THE INFLUENCE OF ACUTE VARIABLE RESISTANCE LOADING ON SUBSEQUENT FREE-WEIGHT MAXIMAL SQUAT PERFORMANCE.

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Introduction

Elastic bands attached to a loaded barbell during a squat exercise create a variable resistance (VR), thus changing the mechanical loading and stress placed through the musculoskeletal system. Preconditioning the neuromuscular system using near-maximal or maximal voluntary contractions (MVC) can induce a phenomenon known as post-activation potentiation (PAP) to enhance performance to 'supramaximal' levels. However, the potentiating effects of VR on subsequent free-weight resistance (FWR) squat performance have not been examined. Thus, the aim of the present study was to examine the influence of VR exercise using elastic bands on subsequent FWR squat performance.

Methods

Sixteen recreationally active men (age = 26.0 ± 7.8 yr, height = 1.7 ± 0.2 m, mass 82.6 ± 12.7 kg) experienced in squatting (>3yr) volunteered for the study after giving written informed consent; ethical approval was granted from the University of Northampton. Subjects' 1-RM were determined then on two subsequent days either a 3-RM FWR (control) or a 3-RM VR (experimental) squat exercise was performed at 85% 1-RM (35% of the load generated from band tension in the VR condition). Five minutes later, motion analysis recorded knee joint kinematics during a subsequent FWR 1-RM squat, with vastus medialis, vastus lateralis, rectus femoris and semitendinosus electromyograms (EMG) simultaneously recorded. Paired t-tests were used to determine significance, accepted at $p<0.05$.

Results

A significant increase in 1-RM (7.7%; $p<0.01$) and a decrease in peak and average eccentric (16-19%; $p<0.05$) and concentric knee velocities (12-21%; $p<0.05$) was found in the VR condition compared to the FWR condition. No change in knee flexion angle (1.8%; $p>0.05$) or EMG amplitude (5.9%; $p>0.05$) occurred. No subjects increased 1-RM in the FWR condition, however 13 of 16 (81%) increased 1-RM by ~10% following VR.

Discussion

Preconditioning the neuromuscular system using VR significantly increased 1-RM without changes in knee extensor muscle activity or knee flexion angle, however eccentric and concentric velocities were reduced. Thus, VR can potentiate the neuromuscular system to enhance subsequent maximal lifting performance. The lack of change in EMG suggests that changes in muscle activity were small or non-existent, which may be explained by force-velocity effects (slower movement = larger forces). Alternatively a greater activation of hip musculature (not measured in the present study) may allow a greater total lower limb force to be developed. Regardless, as 1-RM increased greater lower-limb loading occurred, thus VR potentiated the neuromuscular system and could enhance training stimuli.