

The Effects of Multiple Sets of Squats and Jump Squats on Mechanical Variables

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PURPOSE: To investigate the effects of two non-ballistic squat and two ballistic jump squat protocols performed over multiple sets on mechanical variables. **METHODS:** In a counterbalanced cross-over design, 11 resistance-trained men (age: 21.9 ± 1.8 years; height: 1.79 ± 0.05 m; mass: 87.0 ± 7.4 kg) attended four testing sessions during a three week period where they performed multiple sets of squats and jump squats with a load equivalent to 30% 1-repetition maximum under one of the following conditions: 1) three sets of four non-ballistic repetitions (30N-B), 2) three sets of four non-ballistic repetitions with a 3-second pause between the eccentric and concentric phases (30PN-B), 3) three sets of four ballistic repetitions (30B), 4) three sets of four ballistic repetitions with a 3-second pause between the eccentric and concentric phases (30PB). Force plates and a 3-D motion analysis system were used to determine the mean vertical velocity, mean vertical force, and mean power output during each repetition. **RESULTS:** Significantly greater vertical velocity (mean difference [MD]: $0.25 - 0.21$ m/s, $p < 0.001$, effect size [ES]: $1.70 - 1.74$) and vertical force (MD: 526 N, $p < 0.001$, ES: 1.61) were attained during 30B compared to 30N-B and 30PN-B. Vertical velocity during 30PB was significantly greater than that attained during both 30N-B and 30PN-B (MD: $0.21 - 0.23$ m/s, $p < 0.001$, ES: $1.89 - 1.76$), and vertical force during 30PB was also significantly greater than that during 30N-B (MD: 478 N, $p < 0.001$, ES: 1.63) and 30PN-B (MD: 478 N, $p < 0.001$, ES: 1.62). Mean power output was significantly greater during 30B compared to both 30N-B (MD: 843 W, $p < 0.0001$, ES: 1.66) and 30PN-B (MD: 869 W, $p < 0.001$, ES: 1.67). Mean power output during 30PB was also significantly greater than that during 30N-B (MD: 711 W, $p < 0.001$, ES: 1.73) and 30PN-B (MD: 737 W, $p < 0.001$, ES: 1.72). The increase in power output across the three sets in the 30B condition was significantly greater than the small changes in power output observed during the 30N-B and 30PN-B conditions ($p < 0.001$) and significantly different from the decrease observed during the 30PB condition between sets 2 and 3 ($p = 0.015$). **CONCLUSION:** Ballistic exercises are likely to be effective in the development of power output and their use across multiple sets may induce post-activation potentiation.