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Original Article

Effect of respiratory warm-up on anaerobic power

Mustafa Özdal, PhD[1)*], Özgür Bostanci, PhD[2)], Önder Dağlioğlu, PhD[1)], Seydi Ahmet Ağaoğlu, PhD[2)], Menderes Kabadayi, PhD[2)]

[1)] *Department of Physical Education and Sports, School of Physical Education and Sport, Gaziantep University: BESYO, 27350, Gaziantep, Turkey*

[2)] *Department of Physical Education and Sports, Faculty of Sport Science, Ondokuz Mayis University, Turkey*

Abstract. [Purpose] The aim of the present study was to examine the effects of respiratory muscle warm-up on anaerobic power. [Subjects and Methods] Thirty male field hockey players (age, 20.5 ± 2.0 years) each participated in a control (C_{AN}) trial and an experimental (E_{AN}) trial. The E_{AN} trial involved respiratory muscle warm-up, while the C_{AN} trial did not. Anaerobic power was measured using the Wingate protocol. Paired sample t-tests were used to compare the E_{AN} and C_{AN} trials. [Results] There were significant increases in peak power and relative peak power, and decreases in the time to peak after the E_{AN} trial by 8.9%, 9.6%, and 28.8% respectively. [Conclusion] Respiratory muscle warm-up may positively affect anaerobic power due to faster attainment of peak power.

Key words: Anaerobic power, Warm-up, Respiratory

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INTRODUCTION

The general warm-up has a potentially positive effect on short-term performance[1)]. This may be because of reduction in joint stiffness[2)], increased neurotransmission[3)], and differences in the relationship between power and acceleration[4)]. In addition, disruption of stable links between actin and myosin after warm-up may decrease muscle stiffness and affect short-term performance[5)]. In-depth investigation of the effects of a general warm-up on respiratory muscle activity has recently been performed, and the therapeutic and benefical effects were noted by the researchers[6)]. Accordingly, we hypothesized that respiratory muscle warm-up may positively affect anaerobic power, and investigated this hypothesis in the present study.

SUBJECTS AND METHODS

This was a randomized crossover study. The subjects visited the laboratory three times. During the first visit, they were familiarized with the maximal inspiratory pressure (MIP), Wingate anaerobic tests, and respiratory warm-up. During their second and third visits, a Wingate anaerobic power test with general warm-up as the control trial (C_{AN}) and a Wingate anaerobic power test with general and respiratory warm-up as the experimental trial (E_{AN}), were randomly performed. The trials were applied at the same time each day (between 16:00 and 20:00 h). Exercise and high-intensity physical activity were not allowed before the trials. A total of 30 field hockey players (age, 20.5 ± 2.0 years; height, 179.3 ± 6.9 cm; weight, 73.7 ± 12.7 kg) voluntarily participated in the present study. Informed consent was obtained from all participants in the study. Approval was obtained from Ondokuz Mayis University Clinical Research Ethical Committee (OMÜ KAEK 2014/635). For the general warm-up, low-intensity aerobic running for 10 min and dynamic stretching for 5 min were performed by the subjects. For respiratory warm-up, an inspiratory muscle training device (POWER®Breathe Classic, IMT Technologies Ltd., Birmingham, UK) was used. Two sets of 30 inspirations were performed at an intensity of 40% of MIP with a 2-min rest be-

*Corresponding author. Mustafa Özdal (E-mail: ozdalm@hotmail.com)

tween each set[7]. MIP was measured with a respiratory pressure meter[8] (MicroRPM, CareFusion Micro Medical, Kent, UK). Anaerobic power testing was performed with a cycle ergometer (894E Peak Bike, Monark Exercise AB, Vansbro, Sweden).

The Wingate test procedure[9] and peak power value were recorded. Data analysis was performed using a statistical program (SPSS for Windows, version 16.0, 2008, SPSS Inc., Chicago, IL, USA). Data were presented as mean and standard deviation. Significance was accepted for values of $p<0.05$. Paired sample t-tests were used for comparison of the C_{AN} and E_{AN} trials.

RESULTS

Significant changes in peak power (C_{AN}=767.0 ± 162.9 W, E_{AN}=835.1 ± 175.1 W, percent difference=8.9%), relative peak power (C_{AN}=10.4 ± 1.4 W/kg, E_{AN}=11.4 ± 2.0 W/kg, percent difference=9.6%), and time to peak (C_{AN}=3.9 ± 1.7 s, E_{AN}=2.8 ± 1.4 s, percent difference= −28.8%) were observed between the C_{AN} and E_{AN} trials.

DISCUSSION

Previous studies showed that general warm-up may positively affect anaerobic power and performance[1–5]. However, respiratory warm-up may affect short-term performance in a different way. In particular, when considered as part of an anaerobic energy system, respiratory warm-up may not have an impact at a physiologic level. An increase may occur with rising core temperature induced by respiratory warm-up. Previous research examined the effects of respiratory warm-up on 100-m swimming performance in 15 subjects. After respiratory warm-up, faster performance was observed with statistical significance[10]. Volianitis et al., investigated respiratory warm-up and rowing performance in seven male and seven female rowers, and found higher power output during a rowing test after respiratory warm-up[7]. Cheng et al. studied intermittent sprint performance, and showed that respiratory warm-up resulted in higher power output values than a general warm-up[11]. In conclusion, anaerobic power (peak power) significantly improved after respiratory warm-up, and peaked faster. Respiratory warm-up may positively affect anaerobic power. This effect may be the result of an increase in core temperature[12].

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