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The effect of high intensity anaerobic training on the blood lactate levels after active recovery

Mohammad Rashidi[1], Omid Salehian[2] and Gholamhassan Vaezi[2]

[1]*Department of Physical Education, Semnan Branch Islamic Azad University, Semnan, Iran*
[2]*Department of Exercise Physiology, Faculty of Sport and Exercise Science, University of Tehran, Iran*

ABSTRACT

The accumulation of an enormous amount of lactic acid in the blood is one of the causes of exhaustion for athletes after vigorous exercises, particularly short time exercises with the maximum of speed and intensity. Considering the need of athletes to reach the natural conditions and to be ready for subsequent activities, methods of lactic acid disposal are of high importance. The purpose of this study was to determined The effect of high intensity anaerobic training on the blood lactate levels after recovery. This quasi-experimental research, pre-tested and post tested 60 male athlete students. The athletes randomly were divided into four groups of 15 including the first group to do initial inactive recovery, the second to fourth to do initial active retrieval with the intensity of 55, 60, 65 percent Maximum heart beat . The groups were evaluated by Cunningham test and their blood lactic acid was checked in four phases by manual lactometer(before activity, immediately after the activity, 5 and 20 minutes recovery period the initial situation). There was no significant difference in the average amount of lactic acid blood of athletes in all groups at rest and immediately after activity, but five minutes after initial recovery and twenty minutes after that they were significantly different(P <0.001, for both times). The average of lactic acid in blood twenty minutes after initial recovery was the highest for the inactive group, and the lowest for the group with 60 percent of maximum heartbeat. Also a decrease in lactic acid level five minutes after recovery to twenty minutes after that for the group with 60 was significantly more than the group with 55 percent of maximal heartbeat; and the decrease in the level of lactic acid in group of 65 percent of maximal heart beat was significantly higher than the group of 55percent of maximum heartbeat (P <0.001). The result of this study shows that the initial state of recovery through activity effects is better than passive state. Additionally, doing exercise with is 60 of maximal heart rate in during recovery is the best way for reducing blood lactate.

Keywords*:* lactic acid, the initial condition, passive/inactive state(mode), active state(mode), athletes

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INTRODUCTION

Strenuous exercise leads to lactate and hydrogen ion production in the exercising muscle and a concomitant decrease in intracellular pH, which compromises muscle contraction and glycolytic enzyme activity and, thus, exercise performance [1]. In order to regain optimal performance as soon as possible, fast lactic acid elimination is crucial for athletes. Lactate oxidation takes place primarily in type-I fibers of working skeletal muscle, in the liver and the heart [2]. However, there is some evidence that inactive skeletal muscle also plays a role in lactate metabolism. It was

shown in able-bodied people that inactive skeletal muscle can store lactate [3,4] and retain 24% of the total lactate produced 25 minutes after cessation of strenuous exercise [3]. Furthermore, 5% of the lactate produced during maximal exercise is metabolized in inactive skeletal muscle [4].

In a study, the effects of two schemes of active and passive recovery of initial conditions on the changes of blood lactic acid caused by a maximum intense exercise were surveyed. Results indicate that after 12 minutes of recovery scheme for each group, reducing the level of blood acid lactic was not significantly different between the two groups. Studying the behavior of lactate, it was concluded that active recovery scheme for quick disposal of lactic acid must be done within longer than 12 minutes [3]. In another study, it was indicated that active and passive recovery was not effective on the level of blood lactic acid after an exhausting and intense activity [4]. Another study on the impact of active recovery methods (two intensities) and inactive recovery on blood lactate indicate that its level in swimmers' blood during active recovery with both intensities is significantly less than its amount during inactive recovery[5] In another study on the effect of three kinds of recovery schemes (passive, active and massage) on the amount of blood lactic acid after an exhausting, intense activity it was determined that there was no difference in the level of blood lactic acid in athletes of research groups in these three cases [6]. While in the other it was determined that active recovery scheme has a better effect on the reduction of lactic acid than the passive condition and massage [7]. It seems that the effect of active recovery on the reduction of blood lactic acid is related to the duration of the activity in a way that an active recovery scheme is useful for more than five minutes, but more than 20 minutes can be harmful [8]. This effect also depends on the individual's sport experience in a way that the rate of lactic acid reduction in athletes after recovery, is faster and more than non-athletes.

