

## **RESPIRATORY MUSCLES AND EXERCISE PERFORMANCE**

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Recently, we have shown that an untrained respiratory system does limit the endurance of submaximal exercise (64% peak oxygen consumption) in normal sedentary subjects. These subjects were able to increase breathing endurance by almost 300% and cycle endurance by 50% after isolated respiratory training. The aim of the present study was to find out if normal, endurance trained subjects would also benefit from respiratory training. Breathing and cycle endurance as well as maximal oxygen consumption ( $\text{VO}_2\text{max}$ ) and anaerobic threshold were measured in eight subjects. Subsequently, the subjects trained their respiratory muscles for 4 weeks by breathing 85-160 l min<sup>-1</sup> for 30 min daily. Otherwise they continued their habitual endurance training. After respiratory training, the performance tests made at the beginning of the study were repeated. Respiratory training increased breathing endurance from 6.1 (SD 1.8) min to about 40 min. Cycle endurance at the anaerobic threshold [77 (SD 6) % $\text{VO}_2\text{max}$ ] was improved from 22.8 (SD 8.3) min to 31.5 (SD 12.6) min while  $\text{VO}_2\text{max}$  and the anaerobic threshold remained essentially the same. Therefore, the endurance of respiratory muscles can be improved remarkably even in trained subjects. Respiratory muscle fatigue induced hyperventilation which limited cycle performance at the anaerobic threshold. After respiratory training, minute ventilation for a given exercise intensity was reduced and cycle performance at the anaerobic threshold was prolonged.

In Summary, the condition of the respiratory system is more important for endurance exercise performance of healthy trained subjects than hitherto assumed. Not only do respiratory muscles fatigue during intensive endurance exercise, but prefatigued respiratory muscles can also impair performance. In turn, respiratory endurance training can improve endurance exercise performance.