Lactate Response And Recovery Pattern in long Distance Running- An Overview

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Abstract

The purpose of the study was to present an analytical overview of the lactate response and recovery pattern in long distance running. The study was further delimited to long distance runners. viz. 5,000mts and 10,000mts.The Recovery patterns were investigated by Blood Lactate. It was hypothesized that there will be significant recovery in Blood Lactate as a result of different duration of recovery among 5,000 mts and 10,000 mts runners. For the purpose of this study 20 male Junior National level Long distance runners (10 athletes each of 5,000mts and 10,000mts) from Tata Athletics Academy, Jamshedpur (Jharkhand) were selected. The age of the subjects ranged between 16-20 years. The blood lactate was measured by lactate scout analyzer and reading was recorded in mmol/liters. The subjects were then asked to run exact distance of their event like a competition in a trial run. Immediately after the finish of the respective races their data was collected on blood lactate. Then the athletes were subjected to active recovery for 15 minutes and the data were again collected on the same variable. The data on biochemical variable i.e. blood lactate was taken in similar fashion subsequently at recovery of 30 minutes and 45 minutes from the finish of the race. The mode of the recovery followed by the athletes was active. In order to analyze and compare the blood lactate recovery pattern of long distance runners of 5,000mts and 10,000 mts , Two way Analysis of variance was used .LSD Post Hoc Mean comparison was applied for the significant F- values. The level of significance was set at 0.05. The long distance running events like 5000mts and 10,000mts are not absolutely aerobic event. The anaerobic proportion of Long distance running 5000mts and 10,000mts is of significant level and fatigue caused in these events are due to anaerobic glycolysis and lactate accumulation is also in significant proportion along with aerobic part of the activity. Lactate response in terms of recovery from the effect of 5000mts and 10,000mts event is directly proportional to duration of rest and recovery period. This signifies more the duration of rest period better will be the lactate recovery. The 15 minutes duration of rest after the event provides significant recovery from fatigue in terms of Blood lactate.

KEYWORDS :- Lactate , Recovery pattern, Long Distance Running etc

INTRODUCTION

The field of exercise physiology has become increasingly sophisticated. New research procedure and measurements techniques coupled with advances in equipment, computer technology, and other related disciplines such as biochemistry have contributed to the rapid advancement of the knowledge base. Exercise biochemistry involves examination of the effects of exercise at the cellular level, specifically within the muscle. Although the field of exercise physiology is becoming increasingly specialized, many

professionals in this field recognize that to fully investigate and understand human performance an interdisciplinary approach is necessary. (Deborah A.Wuest, 1992).

Successful distance running primarily requires the development of aerobic endurance. The deviation of the activity and the amount of static muscle contraction involved, the more the performance in that activity will be limited by the functioning of the heart, blood vessels, blood and lungs. The degree to which circulation and respiration limit one's performance depends on many factors, chief of which is the intensity of the exercise. Distance running is a relatively low intensity, low duration activity consisting mostly of rhythmic, non-static muscle contractions and is limited mainly by the aerobic capacity. **(**David R. Lamb, 1983).

The recovery period then is crucial to the quality of running (specificity & more over the energy system) being trained and the lactate tolerance/ clearance/ handling mechanisms. For example, recovery period of less than 2.5 minutes would tend to put intermittent, training in the speed endurance interval training category rather than as "Repetition running". As a guide an exercise/recovery ratio of one or more will stress mainly the aerobic system where as to improve the ability to tolerate lactic acid and stress the anaerobic system more, a exercise/recovery ratio of less than 1 (example 1 : 2 or initially 1 : 3) needs to be employed with an increase in maintain intensity. **(**D.W. Murrie, et al , 1995**)**

METHODOLOGY

To investigate the recovery pattern of Long distance runners i.e. 5,000mts and 10,000mts in relation to Blood Lactate. The study was delimited to Junior National level athletes.

