

DIFFERENCES IN EXERCISE-INDUCED FATIGABILITY AND NEUROMUSCULAR RESPONSES TO UNILATERAL, BILATERAL, AND MIXED ISOKINETIC LEG EXTENSIONS

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INTRODUCTION

- Exercise-induced fatigability is modality-specific, characterized by greater fatigability during unilateral (UL) than bilateral (BL) tasks.
- Interhemispheric Inhibition (IHI) may reduce cortical activation during BL compared to UL tasks, resulting in a BL force production deficit.

OBJECTIVE

- The purpose of the present study was to compare the patterns of responses for peak force, electromyographic (EMG) amplitude (AMP) and EMG mean power frequency (MPF) during fatiguing UL-only, BL-only, and mixed-condition isokinetic leg extensions.

METHODS

- This study included 11 recreationally trained males
- Age = 20.8 ± 1.72 years; body mass = 84.0 ± 16.2 kg; height = 179.3 ± 7.2 cm

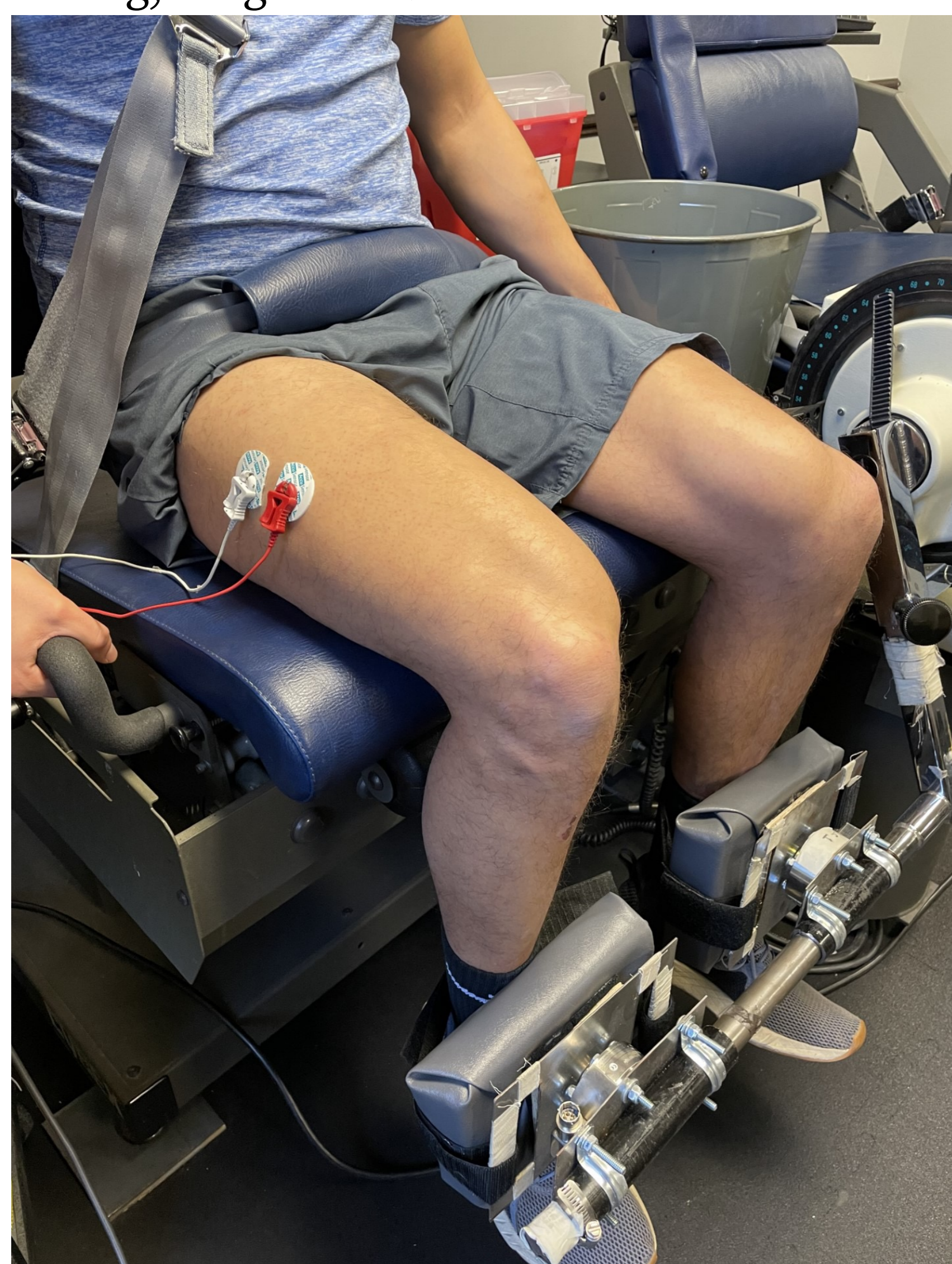


Figure 1. The bilateral isokinetic leg extension set up featuring an electromyographic sensor on the non-dominant vastus lateralis and an independent load cell between the participant's leg and the lever arm of the dynamometer.

