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Low Intensity Blood Flow Restriction Training Study

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Effect of low intensity blood flow restriction training on lower extremity strength and hypertrophy

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Project Summary

This study is looking at the effect of blood flow resctriction in the leg on overall strength gain and muscle increase. Subjects will complete baseline testing that will measure quadriceps muscle cross-sectional area via ultrasound technology, as well as complete 6 weeks of sessions (2 times per week) in which they perform controlled exercises, one leg at a time.

Subjects will be assigned to one of two groups: either the 1.) experimental group or 2.) control group. The experimental group will exercise with a blood flow restriction cuff around their right leg inflated to 100-250 mmHg (depending on participant size), and the control group will also exercise with a cuff on their right leg but with a pressure much less than that of the experimental group. Both groups however will complete the exact same protocol throughout the entirety of the study. Once the 6 weeks of training is up, muscle cross sectional area via ultrasound and 1RM will be re-tested and compared to the initial measurements.

Background

Physically active individuals with the goal of increasing muscle mass and enhancing performance often turn to resistance training. Per the American College of Sports Medicine's recommendations, 70% of a person's 1 repetition maximum, for 6-12 repetitions, is required to induce hypertrophy in human skeletal muscle. Muscle loading below this 70% 1RM has shown to less effective for muscle hypertrophy. Recent research over the past 5-10 years has shown that low load resistance training (30% of 1RM) combined with moderate blood flow restriction has resulted in muscle hypertrophy gains similar to the traditional high load training. Blood flow restriction consists of using blood pressure-like cuffs at the proximal portion of arms or legs with the purpose of restricting ~80% of arterial flow to the muscle and 100% of the venous return. This short-term (~5 minutes for entire protocol) decrease in blood flow has been theorized work via increased: acute muscle cellular swelling, metabolic accumulation resulting in increased muscle fiber recruitment, growth hormone release, proliferation for myogenic stem cells, and enhanced signaling of protein synthesis. BFR has shown favorable results across populations, including elderly, trained athletes, and those recovering from injury who are not able to load their joints at 70% of their 1RM. It is currently being used in rehabilitation settings as well as in professional sports.

Study Purpose/Objective

The purpose of this study is to investigate whether the addition of blood flow restriction to low load exercise, will result in changes in quadriceps hypertrophy or lower extremity strength.

Inclusion Criteria

Male or female ages 18-49

Exclusion Criteria

Pregnant, hypertensive, recent back or lower extremity injury, history of blood clotting, varicose veins, adults lacking the capacity to consent for themselves

Methods and Procedures

Session 1: baseline testing

- 5-minute warm-up; 1RM calculation for both right and left legs using a supine leg press machine; cross-sectional measurement of both right and left quadriceps muscle using ultrasound technology.
- After day 1 testing; randomly allocate subjects to either control group or experimental group

Sessions 2-9: 6 weeks of exercise protocol, 2x/week

Both the experimental and control groups will complete the same protocol for the entirety of the study:

- 5- minute warm up
- Using a single-leg press exercise machine: Subjects complete the testing protocol with either blood flow restriction (cuff inflated to 100-250 mmhg depending on size of person) or no blood flow restriction (placebo inflation) on right limb.
    - Protocol: 30 repetitions – 15 repetitions – 15 repetitions – 15 repetitions with each set separated by ~30 seconds.
    - Right and left legs will be alternating, but only right leg will have the occlusion cuff

Session 10: Re-test

- Re check 1RM, cross sectional area of quadriceps with ultrasound

Data Safety and Monitoring Plan

The PI will be responsible for monitoring and handling any potential problems that arise, including, but not limited to, informing the IRB immediately of any safety issues or concerns.

Injury

In the event that this research activity results in an injury, treatment will be available, including first aid, emergency treatment and follow-up care as needed. Care for such injuries will be billed in the ordinary manner to you or your insurance company. If you think that you have suffered a

research related injury, let the study administrators know right away. If serious injury were to occur, the PI will see to it that immediate medical attention is provided, including having the PI transport the subject to the nearest appropriate medical facility and/or contacting the appropriate emergency services.

Statistical Analyses

Independent Samples t-tests, Paired samples t-test, repeated measures ANOVAs and two-way ANOVAs will all be employed to determine difference within and between groups, across trials and conditions. SPSS v23 will be utilized for all statistical analyses.

Data and Record Keeping

The PI will be responsible for collecting and maintaining all data, and storing said data on a password-protected computer that will remained locked in a Fairview clinic office.

References

Loenneke, J. P., Wilson, J. M., Marín, P. J., Zourdos, M. C., & Bemben, M. G. (2011). Low intensity blood flow restriction training: A meta-analysis. *European Journal of Applied Physiology, 112*(5), 1849-1859. doi:10.1007/s00421-011-2167-x