The study was further delimited to long distance runners. viz. 5,000mts and 10,000mts.The Recovery patterns were investigated by Blood Lactate. It was hypothesized that there will be significant recovery in Blood Lactate as a result of different duration of recovery among 5,000 mts and 10,000 mts runners. For the purpose of this study 20 male Junior National level Long distance runners (10 athletes each of 5,000mts and 10,000mts) from Tata Athletics Academy, Jamshedpur (Jharkhand) were selected. The age of the subjects ranged between 16-20 years. The blood lactate was measured by lactate scout analyzer and reading was recorded in mmol/liters.

The purposive sampling technique was employed as the study was based on Long distance runners of Junior National level belonging to 5,000mts and 10,000mts events. The data for the recovery pattern of long distance runners were obtained with the help of instrument of biochemical parameters. The data on Blood lactate was taken prior to the actual event i.e. 5,000mts and 10,000mts at resting condition.

The subjects were then asked to run exact distance of their event like a competition in a trial run. Immediately after the finish of the respective races their data was collected on blood lactate. Then the athletes were subjected to active recovery for 15 minutes and the data were again collected on the same variable. The data on biochemical variable i.e. blood lactate was taken in similar fashion subsequently at recovery of 30 minutes and 45 minutes from the finish of the race. The mode of the recovery followed by the athletes was active.In order to analyze and compare the blood lactate recovery pattern of long distance runners of 5,000mts and 10,000 mts , Two way Analysis of variance was used

.LSD Post Hoc Mean comparison was applied for the significant F- values. The level of significance was set at 0.05.

RESULTS AND DISCUSSIONS

The energy system involved during the exercise and the enzymatic activities that comes into play as catalyst in various function of anabolism and catabolism during exercise. Lactate accumulation starts at lactate threshold which is defined as a point at which blood lactate begins to accumulate above resting level during an exercise of increasing intensity. (Wilmore H. Jack and Costill L.David, 2008).

The cessation of muscular activity is due to Lactic accumulation in the muscle is evidenced by reduced force and velocity of muscle contraction. The first is an inhibition of actomyosin ATPase, the enzyme responsible for the breakdown of ATP to provide the immediate energy for muscle contraction. The second is an interference of H^+ with the actions and uptake of calcium (Ca^{2+}) that is necessary for the excitation- contraction coupling and relaxation of the protein cross- bridges within the muscle fiber. High levels of lactate ions (La-) may also interfere with cross- bridging. The result of these actions is a decrease in both the force a muscle can exert and the velocity of muscle contraction.(Plowman A. Sharon and Smith L. Denise,2003)Typically for distance runners the lactate threshold is assumed to start at running speed 13km/hr. This is the criterion point of running intensity from where lactate accumulation intensity rapidly increases.

For distance runners the lactate threshold is usually expressed in terms of percentage of maximum oxygen (O_2) consumption (VO_2 max.) at which it occurs. The ability to exercise at high intensity without accumulating lactate is beneficial to the athlete because lactate accumulation contributes to fatigue. The average running performances of the subject of this study were 17-18 km/hr for 10,000mts runners and 20km/hr for 5000mts runners. Hence, 13km/hr running speed where accumulation of lactate starts rapidly and if seen in this context the 15.05 mmol/liter lactate accumulation for 5000mts runners and 12.87Mmol/liter for 10,000mts runners was obvious due to the intensity of the event in terms of running pace. Here, the level of lactate accumulation may be due to the fact that the running pace of the subject was much higher than 13km /hr.

Anaerobic lactate threshold percentage is mostly expressed in terms of percentage which is 50% of VO_2 max. that is 13km/hr running speed.In elite endurance athletes, the lactate threshold is around 70-80 % of VO_2 max. Since the athletes of 5000mts and 10,000mts runners of this study were having average speed of 18km/hr and 20km/hr respectively, the running pace stands at a lap of 400m track is covered with the pace of 1:12.0 minutes to 1:15.0 minutes. Whereas at this average speed the last lap is covered at 55sec-1min. The last lap intensity by this criterion comes to incredible pace of 25-27km/hr.Hence, the lactate accumulation for 5000mts and 10,000mts runners can be directly attributed to the last intense phase of running. That means long distance runners lactate threshold is 80-90% of VO_2 max.

