

CHANGES IN FORCE-LENGTH RELATIONSHIP OF TRICEPS SURAE MUSCLES AFTER REPEATED ECCENTRIC-CONCENTRIC EXERCISES

Toshiyuki Kurihara, Jun Sakuma*, Tetsuo Fukunaga, and Yasuo Kawakami

Faculty of sport sciences, Waseda University, Tokorozawa, Japan

* Graduate school of sport sciences, Waseda University, Tokorozawa, Japan

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INTRODUCTION: Postexercise muscle soreness develops gradually 24 to 48 hours after an eccentric exercise. The prolonged reduction of maximal voluntary force also occurs after eccentric exercise (Nosaka et al, 1991). The reduction in maximal force is thought to be due to peripheral muscle damage derived by eccentric lengthening, but the exact mechanisms are yet to be discovered. One possibility of the reduction in force is the shifting of the optimal length for force production (Prasartwuth et al. 2006). In this study we tested this possibility for the human triceps surae muscles.

METHOD: Six healthy male subjects (age 22.5 ± 1.6 years, height 173 ± 9 cm, and mass 69 ± 9 kg) were instructed to execute one-legged calf raise exercise (eccentric and concentric plantar flexions) at a designated tempo (0.5Hz for one cycle). The exercise consisted of a series of 10 sets of 20 repetitions (200 reps). Measurements were performed before, immediately after, and 1, 2, 3, 4 days after exercise. The assessments included maximal voluntary contraction (MVC) plantar flexion torque, twitch torque and voluntary activation with nerve stimulation, and fascicle length measurements for medial gastrocnemius (MG) and soleus (SOL) by ultrasonography. In each measurement session, subjects were laid supine in an experimental bed with their knee extended and the right ankle fixed to the dynamometer at 80, 90, and 110deg.

RESULTS AND DISCUSSION: Following the exercise, the MVC torque dropped to 64-70% of the initial value and gradually recovered over subsequent 4 days. The twitch torque decreased to 55-77% of the initial value immediately after the exercise, and completely recovered in 2 days and thereafter. There was no depression of voluntary activation, indicating that the depression of voluntary and twitch torques was not caused by central nervous fatigue but peripheral muscle damage. The force-length curve of MG shifted to longer muscle length immediately after exercise and returned in 1 day and thereafter, while that of SOL remained unchanged in any of sessions. The time courses of depression of MVC and twitch torque did not coincide with that of changes in force-length curve.

CONCLUSION: We conclude from the results that the gastrocnemius muscle changed its force-length relationship after exercise, but it is not the primary factor for prolonged depression of voluntary torque production.

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