

Effects of high intensity continuous and intermittent training strategies used for endurance development on cardio-vascular responses

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Purpose:

Purpose of the present study was to examine the potential effects of five high intensity training (HIT) models on central and peripheral components of VO_{2max} .

Methods:

We analysed O_2 consumption (VO_2), cardiac output (Q), stroke volume (SV), heart rate (HR) and arteriovenous O_2 difference ($a-vO_{2diff}$) in different regimes of HIT during loading and recovery periods. Eight well-trained male competitive cyclists take part in the study (age: 22.1 ± 3.1 years; body mass: 66.2 ± 8.5 kg; height: 175.4 ± 5.2 cm; body fat: $7.2\% \pm 1.1\%$; VO_{2max} : 64 ± 5.61 mL·min⁻¹·kg⁻¹). Following familiarization sessions, VO_{2max} was determined, and then, maximal SV, HR, Q and $a-vO_{2diff}$ (SV_{max}), (HR_{max}), (Q_{max}), ($a-vO_{2diff_max}$) were evaluated individually using exercise intensities corresponding to 40 to 110% of VO_{2max} separately, by nitrous-oxide re-breathing (N_2O_{RB}) method. Thereafter, training models were performed as; HIT₁: 16 repetitions with power at $\sim 110\%$ of VO_{2max} for 45-sec (16×45-sec, $p@ \sim 110\% VO_{2max}$) with 1:1 work and recovery (w/r) ratio; HIT₂: 4×3-min at $p@ \sim 93\% VO_{2max}$ with 1:1 w/r ratio; HIT₃: alternating the power between VO_{2max} (1-min) and anaerobic threshold (4-min) × 5 repetitions; HIT₄: 25-min constant-load, HIT₅: 6×30-sec at 7,5% body weight with 1:7 w/r ratio. All participants reached exhaustion at all tested HIT models. After the repeated-measures analyses, possible significant differences were investigated by post-hoc LSD/Wilcoxon.

Results:

T_{spent} above 95% of VO_{2max} was higher in HIT₂ session than other exercise modalities ($p < 0.05$). However, amongst all protocols T_{spent} above 90% of VO_{2max} were not statistically different amongst exercise modalities, except HIT₅ ($p > 0.05$); T_{spent} at VO_{2max} was lowest in HIT₅ ($p < 0.05$). T_{spent} at Q_{max} was higher in HIT₂ and HIT₃ sessions than HIT₁, HIT₂ and HIT₅ ($p < 0.05$). T_{spent} at SV_{max} was higher in HIT₃ and HIT₄ modalities than HIT₁ and HIT₂. T_{spent} at 95% of HR_{max} was higher in HIT₂ session than other exercise modalities ($p < 0.05$). T_{spent} at $a-vO_{2diff_max}$ was higher in HIT₁ and HIT₂ than HIT₃, HIT₄ and HIT₅ ($p < 0.05$).

Discussion:

These results show that different exercise modalities reaching similar VO_{2max} levels may be effective in the development of central or peripheral components associated with VO_{2max} . It may be said that continuous HIT modalities seem to have a higher potential to improve central part of VO_{2max} , while intermittent HIT modalities seems better for peripheral one.

Key words: Aerobic power, maximal oxygen consumption, nitrous-oxide rebreathing, performance, stroke volume.

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