

BACK SQUAT AND DEADLIFT FATIGUING PROTOCOLS ELICIT DISTINCT COUNTERMOVEMENT JUMP PROFILES: PHASE-SPECIFIC PREDICTORS AND SORENESS RESPONSES

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INTRODUCTION: Residual fatigue following resistance exercise can compromise neuromuscular performance and modulate recovery kinetics. The back squat (BSQ) and deadlift (DL) are primary lower-limb multi-joint exercises, yet their fatigue and recovery profiles may differ substantially. Phase-specific countermovement jump (CMJ) metrics may provide greater sensitivity for detecting neuromuscular impairment beyond traditional jump height assessment. This study investigated the acute and 24-hour effects of BSQ and DL on CMJ through force-time curve analysis. **METHODS:** Fifty-four resistance-trained adults (≥ 1 year experience) were randomly allocated to BSQ, DL, or control (CON). Following one-repetition maximum (1RM) estimation, BSQ and DL performed 3 x 12 repetitions at 70% 1RM. CMJ testing using a force platform was conducted at baseline (T0), immediately post-exercise (T1), 30 minutes post-exercise (T30min), and 24 hours after exercise (T24h). Phase-specific CMJ variables, RSI_{mod}, and delayed onset muscle soreness (DOMS; 24-48 h) were analyzed. Percentage changes within conditions and differences versus CON (d) were calculated. **RESULTS:** Both BSQ and DL induced significant decrements in CMJ performance and greater DOMS compared with CON. BSQ reduced jump height at T30min (-7.45%; d=7.32%; p=0.04) and T24h (-1.12%; d=8.13%; p=0.05), whereas DL decreased jump height at T24h (-2.26%; d=9.27%; p=0.01). DL elicited marked reductions in eccentric braking rate of force development at T30min (-17.89%; d=16.61%; p=0.03) and T24h (-13.04%; d=13.41%; p=0.02). Time-related alterations were prominent following BSQ: total jump time decreased at T30min (-4.61%; d=8.42%; p=0.02) and T24h (-2.88%; d=10.01%; p=0.02). Unloading duration decreased in BSQ at T1 (-9.47%; d=13.53%; p=0.01), T30min (-13.10%; d=21.46%; p=0.02), and T24h (-13.61%; d=30.21%; p=0.002), while DL showed reductions only at T24h (-2.75%; d=19.36%; p=0.03). Concentric work declined after BSQ at T1 (-7.07%; d=6.71%; p=0.009), T30min (-8.36%; d=9.70%; p<0.001), and T24h (-0.85%; d=8.92%; p=0.007). RSI_{mod} decreased significantly in DL at T24h (-7.14%; d=9.22%; p=0.03). **CONCLUSION:** A single 3 x 12 session of BSQ or DL at 70% 1RM significantly impairs explosive neuromuscular performance; however, the magnitude and temporal pattern of impairment differ between exercises. BSQ induced greater immediate mechanical perturbations, with partial recovery of jump height by 24 h. Conversely, DL produced smaller acute decrements but persistent deficits in force development. Notably, phase-specific CMJ metrics and RSI_{mod} showed substantial hidden fatigue that was not detectable through jump height alone. These findings emphasize that traditional performance measures can underestimate residual neuromuscular decline, highlighting the importance of analyzing the CMJ force-time curve profile for guiding recovery strategies and optimizing training load prescription.

MECHANICAL AND MORPHOLOGICAL ADAPTATIONS FOLLOWING CONCENTRIC VS. ECCENTRIC TORQUE-ANGLE-TIME MATCHED TRAINING IN HUMAN TIBIALIS ANTERIOR

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INTRODUCTION: Adaptations of the muscle-tendon unit to concentric (CON) versus eccentric (ECC) training remain debated. Surprisingly, CON and ECC training has not yet been compared in a randomized controlled trial [1] and previous research lacked appropriate mechanical matching of CON and ECC training. Further, only 2D ultrasound (US) has been used to evaluate architectural adaptations and no studies investigated adaptations to the aponeurosis despite its crucial role in force transmission. Thus, we conducted a randomized controlled trial comparing CON and ECC training adaptations following comparable mechanical training stimuli using a torque-angle-time matching strategy. Tibialis anterior (TA) adaptations were assessed based on changes to its force-length relation (FLR), muscle architecture and central aponeurosis properties quantified by freehand 3DUS. **METHODS:** Twenty-three participants were randomly allocated to a control (CTRL, N = 10; 6W; 26±3yr [mean±SD]; 67.4±8.3kg; 174±8cm) or training group (N = 13; 5W; 26±2yr; 71.6±10.7kg; 175±9cm). The training group completed an 8-week contralateral intervention, with CON and ECC training randomly assigned to the legs. Training and assessments were done on a dynamometer with participants seated in a reclined position (~70° backrest, 90° knee flexion) and the foot secured to a modified footplate attached to the crank arm. 3DUS tests were conducted in a supine position with the knee near full extension. During each training session, participants received real-time torque feedback and were asked to match predefined torque-angle-time traces that progressively changed. Ankle joint kinematics were constrained by the dynamometer and activation timing was set to result in active fascicle shortening (CON) and lengthening (ECC) only. FLRs were derived from five ankle angles (5° dorsiflexion (DF) to 35° plantar flexion (PF) in 10° increments; 0° = 90° between footplate and tibial). Muscle architecture and central aponeurosis properties were quantified by 3DUS at three ankle angles (5° DF, 15° and 35° PF) during fixed-end contractions at 0, 30, and 60% of the maximal muscle force determined pre-training. **RESULTS:** Linear mixed-effects models revealed significant but similar strength gains of ~7% following CON and ECC training relative to CTRL. Also, active fascicle lengths increased similarly following CON and ECC training relative to CTRL, resulting in a rightward shift of TA's FLR. Both aponeurosis length and apparent aponeurosis stiffness did not significantly change in any group over time. **CONCLUSION:** This study provides the first randomized controlled trial evidence that mechanically matched CON and ECC training resulted in comparable strength gains and architectural and aponeurosis adaptations. This disagrees with previous research showing greater strength gains following ECC training. Consequently, contraction type does not seem to stimulate specific mechanical or morphological adaptations. [1] A. J. Blazevich et al., 2026, JSHS, 10.1016/j.jshs.2025.101090