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Six-week Intermittent Exercise Training with and without Blood Flow Restriction on Physiological Responses and Endurance Performance in Young Adult Men

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Abstract | Exercise training with blood flow restriction (BFR) has gained attention for its potential to enhance muscular strength and hypertrophy, yet its combined effects with high-intensity intermittent exercise training (IET) remain underexplored. This study addresses this gap by evaluating the impact of a 6-week IET program, with and without BFR, on endurance performance and physiological responses in recreationally active young adult men. Twenty-eight participants were pair-matched (using estimated and randomly assigned to IET-BFR (*mean* \pm *SD*: age 21 ± 2 years, body mass 59 ± 9 kg, height 1.7 ± 0.09 cm) and IET-only (*mean* \pm *SD*: age 21 ± 2 years, body mass 60 ± 8 kg, height 1.69 ± 0.08 cm) groups. The IET-BFR group performed high-intensity intermittent exercises with inflatable cuffs (154 ± 6 mmHg) for 19.5 ± 0.5 minutes, while the IET-only group trained without cuffs. Both groups completed 12 training sessions, with assessments conducted using the Yo-Yo Intermittent Recovery Level 1 test (Yo-Yo IR1), blood lactate levels, heart rate (HR), and rate of perceived exertion (RPE). Results revealed a significant improvement in Yo-Yo IR1 performance (IET-BFR: $1,444 \pm 319$ m vs. IET-only $1,330 \pm 362$ m; $p < 0.05$) and significantly lower blood lactate levels during the exercise tests (IET-BFR: 7.37 ± 1.84 mmol.L⁻¹ vs. IET-only 8.33 ± 2.20 mmol.L⁻¹; $p < 0.05$). No significant differences were observed in HR or RPE between the groups. These results indicate that integrating BFR into IET protocols could boost exercise performance, potentially by increasing the efficiency of lactate clearance.

Keywords: *Blood flow restriction, intermittent exercise, physiological responses, endurance performance, lactate clearance.*

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I. INTRODUCTION

This study investigates the combined effects of blood flow restriction (BFR) [1] and high-intensity intermittent exercise training (IET) on endurance performance and physiological responses in recreationally active young men. It addresses the gap in research on BFR's impact when integrated with IET protocols [2], hypothesizing that BFR enhances exercise performance and reduces lactate accumulation.

II. METHODS

Twenty-eight young men (mean \pm SD: age 21 ± 2 years, body mass 59 ± 9 kg, height 1.7 ± 0.09 cm) were divided into: IET-BFR ($n = 14$) and IET-only ($n = 14$). The IET-BFR trained with inflatable cuffs on their thighs (154 ± 6 mmHg), while the IET-only trained with minimal pressure cuffs. The training lasted 6 weeks, 3 days \cdot week $^{-1}$. Performance was measured using the Yo-Yo Intermittent Recovery Test Level 1 (Yo-Yo IR1) [3], blood lactate [4], heart rate (HR) [5] and the rate of perceived exertion (RPE) [6].

III. RESULTS AND DISCUSSION

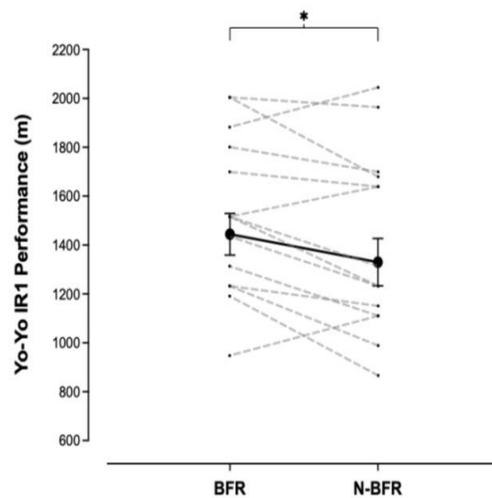


Fig. 1. The distance covered in the Yo-Yo IR1 between IET-BFR and IET-only post training (mean \pm SEM and matched pair score).

The IET-BFR group showed an 8.3% improvement in Yo-Yo IR1 performance ($1,444 \pm 319$ m) compared to the IET-only ($1,330 \pm 362$ m, $p < 0.05$, Fig. 1). Additionally, the IET-BFR had significantly lower blood lactate levels (7.37 ± 1.84 mmol \cdot L $^{-1}$) during exercise compared to the IET-only (8.33 ± 2.20 mmol \cdot L $^{-1}$, $p < 0.05$, Fig. 2). No significant differences were observed in HR or RPE between the groups ($p > 0.05$). The results support the previous study [7], demonstrating that exercise training with BFR significantly enhances endurance performance. Additionally, the study's findings are consistent with those of [8], who reported the effectiveness of training with BFR in attenuating blood lactate levels during exercise.

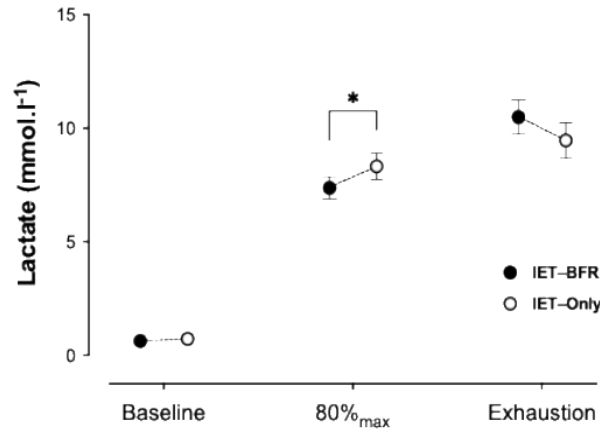


Fig. 2 Mean and standard errors of change in blood lactate at baseline, 80% max, and exhaustion following IET-BFR and IET-only.

IV. CONCLUSIONS

IET with BFR improves performance, possibly via attenuation of the rise in blood lactate level. Future studies should explore long-term effects and potential benefits for different athletic populations and types of exercise.

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