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A STUDY ON LACTATE COMPLETE CLEARANCE RATE ON SWIMMERS

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Abstract: The effect of lactate production on acidosis has been the topic in the field of exercise physiology. The production of lactate does result in a hydrogen ion, potentially resulting in a fall in pH. However, the hydrogen ion is quickly buffered by bicarbonate which forms an intermediary in the blood stream which is quickly converted into water and carbon dioxide. For data collection a sample of 15 swimmers had been selected through purposive sampling. All the swimmers had represented their state in swimming for more than 3 times and were comfortable in doing individual medlay. Their age ranged between 21-25 and all belongs to Maharashtra state. shows the descriptive statistics of the data which has been collected at various time interval. According to the table the mean value of lactate level at initial level or resting lactate value of the subjects is seen as (2.31 $\pm$ 3.867). After performing 200 IM at intense level the peak lactate level of the subjects was seen as (12.65 $\pm$ 4.654). Further the period of active recovery is started and the mean lactate value at first 5th minutes was (6.71 $\pm$ 3.795), 10th minute (6.32 $\pm$ 3.688), 15th minute (5.65 $\pm$ 0.568), 20th minute (5.17 $\pm$ 0.524), 25th minute (4.82 $\pm$ 1.072) and 30th minute (4.37 $\pm$ 2.397). All these readings of lactate have been taken while active recovery was continued. Then at 50th minute of passive recovery the lactate value was (3.11 $\pm$ 0.536), 70th minute (2.21 $\pm$ 1.134), 90th minute (1.12 $\pm$ 0.012). the initial value of lactate in swimmers' body was found to be 2.31 mmol/L but after performing an intense event of 200IM the lactate value bumped to 12.65 mmol/L which was proved to be the result of byproduct of anaerobic glycolysis. The value proved that the nature of the activity was mostly anaerobic which was our aim. During first 5 minute 46.95% of the lactate was removed, 10th minute 50.04% of the lactate was removed, 15th minute 55.33% of the lactate was removed, 20th minute 59.13% of the lactate was removed, 25th minute 61.89% of the lactate was removed, 30th minute 65.45% of the lactate was removed. We can conclude from the calculated and tabulated data that over all 90 minutes are required by an athlete to remove most of the lactate (90%) formed during the anaerobic glycolysis.

I. INTRODUCTION

The effect of lactate production on acidosis has been the topic in the field of exercise physiology. The production of lactate does result in a hydrogen ion, potentially resulting in a fall in pH. However, the hydrogen ion is quickly buffered by bicarbonate which forms an intermediary in the blood stream which is quickly converted into water and carbon dioxide. CO_2 is transported to the lungs and exhaled to maintain acid-base status. This is the reason for the increased respiratory rate with the accumulation of lactate in the blood. This process can be written as chemical equation: Lactic Acid →dissociates→ Lactate + H^+ + H^+ + $HCO3^-$ → H_2CO_3 → H_2O + CO_2 (CO_2 is expired by the lungs to maintain pH). The bicarbonate buffering system is extremely efficient at removing the acidifying hydrogen ion and expelling it form the body in the form of carbon dioxide. The only remaining by product of anaerobic metabolism is lactate. Increase in partial pressure of CO_2, PCO_2 also causes an increase in H^+. During exercise, the intramuscular lactate concentration and PCO_2 increase, causing an increase in [H^+], and thus a decrease in pH. Strenuous anaerobic exercise causes a lowering of pH and pain, called acidosis. The by-product of anaerobic glycolysis, lactate, has traditionally been thought to be detrimental to muscle function. However, this appears likely only when lactate levels are very high. Elevated lactate levels are only one of many changes that occur within and around muscle cells during intense exercise that can lead to fatigue. Fatigue, that is muscular failure, is a complex subject. Elevated muscle and blood lactate concentrations are a natural consequence of any physical exertion. At slightly higher exercise intensity than lactate threshold a second increase in lactate accumulation can be seen and is often referred to as the onset of blood lactate accumulation or OBLA. OBLA generally occurs when the concentration of blood lactate reaches about 4mmol/L [1].

