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DIFFERENCES IN PULSE RATE AND LACTIC ACID LEVELS IN ATHLETES BEFORE AND AFTER LIGHT AND MEDIUM INTENSITY PHYSICAL ACTIVITIES

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Abstract

Strenuous exercise can trigger an increase in pulse rate and lactic acid levels. Stress during exercise can secrete adrenaline so that your heart rate increases, and free radicals including lactic acid. This study aims to determine the effect of light and moderate-intensity aerobic exercise on lactic acid levels and pulse rate during exercise. The research carried out was a quasi-experimental research with a non-random repeat experiment design. Pulse rate and lactic acid levels were assessed before and after the exercise program in 3 groups, namely the light-intensity aerobic exercise (LAIR) treatment group, the moderate-intensity aerobic exercise (LAIS) group, and the control group. The research location is the Harapan Bangsa football stadium in Banda Aceh. The subject is Aceh Diaspora PPLP athlete. The training program was carried out for four weeks. The mean pulse rate and lactic acid levels of the three groups showed differences. A significant decrease in heart rate values after the training test was seen in the group with LAIS (p = 0.000). A significant decrease in lactic acid after the training test was seen in the group with LAIS (p= 0.04). The mean pulse rate of the three groups showed differences. An exercise program carried out with the right intensity, duration, and frequency can reduce increases in heart rate and lactic acid levels. This research shows that moderate-intensity aerobic exercise can reduce pulse rate and lactic acid levels so that it can slow down fatigue during exercise in Acehnese football athletes.

Keywords: ***Pulse, lactic acid, aerobic exercise***

INTRODUCTION

An athlete needs good physical fitness so that they do not experience fatigue quickly during exercise. Achievement and fitness in the world of sports can be achieved not only by nutritional intake, talent but the right training program will also have a positive influence on an athlete [1–4]. High pulse rate and lactic acid levels in the blood are problems that athletes often face when competing. Lactate is an intermediate product of glucose metabolism. Lactate is waste from anaerobic metabolism, this process takes place without the presence of oxygen. High-intensity exercise can trigger the adrenal glands to secrete the hormone adrenaline so that the pulse rate increases. If not reduced, it can cause increased permeability of blood vessels and damage to vascular walls [5,6]. The buildup of lactic acid will inhibit glycolysis, resulting in muscle fatigue. High levels of lactic acid will cause acidosis in and around muscle cells, inhibit coordination, increase the risk of injury, inhibit the energy system from creatine phosphate. High levels of lactic acid in athletes will have a negative impact on athlete performance [6,7]

LITERATURE REVIEW

Nowadays, the aerobic exercise that many people choose to improve their fitness is using a treadmill. Training using a treadmill can move all muscles, especially large muscles, with continuous, rhythmic, forward, and sustainable movements. The treadmill was chosen because it is easy, and can be done indoors and at any time. Exercise results will be more optimal if done with the correct frequency, duration, and intensity. Light exercise intensity is 60-69% of MHR, moderate 70-79%, and high 80-89%.[8] An exercise carried out by its basic principles can improve physical quality. Warburton et al (2006)[9] noted various improvements in biological quality parameters as a result of proper aerobic exercise, including chemical changes, increased stroke volume, increased minute volume, increased blood volume and hemoglobin, effects at the cellular level, increased number and diameter of mitochondria, increased the activity of various types of enzymes involved in the Kreb's cycle and the transfer of electrons and the accumulation of lactic acid is reduced, the pulse becomes normal so that this will influence the occurrence of fatigue.[10–12] Research conducted by Chrisly, M (2015) shows that regular aerobic exercise with a training frequency of three to five times per week, training intensity of 60-80% of maximum heart rate, and training 20-60 minutes results in smoother and faster blood flow. removal of metabolic waste substances so that recovery takes place quickly, and a person can slow down the occurrence of fatigue after exercise.[10,11]. So far, the aerobic training approach has been more developed than interval anaerobic training, which aims to stimulate an increase in the number of mitochondria as a place for producing high-energy ATP, to meet energy needs. Conceptually, physical exercise can be a stressor on the performance of organs in cells, especially mitochondria and blood vessels, namely stable blood pressure and pulse.[13–15]

