



Original Article

Effect of respiratory warm-up on anaerobic power

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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 performance¹⁾. This may be because of reduction in joint stiffness²⁾, increased neurotransmission³⁾, and differences in the relationship between power and acceleration⁴⁾. In addition, disruption of stable links between actin and myosin after warm-up may decrease muscle stiffness and affect short-term performance⁵⁾. In-depth investigation of the effects of a general warm-up on respiratory muscle activity has recently been performed, and the therapeutic and beneficial effects were noted by the researchers⁶⁾. 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 Mayıs 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-

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tween each set⁷⁾. MIP was measured with a respiratory pressure meter⁸⁾ (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 procedure⁹⁾ 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 ($C_{AN}=767.0 \pm 162.9$ W, $E_{AN}=835.1 \pm 175.1$ W, percent difference=8.9%), relative peak power ($C_{AN}=10.4 \pm 1.4$ W/kg, $E_{AN}=11.4 \pm 2.0$ W/kg, percent difference=9.6%), and time to peak ($C_{AN}=3.9 \pm 1.7$ s, $E_{AN}=2.8 \pm 1.4$ 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 performance¹⁻⁵⁾. 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 significance¹⁰⁾. 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-up⁷⁾. Cheng et al. studied intermittent sprint performance, and showed that respiratory warm-up resulted in higher power output values than a general warm-up¹¹⁾. 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 temperature¹²⁾.

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