International Journal of Physical Education, **Vol. 3 No. 1&2 (April & October, 2010) : 44-46**

Research Paper :

Comparison of cardio respiratoy and metabolic responses to maximal exercise among sprint middle and long distance runners

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Accepted : ***July, 2010***

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ABSTRACT

The study was designed to investigate the comparison of cardiorespiratoy and metabolic responses to maximal exercise among sprint, middle and long distance runners. The subjects for this investigation were 18 volunteers. All were physically fit athletes between the age of 18 to 24 years. The subjects were selected from different colleges and athletic clubs in Chennai. The athletes who had represented the state or university in sprint, middle and long distance events were selected as subjects for the research study. The variables chosen were namely, cardio respiratory variables (heart rate minute ventilation) and metabolic variables (maximal oxygen consumption respiratory quotient). The one way analysis of variance was used to determine if any significant difference was present among the three groups of athletes in each of the dependent variable. The study revealed that the maximal oxygen uptake and maximal minute ventilation values of long distance runners was higher than the middle distance runners and sprinters. The maximal heart rate of long distance runners was lower as compared with that of middle distance runners and sprinters.

Key words : Cardiorespiratory, Heart rate, Sprint, Middle and long distance

The control of cardio respiratory system is a complex process. This is true even under resting conditions. Many respiratory and circulatory adjustments are necessary during exercise in order to meet the increased metabolic demands of the working muscles. Furthermore, to do this most efficiently, all of these adjustments must be controlled and co-ordinated with each other. In this study an attempt has been made to find out the comparison of cardiorespiratoy and metabolic responses to maximal exercise among sprint middle and long distance runners.

Allen Thomas (1974) investigated the possibility of occurring circulo respiratory endurance. Its related benefits from 12 week of high resistance, low repetition circuit weight in training. The parameters selected for observation were HR, Cardiac output, stroke volume, systolic and diastolic blood pressure, and max VO_2. Ss were selected from fresh volunteers at the University of North Carolina at Wilmington who were novice to weight training and who had not participated in any form of endurance training during six months before the experiments. The study ended with 33 subjects each in the experimental group and control group. The training programme consisted of 12 week of heavy resistance - low repetition training. Testing was accomplished by pedaling and cranking a bicycle ergometer cardiac output was estimated by a CO_2 rebreathing technique. It was concluded that the circuit weight training programme used in this study did not provide the - necessary stimulus for enhancement of circulorespiratory endurance.

METHODOLOGY

The subject was made to stand on the tread mill. The nose was clipped for prevention of inhalation and exhalation through nose. The inspiratory module was attached to the mouth of the subject. The subject was allowed to settle down for a few minutes with all the equipments being set for exercise testing. As the subject inhaled the atmospheric air during the test, the volume of atmospheric air and the frequency of breathing the air was measured with the help of the inspiratory module. The expected air was sent to the gas mixing chamber which collected the gas samples during the exercise. The gas samples were analysed by Paramagnetic (Oxygen) infrared Carbon-dioxide (CO_2) analyzer. These analyzers measured the percentage of the gases in the expired air samples. The following metabolic variables were sampled namely, oxygen consumption (VO_2), maximal oxygen consumption (VO_2 max), minute ventilation (VE) and Respiratory Quotient (RQ). The above variables were measured by the computerized metabolic cart every 30 seconds during the course of the exercise and till the subject reached the exhaustion stage. The end point of

exercise was determined of the subject RQ exceeded 1.1 or when the subject indicated to stop the testing by raising his hands or if the heart rate reached maximum (220 - age in years). The data were collected by using the above procedure.

OBSERVATIONS AND DISCUSSION

In Table 2 the summary of the analysis of VO_2 max among sprinters, middle and long distance runners to a maximal exercise test is presented. The obtained F value of 3.35 was lower than the required table value of 3.68 for significance at 0.05 level.