The lactate ion at initiation is not known to have any inhibitory effects on either energy metabolism or the contraction process. (Saltin 1990). The lactic acid will, however induce acidosis that probably is involved in the reduced ability to develop muscle tension during short intensive work (Allen et al 1989, Edwards 1981). Consequently, the efficiency by which the muscle fibers manage to release the produced lactic acid might play an important role in resistance to muscle fatigue. Skeletal muscle also plays an important role in the removal of blood lactate. **Muscle fatigue** is defined as a decrease in maximal force or power production in response to contractile activity[2]**.** The high muscle perfusion and the big total mass place the skeletal muscles as the main consumers of lactate, which can be used as substrate for gluconeogenesis (Brooks 1986). In the early phase of passive recovery, the transport capacity of the sarcolemma might be an important factor in the clearance of blood lactate (Gladden, 1989). The lactate flux between intact muscle and blood is not only dependent on the membrane transport capacity but is also dependent on blood flow, capillarization and interstitial concentration (Saltin, 1990) Experiments with giant sarcolemma vesicles, which allow careful control of ion composition on both sides of the membrane have been used by many authors to characterize lactate transport rat as well as human muscle (Juel 1991) The lactate carrier transports lactate and H+ in a manner and is responsible for 50-90 on the actual conditions (Juel, 1991) Training effects on the kinetics of the lactate distribution during recovery after work appears to be both an improved release from muscle to blood (Bassett et al 1991) and a faster removal of lactate from the blood (Donovan, 1990). Increased capacity for lactate clearance m trained individuals prevents or minimizes high lactate accumulation and lactic acidosis during high exercise power outputs. Muscle lactic acidosis which causes intramuscular pH to decline to approximately 6.4 will interfere with excitation contraction coupling and lead to muscle fatigue in very strenuous exercise.

High-intensity exercise training contributes to the production and accumulation of blood lactate, which is cleared by active recovery[3]. Repeat performances are often necessary in championship events. Lactate produced during a maximal effort requires time to metabolize to a base level[4]. Blood lactate concentration, after swimming events might be influenced by demographic features and characteristics of the swim race, whereas active recovery enhances blood lactate removal[5].

Active recovery involves the rapid elimination of waste products (i.e., lactic acid) during moderate aerobic recovery exercise. For example, 62% of lactic acid is removed during the first 10 minutes of continuous light jogging, and an additional 26% is removed in the next 10 minutes. Thus, it is advantageous to implement an active recovery period of 10 to 20 minutes after lactic training sessions (Bonen and Belcastro 1977; Fox et al. 1989)[6]. To verify this theoretical concept the researcher had conducted the study to know about actual total timing of lactate removal after an intense swimming workout and active recovery of 20 min. The complete lactate removal has been defined as the stage of the body when the blood sample for lactate will show the value of lactate below 2mmol/L.

3.1Population and Sample

For data collection a sample of 15 swimmers had been selected through purposive sampling. All the swimmers had represented their state in swimming for more than 3 times and were comfortable in doing individual Medlay. Their age ranged between 21-25 and all belongs to Maharashtra state.

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[1] Parmar, Jayesh N (2015) Lactic acid production and recovery rate in the cop44 d and normal person after an exercise,

[2] Gandevia SC. Spinal and supraspinal factors in human muscle fatigue. *Physiol Rev* 2001; **81**: 1725–1789.

[3] Paul Menzies at.al (2010), Blood lactate clearance during active recovery after an intense running bout depends on the intensity of the active recovery, J Sports Sci, 975-82.

4. Periodization training for sports: Tudor Bompa, 3rd edition

[5] Jason D Vescovi et.al. (2011) Blood lactate concentration and clearance in elite swimmers during competition, Int J Sports Physiol Perfor, 106-17

6. Periodization training for sports: Tudor Bompa, 3rd edition

3.2 Data and Sources of Data

First of all, the subjects were given instruction about the data collection procedure and a NOC report had been filled by them for further research process. The subjects were stress free and completed 8hrs sleep last night. The data of weight, height and BMI was collected initially. The basic lactate level (Lac1) of subjects was taken before warm up, then after warm up the subjects performed a 200m IM with full intensity. Just after IM their peak lactate level (Lac2) has been collected and they were allowed to do active recovery in water with 65% intensity. After every 5 minutes (5th min Lac3, 10th min Lac4, 15th min Lac5, 20th min Lac6, 25th min Lac7, 30th min Lac8) the blood sample has been taken through tip of the fingers and their lactate level was being measured. This process was continued till 30 minutes. After this 30 minute the data was collected after every 20 minute (50th min Lac9, 70th min Lac10, 90th min Lac11) and this process was remained continued till 3 times (90 minute).

