

## **Effects of Blood Flow Restriction Training on Vascular Function: Impacts of Different Types of Cuffs**

LIN-SHENG CHEN, NATALIE MCLAURIN, PHILIPPE BROSELIN PEREZ PALMA, DANIELA CHARRY, TAHA ALHALIMI, and HIROFUMI TANAKA, FACSM

Cardiovascular Aging Research Laboratory; Department of Kinesiology and Health Education; The University of Texas at Austin; Austin, TX

---

*Category: Doctoral*

*Advisor / Mentor: Tanaka, Hirofumi (htanaka@austin.utexas.edu)*

### **ABSTRACT**

Blood flow restriction (BFR) training is becoming a very popular form of resistance training in inducing muscular adaptations. Narrow-elastic bands (NE) and wide-rigid cuffs (WR) are two types of cuffs that are frequently used in BFR. Because these different types of BFR cuffs produce markedly different hemodynamic responses, vascular adaptations resulting from BFR training might differ depending upon what cuffs are used. **PURPOSE:** To examine the hypothesis that BFR with NE would improve vascular function while the use of WR would decrease vascular function. **METHODS:** Ten apparently healthy participants (7 females, 23±5 years) completed supervised BFR training 3 times a week for 2 weeks. During the BFR training, the WR cuff was placed on one arm and the NE band on the other arm in a randomized order. Vascular function was evaluated by brachial artery flow-mediated dilation (FMD), and a 1-repetition maximum (1-RM) test was conducted for biceps curl on both arms. To explore possible mechanisms underlying vascular adaptations, acute blood flow responses (levels of ischemia and retrograde shear rate) to three different conditions (no cuff, WR occlusion, NE occlusion) were measured by Doppler ultrasound. **RESULTS:** Maximal strength of biceps curl increased in both NE arm (20.6±3.5 to 22.6±3.7 kg,  $p=0.006$ ) and WR arm (19.0±3.5 to 21.6±3.7 kg,  $p=0.001$ ). Brachial FMD increased in the NE arm (7.7±0.9 to 10.4±0.8%,  $p=0.015$ ) but did not change in the WR arm (8.1±0.9 to 6.6±0.8%,  $p=0.163$ ). For the possible mechanisms related to the vascular adaptation, blood flow velocity was lower under WR occlusion compared with no cuff (78±7 vs. 93±6 cm/s,  $p=0.049$ ) but was not different between NE occlusion and no cuff (90±6 vs. 93±6 cm/s,  $p=0.357$ ). Retrograde shear rate was highest under WR occlusion (45±5 s<sup>-1</sup>), higher under NE occlusion (31±3 s<sup>-1</sup>), and lowest under no cuff (27±3 s<sup>-1</sup>, all  $p=0.001$ ). **CONCLUSIONS:** Both types of cuffs were effective in gaining muscle strength. However, endothelium-dependent vasodilation was significantly improved with 2 weeks of BFR with NE, but not with WR. The difference in the vascular adaptation between two different cuffs might be explained by a higher level of ischemia (lower blood flow velocity) and greater retrograde shear stress under WR occlusion.