Effects of Continuous and Intermittent Blood Flow Restriction on Physiological Responses during Aerobic Exercise

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Abstract

Blood flow restriction (BFR) during exercise improves cardiovascular fitness with lower work-rates compared to traditional exercise, but differences in continuous (CONT-BFR) or intermittent BFR (INT-BFR) are unknown. This study examines physiological responses to light intensity with no BFR (HI), INT-BFR, CONT-BFR, and high-intensity interval exercise (HIIE). Subjects will participate in four trials: BFR-INT, CONT-BFR, HIIE, and HIIE. Trials consist of five two-minute intervals with a one-minute recovery interval. During CONT-BFR, cuffs will be continuously inflated at 60% of limb occlusion pressure; INT-BFR is similar except cuffs deflate during recovery intervals. Each trial blood pressure, cardiac output, oxygen uptake, and muscle oxygenation will be measured. Oxygen consumption and cardiac output should be similar across light-intensity trials regardless of BFR, but lower than HIIE. Blood pressure and decline in muscle oxygenation should be greater in the CONT-BFR compared to INT-BFR; BFR trials will be greater than HIIE but less than HIIE.

Background Information

- Oxygen Consumption (VO₂) is the amount of oxygen that your body consumes during exercise to create aerobic energy to complete exercise. Cardiac output (CO) measures the amount of blood pumped by the heart per minute and represents oxygen delivered to the muscle. Stroke volume (SV) is defined as the volume of blood pumped each beat. These physiological measurements all increase with exercise intensity.
- Mean arterial pressure (MAP) describes the average pressure that blood exerts on the walls of the arteries and is the force that pushes blood to the muscles. These measurements are important to gather because if cardiovascular stress is too high, damage to the blood vessels is possible.
- Rate-pressure product (RPP) describes how hard the heart is working to deliver blood to the body. This is calculated by multiplying heart rate by systolic blood pressure. Again, if this number climbs too high, adverse effects may be seen.
- Muscle oxygenation (SO₂) is another important measurement to obtain. Especially with BFR, this is a measurement of peripheral stress and how the muscles are reacting to a decreased amount of blood flow.

Introduction

- Blood flow restriction (BFR) is defined as limiting blood flow to an area of the body. This study focuses on limiting blood flow bilaterally to the legs.
- BFR can benefit someone physiologically by improving the cardiovascular system by lowering cardiovascular stress and providing effects similar to high intensity at a lower exercise intensity compared to without BFR.
- The effects of continuous versus intermittent BFR need to be examined to determine if there are differences between the two when it comes to physiological response, or perceived exertion and discomfort.
- If there is a difference, then one can be shown to provide more benefits, and if there is not a difference, then perceived exertion and discomfort can better determine which is more suitable for the individual.

Purpose and Hypothesis

- The purpose of this study is to examine the physiological effects of continuous (CONT) blood flow restriction (BFR), intermittent BFR, low-intensity interval without BFR (LI), and high-intensity interval exercise without BFR (HI).
- It is hypothesized that MAP will be greater and the decrease in (SO₂) will be greater in CONT compared to the INT.
- It is also hypothesized that VO₂ and CO should be similar across all trials, except HI, which will be greater.