Duke University School of Medicine
Doctor of Physical Therapy

Blood Flow Restriction Training: A Systematic Review of Safety and Adverse Event Reporting

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Background

Blood flow restriction training (BFR) is a popular training program that uses a pressure cuff to restrict blood flow to a targeted muscle group, resulting in muscle hypertrophy and increased muscle strength when combined with a low-intensity training program.[1]

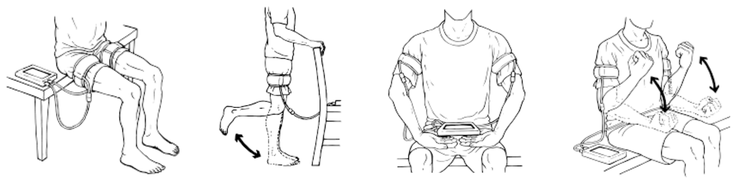
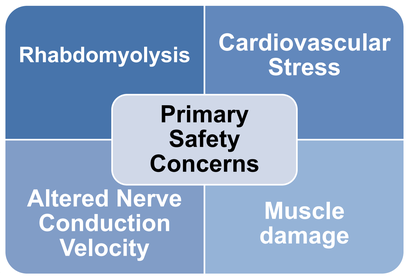


Figure 1. BFR cuff with sample exercises.

Questions still remain about its relative safety and contribution to adverse events during exercise.



Adverse event: any injury, harm, or disability sustained during BFR

Purpose

- To review the available evidence on BFR in order to determine the relative safety of BFR through adverse event reporting
- To determine if BFR negatively impacts the musculoskeletal, neurologic, and cardiovascular systems

Methods

PRISMA	Databases Searched	Inclusion Criteria
• PRISMA guidelines for systematic reviews was followed • 20 titles were used for data extraction	• PubMed • SPORTDiscus • Clinicaltrials.gov • Web of Science • Cochrane Database	• Case reports, experimental and qualitative studies • Subjects aged 7-45 years • All forms of occlusion

Results

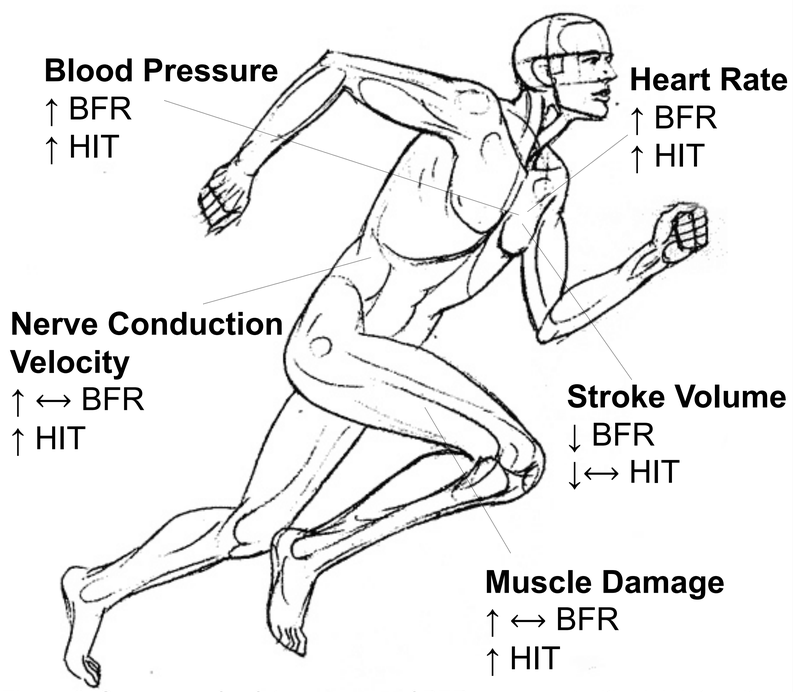
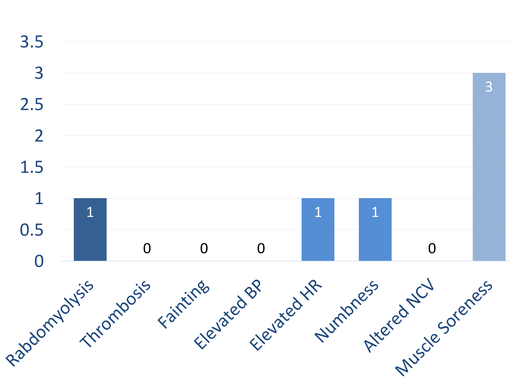


Figure 2. Summary of safety concerns of BFR compared with high intensity resistance training (HIT). Key: ↑ increases; ↓ decreases; ↔ no change.



Severe
1 case report of rhabdomyolysis

Moderate
Of 166 subjects participating in hemodynamic BFR studies, 2 subjects had elevated HR[2]

Mild
3 studies reported muscle soreness

Figure 3. Summary of adverse events reported in 20 studies used for review.

Conclusions

Given low adverse event reporting, BFR appears to be a safe training modality for healthy individuals and presents no greater musculoskeletal, cardiovascular, or neurologic risk than traditional exercise modes

Clinical Relevance

Cuff type + occlusion pressure
- Low pressure (80% resting SBP) eliminates possibility of thrombus formation[3]
- BP elevation: wide cuff > narrow cuff[4]

Pressure cuff placement
- Place proximally on upper arm or thigh to ensure efficient soft tissue protection of nerves from compression

Precautions & contraindications
- Use strong clinical reasoning when choosing to facilitate strengthening with BFR

Individualized training program
- Based on client's tolerance for the modality, strength, and cardiovascular endurance

Limitations & Future Directions

- Interpreting the relative safety of BFR is challenging given the inconsistency of adverse event reporting in the literature
- Future research should consider and report safety of BFR in geriatric, postoperative, and cardiac rehabilitation patients as well as injured athletes to determine appropriate use in patient populations

References

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3. Brandner, C. R., D. J. Kidgell, and S. A. Warmington. "Unilateral bicep curl hemodynamics: Low-pressure continuous vs high-pressure intermittent blood flow restriction." *Scandinavian journal of medicine & science in sports* 25.6 (2015): 770-777
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