短期間の寝たきり生活は青年の筋特性にどのような変化を引き起こすか

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Effects of Short-term Bed Rest on Skeletal Muscle Properties in Young Men

by

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ABSTRACT

Fourteen healthy men（18-28 yr）carried out head-down bed rest（BR）for 20 days. The subjects were divided into three groups: five subjects who performed unilateral dynamic knee extension exercise, five subjects who performed bilateral isometric leg extension exercise, and four subjects who acted as control. The first two groups trained every day at their maximal effort. Before and after BR, physiological cross-sectional areas（PCSA）of the quadriceps muscles were determined from a series cross-sectional MRI scans of the thigh. In the latter two groups, maximal isometric knee extension force was measured and neural activation was assessed by a supramaximal twitch interpolated over voluntary contraction. PCSA decreased by ~10％ in the control subjects and control limbs, but the decrease was much smaller in the trained legs. Decrease in muscle force after BR was greater than that of PCSA in the control subjects, who showed a decrease in

neural activation. Pennation angles of the vastus lateralis, determined by ultrasonography, did not show significant changes in any groups. The results suggest that reduction of muscle strength by BR is affected both by a decreased muscle mass and reduced ability to activate motor units, both of which can be retained by resistance training. It was also shown that static and dynamic exercises are similarly effective as countermeasure against muscle atrophy.

要　旨

健常な青年男性14名（18～28歳）が安静臥床（ベッドレスト）を20日間行ったときの膝関節伸展筋群の筋量（生理学的筋横断面積），筋形状（羽状角）および膝関節伸展筋力と神経系の興奮水準の変化について検討した．ベッドレスト中に行うトレーニングの種類によって被験者を3群（片脚動的トレーニング群，両脚静的トレーニング群，コントロール群）に分けた．ベッドレストによって筋量・筋力ともに低下したが，その程度は非トレーニング肢・群が顕著で，トレーニングを行った実験群では生理学的筋横断面積の低下や筋力の低下が抑えられた．筋形状はどの群においても有意な変化を示さず，20日間のベッドレストでは筋形状は変化しないことが示唆された．ベッドレストによる筋力低下は生理学的筋横断面積の低下を上回り，筋横断面積当たりの筋力が低下するが，これは神経系の興奮水準の低下に関係していることが明らかとなった．また，ベッドレスト中のトレーニング効果の対側への効果やトレーニングの形態の影響などについての知見も得られた．