THE EFFECTS OF INSPIRATORY MUSCLE TRAINING UPON CYCLING TIME-TRIAL PERFORMANCE AND THE WLIM-TLIM RELATIONSHIP

Johnson Michael, Brown Peter, Sharpe Graham
(Nottingham Trent University, United Kingdom)

Improvements in cycling time-trial performance have been observed following inspiratory muscle training (IMT) (Romer et al. 2002). Whilst explanatory mechanisms remain unclear McConnell and Romer (2004) suggest that the ergogenic effect may be dependent upon exercise intensity. To further investigate these issues we examined the effect of IMT on the parameters critical power (CP) and anaerobic work capacity (AWC), which define, based on several exhaustive constant-power exercise bouts, the linear relation between total work done (Wlim) and endurance time (Tlim).

Eighteen competitive male cyclists were assigned to either a pressure-threshold IMT group or a placebo group (PLC). Prior to and following a 6 wk training intervention subjects completed a 25-km cycling time-trial test and, to establish the Wlim-Tlim relationship, 3 constant-power cycling tests designed to induce exercise intolerance within 3-10 (EX1), 10-20 (EX2) and 20-30 min (EX3). IMT was performed using a pressure-threshold device and comprised 30 dynamic inspiratory efforts twice daily at an intensity of 50% maximal inspiratory mouth pressure (MIP). PLC training comprised sham hypoxic training (Sonetti et al. 2001) for 15 min, 5 d/wk.

MIP increased from (mean ± SD) 150 ± 29 to 174 ± 29 cmH2O (+17.1 ± 12.2%) following IMT (P<0.01), whereas no change was observed following PLC (pre vs. post: 153 ± 32 vs. 156 ± 22 cmH2O, +3.9 ± 15.1%). Time-trial performance improved following IMT (36.29 ± 3.64 vs. 35.33 ± 3.70 min, +2.66 ± 2.51%, P<0.01), whereas no change was observed following PLC (35.72 ± 1.97 vs. 35.98 ± 2.12 min, +0.76 ± 3.16%). Performance changes were also different between groups (P<0.05). Prior to the intervention MIP declined 11.8 ± 9.6% and 10.4 ± 7.2% 3 min post-time-trial exercise in IMT and PLC groups, respectively (P<0.01); these decrements were unchanged following IMT and PLC. CP was unchanged following IMT (264 ± 62 vs. 263 ± 61 W) and PLC (249 ± 42 vs. 250 ± 32 W). AWC was also unchanged following PLC (30.7 ± 12.7 vs. 30.1 ± 12.5 kJ), but increased following IMT (24.8 ± 5.6 vs. 29.0 ± 8.4 kJ, P<0.05), although the interaction effect was not significant. EX1 and EX3 cycling endurance improved by 67 s (+18.3 ± 15.1%) and 193 s (+15.3 ± 19.1%), respectively, following IMT (P<0.05), although interaction effects were not significant (P=0.08 and 0.11 for EX1 and EX3, respectively). Improved EX1 endurance following IMT was correlated with the increase in AWC (r = 0.73, P<0.05).

These findings suggest that a shift in the Wlim-Tlim relationship does not contribute to improved cycling time-trial performance in competitive cyclists following IMT. However, the tendency for AWC to increase following IMT suggests that the ergogenic effects may partly reside in enhancing some component(s) of anaerobic capacity. Since IMT is unlikely to affect intramuscular energy stores the ergogenic effect may be perceptual and/or related to muscular fatigue resistance.

Keywords: Endurance Performance, Training, Inspiratory Muscle Function

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