

The Effect of Aerobic Training toward Total Cholesterol Levels in Blood

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This study was to look at the effect of aerobic exercise toward total cholesterol in the blood. This type of research was a quasi-experimental. Samples were respondents who have above normal cholesterol levels and are willing to do aerobic exercise. Data analysis was analyzed using a different test mean "sample dependent t test" with a significance level of $\alpha = 0.05$. This study indicates that aerobic exercise has an effect toward total cholesterol levels, because $t_{obs} (9.30) > t_{table} (1.83)$ with $\alpha = 0.05$ and degrees of freedom (dk) $n-1 = 9$. Thus H_0 was rejected and H_a was accepted, so it can be concluded that Aerobic Exercise provides a Significant Effect toward Reducing Cholesterol Levels. This means that there was a significant effect of aerobic exercise on reducing cholesterol levels.

Key words: *Aerobic Training, Cholesterol.*

Introduction

Cholesterol is one of the causes of coronary heart disease. Coronary heart disease is one of the diseases that cause the most deaths in the world and also in Indonesia. However, at this time the number of patients of heart disease is increasing from time to time. Therefore, to be able to avoid this heart disease, we need to maintain and improve heart performance. This is because most of the deaths due to cardiovascular disease are caused by coronary heart disease (Ministry of Health, R. I. (2017)).

Coronary heart disease is a cardiovascular disease caused by various factors including lifestyle in daily life such as smoking, eating high-fat foods, high blood pressure, high cholesterol, diabetes, obesity, physical activity, and others (Sunu, UFS, Permadi, G., & Fenty, F. (2017); Kurniadi, H. (2013)). Other factors that influence it are high cholesterol, lack of physical activity, and an unhealthy diet (World Health Organization. (2015)). Based

on the opinion above, it can be seen that one of the factors which greatly influence coronary heart disease is high total cholesterol level.

Cholesterol is an essential substance used to form hormones, bile acids, cell skin membranes, and protective layers around the nerves (Fatmah, D. (2010). Cholesterol is a fat compound produced in the liver that is usually found in the blood (Mubarak, S. , Kinanti, RG, & Raharjo, S. (2019)) So it can be seen that cholesterol is a level of fat in the blood.

High blood cholesterol levels are one of the factors that most often cause coronary heart disease (Anaconda, S., Widiyany, F. L., & Inayah, I. (2019). This is because with high cholesterol levels will cause constriction and also blockage of blood vessels so that the occurrence of coronary heart disease. Therefore, high cholesterol is one of the things that must be avoided to get a good degree of health.

Cholesterol in the blood is mostly derived from fat in the blood (Lean, M. E. J. (2013)). Fats that we often know are divided into 2 namely LDL (Low Density Lipoprotein) or saturated fat and HDL (High Density Lipoprotein) or unsaturated fat. LDL is a fat that can damage the ability of the liver to remove cholesterol from the blood, resulting in increased cholesterol levels and enlarge cholesterol deposits in the coronary arteries and other arteries (Pradana, V. O., & Pratama, R. (2018)).

Cholesterol content in the blood is also called total cholesterol, which is the total amount of cholesterol circulating in the human body (Baraas, F. (1993)). Total cholesterol is a combination of several different cholesterol ie low density cholesterol (LDL) or "bad" cholesterol, and high density cholesterol (HDL) or "good" cholesterol, and very low density cholesterol (VLDL) (Pradana, VO, & Pratama , R. (2018)). So, cholesterol in the blood consists of several parts and if the amount is excessive it will give an adverse effect on health so that the cholesterol level in the blood must always be kept in a safe limit for health.

Cholesterol in the body can be endogenously synthesized by the body and exogenous (derived from food eaten), which is endogenous influenced by various factors in the synthesis process, namely: saturated fatty acids, unsaturated fatty acids, lipoproteins and energy used and cholesterol consumption alone. While the exogenous nature is to consume some cholesterol from the food consumed. Cholesterol sources only come from animal products, such as meat, milk, eggs, and fishery products. So if the intake of nutrients and foods that we eat contain a lot of cholesterol, high saturated fatty acids and calories, it can increase cholesterol levels in the blood.

Cholesterol levels in the blood are influenced by various factors namely food consumption, lifestyle, unhealthy diet, and physical activity and other factors. One very influential factor is

physical activity. This is because with less physical activity will cause an imbalance between calorie intake and expenditure resulting in fat accumulation so that the amount of cholesterol levels will also increase.