Based on these studies, the effects of different recovery methods in initial states are inconsistent and require new studies. Thus, two major objectives of this study are 1- to study active and passive conditions on the reduction of blood lactic acid 2- to survey the effects of different intensities of activity (severity 55, 60, 65 percent of maximum heart rate) on the reduction of lactic acid.

MATERIALS AND METHODS

Study Type and sampling: The study is quasi-experimental to pretest and post test 60 male athletes students of Azad University of Semnan in 1387. This number of samples were chosen from selected students through Bruce seven stage test [10]; a highly reliable protocol to evaluate maximal oxygen consumption (vo2max) to determine homogenous groups.

Type of physical activity

Cunningham test is intense exercise maximum in this study of valid short-term anaerobic tests. The test consists of a maximum run on revolving bar (made in Italy, called Technogey with integrated heart rate) with the slope of 20% and speed of eight miles per hour [10]. The samples were asked to take the Cunningham test individually after warm up with the maximum intensity they can do until not having the ability to move continually.

Experimental groups: After exercise, samples were divided into 4 groups of 15, as follows:
1-Passive recovery. The subjects of this group sat on a chair after exercise.
2-Active recovery groups (three groups) with intensity of 55, 60, 65 percent of maximum heart rate. In these groups, athletes ran slowly on the revolving band; the rate of running in groups 2, 3 and 4 respectively was with the intensity 55, 60 and 65 percent of the maximum.

Measuring blood lactic acid: before and immediately after the test, 5 minutes after starting recovery and 20 minutes after active recovery, the blood lactic acid of all samples were measured. A blood drop from the third finger was tested by blood test device to measure the lactic acid (Lactate scout made in Germany) and the rate was registered. Moreover before activity, height, weight, age, resting heart rate of all samples were measured and registered in addition to blood lactic acid.

Statistical analysis: The data were analyzed using Colmogrov Smirnove test, unilateral analysis variance, and Tueky post hoc test in a significant level, 5 percents via software, and 11.5 SPSS.

RESULTS

Considering average age, body mass index, height, weight, resting heart rate after Coningham test and also the average time of taking this test among 4 groups, there was no significant difference (5% P>) (Table 1).

Blood lactic acid

Table 2 shows the level of lactic acid in athletes' blood at rest, immediately after Coningham test, 5th and 20th minute of initial state recovery in four groups (inactive, active with the intensity 55, 60, 65 percent of maximum heart rate maximum). Statistical analysis indicated that there was no significant difference in the blood lactic acid levels between groups at rest and immediately after activity; But the blood lactic acid levels between groups 5 minutes after initial state recovery($P < 0.001$) and also 20 minutes after initial state recovery($P < 0.001$) varied significantly. That is 5 minutes after initial state recovery, the average of blood lactic acid in the inactive group was significantly lower than that of the groups with 60 percent ($P = 0.004$) and 65 percent of maximum heart rate ($P < 0.001$). Also, the level of blood lactic acid of the group with 55 percent of maximum heart rate was significantly lower than the group with 65 percent ($P = 0.001$) and group of 60 percent was less than the group with 65 percent ($P < 0.05$). In addition, comparison between groups (two by two) 20 minutes after initial state recovery revealed significant difference. In other words, average lactic acid 20 minutes after the initial state recovery in inactive group was the highest and in the group with 60 percent maximum rate was lower in all groups (Table 2). The average level of reduced blood lactic acid immediately after activity to 20 minutes after the initial state recovery among 4 groups was significantly different ($F (3,56) = 12.73$, $P < 0.001$) and in the group with 60 percent of heart rate (with average 98 / 2 mmol L) had the highest reduction of all groups ($P < 0.001$) (Table 3).

The level of increasing love of lactic acid immediately after activity to 5 minutes after initial state recovery in four groups had a significant difference ($F (3,56 = 6.60)$, $P = 0.001$); and the increased level in the group with 65 percent maximum rate Heart (with Mia setting 73 / 3 mmol l) was the highest all groups ($P < 0.001$) (Table 4).

