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EFFECT OF SELECTED RECOVERY INTERVENTIONS ON BLOOD LACTATE LEVELS OF ATHLETES AFTER HIGH INTENSITY ENDURANCE RUN

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Effect of Selected Recovery Interventions on Blood Lactate Levels of Athletes after High Intensity Endurance Run

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Abstract – The present study was undertaken with the purpose to analyses the effect of the selected recovery interventions on blood lactate recovery levels on the athletes after high intensity endurance run. For the purpose of the study a total of 10 endurance athletes were selected to act as participants. The recovery interventions selected for the study were active recovery, passive recovery, hyperoxic breathing, massage, contrast water immersion. The participants were administered with the recovery interventions after the cessation of the high intensity endurance run. The data on the blood lactate was collected at baseline i.e. 0 minutes and after 10 minutes, 20 minutes and 30 minutes. Repeated measure design was used in the study. The statistical technique applied to test the significance of the difference was One Way repeated measure ANOVA. The level of significance was 0.05. the result of the s study indicated that active recovery was the most efficient recovery intervention for the removal of blood lactate from body after high intensity interval training followed by contrast water immersion.

Key Words: Recovery, Exercise, Blood Lactate.

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INTRODUCTION

Human beings are by nature competitive and ambitious for their excellence in all athletic performances. The sense of an challenge and competition stimulates, inspires and motivates all the athletes to sweat and strive to run faster, jump higher, throw farther and exhibit greater strength, endurance and skills in present competitive sports world.(Lawrence E. Morehouse and Augustus T. miller1971). Running is one of the most basic human activities and running against another man, the most basic from of competition. (AdrainMetcaffe,1969). Training causes fatigue which occasions a temporary lowering of performance. Calder, A (1996).This impairment may be transitory, lasting minutes or hours after training or competition, or last for a longer period, up to several days.(Cheung K, et.al., 2003)

Training for success has increasingly become a balance between achieving peak performance and avoiding negative consequences of overtraining. In recent past, rest was considered as the only treatment for overtraining or a mean to recover faster after exercise. As a result of growing researches in the field of exercise and sport, the portrait of training structure has completely changed. Scientists around the world are now a day’s engaged in devising innovative methods of recovery and claims are made for one to be better than other based on physiological and psychological reasons. The processes occurring during recovery from exercise are just as important as those occurring during exercise itself. Incomplete recovery between exercise and athletic contests ultimately lead to a decrement in performance. During recovery from exercise oxygen consumption is elevated above resting levels. Also, during recovery, lactic acid is converted to muscles and liver glycogen, blood glucose, protein and particularly CO2 and H2O.

Recovery from exercise training is an integral component of the overall training program and is essential for optimal performance and improvement. If rate of recovery is improved, higher training volumes and intensities are possible without the detrimental effects of overtraining. (Bishop, P.Aet. al. 2008)

Recovery processes involve various organismic subsystems that monitor our bodies and perform important functions before, during and after exercise. The cardiovascular, hormonal, endocrine or muscular subsystems, for example are involved during and of course after the exercise.(Foster C., 1998)

For many years efforts have been made to develop procedures which will accelerate recovery. If the recovery is repeatedly insufficient; fatigue develops with repeated work. Depending on the degree of over fatigue, there is a weakening of effectiveness of the training or its effectiveness of training or its effects are completely lost while the level of performance declines. (Dietrish Hare, 1982)

Athletic coaches and people doing sports research has long been interested in various techniques that might prove helpful in speeding recovery from fatigue and improvement in athletes.. Although many techniques have been tried and are currently being used throughout the world, none have been adequately proven through controlled research to actually give more effective recovery. (Aix b. Harrison 1960)

In present study the research scholar has compared the effect of five recovery interventions on recovery of heart rate after high intensity interval running. Recovery interventions are:-

1) Passive recovery
2) Active recovery
3) Contrast water immersion
4) Massage
5) Hyperoxic breathing

The effect of these recovery interventions are compared on the heart rate recovery of athletes

METHODOLOGY

For the purpose of the study a total of 10 male cross country runners (mean age 20±3 years, height 168 ± 6m, weight 64 ± 6) were randomly selected from Track and Field having represented their university in all India cross country event. The participants have followed approximately a similar kind of training program from last one year and the minimum training age of the participants was two years.

EXPERIMENTAL DESIGN

The same participants underwent the different treatments again and again and data was recorded on selected variables repeatedly after treatment, so, the within-within group design with repeated measures was employed in the study.

Interventions	Time Points			
	Time point 0	Time point 1	Time point 2	Time point 3
RI 1	S1.....S10	S1.....S10	S1.....S10	S1.....S10
RI 2	S1.....S10	S1.....S10	S1.....S10	S1.....S10
RI 3	S1.....S10	S1.....S10	S1.....S10	S1.....S10
RI 4	S1.....S10	S1.....S10	S1.....S10	S1.....S10
RI 5	S1.....S10	S1.....S10	S1.....S10	S1.....S10

Figure 1- within – within group design used in the study

S = Subjects, RI = Recovery Interventions.