Physical activity is one of the factors that influence a person's degree of health (Sepriadi & Eldawaty, 2019). This is because regular and ongoing physical activity will improve physical fitness, and a fit person will definitely have a good health status. One of the physical activities that can reduce cholesterol levels is aerobic exercise or aerobic exercise (Mann, S., Beedie, C., & Jimenez, A. (2014); Durstine, J. L. (2012)). With aerobic exercise can increase levels of High Density Lipoprotein (HDL) or good cholesterol. An increase in HDL levels due to aerobic exercise is caused by the burning of fat as an energy source, resulting in a decrease in triglycerides and VLDL which ultimately causes HDL to increase (Kodama, S. et al (2007)). So it can be seen that aerobic exercise affects blood cholesterol levels.

Aerobic exercise that can reduce cholesterol levels is exercise that is carried out with constant movements and uses large muscles in the body (Nurmalia, R., & Vallery, B. P. (2011)). In aerobic exercise the most intense thing is exercise intensity. Intensity in aerobic exercise can be seen with the achievement of the exercise pulse rate as expected (Dinata, M. (2007)). The intensity of aerobic exercise given in aerobic exercise is 65-80% of the maximum pulse rate (Cooper, K. H. (1994)). While the duration of the exercise is 30-45 minutes for each exercise. It is intended that the body's adaptation to the exercise given and also make it fat as the main energy source so that fat levels in the blood will also be reduced and because excess cholesterol levels will also be reduced.

Methods

This type of research was quasi-experimental, which in this study was intended to reveal cause and effect. This study looked at the effect of aerobic exercise on blood cholesterol levels. This study uses a One Group Pretest Post test Design.

The sample in this study was 10 people and had the amount of cholesterol above normal and was willing to do aerobic exercise that is jogging in accordance with the program that had been prepared. The sample characteristics are as follows like in table 1.

Table 1: Characteristics of Research Samples

Criteria	Mean	Standard Deviation (SD)
Age (years)	44,20	5,37
Weight (Kg)	75.40	4,90

From the table above it can be seen that the characteristics of the sample are those aged 44.20 ± 5.37 years, and body weight 75.40 ± 4.90 kilograms. To get the required data, the steps are as follows:

1. Initial Phase

Before the sample were given treatment with aerobic exercise, the sample were given an initial test to measure cholesterol levels.

2. Implementation Stage

This stage was carried out after initial measurement of cholesterol levels. samples were given aerobic exercise, namely jogging 3 times a week for 6 weeks. Where this exercise was done with exercise intensity ranging from 65-80% of the maximum pulse for 30-45 minutes for each exercise.

3. Final Stage

After being treated for 6 weeks, the final cholesterol level of the sample was measured to see the effect of aerobic exercise given.

To find out the cholesterol level of the respondent, the respondent's blood was taken to measure the total cholesterol level in the respondent's blood. The categories for total blood cholesterol levels were normal if cholesterol levels were <200 mg / dl, high if cholesterol levels were 200-239 mg / dl, and very high if cholesterol levels were ≥ 240 mg / dl.

Data analysis was analyzed by using the different test mean "t dependent sample test" by first testing the analysis requirements, namely the normality test with the Lilliefors test and the significance level was $\alpha = 0.05$.

Result and Discussion

Data Description

Based on the results of measurements taken before treatment, cholesterol sample levels were obtained which varied from 200 mg / dl to 253 mg / dl. This reflects that the respondent's cholesterol level before being given treatment was in the category above the expected limit. After being given the treatment, it was found that there was a decrease in the level of cholesterol of the respondent which was at 183 mg / dl to 213. For more details can be seen in the table 2 below.

Table 2: Results of Measurement of Sample Cholesterol Levels

Data	Maximum cholesterol level (mg/dl)	Minimum cholesterol level (mg/dl)	Average \pm SD
<i>Pre-test</i>	253	200	220,30 \pm 17,26
<i>Post-test</i>	183	213	195,80 \pm 10,74

Based on the table above, it can be seen that the average value of respondents' cholesterol levels in the pre-test was 220.30 gr / dl \pm 17.26 and is in the category above the normal standard limits. And the average cholesterol level of respondents in the post-test was 195.80 gr / dl \pm 10.74 and it was within the normal range.

Normality Test

Data from the results of cholesterol measurements levels both before being treated or after being given treatment were first tested for normality with Lilliefors test, significance level of $\alpha = 0.05$. The results of the analysis of the normality of each data test can be seen in the following table 3.

Table 3: Normality Test

Data	L _{observation}	L _{table}	Status
<i>Pre Test</i>	0,1984	0,2580	Normal
<i>Post Test</i>	0,2297	0,2580	Normal

Based on the data table above, it can be seen in the initial data obtained L_{Obs} (0.1984) $<$ L_{table} (0.2580), it can be concluded that the data originated with normal distribution. And the final data obtained L_{obs} (0.2297) $<$ L_{table} (0.2580), it can be concluded that the data also comes from normal distribution.

