

なぜ多関節トレーニングは二関節筋を肥大させないのか： 筋活動レベルの変化様相の観点からの検討

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Possible Factors Related to Lack of Hypertrophy of the Biarticular Muscles Induced by Multi-joint Training: Its Relation to Changes in Muscle Activation During the Training

by

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ABSTRACT

The purpose of the present study was to examine the factors influencing previously reported exercise-dependence in muscle hypertrophy of the biarticular thigh muscles (i.e., single-joint training induces sizable hypertrophic response while multi-joint training does not), through measurement of muscle activation patterns during a multi-joint exercise. Twelve healthy men performed leg press at a load corresponding to 80% of one repetition maximum (1RM) until exhaustion. Surface electromyographic (EMG) signals were obtained from the quadriceps femoris (vastus lateralis, vastus medialis, rectus femoris) and hamstrings (biceps femoris, semitendinosus, semimembranosus), and root mean square values of the EMG signals (RMS-EMG)

during each repetition were determined (experiment 1). In the experiment 2, five healthy men conducted leg press at a 40% of 1RM (3 sets with 16 repetitions) and an 80% of 1RM (6 sets with 4 repetitions) load on separate days (separated by one week). In addition, transverse relaxation time (T2) -weighted magnetic resonance images of the thigh were obtained before and immediately after the leg press. The T2 of each muscle at mid-thigh was calculated. In the experiment 1, significant increases in the activation of the vastus lateralis and medialis were found following fatiguing leg press, whereas those of the biarticular muscles did not change except for the biceps femoris. In the experiment 2, the leg press exercise induced an increase in T2 of the monoarticular muscles, but not of the biarticular muscles. The relative increase in T2 of each muscle was similar between the two exercise intensities. These results suggest that activation patterns of the thigh muscles differ between monoarticular and biarticular muscles. These differences can explain the lack of hypertrophic response of the biarticular muscles following multi-joint training found in previous studies.

要 旨

本研究では、先行研究において報告されている二関節筋の量的適応におけるトレーニング動作依存性をもたらす要因について、多関節運動時の筋活動様相の観点から検討した。実験1では、12名の健常男性が疲労困憊に至るまで高強度でのレッグプレスを実施し、そのときの大腿部骨格筋の筋活動量を表面筋電図法により定量した。実験2において、磁気共鳴画像法により、低負荷と高負荷の条件下でレッグプレスを行った前後における大腿部骨格筋の横緩和時間 (T2) を算出した (N=5, 2つの条件を別日に実施)。実験1の結果、疲労とともに単関節筋である外側広筋と内側広筋の筋活動量が増加した。一方、二関節筋に関しては、大腿二頭筋を除き変化がみられなかった。実験2において、レッグプレスにより、大腿四頭筋を構成する単関節筋の T2 値が増加したものの、二関節筋の T2 値に変化がみられなかった。以上の結果は、多関節運動時の筋活動様相は、単関節筋と二関節筋の間で異なることを示唆している。