[JPFSM & ECSS Session]

Blood flow restriction combined with low-load resistance-type exercise increases myofibrillar protein synthesis rates in young men

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Purpose: Combining blood flow restriction (BFR) with resistance-type exercise can stimulate skeletal muscle hypertrophy. Recent observations in an animal model suggest that BFR performed without exercise can also induce anabolic effects. We assessed the impact of BFR performed both with and without low-load resistance-type exercise (LLRE) on in vivo myofibrillar protein synthesis rates in young men.

Methods: Twenty healthy young men (age: 24 ± 1 y, BMI: 22.9 ± 0.6 kg/m²) were randomly assigned to remain in resting condition (REST+/-BFR; n=10), or to perform LLRE (LLRE+/-BFR at 20%1RM on a leg press and leg extension machine; n=10), combined with two 5-min cycles of single leg BFR, with 5 minutes of cuff deflation between the cycles. Myofibrillar protein synthesis rates were assessed in a fasted state during a 5-h post-BFR period by combining a primed continuous L-[ring-13C6]phenylalanine infusion with the collection of blood samples, and muscle biopsies from the BFR leg and the contralateral control leg. Phosphorylation status of anabolic signaling (mTOR pathway; mTOR, p70S6K, RS6 and 4E-BP1) and metabolic stress (ACC) related proteins, as well as mRNA expression of genes associated with skeletal muscle mass regulation (mTOR, p70S6K, MuRF1 and MAFbx) were assessed in the collected muscle samples.

Results: Under resting conditions, no differences in anabolic signaling or myofibrillar protein synthesis rates were observed between REST+BFR and REST (0.044 ± 0.004 vs 0.043 ± 0.004 %/h, respectively; $P=0.683$). In contrast, LLRE+BFR increased myofibrillar protein synthesis rates by $10 \pm 5\%$ compared with LLRE (0.048 ± 0.005 vs 0.043 ± 0.004 %/h, respectively; $P=0.042$). Furthermore, compared with LLRE, LLRE+BFR showed higher phosphorylation status of ACC and 4E-BP1, as well as elevated mRNA expression of MuRF1 (all $P<0.05$).

Conclusion: BFR does not increase myofibrillar protein synthesis rates in healthy young men under resting conditions. When combined with low-load resistance-type exercise, BFR increases post-exercise myofibrillar protein synthesis rates in vivo in humans.

Dr. Jean Nyakayiru has spent the last years performing a PhD in the Human Biology department of Maastricht University, under supervision of Dr. Lex Verdijk and Prof. Luc van Loon. During his PhD, Jean performed multiple human in vivo studies assessing the ergogenic potential of dietary nitrate. Jean has successfully published several papers in peer-reviewed journals and has presented his work at international conferences. During the European College of Sport Science conference in 2017, Jean was awarded the Young Investigators Award for his mini-oral presentation on the presence of nitrate in human skeletal muscle tissue. In 2018, Jean was awarded a Young Investigators Award from the European College of Sport Science for his oral presentation on the effect of blood flow restriction, with and without low-load resistance type exercise on myofibrillar protein synthesis rates. Jean is the recipient of the 2019 Naomi Cermak Scholarship, which has allowed him to travel to McMaster University as a visiting research fellow in the group of Prof. Martin Gibala.