METHODS (cont.)

- Performed 50 maximal, isokinetic leg extensions at 180°·s⁻¹ under 4 conditions in random order on separate days:
 - 50 UL
 - 25 UL followed immediately by 25 BL
 - 50 BL
 - 25 BL followed immediately by 25 UL
- Peak force collected from the non-dominant leg
- EMG AMP and EMG MPF examined from the non-dominant vastus lateralis
- All values were normalized to repetition 5; examined with a 4 (Condition) × 10 (Repetition) repeated measures ANOVA and significance at $p < 0.05$.

RESULTS

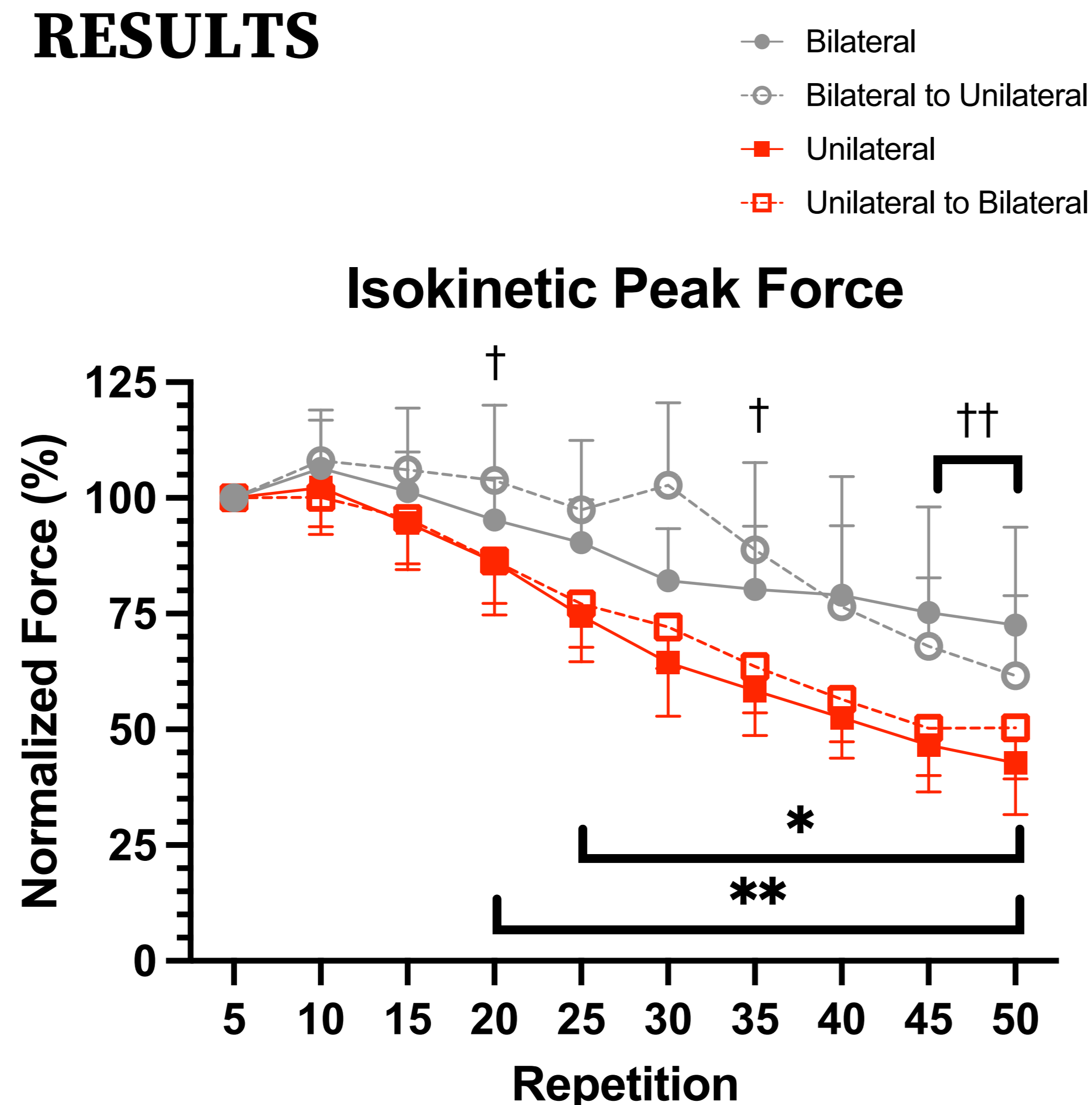


Figure 2. Mean ± SD for normalized peak force across the fatiguing tasks. Compared to repetition 5: * indicates the UL condition exhibited significantly lower values at repetitions 25-50; ** indicates the ULBL exhibited significantly lower values at repetitions 20-50; † indicates the BL condition exhibited significantly lower values for repetitions 20 and 35; and †† indicates the BLUL exhibited significantly lower values at repetitions 45-50.