Hypothesis Testing

After testing the requirements analysis, the hypothesis testing was the next test. The hypothesis proposed in this study is "Aerobic Exercise provides a Significant Effect toward Reducing Cholesterol Levels".

The following are the results of testing the hypothesis in table 4.

Table 4: Hypothesis Testing

Data	Mean	Total sample (n)	t _{observation}	t _{table}	Status
<i>Pre Test</i>	220,30	10	9,30	1,83	Ho rejected
<i>Post Test</i>	195,80				Ha accepted

From the results of data analysis, it was seen that there was a decrease in the average cholesterol level of respondents by 24.5. And after the hypothesis test, the t_{obs} value was 9.30 and t_{table} was 1.83. So because t_{obs} (9.30) > t_{table} (1.83) with $\alpha = 0.05$ and degrees of freedom (dk) $n-1 = 9$. Thus H_0 was rejected and H_a was accepted, so it can be concluded that Aerobic Exercise provides a Significant Effect toward Reducing Cholesterol Levels.

Discussion

From the results of the analysis, it can be seen that there was a decrease in total cholesterol levels in the blood of the respondents by 24.50 ml / gr. This can be seen from the average cholesterol of respondents before doing aerobic exercise routinely at 220.30 ml / gr and after doing aerobic exercise for 6 weeks with frequency of exercise 3 times a week. There was a decrease in average cholesterol of total respondents to 195.80 ml / gr. This means that there was a significant effect of aerobic exercise on reducing cholesterol levels.

Aerobic exercise is an exercise done systematically with a gradual and continuous increase in training load and uses energy derived from combustion using oxygen (Palar, C. M., Wuling, D., & Ticoalu, S. H. (2015)). So it is clearly seen that aerobic exercise is an exercise that has a load and the training load will be increased continuously and use oxygen in the process of energy formation. In aerobic exercise in addition to oxygen needed during the combustion process of energy sources, it is also strongly influenced by the work of the organs of the body such as the heart, lungs, and blood vessels that are useful for transporting oxygen so that the combustion process of energy sources can run perfectly.

Total cholesterol is the amount of cholesterol carried in all cholesterol-carrying particles in the blood, including HDL, LDL and VLDL. Total cholesterol levels are mostly parallel to LDL (Ujani, S. (2016)). The problem of cholesterol is very important to understand as the consumption scheme and modern lifestyles. Cholesterol in a human being is naturally needed for the formation of several vitamins and the reproductive system, but the tendency for unclear understanding of cholesterol when stating that the source of cholesterol is only in food, but in fact, our body also synthesizes cholesterol. So that the opinion that says fat people have high cholesterol or thin people have less cholesterol is wrong. Obesity is one of the causes, but it is not certain that thin people also have low cholesterol (Graha, C. K. (2013)).

Most of the cholesterol in the blood comes from fat in the blood and is divided into 2, they are LDL (Low Density Lipoprotein) or bad cholesterol and HDL (High Density Lipoprotein) or good cholesterol. However, what the body needs is only HDL or good cholesterol.

Meanwhile, the type of bad cholesterol or LDL will be able to be settled in the walls of blood vessels and can cause Cardiovascular disease.

Exercise can decrease cholesterol because exercise or physical activity can stimulate enzymes that help to move LDL (Low Density Lipoprotein) from the blood to the liver. Then, LDL is excreted so that the more intense physical exercise is, the more LDL will be released by the body. According to research by researchers at Duke University Medical Center, it was found that more intense exercise was actually better than moderate exercise for lowering cholesterol. The study revealed that sedentary people who did not change their diet, then did light exercise (equivalent to 12 miles of walking or jogging per week) only slightly lowered their LDL levels. Meanwhile, people who exercise more vigorously (equivalent to 20 miles of jogging a week) better to decrease the cholesterol level (Gabriella Florencia in www.halodoc.com).

Exercise or physical activity has a clear effect on reducing levels of fat and cholesterol in our blood. Without exercising, there will be more chances of getting heart disease (Sadoso Sumosardjuno in Utomo, GT, Junaidi, S., & Rahayu, S. (2012). Aerobic will have a good effect on cholesterol levels (Wang, Y., Xu, D, 2017). Aerobic will affect the body if it is applied systematically, programmed, planned and regular. Whereas in this study the exercise was applied regularly for 6 weeks with a frequency of training 3 times in a week. Training load was for 30-45 minutes each time with an exercise intensity of 65-80% of the Maximum Pulse. This is also in accordance with the American Academy of Sports Medicine (The American College of Sports Medicine) recommends that you can participate aerobic for a minimum of 3 times a week for 20 to 60 minutes. Exercise intensity should be based on a percentage of individual's maximum capacity to function (T. Cotton Richard, 1993).

