

筋萎縮に対する運動の抑制効果と 熱ショック蛋白質70との関連性

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Inhibitory Effect of Exercise on Soleus Muscle Atrophy in Relation to Heat Shock Protein 70 Content

by

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ABSTRACT

Our previous findings have provided strong evidence that mechanical stress is an effective countermeasure against unloading-induced atrophy in antigravity skeletal muscles. The generations of heat shock proteins (HSP) are induced in response to mechanical and metabolic stress in the cytosol and play important roles as molecular chaperones for protein synthesis and degradation. HSP70 is down-regulated by mechanical unloading but is up-regulated by mechanical overloading. In the present study, we investigated whether HSP70

acts as a factor for maintaining muscle mass in the skeletal muscle. Female F344 rats (10 months old) were assigned to either control or hindlimb unloaded (HU) group. HU rats had their hindlimbs suspended for 3 weeks with or without isometric resistance exercise (IRE). IRE was done for 30 min a day, 6 days a week, with an additional load of 30% body mass to the tail during HU period. HU decreased maximum force by 76% and myofibrillar protein by 80% in the soleus muscle compared to the control. IRE suppressed the decreases in maximum force and myofibrillar protein (by 25% and 19%, respectively, compared to the control). HU reduced HSP70 expression in the soleus muscle by 53% but IRE prevented this reduction of HSP70 by 16% compared to the control. These findings suggest that HSP70 expression corresponds with changes in muscle mass, and that HSP70 plays an important role in maintaining the muscle mass.

要 旨

本研究では、萎縮進行過程における等尺性抵抗運動が萎縮筋の熱ショック蛋白質 (heat shock protein: HSP) 70 の発現低下を抑制するか、また、運動の筋萎縮抑制効果と HSP70 の発現変化との関係について成熟ラットを用いて検討した。3週間の非荷重により、ヒラメ筋の最大張力と筋原線維蛋白含量は、対照に比べそれぞれ77%、80%低下した。等尺性抵抗運動 (1日1回、30分間) は非荷重による最大張力と筋原線維蛋白含量の低下をそれぞれ57%、64%までに軽減した。HSP70 の発現レベルは非荷重により53%低下したが、等尺性抵抗運動を負荷した場合は16%の低下であった。以上の結果から、HSP70 の発現レベルは荷重条件や筋量により変化し、運動による筋萎縮抑制機序の一端を担うと考えられた。