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Normalization Removes Differences in Contractile Properties and Corticospinal Excitability Between Single- and Multi-Joint Exercises

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Single- and multi-joint exercises are commonly used resistance modalities to assess contractile function and corticospinal excitability. Initial work suggests neurophysiological function may be task-specific, but results are constrained to smaller corticospinal excitability ranges. **PURPOSE:** The purpose of this study was to compare neurophysiological function during stimulus-response curves (SRC) between an isometric squat (SQT) and knee extension (KE). **METHODS:** Twenty-two young adults (2 women, 20 right-footed, age: 25±5yrs, BMI: 25.9±3.1, VO2: 46.2±8.8 $ml \cdot kg^{-1} \cdot min^{-1}$) performed isometric SQT (n=7) or KE (n=15), with hip-, knee- and ankle-joint angle at 90° as part of a larger study, exposing participants to operational stress during a 5-day long testing series. Maximum strength and muscle activity (RMS) were recorded during maximum voluntary contractions (MVCs) using a linear force transducer and electromyography (EMG) sensors placed over the vastus lateralis, respectively. SRCs were conducted with transcranial magnetic stimulation and a double cone coil from 5-100% of stimulator output over the dominant motor cortex leg hotspot during intermittent isometric contractions at 15% MVC. Corticospinal excitability was assessed by SRC_{MAX}, SRC_{SLOPE} and SRC_{V50} (midpoint of the rising phase). As responses did not differ across days, outcomes were grand-averaged and independent t-tests or Mann-Whitney U were used for between-group comparisons. **RESULTS:** Greater maximum force and muscle activity were evident for KE compared to SQT (Force: 1303.9±407.0 vs. 812.8±189.5N, $p<0.001$; EMG_{RMS}: 0.24±0.1 vs. 0.14±0.1, $p=0.02$). During sustained isometric contractions, absolute EMG_{RMS} was higher in KE (0.056±0.014 vs. 0.043±0.003, $p=0.03$), but similar when normalized to EMG_{MAX} (29.8±15.8 vs. 34.0±11.3%, $p=0.21$). Absolute SRC_{MAX} was almost twice as high in KE compared to SQT (1.4±0.7 vs. 0.7±0.4mV, $p=0.02$), but similar when normalized to mean EMG_{RMS} during sustained isometric contractions (KE: 25.3±14.0 vs. SQT: 17.4±10.7$mV \cdot EMG_{RMS}^{-1}$, $p=0.21$). SRC_{V50} and SRC_{SLOPE} did not differ ($p>0.05$). **CONCLUSION:** Single- and multi-joint exercises present distinct contractile and absolute corticospinal properties, which vanish after normalization, warranting caution when comparing results between studies.

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