

Effect of Resistance Exercise Intensity on the mRNA Expression of PGC-1 α Isoforms in Human Skeletal Muscle

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ABSTRACT

Peroxisome proliferator-activated receptor gamma coactivator-1 alpha (PGC-1 α) is a co-activator of transcription demonstrated to facilitate beneficial adaptations in skeletal muscle induced by exercise, such as mitochondrial biogenesis and enhanced capillarization. Recently, novel variants of PGC-1 α that result from transcription initiation from an alternative upstream promoter (exon 1b) and alternative splicing of the primary transcript have been identified. The original PGC-1 α isoform transcribed from the canonical promoter has been designated as PGC-1 α 1, and the novel PGC-1 α isoforms have been named PGC-1 α 2, PGC-1 α 3, and PGC-1 α 4. PGC-1 α 1, PGC-1 α 2 and PGC-1 α 3 have been shown to specifically affect energy metabolism in brown adipose tissue and skeletal muscle; whereas, PGC-1 α 4 has been implicated to promote skeletal muscle hypertrophy. The purpose of this study was to describe the mRNA expression of PGC-1 α isoforms in response to two resistance exercise intensities. In a randomized, uniform-balanced, cross-over design, 10 men [23.7 \pm 0.9 years old (mean \pm SE)] performed two separate lower-body resistance exercise sessions consisting of a lower-intensity protocol (50% of 1-RM) and a higher-intensity (80% of 1-RM) protocol with equal volume loads. Muscle samples were obtained at baseline, 45-min post-exercise (PE), 3-hr PE, 24-hr PE, and 48-hr PE from the vastus lateralis. From each muscle sample, mRNA expression of PGC-1 α 1, PGC-1 α 2, PGC-1 α 3, and PGC-1 α 4 was determined using reverse transcriptase-polymerase chain reaction (RT-PCR) and normalized to β -actin. Two-way repeated-measures ANOVA were performed ($p \leq 0.05$) with intensity and time as main effects. Post-hoc analyses were performed using Fisher's Least Significant Difference (LSD) Test. Significant main effects existed for time ($p < .05$), but not intensity ($p > .05$) for all PGC-1 α isoforms. Additionally, no interaction effects were observed ($p > .05$). Post-hoc analyses revealed mRNA expression of PGC-1 α 1 to be decreased at 24-hr and 48-hr PE. PGC-1 α 2 expression increased at 45-min and 3-hr PE before returning to baseline levels at 24-hr PE. PGC-1 α 3 expression increased above all other time points at 3-hr PE. Interestingly, PGC-1 α 4 mRNA expression decreased at 45-min PE before increasing to peak expression at 3-hr PE. At 48-hr PE, PGC-1 α 4 expression returned to below baseline expression similar to expression at 45-min PE. The results of this study demonstrate PGC-1 α transcription to initiate exclusively from the alternative upstream promoter in response to resistance exercise. Future research is needed to describe the expression of these PGC-1 α isoforms at the translational level in order to help elucidate their potential role in human skeletal muscle adaptations to resistance exercise.

