
Effects of four weeks of high-intensity interval training combined with blood flow restriction on heart rate variability

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Résumé

Introduction

Heart rate variability (HRV) reflects fluctuations in heart rate and serves as a marker of autonomic nervous system activity. Aerobic training has been shown to enhance HRV through increased parasympathetic activity (Aubert et al., 2003), while high-intensity interval training (HIIT) also induces positive autonomic adaptations. Blood flow restriction (BFR) training, which uses external cuffs to partially occlude circulation, may influence the baroreflex by applying mechanical pressure and promoting metabolite accumulation (Jessee et al., 2018; Spranger et al., 2015). These combined stimuli may affect autonomic regulation. This study aimed to investigate the effects of four weeks of HIIT combined with BFR, using different cuff pressures, on HRV.

Methods

25 participants (11 females, 14 males; 19 ± 7 years; 175 ± 8 cm; 66.8 ± 7.9 kg; 17.3 ± 8.2 % of body fat; 9 ± 5 h of physical activity per week) were trained 3 times a week for 4 weeks with BFR at different levels of occlusion (G1 = 20 mmHg (SHAM); G2 = 40% Limb Occlusion Pressure (LOP); G3 = 60% LOP). Training consisted of 4 to 7 bouts of 90 seconds HIIT+BFR performed at 90% of VO₂max on a cycle ergometer, interspersed with 2 min recovery bouts, where cuffs were deflated. Pre-and post-training HRV parameters were assessed in the time and frequency domains, such as root mean square of successive standard deviations (RMSSD), standard deviation of all NN intervals (SDNN), NN50 count divided by the total number of all NN intervals (pNN50), low frequency and high frequency (HF). Groups and sessions were compared using mixed ANOVA and pairwise t-tests.

Results

In the time domain, the results show a significant increase in RMSSD between sessions

*Intervenant

($p = 0.03$; $d = -0.49$; S2: 40.0 ± 18.3 ms; S4: 49.7 ± 24.4 ms) and pNN50 ($p = 0.04$; $d = -0.39$; S2: 20 ± 16.9 ; S4: 28.2 ± 21.3) and a tendency to an increase in SDNN ($p = 0.05$; $d = -0.44$; S2: 52.9 ± 17 ; S4: 60.8 ± 21.9). In the frequency domain, only HF shows a significant increase between sessions ($p = 0.04$; $d = -0.50$; S2: 619.3 ± 504.9 ; S4: 870.6 ± 676.7). No significant differences were found between groups.

Discussion

This study examined the impact of cuff pressure on autonomic adaptations to four weeks of HIIT combined with BFR. Increases in RMSSD, pNN50, and HF suggest enhanced parasympathetic activity, with a trend toward greater overall HRV, as indicated by SDNN. However, no significant differences between groups indicate that BFR at 40% or 60% of LOP did not alter the HRV response induced by HIIT. These results contrast with Junior et al. (2019), who observed increased parasympathetic activity only with BFR during low-intensity walking. The higher intensity of HIIT in the present study may have independently provided a sufficient stimulus to enhance parasympathetic function, possibly through baroreflex activation and cardiac stretch.

Conclusions / Perspectives

Although BFR stimulates heart rate regulation through mechanical and chemical stimulation of the baroreflex, it did not provide an additional stimulus sufficient to enhance HRV adaptations beyond those induced by HIIT alone. Future research should explore baroreflex sensitivity more directly to better understand the underlying mechanisms.

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