

Neuromuscular and Metabolic Activity During Concentric and Eccentric Squat Exercise

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PURPOSE: This study examined neuromuscular and metabolic activity during concentric (CON) and eccentric (ECC) squat exercise. Specifically, we wanted to determine if the ratio of neuromuscular activation between ECC and CON is similar in comparison to the ECC/CON ratio for energy consumption. **METHODS:** 7 men (age 20.5 ± 0.5) performed two squat protocols on different weeks using CON or ECC muscle actions. Expired air was collected and analyzed for CO₂ production and O₂ consumption using a metabolic cart and a two-way non-rebreathing facemask. Electromyography (EMG) of the vastus lateralis and biceps femoris muscles were recorded using an 8 channel biopotential amplifier and surface electrodes. Data were analyzed using a two-way repeated measures ANOVA, with Fisher's Least Significant Difference (LSD) post hoc analyses wherever appropriate. We hypothesized that the ratio of ECC/CON for muscle activation of the quadriceps and hamstrings (mV) would be similar to the ratio of ECC/CON for energy expenditure (kcal/min). **RESULTS:** The ECC/CON ratios for energy expenditure during sets 1-4 (75.2 ± 9.4 , 67.0 ± 6.8 , 68.0 ± 7.9 , and 68.4 ± 8.4 , respectively) were significantly greater ($p \leq 0.05$) compared to the ECC/CON ratios for quadriceps and hamstring EMG (56.9 ± 13.0 , 49.1 ± 15.3 , 53.7 ± 15.9 , and 52.9 ± 16.0 , respectively), as well as the ECC/CON ratios for EMG from the quadriceps only (42.1 ± 5.8 , 38.6 ± 13.8 , 48.1 ± 18.6 , and 52.8 ± 23.8 , respectively), with the exception of Set 3, which was not significantly different. **CONCLUSION:** When squats are performed with 2 sec CON or ECC muscle actions and 50% of 1-RM, the ECC/CON ratio for EMG for each set was on average $53.2 \pm 1.4\%$, while the ECC/CON ratio for energy expenditure was $69.7 \pm 1.1\%$. These data suggest that neuromuscular activation responses may not change in parallel with energy expenditure responses with different muscle actions.