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Comparison of active recovery and whole body vibration combined with active recovery effects on blood lactate after exhaustive activity

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ABSTRACT

The purpose of this study was to compare the blood lactate (BL) removal during the recovery, using two methods, active resting (AR) and whole body vibration combined with active rest (WBVR), after an exhaustive activity in male students was a footballer. For this purpose the number of 14 students from the universal football team (age 24/2±4/1 years, height 1/75 ± 0/13 m, weight 68/35± 3/50 kg, BMI 22/33 ± 2/11 kg/m2, Vo2max 40/80 ± 1/52 ml/kg) were selected on a voluntary basis. In first stage resting BL was monitored and then those 10 minutes running to warm up and then paid on the revised Astrand test. At the end of the test subject's BL was measured. Then, the subjects did 15 minutes active recovery (on treadmill with zero slope and speed of 5 km/h). At the end of recovery BL level was monitored. The second stage of research that distance was about 1 week, was similar to first stage, except it includes the combined 1 minute vibration in a position with knees bent on the WBV machine (frequency 12/5 Hz and amplitude 10 mm) with 1 minute running on a treadmill with zero slope percent and 5 km/h rate, the time of this stage was 15 minutes. For comparison of the data related T-test (p> 0/05) was used. Our result indicates that between the AR and WBVR no significant difference, although more effective AR on BL was excreted.

Keywords: Recovery, Blood lactate, Whole body vibration, exhaustive activity

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INTRODUCTION

Cardio respiratory endurance has long been recognized as one of the fundamental components of physical fitness. VO2 max is probably the single most important factor determining success in an aerobic endurance sport. Cardio respiratory fitness is increased by exercise training, regardless of age, gender, race, and initial fitness level[1]. The lactic acid which is produced during anaerobic training or when the oxygen reserves are limited can be gathered in the muscle, affect its performance, change the acid-base balance of muscle fibers and thus reduces the enzyme activity and ATP produced by anaerobic training. Lactic acid can also reduce the contraction power of the chords and probably can create a twinge sensation after intense efforts and is followed by physical and mental fatigue [2]. Most of efforts to explain the causes of fatigue and its spot, emphasize on : 1) Energy systems (phosphagen, glycolysis, aerobic oxidation), 2) Repletion of side products of metabolism, 3) nervous system and 4) disorder in contraction mechanism of muscle fibers. Decomposition of lactic acid leads to repletion of hydrogen ions within the muscle cells which causes acidosis in muscles and disrupts the cellular processes for energy production and muscle contraction [3]. During the exercise, muscle cells become stimulated and then face tension but the main compatibility will be achieved during recovery. One method used in most sports teams to increase readiness of athletes is to exercise by whole-body vibration devices. The whole body vibration was first introduced in 1990 and it was applied widely in professional sports, physical fitness centers and rehabilitation clinics [4]. It is now widely used in physical therapy, rehabilitation and professional sports and has gained many users in various fields. Thus, researchers are more focused on evaluation of the short and long term effects of these mechanical stimulations [5]. Studies have shown that whole body vibration exercises can be helpful in physical readiness, the level of health and even improve the recuperation process [6 and 7]. Also in some studies it has been used as a way for recovery in

repelling the blood lactate [4, 8 and 9]. In this study, with regard to the importance of recovery period after exercises, novelty of vibrating devices and their application in sports sciences, we will attempt to find out the difference between the amount of blood lactic acid excreted during recovery using active and compound (active rest with the whole body vibration) after an exhaustive activity among football player students, and also to find out what how these methods influence the amount of blood lactic acid excretion?