IV. RESULTS AND DISCUSSION

The raw data which was obtained through the blood drop samples was analysed through descriptive statistics (Mean, Standard Deviation, Standard Error).

4.1 Results of Descriptive Statics of Study Variables

Table 4.1: Descriptive Statics

S No	Lactate Reading	Lactate reading description	N	Mean value	Std. Deviation	Std. Error Mean
1.	Lac1	Initial lactate level	15	2.31 mmol/L	3.867	.70614
2.	Lac2	Peak lactate level	15	12.65 mmol/L	4.654	.84973
3.	Lac3	Active recovery 5th min reading	15	6.71 mmol/L	3.795	.69303
4.	Lac4	Active recovery 10th min reading	15	6.32 mmol/L	3.688	.67350
5.	Lac5	Active recovery 15th min reading	15	5.65 mmol/L	0.568	.10379
6.	Lac6	Active recovery 20th min reading	15	5.17 mmol/L	0.524	.09576
7.	Lac7	Active recovery 25th min reading	15	4.82 mmol/L	1.072	.19584
8.	Lac8	Active recovery 30th min reading	15	4.37 mmol/L	2.397	.43773
9.	Lac9	Passive recovery 50th min reading	15	3.11 mmol/L	0.536	.43256
10.	Lac10	Passive recovery 70th min reading	15	2.21 mmol/L	1.134	.67689
11.	Lac11	Passive recovery 90th min reading	15	1.12 mmol/L	0.012	.35679

Table1 shows the descriptive statistics of the data which has been collected at various time interval. According to the table the mean value of lactate level at initial level or resting lactate value of the subjects is seen as (2.31 $\pm$ 3.867). After performing 200 IM at intense level the peak lactate level of the subjects was seen as (12.65 $\pm$ 4.654). Further the period of active recovery is started and the mean lactate value at first 5th minutes was (6.71 $\pm$ 3.795), 10th minute (6.32 $\pm$ 3.688), 15th minute (5.65 $\pm$ 0.568), 20th minute (5.17 $\pm$ 0.524), 25th minute (4.82 $\pm$ 1.072) and 30th minute (4.37 $\pm$ 2.397). All these readings of lactate have been taken while active recovery was continued. Then at 50th minute of passive recovery the lactate value was (3.11 $\pm$ 0.536), 70th minute (2.21 $\pm$ 1.134), 90th minute (1.12 $\pm$ 0.012).

Discussion

As we can see from the tabulated value of the lactate that the initial value of lactate in swimmers' body was found to be 2.31 mmol/L but after performing an intense event of 200IM the lactate value bumped to 12.65 mmol/L which was proved to be the result of byproduct of anaerobic glycolysis. The value proved that the nature of the activity was mostly anaerobic which was our aim. As we know that active recovery is found to be the best method of lactate removal from all the other recovery method hence after an active recovery of self-paced the lactate clearance data was collected in interval of every 5 minute. During first 5 minute 46.95% of the lactate was removed, 10th minute 50.04% of the lactate was removed, 15th minute 55.33% of the lactate was removed, 20th minute 59.13% of the lactate was removed, 25th minute 61.89% of the lactate was removed, 30th minute 65.45% of the lactate was removed. During active recovery the formed lactate is sent towards the liver via blood and through cori cycle again the lactate is converted back to glucose and that glucose will be used for further energy supplement[7]. Further during the passive recovery 50th minute 75.41% of the lactate was removed, 70th minute 82.52% of the lactate was removed, 90th minute 91.14% of the lactate was removed. All these data suggests that the lactate removal starts inside the body just after the workout. And within 10 minutes 50% of the lactate is removed from the body if the persons continue to perform active recovery. Through this data we can say that generally 90% of the lactate can be removed from the blood within 90 minutes. This 90-minute plays very crucial role in a swimmer's body and mostly all the lactic acid is removed from the blood with the help of cori cycle[8].

Conclusion

We can conclude from the calculated and tabulated data that over all 90 minutes are required by an athlete to remove most of the lactate (90%) formed during the anaerobic glycolysis. After 90 minutes again a swimmer is ready to perform the anaerobic activity. This can happen with the help of active and passive recovery both. First an active recovery of 30minutes is required and then 60 minute of passive recovery is required to bring the lactate as its initial level.

