The Effects of Aerobic Sports on Fatigue and Vital Sign in Sportsman

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Abstract

The lactic acid buildup has long been suspected as a cause of muscle fatigue. Lactate is a waste of anaerobic metabolism; this process takes place in the absence of oxygen. Blood pressure, pulse, and respiration are vital signs to monitor adaptation to fatigue levels. This study aims to determine the effect of aerobic exercise on the level of fatigue and vital signs in athletes. This research is a quasi-experimental study with a non-random re-experimental design. Lactic acid levels and vital signs were assessed before and after the exercise program in 3 groups, namely the light-intensity exercise treatment group, the moderate-intensity exercise group, and the control group. The research site is at the Harapan Bangsa football stadium in Banda Aceh. The subject of PPLP Dispora Aceh athletes. The exercise was carried out for four weeks. The average lactic acid levels of the three groups showed differences. A significant decrease in lactic acid after the training test was seen in the group with OAIS (p = 0.04). Exercise with the right intensity, duration, and frequency can reduce lactic acid levels and vital signs. This study shows that moderate-intensity exercise can affect reducing lactic acid levels and vital signs so that it can slow down fatigue during exercise in Aceh football athletes.

Keywords: *Light and Moderate Intensity Exercise, Lactic Acid, Vital Signs.*

1. Introduction

An athlete needs good physical fitness so as not to quickly experience fatigue during exercise (Stolen et al., 2005). An achievement and fitness in the world of sports can be achieved not only by nutritional intake, and talent but the right training program will also have a positive influence on an athlete (Irawan, 2007).

High levels of lactic acid in the blood and lack of energy reserves are problems that athletes often face when exercising. This condition will cause fatigue during exercise so that it can lead to the decline of an achievement. Athletes need energy availability. Energy serves as fuel that activates the process of muscle contraction and maximizes athlete performance (Guyton, 2008). Lactic acid is the final product produced from pyruvic acid during anaerobic glycolysis (Sherwood, 2014). Lactic acid buildup 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 (Hernawati, 2010). Efforts to overcome the above problems can be done with the right exercise, nutrition, emotional and physical environment (Laursen, 2005).

Warburton et al. (2006) 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 accumulation of lactic acid is reduced which will affect the occurrence of fatigue.

Aerobic exercise that many people choose to improve their fitness is using a treadmill. Exercise results will be more optimal when done with the correct frequency, duration and intensity. According to the American College of Sport Medicine (ACSM) aerobic exercise must reach a target zone of 60-90% of the maximum heart rate or Maximal Heart Rate (MHR), this area range is commonly referred to as the Training Zone or exercise area. Exercise is said to be light if it reaches 60-69% of the MHR, moderate if it reaches 70-79% of the MHR, and high if it reaches 80-89% of the MHR. The intensity of exercise can be increased by increasing the training load with jumping movements or by accelerating the exercise movement (Ratmawati, 2013).

Aerobic exercise is now more developed than anaerobic exercise, which aims to stimulate an increase in the number of mitochondria as a place for making high-energy ATP so that it can meet energy needs. Conceptually, physical exercise can be a stressor on the performance of organs in cells, especially in the mitochondria (Octa, 2012).

2. Method

Aerobic exercise was carried out for 2 weeks at the Harapan Bangsa Stadium in Banda Aceh using an experimental design for three groups of sports programs. PPLP Dispora Aceh football athletes as subjects in this study. A total of 30 subjects were divided into 3 groups: 10 subjects in the light-intensity aerobic exercise (OAIR) group, 10 subjects in the moderate-intensity aerobic exercise (OAIS) group, and 10 subjects in the control group without exercise (KN).

Aerobic exercise is carried out by walking on a treadmill according to Bruce's protocol, which previously measured weight (BB), height (TB), blood pressure (BP), pulse in a sitting position, and maximum target heart rate (HRmax). The exercise program was carried out for 2 weeks with light intensity aerobic exercise (OAIR), HRmax load of 60-69%, and moderate-intensity aerobic exercise (LAIS) with HRmax load of 70 -79%.

3. Results and Discussions

Characteristics of research subjects can be seen in Table 1.

Table 1. Average ± SD Data Characteristics of Research Subjects

No	Characteristics	Aerobic Sports Group		
		Light Intensity	Light Intensity	Light Intensity
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	Age	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

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

In Table 1 above, it can be seen the characteristics of the research subjects consisting of height between 168-170 cm, body weight between 55-60 kg, BMI between 18.5-25, age between 15-17 years, and a maximum heart rate of 203 x /minute, so it can be seen that in each group there is no significant difference.

A physical examination is done to see the physical condition of an athlete. Good physical condition is an important factor for performance and achievement. The following are the results of the physical examination of the Aceh Dispora soccer athletes which can be seen in table 2.