MATERIALS AND METHODS

To conduct this study we selected 40 footballer students from Ahvaz University Club; 15 footballer students were selected as volunteers for sampling and one of them was excluded from the study, for not attending the second stage of the test and the remained 14 footballer students took the test (with the average age of 24.2 ± 4.1 years, average height of 1.75 ± 0.13 meters, average weight of 68.35 ± 3.50 kgs, average BMI of 22.33 ± 2.11 kg/m2, average VO2max of 40.83 ± 1.52 ml/kg). Participants attended 3 exercises sessions per week at university football stadium. After measuring height, weight and body composition, we explained the study to all the participants. The exhaustive activity we used was Astrand modified test (Vivian H. Heyward) which starts from the first constant velocity of 10 km/h and a slope of zero and then after 3 minutes, 2.5% will be added to the slope. During the later stages, 2.5% will be added to slope in every 2 minutes. Before starting the exercise program, the level of blood level of lactic acid during the rest was measured using lactometer. The blood sample was taken from the tip of middle finger using the lactometer needle. Then, participants tried to warm up for 10 minutes (stretching and jogging). After that each of the samples did the exercises until became tired and exhausted. Immediately after the exercise finished, blood lactic acid level was measured again. Then participant took a rest for 2 minutes. Following this stage, participants performed active recovery for 15 minutes (running on a treadmill with a slope of zero percent and 5 kilometers per hour speed). At the end of recovery, the level of blood lactic acid was measured and recorded. The second stage of the test was carried out after a week, the same as previous stage, but with the difference that at this stage, the recovery period for participants included both active rest and using whole body vibration (in semi-squat position) on compound whole body vibration device for 15 minutes (1 minute vibration with the frequency of 12.5 Hz, 10 millimeter amplitude and 1 minute active rest). Method used for measuring the blood lactic acid level was the same as method in first stage.

RESULTS

By using T test to compare blood lactate levels at rest in both recoveries and with regard to the Table (1), it is obvious that blood lactic acid levels at rest for participants in the first and second stage, does not show any significant difference; Therefore the participants lactic acid level has been in an equivalent condition at the beginning (P≥ 0.05).

Table (1) Paired comparison analysis of lactic acid level at rest in individuals before both recoveries

Time	statistical index				T statistics	Level of Significance
	Mean	Standard Deviation	Confidence Interval 95%			
			Lower Bound	Upper Bound		
Before Active Recovery Before Recovery with WBV	0.05	0.35	- 0.015	0.52	0.25	0.06

* *Significant difference between groups (α < 0.05)*

Results from evaluating the amount of blood lactic acid after recovery shows that both methods have a significant effect on reduction of the amount of blood lactic acid; It was 8.39 millimoles per liter in active recovery and 7.7 millimoles per liter in combined recovery, which means active recovery had more effect compared to combined recovery but it was not significant (Table 2) and (Figure 1).

Table (2) Paired comparison analysis of lactic acid level in individuals during both recoveries

		statistical index				T statistics	Level of Significance
	Blood Lactate changes before to after the test	Mean	Standard Deviation	Confidence Interval 95%			
				Lower Bound	Upper Bound		
	Active Recovery Recovery with WBV	-0.68	3.02	- 2.43	1.06	- .084	0.41

