Effect of Aerobic Fitness on Heart Rate Recovery in Female Fencers

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ABSTRACT

The study was conducted on 20 female fencers of different age groups at NS NIS Patiala. The subjects were distributed in two groups according to their ages as Group1 fencers of ages 14 -18 yrs and Group2, fencers of age more than 18 yrs. The Beep test was conducted to assess their maximum Oxygen consumption (VO_2 max) and the heart rate response was measured during and after the test. Results indicated that the fencers endowed with larger aerobic zone recovered faster within the 1st minute of recovery phase.

KEYWORDS: Fencing, Beep Test, VO_2 max, Heart Rate, Aerobic Zone, Recovery Phase.

INTRODUCTION

Fencing is a combative sport that includes a frequent, short bouts of high intensity exercise. Nature of fencing demands flexibility, muscular strength, muscle power and good motor abilities for repeated bounces. Steps of different direction and lunges occur repeatedly during the competition, for the purpose of hitting the opponent, which also puts considerable demands on the neuromuscular system (Czajkowski, 2005). The distinct combination of longitudinal dimensions, such as stature, arm span, leg length, flexibility, muscular strength, muscular power, and inter-limb coordination, are necessary for successful performance and influencing Fencing specific motor abilities (Barth & Beck, 2007). Harmenberg et al (1991) showed that in terms of reaction time and movement time of a lunge movement performed from the initial grade position, world class fencers could not be differentiated from beginners. However, when initiation of the lunge movement occurred while moving backwards (retreating), the movement time of the lunge was shorter in the skilled compared to the novice fencers.

The inter-group comparison of

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another Fencing study (Yiou & Do, 2001) has reported that the speed performance of a Fencing touch was about equal between two groups of different levels in the isolated condition, but faster in expert versus novice athletes in the touch-lunge condition. When EMG analysis is used to measure response timing and neuromuscular coordination of the Fencing lunge, the onset of muscle activity was significantly faster in the elite group in five of six muscles studied, and elite fencers showed more coherent muscle synergies and more consistent patterns of muscle coordination compared to novice fencers (Williams & Walmsley, 2000).

Fencing requires a high level of anaerobic power for performance success. The motor response of a fencer is required to be fast and explosive.

In the Fencing competitions, the winner of the bout is the first of the two fencers to reach 5 heats in the pool round, and 15 heats in the instance of direct elimination. In different Fencing events like Épée and Foil, there is a time limit of 3 minutes in the pool round and three 3-minute periods separated by 1-minute breaks in direct elimination. In these disciplines, if the bout ends before either fencer has reached 5 (or 15) hits, then the fencer with the most hits is declared the winner. In the modality of Sabre, there is a 1-minute break in the instance of direct elimination when one fencer's score reaches 8. Sabre often involves faster footwork and quicker bouts than Épée and Foil.

Fencing is a unique sport, which is reflected in the asymmetrical development of the muscles involved. Furthermore, the intermittent nature of Fencing puts demands on both the aerobic and anaerobic metabolic systems. The intermittent nature of Fencing suggests that there is a high demand on the phosphocreatine system, especially with a work: rest of 8s:10s. A world class fencer should therefore have developed both their aerobic and anaerobic capacities. Previous research has demonstrated the heart rate to be in the range of 167 to 191 beats per min for 60% of the Fencing duration during a women's epee competition. Understanding the physiological and energy expenditure responses required during the unique nature of Fencing is important for the development of training/nutritional programmes for athletes involved in Fencing. Determining the physiological responses and energy expenditure of these athletes is also important for talent identification and the development of training protocols. The physical demands of Fencing competitions are high, involving the aerobic and anaerobic alactic and lactic metabolisms, and are also affected by age, sex, level of training and technical and tactical models utilized in relation to the adversary. Fencing produces typical functional asymmetries that emphasize the very high level of specific function, strength and control required in this sport. Moreover, the physical demands of Fencing are closely linked to the perceptual and psychological ones, and all are subjected to a continuous succession of changes during the bouts based on the behaviour of the opponent.

Competitive Fencing is a varied and challenging sport. Therefore, it is not surprising that one of the best determinants for success in Fencing is explosive anaerobic power. However, high level of aerobic power plays a significant role in muscular strength, muscular power. Thus, aerobic power testing of a fencer is as equal important as determining the anaerobic power.

Aims and objects

1. To examine the status of aerobic fitness of female fencers.
2. To examine the status of heart rate during and after a maximal aerobic fitness test.
3. To find out the relationship between aerobic fitness and heart rate recovery (HRR)

METHODOLOGY

Selection of subjects

The study was conduct on 20 female fencers of SAI Sports Training Centre (STC), Pay & Play and Come & Play, who were under training at SAI NS NIS Patiala.