Aerobic exercise or exercise will have a good effect on cholesterol levels (Wang, Y., Xu, D, 2017). Aerobic exercise which gives effect if done systematically, programmed, planned, and regularly. In this study, the exercises were carried out routinely for 6 weeks with a frequency of exercise 3 times a week. In addition, the training load consisting of the duration of the exercise carried out for 30-45 minutes each time with a training intensity of 65-80% of the maximum pulse rate.

Aerobic exercise that is done will also have an impact on good cholesterol (HDL) where with regular exercise will increase HDL levels and reduce LDL (Durstine, J. L. (2008)). So that increasing HDL and decreasing LDL will significantly reduce total cholesterol in the blood for the better. Where with the increase in HDL and decreased LDL will reduce the risk for cardiovascular disease, especially coronary heart disease.

Exercise will have an impact by increasing HDL and decreasing LDL (Waggener, J. D., Robison, C. E., Ackerman, T. A., & Davis, P. G. (2015)). Wang, Y., & Xu, D. (2017) explained that the training load, namely the duration of the exercise, the frequency of exercises and the intensity of the exercise, has an effect on the changes caused by exercise in blood lipids. So to reduce levels of LDL or bad cholesterol, it is necessary to increase the burden of aerobic exercise. So from this we can know that aerobic exercise will provide the effect of exercise on reducing total cholesterol in the blood, especially bad cholesterol or LDL.

The decrease in blood cholesterol levels is caused by physical activity, especially aerobic, where the energy source needed comes from burning body fat reserves. aerobic causes the burning of body fat reserves to become a source of energy for the body during exercising. In our body there is always a biochemical process to obtain energy for each body movement. Aerobics performed at low to moderate intensity within 30 minutes or more will burn fat (Lyne Brick, 2001). Cooper also explained that achieving a high level of fitness with aerobic exercise activities can provide benefits. One of them is a reduction in blood fat levels. For example, an increasing in good cholesterol or HDL and a decrease in the ratio of total cholesterol in the blood. The more fit a person is aerobically, the more likely the person's HDL cholesterol will be higher (Utomo, G. T., Junaidi, S., & Rahayu, S. (2012)).

Based on the explanation above, we can know that aerobic, especially jogging, will have a significant effect toward total cholesterol levels in the blood. Where, from the results of data analysis can be seen that the decrease in total cholesterol levels of respondents after being treated with aerobic. This happens because of the use of fat as an energy source, causing fat in the body to be more used as an energy source during exercise. With the use of fat as an energy source, the level of fat in the blood will also decrease so that the total cholesterol level in the blood will also be reduced.

Other than physical activity factor, cholesterol levels in the blood are also greatly affected by food (Soleha, M. (2012) Kurniawati, FK (2015), Sari, YD, Prihatini, S., & Bantas, K. (2014) Wahan, EW (2020). Consume unhealthy and excessive food will cause overweight and overweight has a tendency to have cholesterol levels 30% higher than normal weight respondents (Soleha, M. (2012)). This is also caused by high-cholesterol foods which are widely consumed in public. Even young people have more opportunities to consume these foods. Diet and lifestyle are factors involved in stimulating an increasing or decreasing in cholesterol levels. So, it can be concluded that hypercholesterolemia is a risk factor that can be controlled (Kumar, et al., 2007). Weight gain also coincides with an increase in cholesterol levels. Every 1 kg / m² increase in body mass index (BMI) will also be correlated with total plasma cholesterol of 7.7 mg / dl and a decrease in HDL of 0.8 mg / dl, and obesity. It also

causes endogenous cholesterol synthesis rates of 20 mg per day for every kilogram of excess body weight, increased VLDL synthesis and triglyceride production (Setiono et al., 2012).

Cholesterol levels are also affected by age and sex, heredity, smoking, obesity, exercise, hormonal contraception and diabetes mellitus (Kumar, V; Cottran, Ramzi S; Robins, Stanley L., (2007); Ujani (2016); Nugroho, PS, & Fahrurrozi, DS (2018); Graha, CK (2013)). However, we don't need to be afraid because cholesterol levels in the blood can be prevented by routine physical activity and also proper dietary management.

Conclusion

Aerobic exercise has an effect on total cholesterol levels. It can be seen that there was a decrease in total cholesterol levels in the blood of respondents by 24.50 ml / gr. It can be seen from the average cholesterol of respondents before doing aerobic exercise routinely at 220.30 ml / gr and after doing aerobic exercise for 6 weeks with frequency of exercise 3 times a week. There was a decrease in average cholesterol of total respondents to 195.80 ml / gr. This means that there was significant effect of aerobic exercise toward reducing cholesterol levels.

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