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Respiratory Rate Response and Recovery Pattern of Long Distance Runners

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Abstract

The purpose of the study was to find out the Respiratory rate Response and Recovery Pattern of Long Distance Runners. The study was delimited to Junior National level athletes belonging to long distance viz. 5,000mts and 10,000mts.It was hypothesized that there will be significant recovery in Respiratory rate 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 from each) from Tata Athletics Academy, Jamshedpur (Jharkhand) were selected. The age of the subjects ranged between 16-20 years. The Respiratory rate was measured by Palpation test and it was recorded in Numbers/min. The data on Respiratory rate, 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 Respiratory rate. Then the athletes were subjected to active recovery for 15 minutes and the data were again collected on the same variable. The data on Respiratory rate 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 physiological responses and recovery pattern of long distance runners of 5,000mts and 10,000 mts in relation to their Respiratory rate, 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. It is observed that there is a significant difference between 5,000mts and 10,000mts runners as the mean difference of respiratory rate 1.74 which is greater than the critical difference 1.02. It may therefore be concluded that the 10,000mts runners have better Respiratory rate (23.8) than 5,000mts runners (22.06).It may therefore be concluded that The long distance running events like 5000mts and 10,000mts are not absolutely aerobic event. The 15 minutes duration of rest after the event provides significant recovery from fatigue in terms of Respiratory rate.

Keywords: Respiratory Rate, Physiological Responses, Recovery Pattern, Long Distance Runner.

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,

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non-static muscle contractions and is limited mainly by the aerobic capacity. (David R. Lamb, 1983).

It is well known that the energy releasing or "respiratory" processes can be divided into two main sections, aerobic (requiring oxygen) and anaerobic (without oxygen). Both have as their goal the synthesis and re- synthesis of the fuel needed by muscles; adenosine triphosphate or ATP. It is important to note that for all levels of activity the body derives energy from both anaerobic and aerobic metabolism. (D.W. Murrie, et al, 1995).For an activity lasting up to 20 minutes (continuous running) carbohydrates generally are the dominant fuel source for re-synthesis of ATP, while fats play a relatively minor role. High but not maximal levels of lactic acid will appear in the blood. As the time of performance proceeds past an hour, glycogen stores begin to show significant decrease in concentration and fats become more important as a source for ATP re-synthesis. Hence the Purpose of the study was to **to analyze the Physiological responses and recovery pattern of Long distance runners i.e. 5,000mts and 10,000mts in relation to Respiratory rate**

Methodology

To analyze the Physiological responses and recovery pattern of Long distance runners i.e. 5,000mts and 10,000mts in relation to Respiratory rate .The study was delimited to Junior National level athletes. The study was further delimited to long distance runners. viz. 5,000mts and 10,000mts.It was hypothesized that there will be significant recovery in Respiratory rate 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 Respiratory rate was measured by Palpation test and it was recorded in Numbers/min. 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 on Respiratory rate, 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 competiton in a trial run. Immediately after the finish of the respective races their data was collected on Respiratory rate. Then the athletes were subjected to active recovery for 15 minutes and the data were again collected on the same variable. The data on Respiratory rate 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 physiological responses and recovery pattern of long distance runners of 5,000mts and 10,000 mts in relation to their Respiratory rate, 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.

Table-1

Two-Way Anova of Mean Scores for Respiratory Rate During Physiological Response Recovery Pattern of Long Distance Runners

Source of Variances	df	S.S.	M.S.S.	F-ratio
Group	1	75.69	75.69	11.64*
Time	4	5799.96	1449.99	222.96*
Group* Time (Interaction)	4	13.56	3.39	0.52
Error	90	585.30	6.50	
Total	100	59053.00		

***Significant at 0.05 level $F_{.05}$ (1, 90) = 3.94
$F_{.05}$ (4, 90) = 2.46

It is evident from Table-1 that the F- value for Respiratory rate for group is 11.64 which is significant at 0.05 level. It means that the adjusted mean scores of Respiratory rate of 5,000mts and 10,000mts differ significantly.

