

## **Hemodynamic and Cerebrovascular Responses to an Acute Bout of Blood Flow Restriction Resistance Exercise**

JUSTIN D SPRICK, HANNAH B COLBY, and CAROLINE A RICKARDS

Cerebral & Cardiovascular Physiology Laboratory, Institute for Cardiovascular & Metabolic Diseases, University of North Texas Health Science Center, Fort Worth, TX

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*Category: Doctoral*

*Advisor / Mentor: Rickards, Caroline, Ph.D. (caroline.rickards@unthsc.edu)*

Blood flow restriction (BFR) training is a novel exercise modality characterized by restricting blood flow to active muscles by the use of an occlusive device. A hallmark of this training is the use of lighter resistance loads, making it a potentially valuable tool for the elderly as well as patients exercising in a rehabilitative setting. Despite the growing interest in this novel mode of exercise, no investigation has comprehensively assessed the combined arterial pressure and cerebrovascular responses (flow and oxygenation) to BFR training, factors which may limit its application for cardiac and stroke rehabilitation. One concern about these applications is the potential for an amplification of the exercise pressor reflex, which could cause an unsafe rise in arterial blood pressure. The aim of this investigation was to compare the hemodynamic and cerebrovascular responses between BFR resistance exercise and traditional resistance exercise (TE). We hypothesized that the exercise-induced elevation in arterial pressure and cerebral blood flow would be attenuated with BFR, due to the use of lower workloads. Five healthy human volunteers (3 males, 2 females; age,  $25.4 \pm 1.1$  years) performed 3 sets of 10 repetitions of bilateral leg press with (BFR) or without (TE) bilateral blood flow restriction (220 mmHg cuff pressure), separated by 1-min rest periods (randomized, cross-over design). BFR was performed at 20% of 1 repetition maximum (1RM) while TE was performed at 65% of 1RM. Heart rate (HR) and arterial pressures were collected via ECG and finger photoplethysmography. Middle cerebral artery blood velocity (MCAv) was measured via transcranial Doppler ultrasound, and oxygen saturation of the frontal cortex (ScO<sub>2</sub>) was measured via near-infrared spectroscopy. Rate pressure product (RPP) was calculated as systolic arterial pressure multiplied by HR, and used as an index of myocardial oxygen demand. Mean arterial pressure (MAP) and RPP were both higher during TE compared with BFR during sets 2 and 3 (MAP: TE,  $116 \pm 10$  mmHg vs. BFR,  $104 \pm 6$  mmHg for BFR,  $P=0.05$  (Set 3); RPP: TE,  $16229 \pm 2387$  mmHg\*bpm vs. BFR,  $11889 \pm 978$  mmHg\*bpm,  $P \leq 0.02$  (Set 3)). While MCAv and ScO<sub>2</sub> increased with exercise ( $P < 0.001$ ), there were no differences in these responses between the two conditions at any time point ( $P \geq 0.212$ ). This is the first investigation to simultaneously measure arterial pressure, cerebral blood flow, and cerebral oxygenation during an acute bout of BFR resistance exercise. While there were no differences in cerebral blood flow or oxygenation responses at any time point between conditions, BFR exercise appears to induce an attenuated stress on the cardiovascular system as indicated by lower arterial pressures and myocardial oxygen demand. These findings suggest that BFR training does not elicit an exaggerated exercise pressor reflex compared with traditional exercise in healthy human subjects, primarily due to the use of lower workloads.