高負荷スクワット運動が腰椎椎間板に及ぼす急性の影響
－腰椎前弯角度，体幹筋の筋量および下肢柔軟性との関連性－

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Acute Effects of High-Load Barbell Back Squat Exercise on Lumbar Intervertebral Discs: Relationship with Lumbar Lordosis Angle, Trunk Muscle Size, and Lower Extremity Flexibility

by

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ABSTRACT

This study aimed to evaluate mechanical stress placed on each lumbar intervertebral disk during high-load back squat exercise using magnetic resonance（MR）imaging and assess the relationship between degree of mechanical stress and individual intrinsic

physical factors such as lumbar lordosis angle, trunk muscle size, and lower extremity flexibility. Thirteen participants (11 males and two females) performed parallel back squat exercises (80% of one repetition maximum, eight repetitions, five sets) using a Smith machine. Sagittal MR diffusion-weighted images of the lumbar spine were obtained using a 1.5-Tesla MR system with a spine coil before and immediately after the exercise to calculate apparent diffusion coefficient (ADC; an index of water movement within tissues) values of all lumbar intervertebral disks. Additionally, lumbar lordosis angle and muscle cross-sectional area of each trunk muscle were evaluated using MR imaging before the exercise. Passive range of motions of hip flexion and ankle dorsiflexion were assessed using digital photos and an image processing software (Image J) before the exercise. ADC values of the L4/5 and L5/S1 intervertebral discs significantly decreased after squat exercise ($P < 0.01$). However, the changes were not significantly correlated with lumbar lordosis angle, cross-sectional areas of the trunk muscles, and passive range of motion of hip flexion and ankle dorsiflexion. The study findings suggest that lower lumbar intervertebral disks are subject to great mechanical stress during high-load parallel back squat exercises and that changes are not related to individual physical intrinsic factors such as lumbar lordosis angle, trunk muscle size, and lower extremity flexibility.

要　旨

本研究は，MRIを用いて高負荷スクワット運動が腰椎椎間板に与える力学的ストレスを評価するとともに，そのストレスの程度が個人の腰椎前弯角，体幹筋の横断面積および下肢柔軟性と関連を示すのかを検証することを目的とした．男女13名を対象に，スクワット（最大挙上重量の80%の重り，8回5セット）前後で，腰椎のMRI拡散強調像を取得し，各椎間板のapparent diffusion coefficient値（ADC；髄核内の水の動きを評価）を算出した．加えて，MRIを用いて腰椎前弯角と体幹筋の横断面積を算出するとともに，股関節屈曲と足関節背屈の関節可動域を計測した．スクワット運動後にL4/5ならびにL5/S1の椎間板は有意なADC値の低下を示したが，それらの変化は腰椎前弯角，体幹筋の横断面積および下肢柔軟性と有意な相関を示さなかった．高負荷スクワット運動は下位の腰椎椎間板に力学的なストレスを与えやすいが，そのストレスは個人の腰椎前弯角，体幹筋の横断面積および下肢柔軟性と関連性をもたなかった．