METHOD

The training program was carried out for 4 weeks at the Harapan Bangsa Stadium in Banda Aceh using an experimental design for three training program groups. Aceh Dispora PPLP football athletes were the subjects in this research. A total of 30 subjects were divided into 3 groups: 10 subjects in the light intensity aerobic exercise group (LAIR), 10 subjects in the moderate intensity aerobic exercise group (LAIS) and 10 subjects in the control group without an exercise program. Research procedures include subject preparation, training tests and training programs. During subject preparation, 30 subjects voluntarily signed an informed consent form after explaining the aims, procedures, benefits and risks of the research. The training test was carried out by walking on a treadmill according to Bruce's protocol, namely previously measuring body weight (BB), height (TB), blood pressure (BP), pulse in a sitting position and maximum target heart rate (HRmax). The training program was carried out for 4 weeks with light intensity aerobic exercise (LAIR), HRmax load of 60-69% and moderate intensity aerobic exercise (LAIS) with HRmax load of 70-79%. The data that has been collected is then processed using a computer with SPPS. The mean values obtained were analyzed descriptively, followed by inferential statistics with the t-test and one way ANOVA with pairwise comparison LSD.

RESULTS AND DISCUSSION

Results

The characteristics of the research subjects can be seen in Table 1.

Table 1. Mean ± SD Data on Characteristics of Research Subjects

No	Characteristics	Aerobic Exercise Group		
		Light Intensity	Medium Intensity	Control
1	BB	58.30±4.29	55.90±4.17	60.70±6.75
2	TB	170.50±5.21	168.90±4.45	170.50±3.97
3	IMT	20.09±1.08	19.70±0.90	20.88±1.94
4	Umur	15.80±0.78	16.40±0.51	17.00±0.81
5	HR_{max}	204.20±0.78	203.60±0.51	203.00±0.81

BB: Body weight (kg) BMI: Body mass index (kg/m2)
TB: Height (cm) HRmax:: Maximum heart rate (x/minute)

Based on table 1, it can be seen that the subject characteristics in the form of weight, height, body mass index, age and maximum heart rate (HRmax) in each group did not have any significant differences. The nutritional status of the research subjects was normal (18.5 – 25.0). The minimum age of the subject is 15 years and the highest is 18 years. With an average HRmax that must be achieved is 203 x/minute.

Table 2. Mean ± SD of Lactic Acid and Pulse Rate Variables

No	Dependent variable	Aerobic Exercise Group					
		Light Intensity		Medium Intensity		Control	
		Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	AL	6.94±3.36	6.82±2.47	9.02±2.55	6.00 ±2.76	9.82 ±3.27	8.99 ±4.14
2	DN	144.50±6.11	130.80±14.61	148.50±7.13	121.30 ±10.70	153.90 ±7.09	152.00 ±4.71

AL: lactic acid (mmol/L)
DN: Pulse rate (x/minute)

From table 2 it can be seen that in the light intensity aerobic exercise group (LAIR), moderate intensity aerobic exercise group (LAIS) and the control group there was a decrease in lactic acid levels and pulse rate.

Table 3. Data Normality Test

No	Variabel	Aerobic Exercise Group					
		Light Intensity		Medium Intensity		Control	
		Df	Sig	df	Sig	Df	Sig
1	Pre Test (Practice Test 1)	10	0.158	10	0.418	10	0.962
2	PostTest (Practice Test 2)	10	0.227	10	0.943	10	0.125

Based on the results of the normality test, the results for each group, both pre-test and post-test, had a significance value of > 0.05, which means the data was normally distributed. In bivariate analysis using the paired t statistical test.

