glutathione peroxidase are examples of the types of antioxidants that biological systems like the human body are often able to create on their own (an endogenous antioxidant). Because oxidative stress is caused by an excess production of reactive oxygen species (ros), the body's endogenous antioxidants need to get additional antioxidants from outside the body (exogenous antioxidants). These exogenous antioxidants can come from the food and drinks that are consumed on a daily basis. Enzymes such as superoxide dismutase, catalase, and glutathione peroxidase are examples of the types of antioxidants that biological systems like the human body are often able to create on their own. (escribano et al., 2010).

Antioxidants play a very important part in maintaining the health of the human body because their function has the ability to inhibit and neutralize the occurrence of oxidation reactions involving free radicals. Since oxidative stress is caused by excessive production of ros, antioxidants play a very important role in maintaining the health of the human body. Antioxidants affect the protection of tissue damage due to free radical attacks. The inhibition mechanism of antioxidants usually occurs at the time of initiation or propagation reactions in the oxidation reactions of fats or other molecules in the body by absorbing and neutralizing free radicals or decomposing peroxides (urso and clarkson, 2003).

Sod is an endogenous antioxidant, working to capture free radicals and release one electron of its own, thus becoming a more stable compound and preventing oxidation by free radicals that can damage other molecules. Sod is referred to as the enzyme scavenger against hydrogen peroxide, found mainly in mitochondria (zheng and wang, 2009). The findings of this study are consistent with the findings of earlier investigations that were carried out by azizbeigi et al. (2013) with the intention of determining the effect that gradual resistance exercise has on the levels of oxidative stress and enzymatic antioxidant activity in erythrocytes. The findings demonstrated that progressive resistance exercise performed at a moderate intensity induced a considerable increase in erythrocyte sod activity, a decrease in mda concentration, and a tendency for gpx levels to increase.

Research to test the role of vitamin c in the occurrence of infections has shown that giving vitamin c at a dose of 600 mg/day can reduce infection. The results of other studies state that the consumption of vitamin c 500-1000 mg/day can provide optimal antioxidant effects (johnston and cox, 2001). Supplements containing antioxidants and vitamins are widely used to improve the health and achievement of athletes (kennedy et al., 2013). There is a strong connection between the functions of vitamin c as an antioxidant and its function as a component of the immune system. Vitamin c is able to readily donate its electrons to free radicals, which helps protect cells, especially immune cells, from the damage that can be caused by free radicals (azizbeigi et al., 2013; kawamura et al., 2018).

Vitamin c is able to readily donate its electrons to free radicals, which helps protect cells, especially immune cells, from the damage that can be caused by free radicals (canoy et al., 2005). The intake of vitamin c by cells takes place through the same mechanisms that are responsible for its absorption in the intestines. The intake of vitamin c by cells takes place through the same mechanisms that are responsible for its absorption in the intestines. The ascorbyl free radical is produced as a result of the initial monovalent oxidation. Due to its reversible monovalent oxidation with the ascorbyl radical, ascorbic acid is prone to electron loss and has a short half-life (nakhostin et al., 2008; brubacher et al., 2000).

CONCLUSION

The combination of regular exercise and exogenous antioxidants can increase the activity of endogenous antioxidants such as superoxide dismutase (sod) so that there is an increase in immunity to prevent viral infections.

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