References

1. Parmar, Jayesh N (2015) Lactic acid production and recovery rate in the cop44 d and normal person after an exercise,
2. Gandevia SC. Spinal and supraspinal factors in human muscle fatigue. *Physiol Rev* 2001; **81**: 1725–1789.
3. Paul Menzies at.al (2010), Blood lactate clearance during active recovery after an intense running bout depends on the intensity of the active recovery, J Sports Sci, 975-82.
4. Periodization training for sports: Tudor Bompa, 3rd edition
5. Jason D Vescovi et.al. (2011) Blood lactate concentration and clearance in elite swimmers during competition, Int J Sports Physiol Perfor, 106-17
6. Periodization training for sports: Tudor Bompa, 3rd edition
7. Comparison of self-selected recovery methods on lactic acid removal rates Bonen A, Belcastro AN, Medicine and Science in Sports, 01 Jan 1976, 8(3):176-178 17 Comparison of Swim Recovery and Muscle Stimulation on Lactate Removal After Sprint Swimming Neric, Francis B; Beam, William C; Brown, Lee E; Wiersma, Lenny D Author Information Journal of Strength and Conditioning Research: December 2009 - Volume 23 - Issue 9 - p 2560-2567
8. Periodization training for sports: Tudor Bompa, 3rd edition
9. Enhancement of blood lactate clearance following maximal swimming: Effect of velocity of recovery swimming William C. McMaster, MD, Terry Stoddard, William Duncan First Published July 1, 1989

[7] https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/cori-cycle

[8] http://hyperphysics.phy-astr.gsu.edu/hbase/Biology/Cori.html

10. Effect of self-paced active recovery and passive recovery on blood lactate removal following a 200 m freestyle swimming trial Márcio Rabelo Mota , Renata Aparecida Elias Dantas , DOI: 10.2147/OAJSM.S127948
11. Bolen Et.al. "Post-competition blood lactate concentrations in collegiate swimmers"
12. Brubatter P, O. C. (2011). "Cardio respiratory responses during underwater and land treadmill exercises in college athletes;" Journal of sports rehabilatation , 20 (3), 345-54.
13. Butts NK, T. M. (1991). "Physiologic responses to maximal treadmill and deep water running in men and women" The American Journal of sports Medicine , 612-4.
14. Deborah Wuest, C. B. (2006). "Foundations of Physical Education, Exercise Science, and Sport". New york: McGraw-Hill.
15. Edward L. Fox Et.al. "The physiological basis of physical education and athletics" 4th Edition USA: Wm.C.Brown Publishers, 1989, P.50.
16. E Franching Et.al. "Effects of recovery type after a judo combat on blood lactate removal" Journal of Sports Medicine and Physical Fitness; Dec 2003; 43, 4; ProQuest Medical Library pg. 424
17. Garner, R. T. (2013)." Lactate threshold: land v/s water treadmill running' Logan, Utah: digit
18. Goppmaier E, L. W. (2006). "Aerobic exercise in water versus talking on land : effects on indices of fat reduction and weight loss of obese women" . Journal of sports medicine and physical fitness , 546-9.
19. M. N. Sawka Et. Al. "Effect of different intensity zones on lactate recovery of swimmers" European Journal of Applied Physiology and Occupational Physiology volume 41, pages93–99(1979)
20. Márcio Rabelo Et.al. "Effect of self-paced active recovery and passive recovery on blood lactate removal following a 200 m freestyle swimming trial"
21. Nicolò1 Andrea Respiratory Frequency during Et. al "Exercise: The Neglected Physiological Measure"
22. Paul Menzies Et.al. "Blood lactate clearance during active recovery after an intense running bout depends on the intensity of the active recovery"
23. Ranjol Gill, "Effects of varying levels of physical fatigue on selected psychomotor and motor ability components of sports men and non-sportsmen." Unpublished doctoral thesis, Jiwaji University Gwalior, August 1987, P.1.
24. Raju, A (2011), "Effect of sub maximal exercise on blood lactate and recovery heart rate on various age groups"
25. Neric, Francis Et.al. "Comparison of Swim Recovery and Muscle Stimulation on Lactate Removal After Sprint Swimming" Journal of Strength and Conditioning Research: December 2009 - Volume 23 - Issue 9 - p 2560-2567
26. William C. Et al." Enhancement of blood lactate clearance following maximal swimming: Effect of velocity of recovery swimming" First Published July 1, 1989
27. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/cori-cycle
28. http://hyperphysics.phy-astr.gsu.edu/hbase/Biology/Cori.html