International Journal of Yoga, Physiotherapy and Physical Education
Online ISSN: 2456-5067; Impact Factor: RJIF 5.24
www.sportsjournal.in
Volume 2; Issue 4; July 2017; Page No. 40-43

Comparison of selected post-recovery interventions on blood lactate clearance among athletes

[*1] Pandey Gayatri, [2] Shrivastava Vijay Kumar, [3] Dr. Pandey Vivek, [4] Das Pramod Kumar
[1] Research scholar, Department of Exercise Physiology, L.N.I.P.E., Gwalior, Madhya Pradesh, India
[2] Professor Department of Exercise Physiology, L.N.I.P.E., Gwalior, Madhya Pradesh, India
[3] HOD of Department of Exercise Physiology, L.N.I.P.E., Gwalior, Madhya Pradesh, India
[4] Assistant Professor, Department of Exercise Physiology, L.N.I.P.E., Gwalior, Madhya Pradesh, India

Abstract
Fatigue occurs due to the lactate accumulation and causes prevention of muscle contraction. The present study was designed to compare the effect of passive (PR), active (AR) and cold water immersion recovery (CWI) interventions on blood lactate (BLac) clearance among athletes. Statistical population of this study were thirty male athletes age ranging between 19-23 year with a mean and SD of age: 22 ± 1.23 years. The participants were randomly and equally divided in three groups. Pre-blood lactate data were collected just after high-intensity exercise (85-90%) on treadmill and post-blood lactate data were collected just after ten minutes recovery intervention in the biomechanics laboratory at the LNIPE, Gwalior. Data was analyzed using descriptive statistics; analysis of covariate (ANCOVA) and significance level was set at 0.05. The result showed (cal. F-value: 124.26 > Tab. F-value 3.37 at 2, 26 df) significant difference on blood lactate clearance between passive, active and cold water immersion after high intensity exercise. So, this experiment reveals that AR and CWI have a significant effect on the reduction of BLac ($p<0.05$) level. It could be concluded that AR is better than PR whereas CWI is better than AR and PR both.

Keywords: passive recovery, active recovery, cold water immersion recovery, blood lactate, high-intensity exercise

Introduction
The success of any training programme mostly depends upon two important components that are rest and recovery. They are also the least planned and underutilized ways to improve performance. Recovery, however, refers to methods and actions taken to maximize the body's reparation. This include various fundamental aids like heat, ice bath, hydration, nutrition, posture, stretching, self-myo fascial release, massage, compression, and time spent standing versus sitting versus lying down. A balanced combination of work and recovery along with proper diet could produce and successful and sensible athletes (Jeff Kuhland). After exercising need to let the body recover in the aspects of physical and physiological as well as the psychological.
Fatigue as decrease of muscle function during activity. Due to Fatigue athletes are unable to continue the exercise due to unwanted effects and this reduces the quality and quantity of athletes' workout. There are lots of effective factors on a fatigue occurrence that the lactate increment is the most important ones. Increasing the blood lactate level is one of the most important factors that cause the fatigue. After strenuous exercises, fatigue is created due to the changes in the muscle and then in the chemical factors of blood serum of the athletes These changes are due to the waste products such as lactic acid. This substance is the product of anaerobic metabolism (Sesboüé, & Guincestre, 2006) [5]. Lactate accumulation avoids the muscle contraction and causes fatigue. It has been seen that short-term high intensity exercise produces high levels of arterial lactate with values reported in highly motivated individuals (Mainwood and Renaud, 1985; McLoughlin, *et al*., 1991; Rowell *et al*., 1986).
There are two categories of recovery namely immediate (short-term) recovery from a particularly intense training session or event, and Long-term recovery techniques refer to those that are built into a seasonal training program. Active recovery occurs in the hours immediately after intense exercise. Active recovery refers to engaging in low-intensity exercise after workouts during both the cool-down phase immediately after a hard effort or workout (Quinn Elizabeth, 2016) [3]. Cryotherapy involves sitting in a tub of cold water for 5-10 minutes at 12–15°C appears.
The amount and type of recovery time needed depends upon type of exercise and duration of the workout. After the finish a workout, need to replenish lost fluids, energy stores and clear blood lactate. The various recovery methods are available for recovery. On the basis of analysis of numerous research paper and articles it has found that there is lot of contradiction that which method is more appropriate at which time interval.

Objective
The objective of the study was to compare the effect of passive (PR), active (AR) and cold water immersion recovery (CWI) interventions on blood lactate (BLac) clearance among athletes.

