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# Metabolic Costs of Blood Flow Restriction Training Under Moderate Load to Failure

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# Metabolic Costs of Blood Flow Restriction Training Under Moderate Load to Failure

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Exercise, Health & Sport Science

**Abstract**

This research focused on the metabolic costs associated with squatting to failure and squatting to failure with blood flow restriction cuffs. Each individual training program lasted a total of three weeks; consisting of two training days per week. Two groups were used for this study; proximal occlusion of legs and non-occluded legs. The occlusion group left the cuffs on until their final set was complete and pressure was maintained at 140 mmHg. The final session was monitored by a metabolic cart which recorded oxygen consumption levels throughout the workout. Oxygen consumption levels can be used to estimate aerobic costs, which can be combined with anaerobic cost estimates to produce a total metabolic cost profile for this squatting to failure program.

**Introduction**

Occlusion training studies have explored the effects on hypertrophy and strength gains, but the movements have been on smaller muscle groups, such as the biceps. This study was the first to utilize the squat to failure, a major movement involving large muscle recruitment. It was also the first to research the effects of a moderate working load of 50%, as most occlusion programs focus on low resistance levels with high repetition patterns. Cuffs were readjusted/inflated between each set to ensure consistent tension. Final session involved metabolic testing. Subject's resting blood lactate and resting O<sub>2</sub> uptake were measured before performing final session connected to metabolic cart. O<sub>2</sub> uptake was recorded throughout the session, and both O<sub>2</sub> and blood lactate are recorded until O<sub>2</sub> uptake returns to resting levels.



**Methods**

Subjects were recruited based on previous training status, requiring a minimum of 6 months training prior to study and fall between the ages of 18 and 45 in order to participate. After initial health screening and consent, subject would be randomly assigned into either occluded or non-occluded groups. Working load is 50% of 1RM. Oxygen uptake measurements were recorded using a metabolic cart throughout rest, exercise, and post-exercise oxygen consumption (EPOC). Resting energy expenditure was determined by measurement by the metabolic cart for a five minute period prior to the 20 air squat warm up and squat program. Blood lactate measurements were taken pre-exercise, three minutes post-exercise, and five minutes post-exercise to estimate anaerobic energy contributions. Oxygen consumption was recorded until resting levels were reached once again.



**Results**

	Aerobic (kcal)	Anaerobic	Total Cost
<b>BFR</b>	62.1 + 22.9	9.2 + 4.9	71.3 + 27.1
<b>Non-BFR</b>	51.8 + 8.2	11 + 4.8	62.8 + 12.3
<b>P-Value</b>	0.07	0.96	0.09

	Peak Lactate Levels
<b>BFR</b>	9.4 + 2.4 mmol
<b>Non-BFR</b>	11.5 + 3.1 mmol
<b>P=0.76</b>	

**Discussion**

Differences between BFR and non-BFR were statistically insignificant. Squat to failure programs do not show promise for individuals attempting to increase their metabolic costs, especially in comparison to walking, running or traditional resistance training. In metabolic regards, no significant difference exists between BFR and non-BFR when squatting to failure. Squat to failure programs, whether Blood Flow Restricted or not, have a performance based incentive rather than metabolic expenditure incentive. Individuals looking to lose weight by increasing their total caloric costs should be wary of the intense RPE, soreness, and relatively low calorie costs associated with BFR and squatting to failure.