CHANGES IN SIGNALLING PATHWAYS REGULATING PROTEIN SYNTHESIS FOLLOWING RESISTANCE EXERCISE – COMPARISON BETWEEN THE EFFECT OF ONE AND TWO EXERCISE SESSIONS
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Introduction
Resistance exercise is associated with increased strength and muscle mass due to a positive net protein balance. The changes in protein turnover are regulated by activation of signalling pathways, e.g. the Akt-mTOR-p70S6k pathway. In a previous study on human subjects, no effect of one single bout of resistance exercise was found on the activation of this pathway (1). However, repeated isometric contractions for 30 min induced by stimulation of the sciatic nerve in experimental animals lead to a marked increase in p70S6k phosphorylation as compared to a single session (2). We hypothesize that there is a larger effect on key enzymes involved in the regulation of protein synthesis after a second bout of resistance exercise compared to the first exercise. In addition to the Akt-mTOR-p70S6k pathway, the effect on the elongation factor eEF2 was investigated.

Subjects
Eight male subjects, age 23 ± 2 yrs, weight 75 ± 4 kg performed resistance leg exercise, 4 x 10 repetitions at 80% of one repetition maximum on two days with 48 h rest between. Muscle biopsies were taken from the vastus lateralis before, after 1 h and 2 h after exercise on both occasions. Biopsies were freeze dried and dissected free from blood and connective tissue. After homogenisation the samples were analysed with Western blot technique using phosphospecific antibodies raised against Akt (Ser 473), mTOR (Ser 2448), p70S6k (Thr 389, Ser 424/Thr 421), ribosomal protein S6 (Ser 235/236) and eEF2 (Thr 56).

Results
Resistance exercise led to increases in p70S6k phosphorylation at Thr 421/Ser424 and Thr 389 that persisted for 2 h after both the first and second exercise sessions. In line with this, the S6 phosphorylation was increased on both occasions. There was a tendency for higher phosphorylation after the second exercise bout; 7 out of 8 subjects showed a greater Thr 389 phosphorylation up to 1 h after exercise and mTOR phosphorylation was increased up to 1 h of recovery only in the second exercise. Akt phosphorylation was not influenced by any of the exercises, although, there was a trend for higher phosphorylation after the second bout (p=0.12), whereas the phosphorylation of eEF2 was significantly decreased after both exercises.

Discussion
A second exercise session did not cause significantly larger effects on enzymes in the protein signalling pathway, although there was a tendency for higher phosphorylation of Akt and p70S6k and mTOR was increased only after the second exercise bout. It is therefore possible that more than two exercise sessions performed on separate days are necessary to achieve a pronounced difference in enzyme phosphorylation as compared to one single exercise session.

References

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