

HIGH-INTENSITY ENDURANCE EXERCISE INCREASES MORE MUSCLE PGC1- α mRNA EXPRESSION THAN LOW-INTENSITY ENDURANCE EXERCISE WITH BLOOD FLOW RESTRICTION

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Abstract

The main of the present study was to compare the acute molecular response after Low-intensity Endurance Exercise with Blood Flow Restriction (LI-EE+BFR), High-Intensity Endurance Exercise (HI-EE) and High-Intensity Resistance Exercise (HI-RE). **Hypothesis:** we expect to find similar responses to PGC-1 α and other genes related to mitochondrial biogenesis, between LI-EE+BFR and HI-EE, and also similar responses to mTOR, 4E-BP1 and related proteins, between LI-EE+BFR and HI-RE. **Methods:** Nine untrained healthy male subjects performed this study. A resting muscle biopsy (Rest) was taken. The subjects attended three more visits to perform one of three following exercise protocols: HI-ET (30min of cycling, 70% VO₂peak), HI-RT (4x10 Leg Press, 70% one-repetition maximum (1RM)) and LI-ET+BFR (15min of cycling, 40% VO₂peak) where the pressure during LI-ET+BFR was 80% of maximum restriction pressure. One biopsy was taken three hours (3hr) after each exercise session from vastus lateralis. **Results:** There were significant increases of PGC-1- α and VEGF mRNA expression to HI-EE. There were no changes in protein phosphorylation. The results indicate that acute HI-EE increases more muscle PGC1- α mRNA expression than LI-EE+BFR.

Key words: Exercise with Blood Flow Restriction; PGC1- α ; Protein Synthesis.

Introduction

Several studies have been shown that HI-ET promotes great increases in cardiorespiratory fitness (VO₂peak) but not in strength and hypertrophy. These functional adaptations are regulated mainly by a pool of gene expression orchestrated by PGC-1 α that consequently increases mitochondrial biogenesis and lead to improve cardiorespiratory fitness. On the other hand, HI-RT can improve muscle strength and hypertrophy but not cardiorespiratory fitness. These improvements occur mainly due to the phosphorylation of proteins strongly related to myofibrillar protein synthesis, such as the mTOR, that consequently improve muscle growth. However, it has been shown that LI-EE+BFR can improve VO₂peak, muscle strength and hypertrophy concurrently¹. However, the molecular mechanisms to promote these concurrently adaptations have not been investigated. The main of the present study was to compare the acute molecular response after LI-EE+BFR, HI-EE and HI-RE.

Results and Discussion

Nine untrained healthy male subjects performed this study. A muscle biopsy (Rest) was taken. Following a randomized cross-over design, the subjects attended three more visits to perform one of three following exercise protocols: HI-ET (30min of cycling, 70% VO₂peak), HI-RT (4x10 Leg Press, 70% one-repetition maximum (1RM)) and LI-ET+BFR (15min of cycling, 40% VO₂peak) where the pressure during LI-ET+BFR was 80% of

maximum BFR. One biopsy was taken three hours (3hr) after each exercise session from vastus lateralis. After performed a One Way ANOVA followed for a Tukey post hoc it was found a significant increase of PGC-1- α mRNA expression to HI-ET ($p < 0.0001$) compared to Rest, HI-RE and LI-EE+BFR. VEGF mRNA expression was also significantly increased to HI-EE ($p = 0.0027$) compared to Rest and HI-RE. There were no significant differences in COXIV and HIF1- α mRNA expression, and in mTOR^{S2448}, 4E-BP1^{T37-46}, p70S6K^{T389}, p53S15, AMPK^{T172}, eEF2^{T56} protein phosphorylation.

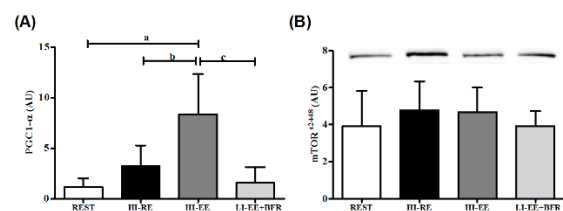


Figure 1 - (A) PGC1- α mRNA expression in skeletal muscle in four different conditions. (B) mTOR^{S2448} phosphorylation in skeletal muscle in four different conditions. Rest and 3 hours after HI-RE (High-Intensity Resistance Exercise), HI-EE (High-Intensity Endurance Exercise) and LI-EE+BFR (Low-Intensity Endurance Training with Blood Flow Restriction). a - Different from REST, b - Different from HI-RE, c - Different from HI-ET.

Conclusions

In summary, acute HI-EE increases more muscle PGC1- α mRNA expression than LI-EE+BFR.

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