

学位論文の要旨

一過性の筋収縮がラット速筋におけるタイチン依存性収縮特性に及ぼす影響

論文題目 Effects of acute muscle contraction on titin stiffness-related contractile properties in rat fast-twitch skeletal muscle

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論文の要旨

Titin is a giant filamentous protein in striated muscle, which is a crucial element to produce passive force. According to the recent view that the passive force levels can regulate the active contractile properties, titin is likely to play a more important role in force generation than previously thought. In light of these findings, this thesis was conducted to examine the effects of acute muscle contraction on titin stiffness-related contractile properties in rat fast-twitch skeletal muscle.

Male Wistar rats were used in all experiments (1-4). The effects of isometric contraction (ISC) were examined in the experiments (EXs) 1 and 2, whereas the effects of eccentric contraction (ECC) were examined in the EXs 3 and 4. The superficial region of gastrocnemius muscle were electrically stimulated to induce ISC or ECC. Immediately after the stimulation, mechanically skinned fibers were prepared.

The extent of a stretch-induced increase in the maximum Ca^{2+} -activated force decreased with the ISC, but not the ECC. The ISC resulted in a decrease in the passive force, which would be mediated via reduced levels of phosphorylation by protein kinase $\text{C}\alpha$ (EX 1). On the other hand, the ECC led to an increase in the passive force, because of a reduction in phosphorylation by protein kinase A (EX 3). Both ISC and ECC potentiated length-dependent activation and passive force enhancement, but not residual force enhancement (EXs 2 and 4).

These results suggest that for ISC, a contraction-related decrease in passive force may contribute to muscle fatigue and that some of changes in titin stiffness-based contractile properties may function to resist muscle fatigue in the muscles of the exercising body.