

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

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Effects of Acute Muscle Contraction on Titin Stiffness-Related Contractile Properties in rat fast-Twitch Muscles

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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.