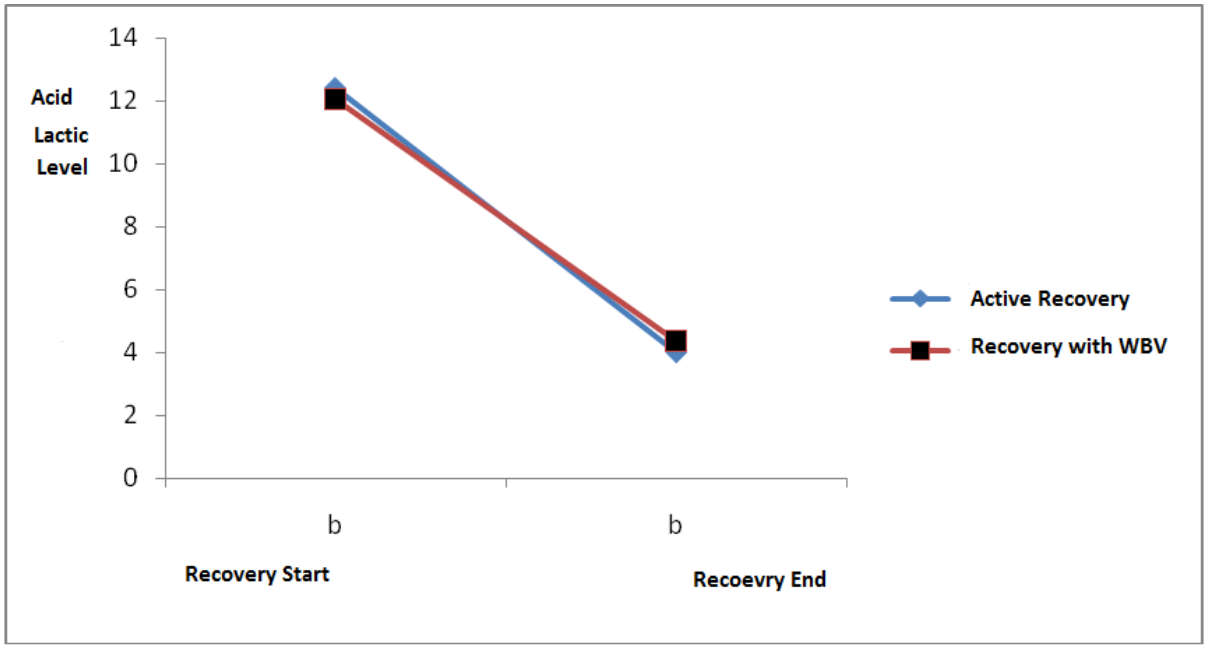

Figure (1) Comparison of blood lactate changes in active recovery and recovery with vibration

DISCUSSION

The results show that both recovery methods have the same effect on the amount of blood lactate. During the recovery both catabolic and anabolic reactions become activated after the exercise, to first recover the energy resources consumed during the exercise, and then restore conditions like acidosis, muscle injury, disorders in liquid and electrolytes balance. When we focus on studies which have an appropriate methodology, we will find out that even with no carbohydrate consumption, the amount of glycogen synthesis has been between 12 to 15 millimoles per wet kilograms an hour. It is believed that this too much amount of glycogen synthesis causes the lactate to reconvert in pyruvate and consequently reverses the glycogen and produces a 6 phosphate glucose which finally can lead to storage of glycogen. In addition, it is figured out that the lactate can be released from the skeletal muscle by a transfer mechanism. This process which is also recognized by rapid increase of blood lactate during the first moments of recovery is an effective process. However, studies done using radioactive isotopes show that lactate carbons will turn into muscle glycogen, carbon dioxide, amino acid and probably glycolytic intermediates. During an active recovery after exhaustive activity, intermediates accumulated as a result of glycolysis and muscle lactate, turn into pyruvate and will be used in mitochondrial respiration [10]. Since there was no carbohydrate used after recovery in this study, it is safe to assume that reduction of blood lactic acid during recovery is a result of its conversion into pyruvate. In active recovery there is the possibility that it avoids the catecholamine preliminary response and prevents the more accumulation of blood lactate and makes it to release easier. Restraining beta-adrenergic receptors, especially epinephrine often will lead to a reduction in lactate density of blood and muscle or both of them [11]. Also the activity of liver, heart muscle and skeletal muscles (especially legs muscles) will be increased and use the produced lactate as a substrate and makes it to be excreted easier from the blood [11]. In other words, active recovery causes a delay in evoking muscle fibers of fast-twitch glycolytic units and increases the activity of muscle fibers of slow-twitch units, restrains from glycolysis process and leads metabolism towards mitochondrial respiration and therefore blood lactic acid will be decomposed and its amount will be reduced.
Combined recovery method is effective in excretion of blood lactic acid because of the following reasons:

1. The whole body vibration with low frequencies (such as 12 Hz) might act as a mechanical massage and helps excretion of wastes that obstacle renewal of tissues, by increasing blood flow towards the active muscles. Also by increasing stimulation in muscle receptors will decrease tension in muscles and relieves them [9].
2. Reduction in blood lactate due to whole body vibration can be related to regulation of motor units usage (increasing slow-twitch motor units versus fast-twitch motor units) or reduction in production of lactate (by entering pyruvate in mitochondrion and increasing cellular metabolism) and the increase in its excretion from the blood.
3. Whole body vibration causes the small veins to dilate will increase the blood flow, reduces the index of blood resistance and also decreases the blood viscosity and improves the blood circulation [12] and can lead to an increase in the amount of oxygen consumption, since excretion of blood lactic acid human is significantly affected by the amount of oxygen consumed [8], and therefore, probably increasing the consumed oxygen might be effective on the excretion amount of blood lactic acid.