The difference of decrease in average level of lactic acid 5 minutes after initial state recovery to 20 minutes after that, was significant in all groups ($F (3,56) = 73.42$, $P < 0.001$), and the reduction in the group with 60 percent maximum heart rate (with average 34 / 6 mmol L) was the most of all groups ($P < 0.001$) (Table 5).

DISCUSSION AND CONCLUSION

The results indicate that to excrete the lactic acid accumulated in athletes' blood all the methods of initial state recovery were useful. But according to the measurements, it was observed that active initial state recovery with the intensity of 60 percent of maximum heart rate repelled most acid lactic of all methods.

The findings show that immediately after activity and 5 minutes after initial sate recovery, the amount of blood lactic acid increased in all groups because of secretion of the lactic acid produced by muscle into blood. During the Coningham test (maximum intense exercise), anaerobic glycolysis system in active muscle is responsible for produce energy resulting in lactic acid production. The lactic acid should be released in blood and when immediately after the test we measure the density of blood lactic acid, still little lactic acid is not secreted into the blood. Then the first five minutes of initial state recovery is somehow synchronized with the stage of loan oxygen without lactic acid. Greater amount of lactic acid produced secreted into the blood results in the increase of blood lactic acid concentration compared to the test mode. Findings of the mentioned survey is consistent with Ardeshir Zafari[3]. Also, 20 minutes after initial state recovery average in all groups (two by two) the difference was significant ;in other words average lactic acid 20 minutes after initial state recovery in the inactive group was higher than the that in others and group of 60 percent maximum heart rate of all groups was less than others.

The findings of the current research indicate that initial state recovery scheme is much more beneficial than the inactive scheme and this result is in consistency with the findings of other researchers [24,7,11,21,13,22], but not with some others' [4, 6] probably due to differences in methods, samples, and initial state recovery duration [20].

The results show that the average decrease in lactic acid in the group with 60 percent maximum heart rate was significantly higher in all groups, indicating that the initial state recovery scheme with intensity of 60 percent of the maximum heart rate had much more useful effects on reducing lactic acid after exhausting and intense activities than other schemes.

In a recent study it is demonstrated that active recovery with the intensity of 50 and 60 percent, 100 meter freestyle swimming, without any effects on athletes' performance has considerable effects on reducing the rate of lactic acid concentration (16).

Based on age and maximum heart rate of participants in this study, the rate of heart beats with intensity of 60 percent maximum heartbeat would be in the range of 120 ± 2 per minute which is in consistency with other studies which claim that:" the intensity of aerobic exercise used I initial active state recovery should not be higher than 60 percent of maximum heart rate is athletes" [17].

It is still unclear that why we observe more reduction of lactic acid during active recovery? Although recent studies indicate that the half-life of removing lactic acid from blood and muscle during active recovery is less than inactive recovery [19, 23]

The result of this study shows that the initial state of recovery through activity effects is better than passive state. Additionally, doing exercise with is 60 of maximal heart rate in during recovery is the best way for reducing blood lactate

Table3:Mean and SD reduction of lactate acid immediately after training until 20 minutes after recovery in four groups (mmol/liter)

p-value	max	min	SD	mean	Number of samples	group
0/001<	2/60	0/5	0/65	1/75	15	50%HR
	2/90	1	0/50	2/03	15	55%HR
	3/80	2	0/51	2/98	15	60%HR
	3/60	1/70	0/62	2/35	15	65%HR

Table4: Mean and SD reduction of lactate acid immediately after training until 5 minutes after recovery in four groups (mmol/liter)

p-value	max	min	SD	mean	Number of samples	group
0/261	3/70	1/70	0/60	2/79	15	50%HR
	4/50	2/10	0/58	3/14	15	55%HR
	4/60	2/30	0/64	3/36	15	60%HR
	4/40	2/70	0/56	3/73	15	65%HR

Table5:Mean and SD reduction of lactate acid 5 minutes after training until 20 minutes after recovery in four groups (mmol/liter)

p-value	max	min	SD	mean	Number of samples	group
0/001<	5/30	3/80	0/40	4/54	15	50%HR
	5/60	4/60	0/30	5/17	15	55%HR
	7/0	5/40	0/42	6/34	15	60%HR
	6/80	5/40	0/36	6/07	15	65%HR

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