Further it is evident that the adjusted F value for time interval is 222.96 which is significant at 0.05 level. It indicates that adjusted mean scores of Respiratory rate at various time intervals differ significantly.It is also evident that the adjusted F value for interaction between group and time interval is 0.52 which is not significant at 0.05 level. It means that the adjusted mean scores of Respiratory rate of 5000mts and 10,000mts runners at different time intervals do not differ significantly.

Table - 2

Row Wise LSD Post HOC Comparison for Respiratory Rate among 5000m and 10000m Runners

5,000M Runners	10,000M Runners	Mean Difference
22.06	23.8	1.74*

*** Significant at 0.05 level. C. $D_{.05}$ (4, 90) = 1.02

It is observed from Table-2 that there is a significant difference between 5,000mts and 10,000mts runners as the mean difference of respiratory rate 1.74 which is greater than the critical difference 1.02. It may therefore be concluded that the 10,000mts runners have better Respiratory rate (23.8) than 5,000mts runners (22.06).

Table -3

Column Wise LSD Post HOC Comparison for Respiratory Rate among Different Time Intervals

Pre-Test	Post- Test	After 15 minutes	After 30 minutes	After 45 minutes	Mean difference
15.45	36.7				21.25*
15.45		25.2			9.75*
15.45			19.8		4.35*
15.45				17.5	2.05*
	36.7	25.2			11.5*
	36.7		19.8		16.9*
	36.7			17.5	19.2*
		25.2	19.8		5.4*
		25.2		17.5	7.7*
			19.8	17.5	2.3*

***** Significant at 0.05 level. C. $D_{.05}$ (4, 90) = 1.61

It is evident from Table-3, that obtained mean differences for Respiratory rate among different time internal are significant. The mean difference between Pre-test – Post- test, Pre-test- After 15 minutes, Pre-test - After 30 minutes, Pre-test - After 45 min, Post-test - After 15 minutes, Post-test -After 30 minutes, Post-test - After 45 minutes, After 15 minutes - 30 minutes, After 15 minutes - 45 minutes & After 30 minutes - 45 minutes are 21.25, 9.75, 4.35, 2.05, 11.5, 16.9, 19.2, 5.4, 7.7 and 2.3 respectively is significant at 0.05 level as the values were greater than critical difference 1.61.

The graphical representation of Mean of Respiratory rate at different time intervals of 5000mts runners is shown in Figure 1.

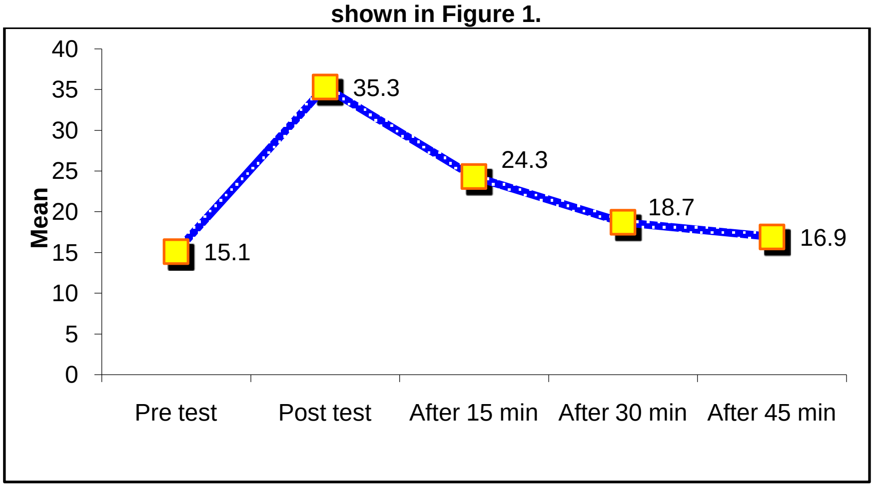

Fig1. Mean of Respiratory rate at different time intervals of 5,000mts runners

The graphical representation of Mean of Respiratory rate at different time intervals of 10,000mts runners is shown in Figure 2

