28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Maximal oxygen uptake is not reduced during a maximal incremental running protocol with muscle blood flow restriction

Chryssanthopoulos, C.1, Skaraki, V.1, Cherouveim, E.D.1,2, Michailidis, A.R.1, Patakioutis, K.1, Karatzanos, E.1, Poulos, S.1, Maridaki, M.2, Vassilakopoulos, T.1, Philippou, A.1

National & Kapodistrian University of Athens

INTRODUCTION:
Numerous studies have been conducted examining the chronic benefits of blood flow restriction (BFR) to muscle strength and hypertrophy, as well as to aerobic and anaerobic capacity and performance [1]. However, the acute effect of BFR on maximal oxygen uptake ($\dot{V}O_2max$) has not been studied particularly in running. The purpose of this study was to investigate the influence of BFR application during a maximal incremental running protocol on parameters determining endurance performance, i.e., on $\dot{V}O_2max$, velocity at $\dot{V}O_2max$, running economy, and anaerobic threshold (AT) [2].
METHODS:
Fifteen male club-level runners (age: 35.7±10.1 yrs, height: 176.3±5.7 cm, body mass: 73.6±5.0 kg, mean±SD) performed an incremental running protocol (speed increment 1 km/h per 90 s, inclination 0%) to volitional fatigue twice, i.e., with (BFR) and without (C) BFR in a random order. The occlusion pressure applied for BFR was at 40% of the arterial occlusion pressure (AOP) and cuffs were placed at the upper third of both thighs. Diet and physical activity on the day before and the day of the measurements were controlled.
RESULTS:
No difference ($p = 0.097$) was observed in $\dot{V}O_2max$ between the two conditions (BFR: 49.7±4.9 Vs. C: 51.4±5.2 ml/kg/min), whereas time to exhaustion (BFR: 476.7±83.3 Vs. C: 607.5±80.0 s) and velocity at $\dot{V}O_2max$ (BFR: 16.4±1.6 Vs. C: 17.5±1.9 km/h) were significantly lower ($p < 0.01$) with BFR. Oxygen uptake at four common to both conditions submaximal speeds (about 12-15 km/h), reflecting running economy, was not different ($p > 0.05$), while velocity at AT (BFR: 13.3±1.3 Vs. C: 14.0±1.8 km/h) was significantly higher ($p = 0.01$) in C. Maximal perceived rate of exertion (BFR: 17.3±1.2 Vs. C: 16.2±1.7) and maximal pain in a 10-point scale (BFR: 7.8±1.2 Vs. C: 5.5 ± 2.1) were significantly lower ($p < 0.05$) in C, while maximal heart rate was similar between conditions (BFR: 185±9 Vs. C: 187±11 b/min) ($p > 0.05$).
CONCLUSION:
The application of BFR at 40% of the AOP during a maximal incremental running protocol reduces time to exhaustion, velocity at $\dot{V}O_2max$ and AT, but does not affect $\dot{V}O_2max$ in male club-level runners.

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Topic: Physiology

Presentation Oral

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