Blood lactate was measured by blood lactate analyzer (Lactate Pro2) manufactured by Arkrey technology, Japan, an internationally established diagnostic clinical instrument manufacturer and was available at human performance laboratory, LNIPE, Gwalior. A standard procedure prescribed in user's manual of product by Globus technology was adopted while administrating the test for lactate analysis. The reliability coefficient for the scores of the blood lactate levels tested through test retest method was .930, which was considered as statistically significant.

The participants ran for 10 minutes at a high intensity i.e. at 80-85% of their maximum heart rate on treadmill. Initial 2 minutes before the workout of 10 minutes were devoted for gradual rise in running velocity and efforts were made to attain the target heart rate of the participants. After 2 minutes, the intensity was maintained by taking note of heart rate on the fully automatic digital heart rate monitor. Just after the cessation of the high intensity run the baseline data for blood lactate was collected at the 0 minute time point, after 10 minutes and after 20 minutes and after 30 minutes. The treatments were randomly assigned to the participants in counterbalancing manner.

The procedure adopted for the administration of various recovery interventions are described in this section as follows:

Passive recovery: - After the high intensity running for 10 minutes the participants rested laid down in supine position without making any movement for 20 minutes.

Active recovery: - After the high intensity run for 10 minutes the participants continued to run for other 10 minutes at 40% - 45% of their target heart rate. After 10 minutes participants lied down on the floor and rested passively.

Massage: - After the cessation of high intensity run participants were given massage for 10 minutes by an expert massager. The techniques chosen for the massage were basically aimed at increasing the subcutaneous blood flow in the treated area. The participants were given massage in upper and lower parts of the body for duration of 10 minutes.

Contrast water immersion: - The participants were immersed up to neck alternately in two separate water tanks containing hot and cold water. The temperature of the hot and cold water was 100 – 140 Celsius and 400 – 440 Celsius respectively. The participants were first immersed in hot water (for 2 minute) and then cold water (for 1 minute).

Hyperoxic breathing: - In this intervention the participants inhaled oxygen from a cylinder for 10 minutes from an inhaling mask in supine position.

RESULTS

Descriptive Statistics of the Scores of Blood Lactate Recovery after Applying Selected Interventions at Subsequent Regular Time Points

Intervention	Time Point	Mean	Std. Deviation	S.E. Mean	C.V.%	Skewness	Kurtosis
Passive	0 minute	11.67	0.53	0.16	4.54	.066	-1.024
Passive	10 minutes	7.55	0.51	0.16	6.75	-.155	-.674
Passive	20 minutes	5.48	0.41	0.13	7.48	-.310	-.964
Passive	30 minutes	4.59	0.51	0.16	11.11	-.557	-1.578
Active	0 minute	11.46	0.77	0.24	6.71	-.048	-.843
Active	10 minutes	6.27	0.54	0.17	8.61	-.493	.497
Active	20 minutes	4.66	0.45	0.14	9.65	.873	.678
Active	30 minutes	3.62	0.45	0.14	12.43	.895	-.582
Massage	0 minute	11.31	0.63	0.20	5.57	-.210	-.823
Massage	10 minutes	7.15	0.41	0.13	5.73	-.042	.215
Massage	20 minutes	5.52	0.63	0.20	11.41	.634	.519
Massage	30 minutes	4.40	0.43	0.13	9.77	.558	-1.086
CWI	0 minute	11.55	0.93	0.29	8.05	.666	-.989
CWI	10 minutes	6.92	0.75	0.23	10.83	-.216	-.949
CWI	20 minutes	5.11	0.29	0.09	5.67	-.657	-.466
CWI	30 minutes	4.22	0.68	0.21	16.11	-.357	.275
HOB	0 minute	11.67	0.88	0.28	7.54	-.323	.253
HOB	10 minutes	7.17	1.22	0.38	17.01	.189	-.926
HOB	20 minutes	5.51	0.47	0.15	8.69	-.463	-.734
HOB	30 minutes	4.43	0.53	0.16	11.96	-.094	-1.743

Tests of Within-Subjects Effects for Interventions, Time Points and Their Interactions on Blood Lactate Recovery Scores

Measure: Blood Lactate

Source	Type III Sum of Squares	df	Mean Square	F	P-Value	Partial Eta Squared
Intervention (Sphericity Assumed)	16.0	4	4.02	6.1*	.001	.406
Error(intervention) (Sphericity Assumed)	23.4	36	.65			
Time Point (Sphericity Assumed)	1556.5	3	518.8	2440.4*	.000	.996
Error(Time Point) (Sphericity Assumed)	5.7	27	.21			
Intervention * Time Point (Greenhouse-Geisser)	5.1	4.4	1.16	1.397	.250	.134
Error(intervention*Time Point) (Greenhouse-Geisser)	33.1	39.7	.83			

***Significant at 0.05 level of significance**

In table above it is evident that the main effect for overall interventions was significant as the P-Value (.000) is less than 0.05 level of significance. The main effect for overall time points was also found significant as the P-Value (.000) is less than 0.05 level of significance.

From the table it is also evident that the simple effect (recovery interventions*time points) was found insignificant as the P-Value is greater than 0.05 level of significance.

