

The Comparison Effect of Aerobic Training on Low Intensity and Moderate Intensity in Vo2max Adolescence with Active Smoker

Ayu Permata, Renni Hidayati Zein, Nova Relida Samosir, Ismaningsih, Sari Triyulianti
Vocational Program of Physiotherapy
Faculty of Pharmacy and Health Sciences, Abdurrah University
Pekanbaru, Indonesia

Abstract—Vo2max is used as an indicator to determine aerobic ability. Aerobic ability are closely related to the cardio system and the respiratory system in effort to supply and use oxygen in the body. Adolescence is the age where the level of physical fitness and aerobic endurance is the highest and can still develop. However, if at the age of adolescence has become an active smoker it will damage aerobic endurance. The effect of smoking on various organ systems is the cause of the greatest mortality in the cardiovascular system. In the case of adolescent active smokers, physiotherapy helps physical fitness, increases endurance and especially increases Vo2max levels. Physiotherapy intervention for physical fitness is low intensity aerobic exercise which can increase the maximum oxygen volume which can increase the maximum oxygen volume (VO2max). This research method is pre-experimental with a before and after design. The research sample was 10 active smokers with an age range of 19 – 21 years. The results showed that the Pre and Post significance value was $p = 0.003$. The conclusion of this study that low aerobic exercise intensity can increase VO2max in adolescent active smokers.

Keywords:- Aerobics Moderate Intensity, Adolescents, Active Smokers, VO2max, Physiotherapy.

I. INTRODUCTION

The increasing prevalence of smoking in developing countries, including Indonesia, causes the cigarette problem to become serious. Global epidemiological data show that smoking kills more than five million people in the world each year due to lung cancer, heart disease and other diseases related to smoking. It is estimated that by 2030, the death rate can reach more than eight million people every year.

Public knowledge about the role of physiotherapy on respiratory system problems in the environment is very limited. So that people do not get knowledge about problems in cardiorespiratory caused by several things, one of which is the impact of the dangers of smoking on body health, especially in adolescents. Smoking is still the main cause of morbidity and mortality in Indonesia.

Global Youth Tobacco Research shows the prevalence rate of adolescent smoking in Indonesia it is very concerning. It is estimated that out of 70 million Indonesian children, 37% or equivalent to 25.9 million Indonesian children is a smoker and the amount it generates Indonesia as a country with numbers most smokers in Asia. [1]

According to the Chairman of the National Tobacco Control Commission, F.A.Moeloek, that Indonesia is the largest smoking country in ASEAN countries. This is based on data from The ASEAN Tobacco Control Report 2007, which states that the number of smokers in ASEAN reaches 124,691 million people and Indonesia contributes the largest smoker, namely 57,563 million people or about 46.16, percent. In 2008, The World Health Organization (WHO) has designated Indonesia as the third largest country as a cigarette user. More than 60 million Indonesians have experienced it helplessness as a result of cigarette nicotine addiction, and death due to cigarette consumption recorded more than 400 thousand people per year. [2]

The prevalence of adults smoking has shown no decline over this 5 year period, while the prevalence of smoking among adolescents aged 10-19 has increased from 7.2% in 2013 to 9.1% in 2018 - an increase of around 20%. The latest 2019 Global Youth Tobacco Survey (GYTS) data released today shows that 40.6% of Indonesian students (aged 13-15), 2 out of 3 boys, and nearly 1 in 5 women have used tobacco products: 19, 2% of students currently smoke and 60.6% are not even prohibited from buying cigarettes because of their age, and two thirds can buy cigarettes at retail. [3]

Based on the Health Research and Development Agency of the Republic of Indonesia in 2013, the proportion of age at starting to smoke among adolescents tended to increase in Basic Health Research 2007, 2010 and 2013. The highest proportion was in the 15-19 age group, namely in the 2007 Basic Health Research (36.3%), Basic Health Research 2010 (43.3%) and Basic Health Research 2013 (55.4%). The proportion of smokers in Riau is 24.2%, with the proportion of daily smokers at the age of 15-19 years of 8.5% and occasional smokers of 5.8%. The city of Pekanbaru has a proportion of daily smoking habits among residents aged ≥ 10 years of 19.4% and occasional smokers 5.1%. [4]

Adolescence is an age that is prone to doing new things as a form of self-discovery phase. Adolescence is the age where the level of physical fitness and aerobic endurance is highest and can still be developed. However, if the adolescent has consumed or smoked cigarettes, it will damage his aerobic endurance. The consequences are not only for smokers but for those who inhaled secondhand smoke. The habit of smoking in adolescence can cause adolescents, especially school age, to experience impaired learning achievement at school, impaired lung development, more difficult to recover when sick because smoking can also affect immune addiction, look older than age, often experience acne or skin problems others, as well as causing plaque on the teeth.