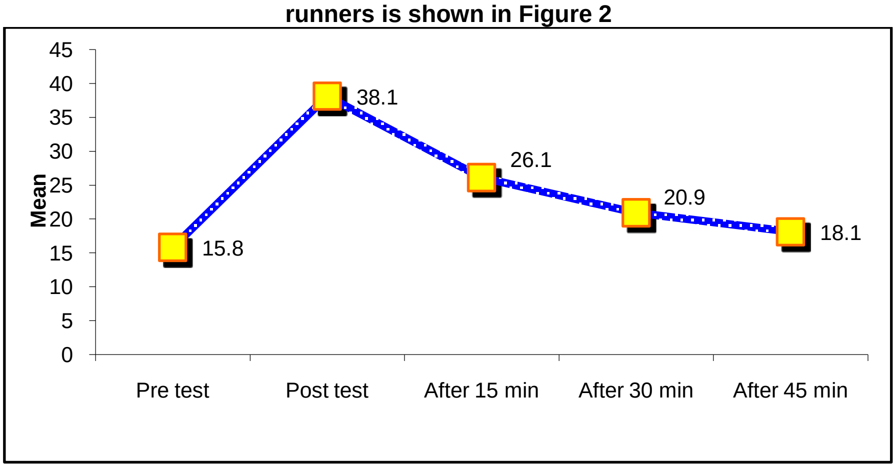

Fig 2 Mean of Respiratory rate at different time intervals of 10,000mts runners

Discussions

Respiratory rate was also compared for both groups of athletes as Pre-test, Post-test and in three recovery durations. This comparison was indicative of recovery and VO_2 max. capacity. Respiratory rate at the end of the event for 10,000m runners showed almost 150 % rise from 15.8 counts to 38.0 counts per minute. The post event rest duration assessment showed that the first 15 minutes duration facilitate best recovery rate with decrease of respiratory rate by 12 counts which amounts to approx. 35% decrease. Similarly the 30 minutes and 45 minutes duration phase also showed significant recovery in Respiratory rate when compared with its previous phase, but, the findings shows that first 15 minutes duration is highly effective. At the same time 45 minutes duration of post event recovery significantly aided in recovery and brought down Respiratory rate to near normal level.Similar trend of findings is observed for 5000mts runners in relation to Respiratory rate response; immediately the post event Respiratory rate rises to more than 110%. Showing the energy demand or workload demand of the 5000mts event, the post test assessment in terms of three phase recovery revealed similar trend as of 10,000mts. This showed the first 15 minutes recovery duration was highly significant from the point of respiratory recovery rate. It is also visible that all the phases were significant in terms of recovery of respiration.

During the initial phase of recovery i.e. first 15 minutes, even though the muscles are no longer actively working, oxygen demand does not immediately decrease. Instead, oxygen consumption remains elevated temporarily. This consumption, which exceeds that usually required when at rest, traditionally has been referred to as the oxygen debt. A more common term today is Excess Post Exercise Oxygen Consumption (EPOC). The EPOC is the volume of oxygen consumed above that normally consumed at rest. EPOC curve was described as having two distinct components: initial fast component and secondary slow component. According to classical theory, the fast component of the curve represented the oxygen required to rebuild the ATP and PCr used during exercise, especially in its initial stages. Without sufficient oxygen, the high-energy phosphate bonds in these compounds breaks to supply energy. During recovery, these bonds would need to be reformed, via oxidative processes, to replenish the energy stores, or repay the debt. The slow component of the curve was thought to result from removal of accumulated lactate from the tissues, by either conversion to glycogen or oxidation to CO_2 and H_2O, thus providing the energy needed to restore glycogen stores.(Wilmore H. Jack and Costill L.David, 2008)

The extremely high rate of respiration observed at immediate end of the event is of significance due to highly aerobic stage of the event, the high rate of O_2 consumption results rise in frequency of breathing. Rise in respiratory rate is also indication of energy demand, workload and fatigue in relation to the respective events.

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. The 15 minutes duration of rest after the event provides significant recovery from fatigue in terms of Respiratory rate.
4. 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.

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