HKSI Fencing

Dataset · March 2015

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DEPARTMENT OF MEDICAL SCIENCE "MARIO ARESU"
LABORATORY OF SPORTS PHYSIOLOGY
Asian Conference on Sport Science 2013
Sport Science and Elite Training programme for World Class Performance
25-26 October 2013
Hong Kong Sports Institute
HONG KONG SPORTS INSTITUTE 香港體育學院

Physiological responses and energy cost during a simulation of fencing

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Introduction

Fencing is an Olympic combat sport during which athletes perform a one to one action using bladed weapons. The combat consists in 3 x 3 minutes fighting, with 1 minute rest between each combat. There are few studies investigating on oxygen uptake and energetic demand during Fencing competition, thus the energetic expenditure (EE) and requests in this sport remain speculative. This study was performed to obtain an understanding of the physiological capacities underlying fencing performance.

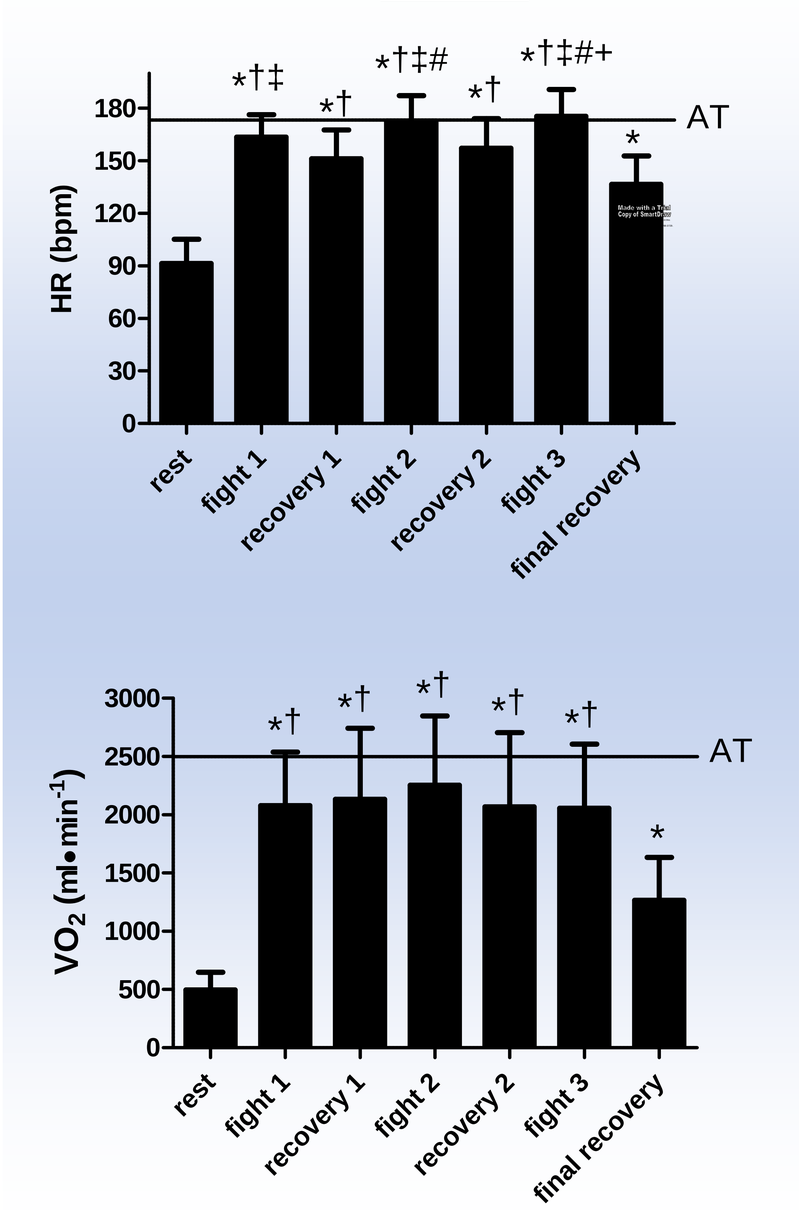
Methods

•The aerobic energy expenditure and the recruitment of lactic anaerobic metabolism were determined in 15 athletes (2 females and 13 males) during a simulation of fencing by using a portable gas analyser (MedGraphics VO2000), able to provide data of oxygen uptake ($V'O_2$), carbon dioxide production ($V'CO_2$) and heart rate (HR). The excess of CO_2 production ($CO_{2excess}$) was also measured in order to obtain an index of anaerobic glycolysis. Blood lactate (Bla) was assessed by means of a portable lactate analyzer (Lactate Pro, Arkray Inc., Kyoto, Japan).

Results

•During the match group EE was on average (mean ± standard deviation) 10.5±2.8 kcal·min^{-1}, corresponding to 9.1±2.3 metabolic equivalents. $V'O_2$ and HR were always above the level of the anaerobic threshold previously assessed in a preliminary incremental test. $CO_{2excess}$ showed an abrupt increase in the first recovery after the first fight and reached a value of 339.1±240.1 mL·min^{-1}. Blood lactate concentration at peak was 6.8±2.4 mmol·L^{-1}.

Figure 1



Graph 1. Group heart rate values (HR, top panel) and oxygen uptake (VO_2, bottom panel) during the various periods of the fencing match. The level of anaerobic threshold is identified by a horizontal line. Values are mean ± SD (n=15). *****= $p<0.05$ vs. rest; †= $p<0.05$ vs. final recovery; ‡= $p<0.05$ vs. recovery 1; #= $p<0.05$ vs. recovery 2; += $p<0.05$ vs. fight 1.

Discussion

To the best of our knowledge this is the first study to assess energy requirements during fencing. Thus, the present information could be useful for coaches to devise specific training programs able to develop the specific adaptations required by fencing. Notwithstanding the fact that aerobic energy source appeared to be only moderately recruited and that athletes performed below the level of AT, it is noteworthy that the energy expenditure seemed to be high, since EE was on average about 10 kcal·min^{-1} (i.e. 600 kcal·h^{-1}) during combat. This phenomenon can be explained taking into consideration that the mean AT level of the fencers enrolled in the present investigation was high in relation to VO_{2max}, as it was on average about 78% of VO_{2max}. Hence, even though athletes performed below the AT level, it should be considered that their EE was high in absolute terms. This elevated AT in relation to VO_{2max} bore witness to the concept that our group was constituted by well trained athletes. It is to be noted that this energy expenditure very likely underestimated the real energy requirement since it did not take into account the energy derived from the anaerobic metabolism.

References

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