Materials and Methods
The methodology of the study is consists of selection of subjects, selection of variables, criterion measures, testing procedure and statistical technique employed for analysis of data.
For achieving the purpose of the study thirty male athletes age ranging between 19-23 year with a mean and SD of age: 22 ± 1.23 years, height 168± 6cm, weight 66± 4 were randomly selected from Hockey, Basketball, Badminton, Football and volleyball who represented Lakshmibai National Institute of Physical Education Gwalior, in Inter-University competition,

were selected as subjects for this study. The participants were also asked to abstain from exhaustive exercise from 48 hours and avoid food and fluids except water from 2 hours before all data collection sessions.

Participants ran for the 10 minutes at 85-90% of their maximum heart rate (MHR) on the treadmill the available at biomechanics laboratory. Initial 2 minutes before the workout were devoted to a gradual rise in the running velocity and effort was made to attain the target heart rate. After 2 minutes, the intensity was maintained by taking heart rate on the fully automatic heart rate monitor. Just after the session of high intensity exercise the base line data of blood lactate was collected. Blood lactate scout (Pro2) was used to collect the blood lactate data in mmol/L. Then participants had undergone different recovery interventions allocated randomly.

Passive Recovery

The subjects were asked to lie down on yoga mat in supine lying position for ten Minutes.

Active Recovery

The participants were continued running next for next ten minutes at 45-50% of maximum heart rate.

Fig 1: Lactate analyser with lancet, needle and testing strips

Fig 2: Cold Water intervention

Cold Water Immersion- The subjects were immersed up to bottom of rib cage in the tank containing cold water of 10 to $15^{\circ c}$ for 10 minutes.

Statistical analysis was done with SPSS (Statistical Package for the Social Sciences, 20.0, USA). The descriptive analysis was represented in the form of mean and standard deviation in order to present a knowledge about the all role of selected independent variables on blood lactate clearance while performing, analysis of covariance was employed after fulfilling all the assumptions of selected parametric test. Then obtained "F" value was tested at 0.05 level of significance. Partial eta was also calculated to find out the total magnitude of the mean differences along with its significance level (Effect Size).

Results

Table 1: Descriptive Statistics & Adjusted Mean Score of Passive Recovery, Active Recovery and Cold Water Immersion on Blood Lactate

Intervention	N	Pre-Mean ± SD	Post Mean ± SD	Adjusted mean ± SD
Passive Recovery(PR)	10	12.16± .65	8.35±.55	8.35 ± .09
Active Recovery (ACR)	10	12.14± .53	7.06±.21	7.07 ± .09
Cold Water Immersion(CWI)	10	12.17± .59	6.26±.21	6.26 ± .09

Table 1 shows descriptive statistics after eliminating the effect of covariate of Passive, Active & Cold water immersion. In Passive recovery group, the pre, post & adjust mean along with standard deviation was 12.16± .65, 8.35±.55 & 8.35 ± .09. Similarly, Active recovery group pre, post & adjust mean along with standard deviation was 12.14± .53, 7.06± .21 & 7.07± .09. Further Cold water immersion group the pre, post & adjust mean along with standard deviation was 12.17± .59, 6.26±.21 & 6.26± .09. The graphical presentation of mean scores are illustrated in Figure 3.

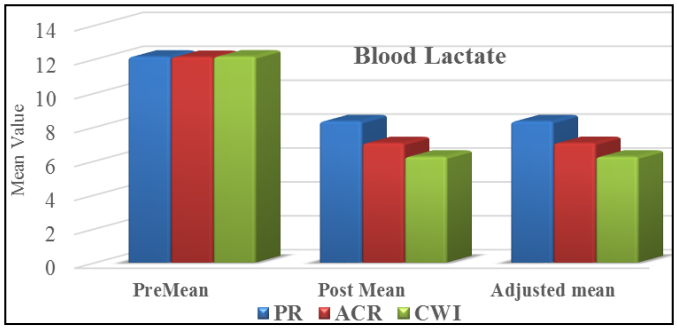

Fig 3: Mean Score of Passive Recovery, Active Recovery and Cold Water Immersion on Blood Lactate

Table 2: Analysis of Co-Variance

Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Pre-Blood Lactate	1.14	1	1.136	12.66	.001*	.328
Recovery Intervention	22.29	2	11.143	124.26	.000*	.905
Error	2.33	26	.090			

* Significant at .05 level, F.05 (2, 26) = 3.37

Note: The above represents that the F-value for Pre- Blood Lactate (covariate) is also significant. it shows that initial condition was not same that's why ANCOVA was applying**.**

Table 3: Pairwise Comparisons of Mean Score of Passive Recovery, Active Recovery and Cold Water Immersion on Blood Lactate Dependent Variable: Blood Lactate

(I) Recovery Intervention	(J) Recovery Intervention	Mean Difference (I-J)	Sig.[b]	95% Confidence Interval for Difference[b]	
				Lower Bound	Upper Bound
PR	ACR	1.283*	.000	1.008	1.558
	CWI	2.094*	.000	1.818	2.369
ACR					
	CWI	.811*	.000	.535	1.086

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 3 shows that p-value and mean difference between intervention PR & ACR, CWI and ACR & CWI are .000 & 1.283, .000 & 2.094 and .000 &s811 respectively. It noted that p- values are less than 0.05, so all the three mean difference are significant at 5% level.

