

## **The Effects of Squats and Jump Squats on Mechanical Work and Energy Expenditure**

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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 the total mechanical work performed and oxygen uptake. **METHODS:** In a counterbalanced cross-over design, 11 resistance-trained men (age:  $21.9 \pm 1.8$  years; height:  $1.79 \pm 0.05$  m; mass:  $87.0 \pm 7.4$  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 total mechanical work performed during each session while a portable gas analysis system was used to collect expired gases. **RESULTS:** Total mechanical work performed during each set was significantly greater during 30B compared to 30N-B (mean difference [MD]: 7,792 J,  $p < 0.001$ , effect size [ES]: 1.88) and 30PN-B (MD: 7,749 J,  $p < 0.001$ , ES: 1.89), while that during 30PB was significantly greater than that during both 30N-B (MD: 7,488 J,  $p < 0.001$ , ES: 1.89) and 30PN-B (MD: 7,445 J,  $p < 0.001$ , ES: 1.90). Energy expenditure during each set was significantly greater during the 30B condition compared to the 30N-B (MD: 13,983 J,  $p < 0.001$ , ES: 1.08) and the 30PN-B (MD: 11,326 J,  $p = 0.001$ , ES: 0.92). Energy expenditure during 30PB was also significantly greater than that during 30N-B (MD: 12,615 J,  $p = 0.001$ , ES: 1.04) and 30PN-B (MD: 9,958 J,  $p = 0.006$ , ES: 0.86). Furthermore, energy expenditure during set 1 was significantly greater than that during set 2 (MD: 6,840 J,  $p < 0.001$ , ES: 0.64) and set 3 (MD: 8,070 J,  $p < 0.001$ , ES: 0.75). **CONCLUSION:** Ballistic resistance training exercises may represent a more effective metabolic stimulus compared to traditional resistance training exercises and a pause inserted between the eccentric and concentric phases has little effect.