ABSTRACT

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Circulating and early muscle adaptive responses to an acute *Flywheel* isoinertial exercise

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Aim: flywheel isoinertial exercise has been proposed as an aid to counteract muscle atrophy in astronauts, improve athletic performance and prevent or rehabilitate skeletal-muscle injuries. The purpose of this study was to evaluate changes in inflammation, metabolism and muscle damage markers after an acute eccentric-overloading isoinertial exercise.

Methods: resistance training-accustomed collegiate students (n=8, males) completed five sets of ten squat repetitions repetition on the "D11" flywheel device (Desmotec, Italy). IL-6, IL-6R, MCP-1, TNF-α, IkBα, IGF-1Ea/Eb/Ec isoforms and PGC-1α mRNA levels were determined in the *vastus lateralis* muscle by fine needle aspiration coupled with real-time PCR before and 2h post-exercise. Circulating skeletal muscle creatine kinase (CK-MM) and IGF-1 were quantified by ELISA, in plasma samples before and 2, 24, 48h post-exercise. Peripheral blood mononuclear cells (PBMC) inflammatory gene expression was also compared before and 2h post-exercise.

Results: exercise increased muscle IL-6, MCP-1, TNF-α, IkBα and PGC-1α and peripheral PBMC IL-6, MCP-1 and IkBα mRNA levels 2h post-exercise. On the contrary, muscle IGF-1Ea isoform mRNA content was down-regulated 2h after the exercise bout. Muscle and PBMC IL-6R and IGF-1Eb/Ec mRNA levels were unaffected. Plasma CK-MM increased after 2h post-exercise peaked at 24h and returned to baseline by 48h. Post exercise plasma IGF-1 concentrations significantly increased only at 24h.

Conclusions: we demonstrated a marked increase of pro-inflammatory genes expression in skeletal muscle and PBMC after the exercise load. We found local changes in mRNA abundance related to anabolic growth factor (IGF-1Ea down-regulation) and mitochondrial biogenesis (PGC-1α up-regulation) and a systemic increased of muscle damage marker (CK-MM) and IGF-1 during the first 24 h of recovery.
These results indicate early molecular adaptations of skeletal muscle to loading, supporting the hypothesis that eccentric-overload offers a potent stimulus to critically optimize the benefits of resistance exercise.