Discussion of Finding

The intention of the present study was to compare the effect of three selected recovery methods on the blood lactate clearance. Table 1 showed that immediately applying recovery methods after high intensity running, the blood lactate levels significantly decrease compared to the after running position (Figure 3). Also, results table 2 demonstrated that recovery intervention very effective in clearance of blood lactate whereas table 3 indicates that there was significant difference between passive recovery and active recovery as well as cold water immersion, similarly there was significant difference between active recovery and cold water immersion. This result continues with the result of Miad Mokayef, Mehrzad Moghadasi and Reza Nuri, 2014.

As results showed that after the passive recovery, blood lactate level is reduced, but this reduction in the passive recovery group was lower than other intervention's groups. The adequate amount of Oxygen is available during the active recovery intervention that associates with decrements in intensity of the exercise. This aid is to combine with the hydrogens of the lactate acid and consequently oxidized (Fatimah Lateef, 2010) [7]. As a result, lactate acid converts to the pyruvic acid effortlessly and reused as a new source of energy (Wilmore, Costill & Kenney, 2008) [4]. Active recovery associated increase in blood flow throughout the body which, may also increase the metabolism of substrates produced during exercise. There have been notes that this increased substrate metabolism clears the post exercise blood lactate following active recovery. Considerate of the precise mechanism through which lactate is more effectively removed during active recovery continues to be refined (Ahmaidi *et al*., 1996; Corder *et al*., 2000). Further, most reduction in lactate acid was observed in the results obtained from cold water immersion rather than the one from the passive one. Cold water immersion (CWI) is a trendy recovery modality in fatigue reduction after doing intensive exercises. It may be because the physiological response to cold water immersion has been attributed mainly to the effects of hydrostatic pressure and water temperature. Cardiovascular changes are likely induced only by cryotherapy modalities that expose a large proportion of body mass to cooling. Compressive forces commonly combined with cold (i.e. hydrostatic forces of water, wraps used with ice bags/immersion, etc.) structurally limit swelling and fluid accumulation, while facilitating removal of wastes and increasing central blood volume. This external act of hydrostatic pressure results into haemodilution and redistribution of blood flow to area of lower pressure (Wilcock *et al*. 2006 & Farhi *et al*, 1997). In addition to this the hydrostatic pressure creates a pressure gradient inside the body which causes waste metabolic fluids move from interstitial space to the intravascular space leading to haemodilution (Johnsen *et al*. 1997) which lead to faster removal of blood lactate.

Conclusion

The results of the present study advise that there are benefits to using a short duration post recovery intervention namely passive recovery, active recovery and cold water immersion for blood lactate clearance. The study seems to have created a practical application of recovery strategy that could be employed by athletes. The cold water immersion is considered as best effective method for the removal of blood lactate. In addition, future research is to examine the benefits of other post recovery intervention in relation to different following period. Thus, it is important to have an post-exercise recovery plan.

References

1. Jeff Kuhland. MovNat, Mobility & Recovery: 7 Essential elements of rest and recovery. Retrieved on, 2017. From https://breakingmuscle.com/fitness/7-essential-elements-of-rest-and-recovery.
2. Chloe Trousselot. Why it's important to recover after working out. Retrieved on, 2017. From https://wheycartel.com/articles/why-recovery-is-important-after-a-workout.

3. Quinn Elizabeth. Why Athletes Need Rest and Recovery After Exercise. Retrieved on, 2016, 2017. from https://www.verywell.com/the-benefits-of-rest-and-recovery-after-exercise-3120575.
4. Wilmore JH, Costill DL, Kenney WL. Physiology of sport and exercise, Human Kinetics, 4th Edition, 2008.
5. Sesboüé B, Guincestre JY. Muscular fatigue. Ann Readapt Med Phys. 2006; 49:257-264:348-354.
6. Fox E, Gisolfi, Robinson S, Turrell E. Effect of aerobic work performed during recovery from exhaustive work. European Journal of Appllied Physiology. 1989; 21:1767-772.
7. Fatimah Lateef. Post exercise ice water immersion: Is it a form of active recovery. J Emerg Trauma Shock. 2010, 2017; 3(3):302. Retrieved from https://www.ncbi. nlm.nih.gov/pmc/articles/PMC2938508/.