Subject distribution

The distribution of subjects of the present study is given as follows.

Table-1 : Group distribution of subjects

Junior Team	Senior Team
	Mean
Groups	
Group 1 (14 yrs to 18 yrs)	10
Group 2 (above 18 yrs)	10

Physiological variables

The selection of the tests was made in the light of the objectivity and reliability of the tests. The selected physiological variable are furnished hereunder.

Table-2: Physiological variables with their units

Sl.	Junior Team	Measurement units
1.	Maximum oxygen consumption (VO_2 max)	ml. kg^{-1}. min^{-1}
2.	Heart rate	Beats min^{-1}

Methods and instruments used for measurement of variables

1. Instruments used for measuring of Physiological variables-
   a. Telemetric Heart Rate monitors. (Polar Team2)
2. Protocols for the assessment of Physiological variables-
   a. The Beep tests

RESULTS & DISCUSSION

The statistical analysis of data on selected physiological variable is presented in this chapter. The data obtained on physiological variables have been analysed by mean of physiological variables of the subjects.

Table-3 : Mean and SD of Physiological Parameters (understudy) of Female Fencers

Parameter	Group 1 (14 to 18 yrs)	Group 2 (Above 18 yrs)
Vo2 Max (ml/kg/min)	35.71 (3.31)	37.95 (5.12)
Maximum Heart rate achieved (bpm)	194 (12.57)	198 (8.65)
Recovery Heart Rate after 1 min (bpm)	165.1 (8.12)	158.2 (4.39)

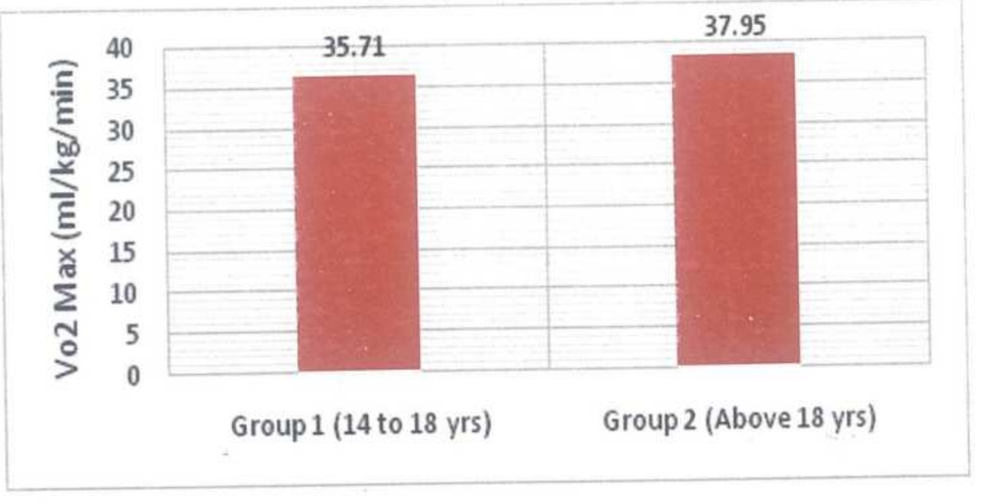

Fig-1 : VO_2 max (mean) of female fencers

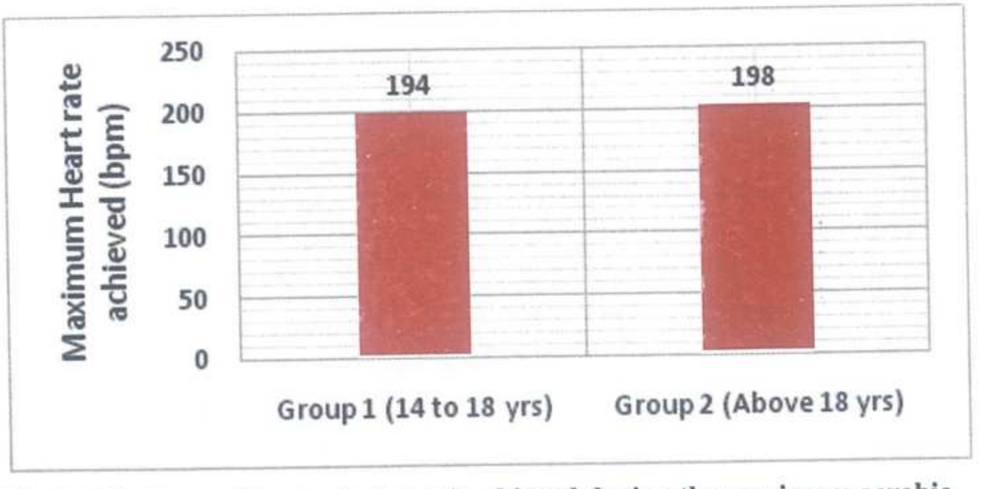

Fig-2 : Maximum Heart rate (mean) achieved during the maximum aerobic fitness test by female fencers