VO2max is generally used as an indicator to determine aerobic ability, where aerobic ability is closely related to the cardio system and the respiratory system in providing oxygen and the ability to use oxygen in the body. VO2max requires analysis of expiration time, measurement of air collected during high-intensity training. [5]

The intervention that the authors use in this case is comparison of aerobic exercise with low and moderate intensity. Aerobic exercise does not change the size of the lungs, but reduces the residual portion, namely the space in the lungs that is not normally used for oxygen absorption. Thus, the capacity of the lungs to absorb oxygen is greater, even though they are still in size. During this exercise, blood volume and hemoglobin increase with exercise. Aerobic exercise also reduces resting heart rate. A trained heart pumps more blood at each pump so that it doesn't need to beat faster, so aerobic exercise can increase the maximum oxygen level (VO2max) in the body.

II. RESEARCH METHOD

This research method is experimental with pre and post test design. In this study, the research subjects were divided into 2 groups, namely given the intervention of low intensity aerobic exercise and intervention of moderate intensity aerobic exercise 3 times a week for 4 weeks. The research sample was taken using the Consecutive Sampling method where the number of samples in this study were 20 people aged 18-21 years who were included in the category of active smokers, based on the number of cigarette consumption included in the low smoker group (consuming 1-10 cigarettes per day.). The research time was from May to August 2020. The research instrument was a cooper test assessment.

III. RESULTS AND DISCUSSION

The criteria for respondents can be seen based on the distribution group of sample data given low intensity aerobic exercise and moderate intensity aerobic exercise tested based on gender, age, heart rate, pulse, daily cigarette consumption, before and after test scores of cooper. The results of the sample homogeneity test analysis are presented in Table 1 below:

TABLE 1

| Characteristics | Uji Homogenitas | |
|-----------------------------|--------------------------------|-------|
| | Levene statistic One Way Anova | |
| | Rerata ± SB | P |
| Gender | 0.000 ± 1 | 1.000 |
| Age | 1.250 ± 1 | 0.634 |
| Heart Rate | 0.200 ± 1 | 0.267 |
| Pulse | 3.200 ± 1 | 0.075 |
| Daily Cigarette Consumption | 1.800 ± 1 | 0.349 |
| Cooper Test Pre | 0.200 ± 1 | 0.548 |
| Cooper Test Post | 16.200 ± 1 | 0.331 |

Based on table 1, the characteristics of respondents are based on gender, age, heart rate, pulse rate, daily cigarette consumption, the value of the cooper test pre and the value of the cooper test post based on the homogeneity test with a value of p> 0.05, which means that the variants are not the same or not homogeneous.

The difference in the scores of the cooper test before and after was carried out for each sample group, namely group 1 with low intensity intervention and group 2 with moderate intensity intervention. The effect test was carried out by using a non-parametric test with the sample related to Wilcoxon 2 which is presented in Table 2 below:

TABLE 2

| Nilai Cooper Test | | Wilcoxon |
|-------------------|------|------------------------|
| | | Asymp. Sig. (2-tailed) |
| Group 1 | Pre | 0.003 |
| | Post | |
| Group 2 | Pre | 0.004 |
| | Post | |

Based on Table 2, it shows the significance value before and after in group 1 (low intensity) with a value of p = 0.003 which means <0.05, it can be excluded that there is an assessment of the value of cooper before and after in group 1 (low intensity). Table 4.3 above also shows the significance value before and after in group 2 (moderate intensity) with p-value = 0.004 which means <0.05, it can be said that there is a difference in the value of the cooper test before and after in group 2 (moderate intensity).