Table 4. Paired t test - Lactic Acid Levels and Borg Shortness Scale

No	Variabel Kelelahan	Klp	Pretest		Posttest		t Value	P
			Mean	± SD	Mean	± SD		
1	Asam Laktat	LAIR	6,94	3,36	6,82	2,47	0,12	0,90
		LAIS	9,02	2,55	6,00	2,76	2,32	0, 04*
		Kontrol	9,82	3,27	8,99	4,14	0,65	0,53
2	Denyut Nadi	LAIR	144.50	6.11	130.80	14.61	1.86	0.096
		LAIS	148.50	7.13	121.30	7.13	8.14	0.000*
		Kontrol	153.90	7.09	153.90	7.09	1.00	0.343

P = < 0,05

Based on the results of the paired t test with a significance level of p = <0.05, the results showed that there were no significant differences in lactic acid levels and heart rate between pretest and posttest in the light intensity aerobic exercise group. For the moderate intensity aerobic exercise group, there were significant differences in lactic acid levels and heart rate between pretest and posttest. And there were no significant differences in lactic acid levels and pulse rate between pretest and posttest in the control group.

Discussion Results

A football player must have an ideal body or a normal body mass index (BMI). Body composition must be proportional between muscle mass and fat. There should be no excess fat. With the right training program, apart from forming an ideal body, you can also improve an athlete's performance and fitness. Good physical fitness causes athletes to not get tired quickly during exercise. [1,2]. From the results of the paired t test in table 4, it shows that in the LAIS group there was a significant difference in the second training test (posttest) after receiving the training program compared to the first training test (pretest) in assessing lactic acid levels and pulse rate. An exercise program that is carried out regularly based on appropriate duration, frequency and intensity will have an impact on reducing lactic acid levels and decreasing heart rate during exercise, thereby slowing down fatigue. Warburton et al (2006)[9] noted various improvements in biological quality parameters as a result of proper aerobic exercise, including chemical changes, increased stroke volume, increased minute volume, increased blood volume and hemoglobin, effects at the cellular level, increased number and diameter of mitochondria, increased the activity of various types of enzymes involved in the Kreb's cycle and electron transfer and the accumulation of lactic acid is reduced which will influence the occurrence of fatigue. One form of aerobic exercise that is simple but qualifies as exercise to improve fitness is exercise using a treadmill.

This research is in accordance with research conducted by Crisly. Training with an intensity of 60-80% of the maximum heart rate, and a training duration of 20 - 60 minutes results in the removal of metabolic waste substances and reduces lactic acid levels so that recovery takes place quickly, and a person will not experience fatigue [16]. Aerobic exercise according to ACSM (American College of Sports Medicine) will be more meaningful if aerobic exercise is done between 70% and 80% of maximum heart rate, regularly three times a week with an intensity that increases heart rate[17]. This concept is in line with research results that a significant reduction in lactic acid levels can be seen in subjects who receive a moderate intensity aerobic exercise program (LAIS) with a training load of 70-79% HRmax carried out three times a week. The buildup of lactic acid will inhibit glycolysis, resulting in muscle fatigue. High levels of lactic acid will cause acidosis in and around muscle cells, inhibit coordination, increase the risk of injury, inhibit the energy system from creatine phosphate. High levels of lactic acid in athletes will have a negative impact on athlete performance [7]. Efforts to overcome the above problems can be done by setting the correct training program, providing nutrition, emotional and physical environment [18]. Athletes'

performance can be improved through various forms of training with light and moderate loads over a long period of time. One form of aerobic exercise that is simple but qualifies as exercise to improve fitness is exercise using a treadmill. By adjusting the intensity and time of exercise using a treadmill appropriately, it is hoped that it will also provide a good aerobic training effect.[19]

Conclusion

Based on the results of data analysis and discussion, it can be concluded that the light intensity aerobic exercise group for assessing lactic acid levels (p=0.90) and pulse rate (p=0.096) showed that there was no significant difference between training test 1 (pretest) and training test 2 (posttest). In the moderate intensity aerobic exercise group, significant differences were found in the overall fatigue assessment. To assess lactic acid levels (p=0.04) and pulse rate (p=0.000) between training test 1 (pretest) and training test 2 (posttest). This shows that a moderate intensity aerobic training program with an HRmax of 70-79% has an effect in slowing down fatigue in PPLP Dispora Aceh athletes because training carried out in accordance with its basic principles can improve the physical quality and performance of athletes.

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