Table 2. Average ± SD of Subject Physical Examination Data After Training Test

No.	Independent Variables	Aerobic Sports Group					
		Light Intensity		Light Intensity		Light Intensity	
		Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	TDS	147.00 ±9.77	132.00 ±13.16	137.00 ±7.88	123.00 ±5.37	146.00 ±7.74	143.50 ±11.31
2	TDD	52.00 ±7.88	58.00 ±13.98	51.00 ±5.67	58.00 ±4.21	49.00 ±9.94	48.00 ±8.88
3	N	144.50 ±6.11	130.80 ±14.61	148.50 ±7.13	121.30 ±10.70	153.90 ±7.09	152.00 ±4.71
4	FP	34.60 ±8.11	32.00 ±3.77	37.60 ±9.08	27.60 ±3.86	38.00 ±5.41	32.40 ±4.78

TDS: systolic blood pressure (mmHg) FP : Respiratory rate (x/minute)
TDD: diastolic blood pressure (mmHg) N: Pulse (x/minute)

From Table 2, it can be seen that there was a decrease in systolic blood pressure, pulse and respiratory rate in the three exercise groups after the subjects received aerobic exercise. The average decrease in systolic blood pressure in OAIR was 15 mmHg, the decrease in systolic blood pressure in OAIS was 14 mmHg and the decrease in systolic blood pressure in controls was 2.5 mmHg. The average diastolic blood pressure increased in the OAIR and OAIS groups, while in the control group there was a decrease. In the OAIR group, the average increase in diastolic blood pressure was 6 mmHg. In the OAIS group, the mean increase in diastolic blood pressure was 7 mmHg. In the control group, the average decrease in diastolic blood pressure was 1 mmHg. The mean pulse rate decreased in the OAIR, OAIS and control groups. In the OAIR group, the average decrease in pulse rate was 13.7 x/minute. In the OAIS group, the mean decrease in pulse rate was 27.2 beats/minute. In the control group, the average decrease in pulse rate was 1.9 x/minute. For respiratory frequency, there was a decrease in the OAIR, OAIS and control groups. In the OAIR group, the average decrease in respiratory rate was 2.6 x/minute. In the OAIS group, the average decrease in respiratory rate was 10 x/min. In the control group, the average decrease in respiratory rate was 5.6 x/minute.

Table 3. Average ± SD Variable of Lactic Acid

No.	Dependent variable	Aerobic Sports 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

From table 3 it can be seen that in the light-intensity aerobic exercise group (OAIR), the moderate-intensity aerobic exercise group (OAIS), and the control group there was a decrease in lactic acid levels.

Table 4. Paired t-test for Lactic Acid Levels

No.	Fatigue Variable	Klp	Pre-test		Post-test		t	P
			Mean	± SD	Mean	± SD	Value	
1.	Lactate Acid	OAIR	6,94	3,36	6,82	2,47	0,12	0,90
		OAIS	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

Based on the results of the paired t-test with a significance level of p = <0.05, it was obtained that there was no significant difference in lactic acid levels between the pretest and posttest in the aerobic exercise group with light intensity. For the aerobic exercise group with moderate intensity, there was a significant difference in lactic acid levels between the pretest and posttest. And there was no significant difference in lactic acid levels between the pretest and posttest in the control group.

Based on table 4, it can be seen that the group with OAIS had the highest mean decrease in lactic acid levels, which was 3.02 mmol/L. The results of the paired t-test in table 4 show that the OAIS group had a significant difference in the second training test (posttest) after receiving an exercise program compared to the first training test (pretest) on the assessment of lactic acid levels. An exercise program that is carried out regularly based on the appropriate duration, frequency, and intensity will have an impact on decreasing lactic acid levels so that it can slow down fatigue (Susilowati, 2010; Powers, 2007).

4. Conclusions

A football player must have an ideal body or a normal body mass index (BMI). Body composition must be proportional to muscle mass and fat. There should be no excess fat. With the right exercise program in addition to forming an ideal body, it can also increase the achievement and fitness of an athlete. Good physical fitness causes athletes not to tire quickly during exercise.

There are 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 accumulation of lactic acid is reduced which will affect the occurrence of fatigue. One form of aerobic exercise that is simple but qualifies as an exercise to improve fitness is exercise using a treadmill.

The lactic acid buildup 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, and inhibit the energy system from creatine phosphate. High levels of lactic acid in athletes will harm athlete performance. Efforts to overcome the above problems can be done by setting the right exercise program and providing nutrition, and an emotional and physical environment. Athletes' performance can be improved through various forms of exercise with light and moderate loads for a long time. One form of aerobic exercise that is simple but qualified as an 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 will give a good effect on aerobic exercise as well.

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