Pairwise Comparisons between Overall Interventions of Blood Lactate Recovery

The results derived from pairwise comparison revealed that there was a significant difference between the passive & active interventions of blood lactate recovery as the P-Value is significant at 0.05 level, whereas, the insignificant differences were found between passive & massage, passive & contrast water immersion and passive & hyperoxic breathing interventions of recovery as the P-Values are greater than 0.05 level of significance. A significant difference also lies in blood lactate recovery between active & massage and active & hyperoxic breathing as the P-Values are less than 0.05 level of significance, whereas, the insignificant difference was found between active & contrast water immersion interventions of recovery as the P-Value is greater than 0.05 level. Insignificant difference was also observed between massage & contrast water immersion, massage & hyperoxic breathing and contrast water immersion & hyperoxic breathing interventions of recovery as the P-Values are less than 0.05 level of significance.

DISCUSSION OF FINDINGS

Blood lactate was selected as one of the physiological indicators of recovery because the concentration of the intra myocellular lactic acid is proposed to cause various deleterious electrochemical influences over excitation/contraction coupling and metabolic function.

The results revealed that during Active recovery the blood lactate level was least as compared to other recovery interventions in the terms of rate of blood lactate removal after fatiguing exercise. During active recovery exercise is used as a therapeutic tool to speed up recovery. In the present investigation subjects continued running at 40% intensity for duration of 10 minutes. The process of blood lactate removal during active recovery is complex as it depends on a range of factors for example, local blood flow, chemical buffering, movement of lactate from muscle to blood, lactate conversion to pyruvate in liver, muscle and heart (McArdle, W.D et.al. 2001). Dodd et al. (1984) also found that a recovery period of moderate continuous intensity facilitated lactate removal faster than passive recovery. In a study Ahmaidi S. et. al. found that active recovery immediately after the event encourages recovery and reduces muscle lactate levels faster than complete rest. Signorile et al. (1993) claimed that during recovery from low intensity cycling, lactate clearance may be enhanced by active muscles causing a pumping action and adjacent muscles providing oxidative metabolism to removing metabolites.

Contrast water immersion has also shown to have a significant effect on the blood lactate removal after high intensity workout without any extra energy cost involved. Gill N.D. (2006) concluded that contrast water immersion therapy has recently been shown to enhance post-match creatine kinase clearance (estimated from transdermal exudate samples) in rugby players compared with passive recovery.

According to Calder (1996) the contrast hot–cold water technique is thought to speed recovery by increasing the peripheral circulation by removing metabolic wastes and stimulating the central nervous system. Calder (2001b) further claims that contrast hot–cold increases lactate clearance, reduces post exercise edema and enhances blood flow to the fatigued muscle. Myrer et al. (1997) suggested that the significant skin temperature fluctuations from the hot–cold contrast packs caused vasoconstriction and vasodilatation thereby initiating subcutaneous response and mechanical shunting. In the present investigation it has been found that active recovery leads to accelerated removal of blood lactate as compared to contrast water immersion but in the conditions where an athlete requires participate in next bout of exercise contrast water immersion may prove to be a better option because of the reason that active recovery results in further depletion of glycogen stores. Choi et al. have shown active recovery delays glucose synthesis after high intensity cycling in untrained males. Active recovery often requires additional energy that further depletes precious energy stores therefore, if passive recovery is proven to increase glycogen resynthesis contrast hydrotherapy may be justified as a post training tool.

Massage was chosen as a recovery intervention in the present investigation with objective of accelerating the blood flow in major muscles. It was assumed that the increased blood flow may result in accelerated removal of metabolites and enhance the recovery. The results of the study showed that the massage was not as effective as active recovery and contrast water immersion. Although massage resulted in better recovery in terms of removal of blood lactate than passive recovery and hyperoxic breathing, but its effectiveness in accelerating physiological recovery is questionable. It has been argued that an increase in muscle blood flow would hasten the delivery of oxygen, increase muscle temperature and buffer blood pH, which would then aid in the performance of exercise (Cafarelli E and Flint F (1992).

In the study conducted by Bale et. al., it was reported that massage treatment could increase blood lactate removal after strenuous exercise. A variety of controlled clinical trials have used venous occlusion pethysmography, the 133Xenon wash-out technique, or pulsed Doppler ultrasound velocimetry to examine the effects of massage on blood flow. Although several authors have agreed that massage could increase blood flow. Hemmings B. et. al. (2000) also found that hyperoxic breathing have insignificant effects on the levels of blood lactate as compare active recovery, however, produced a superior blood lactate removal rate than massage therapy. Other studies showed no benefit from massage.

Chia-Lun Lee (2007) concluded that the inhalation of the gas mixture with 60%O2 after exhaustive exercise, increased the vagal modulation of the autonomic nervous system on the heart and improved physiologic recovery after intense exercise. The primary cause of the finding in our study may be attributed to the less duration of hyperoxic breathing. It might also be argued that in humans the availability of oxygen in the lungs is not a limiting factor for performance but the capacity of body to transport and extract oxygen present in the blood stream.

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