The findings related to lactate accumulation of 15.05 mmol/liter and 12.87 mmol/liter for 5000m and 10,000m runners respectively may be attributed to the last two laps of intense running pace of the events. For endurance athletes of 5000m and 10,000m anaerobic lactate threshold just cannot occur in beginning or in early part of running

event as specificity of training, state of training in distance running provides economy of effort to long distance runners. Under aerobic conditions Lactate's rate of removal by other tissue matches its rate of formation resulting in no net lactate accumulation i.e. blood lactate concentration remains stable and the blood lactate accumulates only when removal does not match production. (Mc Ardle, Katch & Katch, 2001)

The Blood lactic acid depend on three factors namely resting lactic acid level, rate of formation and rate of dissimilation during work and after work. Moving below threshold level all oxygen (O_2) will not be used for bio-synthesis of ATP, some Oxygen (O_2) will be used for reversal of lactic acid to pyruvic acid. Running all out speed shoots up the Blood lactate level much higher than the anaerobic threshold than running slowly at anaerobic threshold (AT). All subjects were not having equal training period, aerobic and anaerobic fitness level. The physiological responses the sum total effect of individual capacities.

Despite wide inter-individual differences related to muscle fiber type in a resting recovery situation approximately half of the lactate is removed in about 15-25 minutes no matter what the starting level is. This is half- life of lactate. Near resting levels are achieved in about 30-60 minutes, regardless of the starting level. Thus, the initial post exercise concentration of lactate is first factor that influence the rate of removal. The higher the concentration, the faster the rate of removal is. The second factor that determines the rate of lactate removal is whether the individual follows a rest (passive) recovery or an exercise (active) recovery regimen. Thirdly, if an exercise recovery is employed, intensity of exercise expressed in percentage of VO_2 max. will make difference. Fourth, the modality of exercise employed in the recovery phase may influence the optimal percentage of VO_2 max. at which removal occurs.(Plowman A. Sharon and Smith L. Denise,2003)

CONCLUSIONS

1. The long distance running events like 5000mts and 10,000mts are not absolutely aerobic event.

2. The anaerobic proportion of Long distance running 5000mts and 10,000mts is of significant level and fatigue caused in these events are due to anaerobic glycolysis and lactate accumulation is also in significant proportion along with aerobic part of the activity.

3. Lactate response in terms of recovery from the effect of 5000mts and 10,000mts event is directly proportional to duration of rest and recovery period. This signifies more the duration of rest period better will be the lactate recovery.

4. The 15 minutes duration of rest after the event provides significant recovery from fatigue in terms of Blood lactate,

5. Since 15 minutes recovery provides significant level of fatigue elimination it could be considered important in training implication for long distance runners, from the point of planning interval training, extensively or intensively. In the similar lines, repetition training schedule can also be decided on the basis of fatigue recovery rate during 15, 30 and 45 minutes recovery.

REFERENCES

David R. Lamb, (1983) *Physiology of Exercise Responses and Adaptations,* New York :Macmillan Company.

Edward L Fox, Richard W. Bowers and Merle L. Foss, (1989) The Physiological Basis of Physical Education and Athletics (USA: Wim C. Brown publishers)

Fox L. Edward, Bowers, W. Richards, Foss L. Merle, (1989) *The physiological basis of physical education and athletics*, Wm.C. Brown publishers, Iowa.

McArdle D. William, Katch I Frank and Katch L. Victor, (2001) *Exercise Physiology, energy, nutrition and human performance*, Lippincott Williams and Wilkins, 6th Ed.

Reuben B. Forst, (1971) *Psychological Concepts Applied to Physical Education and Coaching*, London: Acklison Wesley publishing Co.

Wilmore H. Jack and Costill L. David (2008), *Physiology of Sports and Exercise*, Human Kinetics