Table 1 : The mean values of the cardio respiratory and metabolic variables of sprinters, middle and long distance runners

Variables	Sprinters	Middle distance runners	Long distance runners
VO_2 max ($ml^{-1kg-}1$, $min^{-1)}$	55.31	57.17	61.55
VAE_2 max $ml^{-1kg-}1$, $min^{-1)}$	99.52	101.27	105.27
HR max $ml^{-1kg-}1$, $min^{-1)}$	182.17	187.17	177.33

Table 2 : One way ANOVA for maximal oxygen consumption (VO_2) among sprinters, middle and long distance runners

Variables	SS	Df	MS	F
Within sets	275.95	15	18.39	3.35
Between sets	123.16	2	61.86	
Total	399.11	17		

Table value 0.05 (2,15) = 3.68

In Table 3 the summary of the analysis of VE_2 max among sprinters, middle and long distance runners to a maximal execise test is presented. The obtained F value of 0.396 was lower than the required table value of 3.68 for significance at 0.05 level.

In Table 4 the summary of the analysis of HR max among sprinters, middle and long distance runners to a maximal exercise test is presented. The obtained F value of 1.49 was lower than the required table value of 3.68 for significance at 0.05 level.

Table 3 : One way ANOVA for maximal minute ventilation (VE_2) among sprinters, middle and long distance runners

Variables	SS	Df	MS	F
Within sets	1970.27	15	131.35	0.396
Between sets	104.05	2	52.02	
Total	2074.32	17		

Table value 0.05 (2,15) = 3.68

Table 4 : One way ANOVA for maximal heart rate (HR max) among sprinters, middle and long distance runners

Variables	SS	Df	MS	F
Within sets	1457.00	15	97.13	
Between sets	290.11	2	145.05	1.49
Total	1747.11	17		

Table value 0.05 (2,15) = 3.68

The cardiorespiratory, and metabolic response to exercise is often regarded as one of the most important means for evaluating the immediate and long term effects of exercise on the athletes. In this research study, the cardio respiratory, and metabolic responses of sprinters, middle distance runners and long distance runners at maximal exercise were studied.

Cardioresoiratory and metabolic variables:

The mean values of maximal heart rate (beats/ minutes) and the maximal minutes ventilation (m1'Kg'. mm^4) for sprinters, middle and long distance runners showed considerable variation but the values were non-significant (Table 3 and 4). The mean VO_2 max values of long distance runners (61.5m1 'Kg'. min') was higher than both the middle distance runners (57.17m['Kg'. min')and the sprinters (55.31m1'Kg'. min') as can be seen from Table 1. It has been documented that endurance athletes are characterised by very high maximal oxygen uptake 0/02 max) compared to athletes of other events.

The mean maximal heart rate of long distance runners was the lowest (177.33 beats/mm) compared to the middle distance (187.17 beats 1mm) and sprints (182.17 beats / mm). The maximal heart rate of endurance athletes will be lower than the athletes who are not endurance trained. The results of this study has documented a similar effect with the long distance runners having lowest mean maximal heart rate compared to middle distance runners and sprinters. However, when analysed, statistically no significant difference was obtained as can be seen from Table 3.

Conclusion:

Based on the results of the study it was concluded that

– The maximal oxygen uptake of long distance runners was higher than the middle distance runners and sprinters. However, no significant differences were obtained.

– The maximal minute ventilation values of long distance runners was higher than the middle distance runners and sprinters, However, no significant difference were obtained.

– The maximal heart rate of long distance runners was lower when compared with that of middle distance runners and sprinters. However, no significant differences were obtained.

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REFERENCES

Allen Thomas E., Jr. (1974). The effect of circuit weight training on cardiac output during arm and leg work, *Completed Res*., **6** : 108.

Barry, A. Franklin (1980). Relationship between per cent maximal 02 uptake and per cent maximal Heart rate in women, *Res. Quarterly*, **51** : 616-624.

Butts, N.K. (1980). Influence of test modality on maximal oxygen consumption of female joggers and swimmers, Research Papers (AAHPERD, 1980), p. 134.

Cherry, J. Coehn and Roseman, Aten (1980). Reproductibility of heart rate response to a submaximal treadmill test, Abstracts Research Paners (AAHPERD Convention, 1980), p. 8.

Daniel, Michael, L. (1973). The effect of initial fitness and exercise intensity on trainability of cardiorespiratory parameters in females, *Completed Res*., **5** : 108

Foster, C., Pollock, M.K., Schusdt, D.H. and Hellman, C. (1980). Comparative analysis of maximal graded exercise test protocols on women, Research Papers (AAHPERD, 1980), p. 12.

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