

# Inspiratory muscle training improves rowing performance

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## ABSTRACT

VOLIANITIS, S., A. K. MCCONNELL, Y. KOUTEDAKIS, L. MCNAUGHTON, K. BACKX, and D. A. JONES. Inspiratory muscle training improves rowing performance. *Med. Sci. Sports Exerc.*, Vol. 33, No. 5, 2001, pp. 803–809. **Purpose:** To investigate the effects of a period of resistive inspiratory muscle training (IMT) upon rowing performance. **Methods:** Performance was appraised in 14 female competitive rowers at the commencement and after 11 wk of inspiratory muscle training on a rowing ergometer by using a 6-min all-out effort and a 5000-m trial. IMT consisted of 30 inspiratory efforts twice daily. Each effort required the subject to inspire against a resistance equivalent to 50% peak inspiratory mouth pressure ( $P_{i,max}$ ) by using an inspiratory muscle training device. Seven of the rowers, who formed the placebo group, used the same device but performed 60 breaths once daily with an inspiratory resistance equivalent to 15%  $P_{i,max}$ . **Results:** The inspiratory muscle strength of the training group increased by  $4 \pm 25$  cm H<sub>2</sub>O ( $45.3 \pm 29.7\%$ ) compared with only  $6 \pm 11$  cm H<sub>2</sub>O ( $5.3 \pm 9.8\%$ ) of the placebo group ( $P < 0.05$  within and between groups). The distance covered in the 6-min all-out effort increased by  $3.5 \pm 1.2\%$  in the training group compared with  $1.6 \pm 1.0\%$  in the placebo group ( $P < 0.05$ ). The time in the 5000-m trial decreased by  $36 \pm 9$  s ( $3.1 \pm 0.8\%$ ) in the training group compared with only  $11 \pm 8$  s ( $0.9 \pm 0.6\%$ ) in the placebo group ( $P < 0.05$ ). Furthermore, the resistance of the training group to inspiratory muscle fatigue after the 6-min all-out effort was improved from an  $11.2 \pm 4.3\%$  deficit in  $P_{i,max}$  to only  $3.0 \pm 1.6\%$  ( $P < 0.05$ ) pre- and post-intervention, respectively. **Conclusions:** IMT improves rowing performance on the 6-min all-out effort and the 5000-m trial. **Key Words:** RESPIRATORY MUSCLE TRAINING, PERFORMANCE ENHANCEMENT, INSPIRATORY MOUTH PRESSURE, RESPIRATORY FATIGUE, DYSPNEA

Historically, exercise performance has not been considered to be limited by ventilation or respiratory muscle function. However, occurrence of respiratory muscle fatigue after prolonged submaximal exercise (23), as well as short-term maximal exercise (19,25), has suggested that the ventilatory system might contribute to exercise limitation. Some studies in which the inspiratory muscles were partially unloaded during prolonged exercise, and respiratory muscle fatigue was supposedly alleviated, reported no effect on ventilation or exercise performance (11,20), whereas other studies show significant improvements in performance (14,15).

In addition, several studies in recent years have examined the effects of specific respiratory muscle training upon exercise performance, but the literature is inconclusive; some have shown improvements (4,5,30), whereas others show no effect on performance (13,24). The discrepancies between

studies may reflect differences in the exercise intensities and durations used for testing, as well as differences in experimental design and fitness level of the subjects.

Rowing is a sport requiring large aerobic power and a high minute ventilation, typically greater than  $200 \text{ L} \cdot \text{min}^{-1}$  in elite males (26). Peak expiratory flow rates can reach values up to  $15 \text{ L} \cdot \text{s}^{-1}$  in elite male rowers (7). The entrainment of breathing in rowing (31) places additional demands on the respiratory muscles, which must stabilize the thorax during the stroke, as well as bringing about breathing related excursions of the thorax. If respiratory muscle fatigue occurs during competitive rowing, it might be of physiological significance to the regulation of ventilation and breathing pattern, and to respiratory muscle recruitment and hence respiratory sensation. Furthermore, an alteration of the recruitment pattern could have an effect on the mechanical efficiencies of breathing and rowing, with detrimental consequences for performance.

In view of the unique respiratory demands of rowing and the discrepancies in the literature with regard to the benefits of inspiratory muscle training, this study investigated the effect of inspiratory muscle training upon rowing performance.

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