The difference test was performed using the N-Gain Score test against the cooper test after the intervention was given to the two sample groups. The Normative Value of the N-Gain score obtained in the N-Gain Interpretation of the Category of the Efficacy by Hake, R.R. 1999 is as follows Table 4:

TABLE 4

| Percentage | Interpretation |
|------------|------------------|
| < 40 | Ineffective |
| 40 -55 | Less effective |
| 56 – 75 | Effective enough |
| >76 | Effective |

The results of the difference test against the cooper test value after being given intervention in the two groups are presented in table 5 below:

TABLE 5

| n | Kelompok 1 | Kelompok 2 |
|---------|-----------------------|-----------------------|
| 1 | Cooper Test Post (mm) | Cooper Test Post (mm) |
| 2 | 1800 | 2800 |
| 3 | 2400 | 2600 |
| 4 | 2600 | 2800 |
| 5 | 2000 | 2800 |
| 6 | 2000 | 2400 |
| 7 | 2600 | 2600 |
| 8 | 2200 | 2400 |
| 9 | 2400 | 2800 |
| 10 | 1800 | 2800 |
| 11 | 2000 | 2600 |
| Average | 31.67 | 16.67 |
| Minimum | 16.67 | 50.00 |
| Maximum | 50.00 | 87.33 |

Based on table 5, it can be seen that the N-Gain Score the average value for group 1 is 31.67% (including in the ineffective interpretation of the effectiveness of N-Gain). Whereas for N-Gain Score the average value for group 2 was 87.33% (included in the interpretation of the effectiveness of the effective N-Gain). It can be concluded that the intervention group 2 (moderate intensity) was more effective than the intervention group 1 (low intensity).

The adolescent age group who has become active smokers can cause a decrease in the level of physical fitness. Physical fitness is the ability to meet demands in maintaining the safety of everyday life and effectively without experiencing fatigue and still having the energy to carry out other activities and recreational activities. Physical fitness is closely related to cardiovascular endurance. Cardiorespiratory endurance can be increased by adapting the cardiorespiratory system to the physical exercise the body is doing. Regular physical exercise with the right dose can improve a fit physical condition.

Smoking habits can affect cardiovascular endurance or aerobic endurance. This will cause a decrease in the volume of oxygen inhaled by the body. Cardiovascular endurance is a key element of physical fitness for adolescent active smokers. So that it can cause adolescents, especially school age, to experience disruption in learning achievement at school, disrupted lung development, it is more difficult to recover when sick because smoking can also affect the body's immune addition, look older than their age, often experience acne or other skin problems, and cause plaque on the teeth.

VO2 max increases due to increased skeletal muscle activity during exercise and results in a partial increase in oxygen consumption, so large muscles must be used if you want to achieve maximum oxygen consumption. This will also have an effect on increasing the circulation of the blood system from the inactive to the active part and the tissue's ability to absorb blood. And this also results in differences in oxygen content between the blood in the veins and in the arteries, most of the blood that contains oxygen will flow to the muscles that are working. [6]

Aerobic exercise is best done with a frequency of 3-5 times per week with a duration of 20-30 minutes of exercise per exercise (Wilmore, 1994). Another expert, Giam (1992) said that a duration of 15-30 minutes of exercise is considered sufficient if the exercise is carried out continuously and is preceded by a 3-5 minute warm up and ended with a 3-5 minute cool down. Abe et al. (1997) reported that aerobic exercise 3-5 times per week as recommended by the American College of Sports Medicine (ACSM) can increase oxygen levels in the body.

IV. CONCLUSION

Based on the results of the interpretation of the analysis of the effect of the intervention test on the sample group that was given low intensity and moderate, the significance value of $p = 0.003$ in the low intensity group was obtained, which means that there was an effect of using low intensity intervention on the cooper test scores before and after the intervention. In the sample group that was given moderate intensity, the value of $p = 0.004$ means that there is an effect of using moderate intensity intervention on the value of the cooper test before and after the intervention.

Based on the results of the different test scores for the cooper test after intervention in the two groups, the value of $p = 0.002$ was obtained, which means that there was a difference in the value of the cooper test after the intervention between groups.

Based on the different test scores for the cooper test after the intervention was carried out to determine the effectiveness of the intervention, the N-gain Score test was carried out. N-gain score test results were obtained. The mean score for group 1 was 31.67% (included in the ineffective interpretation of N-Gain effectiveness). Whereas for N-Gain Score the average value for group 2 is 87.33% (included in the interpretation of the effectiveness of the effective N-Gain). It can be concluded that the intervention group 2 (moderate intensity) was more effective than the intervention group 1 (low intensity).

Although in this study the findings of an increase in VO2 max after treatment of low and moderate intensity aerobic exercise, the evidence that low and moderate intensity aerobic exercise can increase VO2 max in active smokers suggests: (1) research is needed by increasing the number of subjects and time of the study so that a more reliable benefit is obtained, (2) research is needed using a control group, so

that the results obtained are relatively not subject to refraction and understanding can better monitor and see more definite results, (3) further research is needed using other measuring instruments such as spirometry. , (4) needed to pay attention and control the activities of the subject.

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