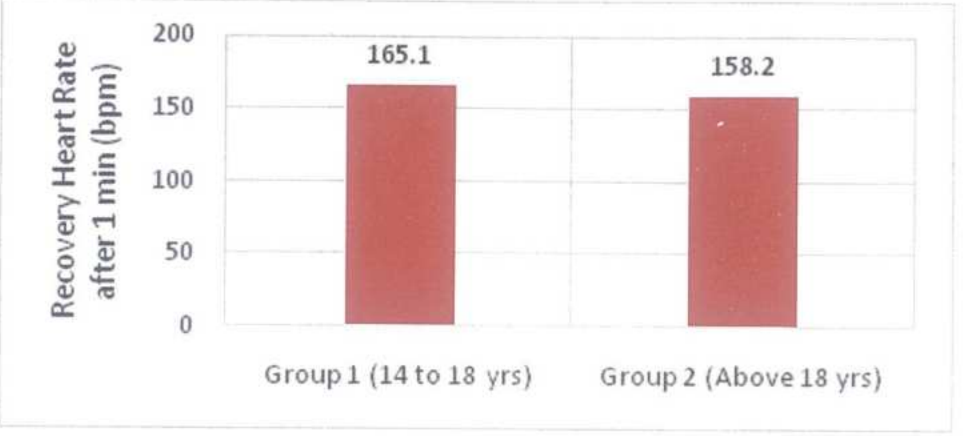

Fig-3 : Heart rate recovery (mean) after 1 min of end of the maximun aerobic fitness test of female fencers

Table-4 : Showing mean difference between groups for VO2max and HR recovery

Parameter	Group 1		Group 1		t-test	Significance
	Mean	SD	Mean	SD		
VO2 max	35.71	3.31	37.95	5.12	1.162	1.162
HR recovery	165.1	8.12	158.2	4.39	2.364	2.364

* Significant at $p < 0.05$

It has been well documented that aerobic endurance training can improve recovery form submaximal and maximal exercise. Results indicated that the sports persons belonging to Fencing are endowed with larger aerobic zone as well as a very high level of fractional utilization of oxygen consumption at the level of anaerobic threshold and low heart rate at 1st min of recovery. This also indicated that the Fencing of present study have large endurance capacity. Since a high aerobic-anaerobic transition zone represents a large aerobic component and has been found to be highly co-related with endurance running performances.

VO_2 max or maximal aerobic capacity represents the maximum rate at which aerobic metabolism can supply energy. Increase in VO_2 max and aerobic capacity results from endurance training.

Aerobic fitness and recovery following high intensity intermittent exercise has already been found to be related. The elevation of exercise oxygen consumption has been found to be at least partially responsible for the larger fast component of excess post exercise oxygen consumption (EPOC) seen in endurance trained athletes.

Replenishment of phosphocreatine has been found to have a very strong relationship with VO_2 max during intense exercise involving large muscle mass. Some studies have also supported an association between aerobic fitness and lactate removal following high intensity exercise, whereas some other has failed to confirm an association. However studies on the recovery pattern of different groups of athletes following a standard bout of maximal exercise (CPET), is somewhat lacking, particularly in context to the Indian Scenario, except for Mukhopadhyay et al, 2001, and Sukhjinder, 2004, who primarily marked with elite athletes.

Earlier studies (Wenger, 2001; Petersen & Cooke, 1994; and Sukhjinder et al, 2004) have established a strong relationship between VO_2 max and recovery. The present study demonstrate that there is significant difference for heart recovery between groups and faster heart rate recovery is shown for Group 2 which shows high aerobic capacity.

It is therefore reasonable to postulate that an individual with higher aerobics fitness will possess a greater capacity to deliver oxygen to working muscles, which in turn will lead to a greater and quicker recovery.

Further, it would seem in accordance with our present knowledge of understanding the complex cardio respiratory responses and VO_2 max may be intimately related, and both might affect the recovery responses of athletes.

The capability to recover faster is critical in many team sports like Football and Hockey and in combat sports like Boxing and Judo. It has been suggested that adaptation associated with endurance training should enhance the recovery. The ability to recover following a bout of intense activity may therefore to a large extent, influence performance or even in selection of players for particular position in game/ sport. Furthermore, recovery constitutes an important component of interval-style training to maximize the training effect.

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