4. Since in the present study we used 1 minute intervals of running after whole body vibration, it is possible that the body has used acid lactic as a substrate during these periods and has consumed them.
5. In whole body vibration, it is possible that during active recovery, activity of liver, heart muscle and skeletal muscles (especially legs muscles) get increased and use the produced lactate as a substrate and cause it to excrete easier from the blood.
6. Those muscles affected by whole body vibration device consume more glucose and oxygen and energy production will be inclined toward aerobic production, so the heart incur a pressure to pump blood and oxygen to muscles [12 , 13 and 14], therefore by increasing the blood flow, muscles use blood lactic acid and its excretion will be easier.
7. The whole body vibration leads to fast concentric and eccentric twitches which cause an increase in the amount of muscle metabolism [15], therefore leads to warm up and increase in muscle temperature which improves the neural efficiency and decreases the blood viscosity resistance and makes the blood excretion easier [15].
8. Lactic acids in muscle fibers excrete through oxidation or they get transported into the blood and will be excreted from cell to cell according to lactic acid shuttle and this excretion of lactic acid will be facilitated by monocarboxylate transporters. Most important isoforms are MCT4 and MCT1 transporters which have more intensity in glycolytic and oxidative muscles respectively. It is possible that whole body vibration affects the amount or operation of these transporters and thus be effective on excretion amount of blood lactic acid, but there is no evidence to confirm that whole body vibration will affect the amount of these transporters. When the amount of blood lactic acid increases during the exercise, muscle fibers can consume the lactic acid during the recovery period [16].

CONCLUSION

The results of this study show that there is no significant difference between combined and active recovery in terms of blood lactic acid excretion. Though the active recovery had more effect on excretion of blood lactate , but since in the combined recovery method less time spent running (7 minutes versus 15 minutes), therefore it can be said that, compared to active recovery, combined recovery can be more effective and we can use it as an effective recovery method after exhaustive activity for athletes.

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REFERENCES

[1] Sabbaghian Rad L, and Gholami M, *Annals of Biological Research*, **2012**, 3 (4):1821-1827
[2] Sharkey, Brian and Gaskill, Steven E. *J Appl Physiol*, (**2006**). 22: 61 – 70.
[3] Wilmore, Jack H and Costill, David L. *Br J Sports Med*, (**2004**). 139 ,203–213.
[4] Im Yongtaek Kim, Jaedeung, Kwon Hyeongsu. *Acta Physiol Scand Suppl* (**2007**), 77: 1403–1410.
[5] Darryl J, Cochrane J, Lgg J, Michael J. *J Strength Cond Res*. **2004**.18(4), 828-32.
[6]Delecluse C, Roelants M, Verschueren S. *Med Sci Sports Exe*.(**2003**).1033-41.
[7] Ronnestad B. *J Strength Cond Res*. (**2004**).18:839_ 845.
[8] Arshadi, S, Gharakhanlu, R and Agha Alinejad, H. ISNA - Tehran, Service: Sports - Wrestling. (**2007**) . 1388/01/21, Archive Code 8712-14152.
[9] J. Edge Æ T. Mu¨ndel Æ K. Weir Æ D. J. Cochrane.. *Eur J Appl Physiol*.(**2009**). 105:421–428 DOI 10.1007/s00421-008-0919-z.
[10] Robergs, Robert A and Roberts, Scott. *Med Sci Sports Exe* (**2000**). 76: 1462-1467.
[11] Weltman, Arthur.(1995). *J Appl Physiol* ,(**1994**),77: 1403–1410.
[12] Kerschan-Schindl K, S.Grampp C, Henk H and et al. *Clinical physiology*.(**2001**). 21, 3, 377-382.
[13] RITTWEGAR J. H. Schiessl and Felsenberg D. *Eur. J.Appl. physiol*. (**2001**). 86:169-173.
[14] Rammohan V. Maikala. Sharla King Yagesh N. *Int Arch Occup Environ Health*. (**2006**). 79: 103-114.
[15] Cochrane D.J, Legg S.J, and Hooker M.J. *J.Strength cond. Res*. (**2004**). 18:828-832.
[16] Thomas C.S.Perrey, K. Lambert, G.Hugon, D. Mornet, and J. Mercier. *J Appl Physiol*, (**2005**) 77: 1403–1410.