Title: Does treadmill running performance, heart rate and breathing rate response during maximal graded exercise improve after volitional respiratory muscle training?

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Abstract

Maximal physical exertion in sports usually causes fatigue in the exercising muscles, but not in the respiratory muscles due to triggering of the Respiratory muscle metabo-reflex, a sympathetic vasoconstrictor response leading to preferential increment in blood flow to respiratory muscles (1). We planned to investigate whether a six week yogic pranayama based Volitional Respiratory Muscle Training (VRMT) can improve maximal Graded Exercise Treadmill Test (GXTT) performance in healthy adult recreational sportspersons.

Consecutive, consenting healthy adult recreational sportspersons aged 20.56±2.49 years (n=30), volunteered to ‘baseline recording’ of resting heart rate (HR), blood pressure (BP), respiratory rate (RR), and Bruce ramp protocol maximal GXTT until volitional exhaustion providing total test time (TTT), derived VO$_{2\text{max}}$, Metabolic Equivalent of Task (METs), HR and BR response during maximal GXTT and drop in recovery HR data. After six weeks of observation, they underwent ‘pre-intervention recording’ followed by supervised VRMT intervention for 6 weeks (30 minutes a day; 5 days a week) and then ‘post-intervention recording’. Repeated measures ANOVA with pairwise t statistical comparison was used to analyze the data.

After supervised VRMT, we observed significant decrease in their resting supine RR (p<0.001), resting supine HR (p=0.001), HR after 5 minutes of assuming standing posture (p=0.003); significant increase in TTT (p<0.001), derived VO$_{2\text{max}}$ (p<0.001), METs (p<0.001) and drop in recovery HR (p=0.038); altered HR response (Figure 1) and BR response during exercise (Figure 2).

We hypothesize that these changes are probably due to VRMT induced learnt behavior to control the breathing pattern that improves breathing economy, improvement in respiratory muscle aerobic capacity, attenuation of respiratory muscle metabo-reflex, increase in cardiac stroke volume and autonomic resetting towards parasympatho-dominance. Yogic Pranayama based VRMT can be used in sports conditioning programme of athletes to further improve their maximal exercise performance, and as part of rehabilitation training during return from injury.