RESULTS (cont.)

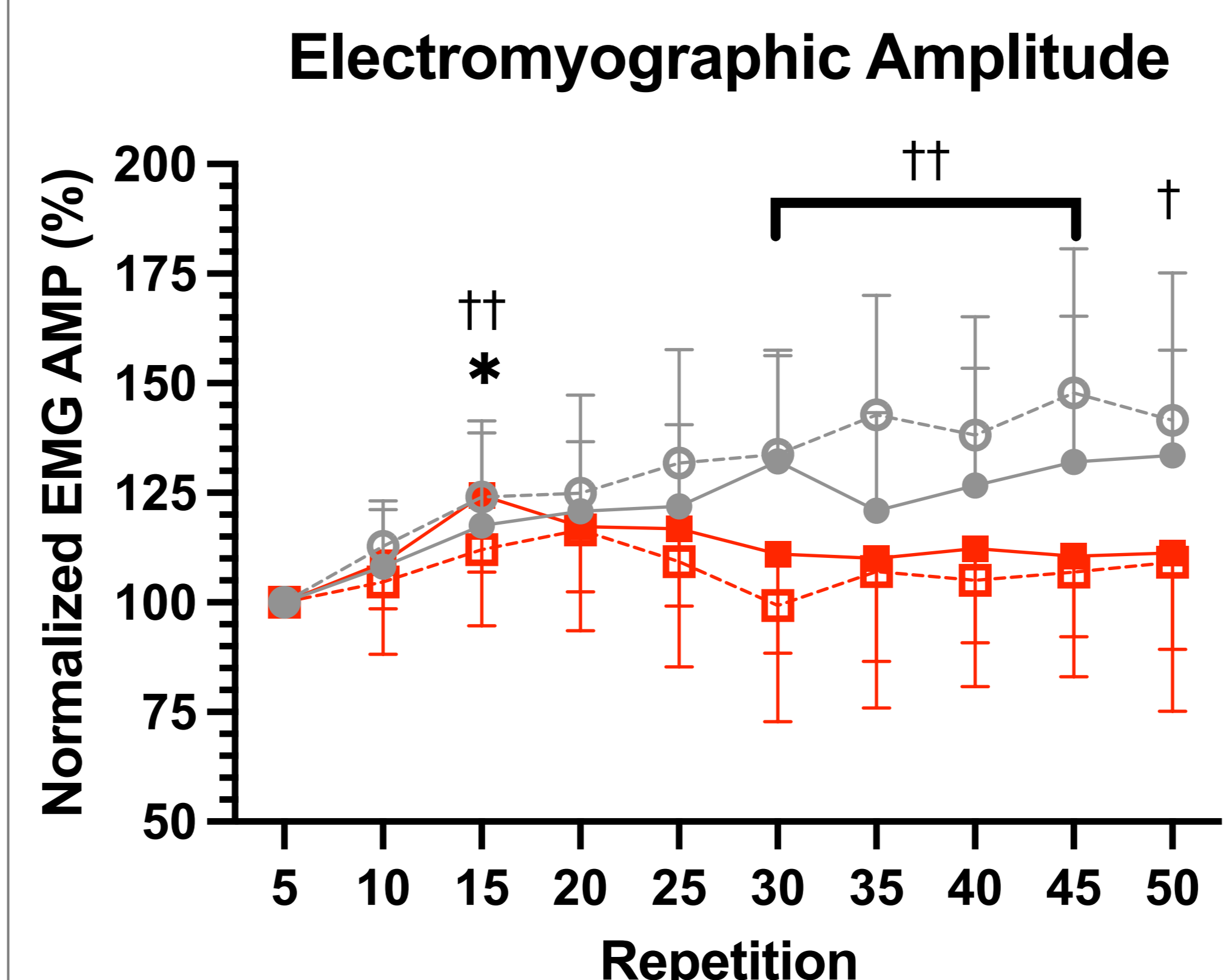


Figure 3. Mean ± SD for normalized electromyographic amplitude (EMG AMP) across the fatiguing tasks. Compared to repetition 5: * indicates the UL condition exhibited significantly greater value at repetitions 15; † indicates the BL condition exhibited a significantly greater value for repetition 50; and †† indicates the BLUL exhibited significantly greater values at repetitions 15 and 30-45.

Electromyographic Mean Power Frequency

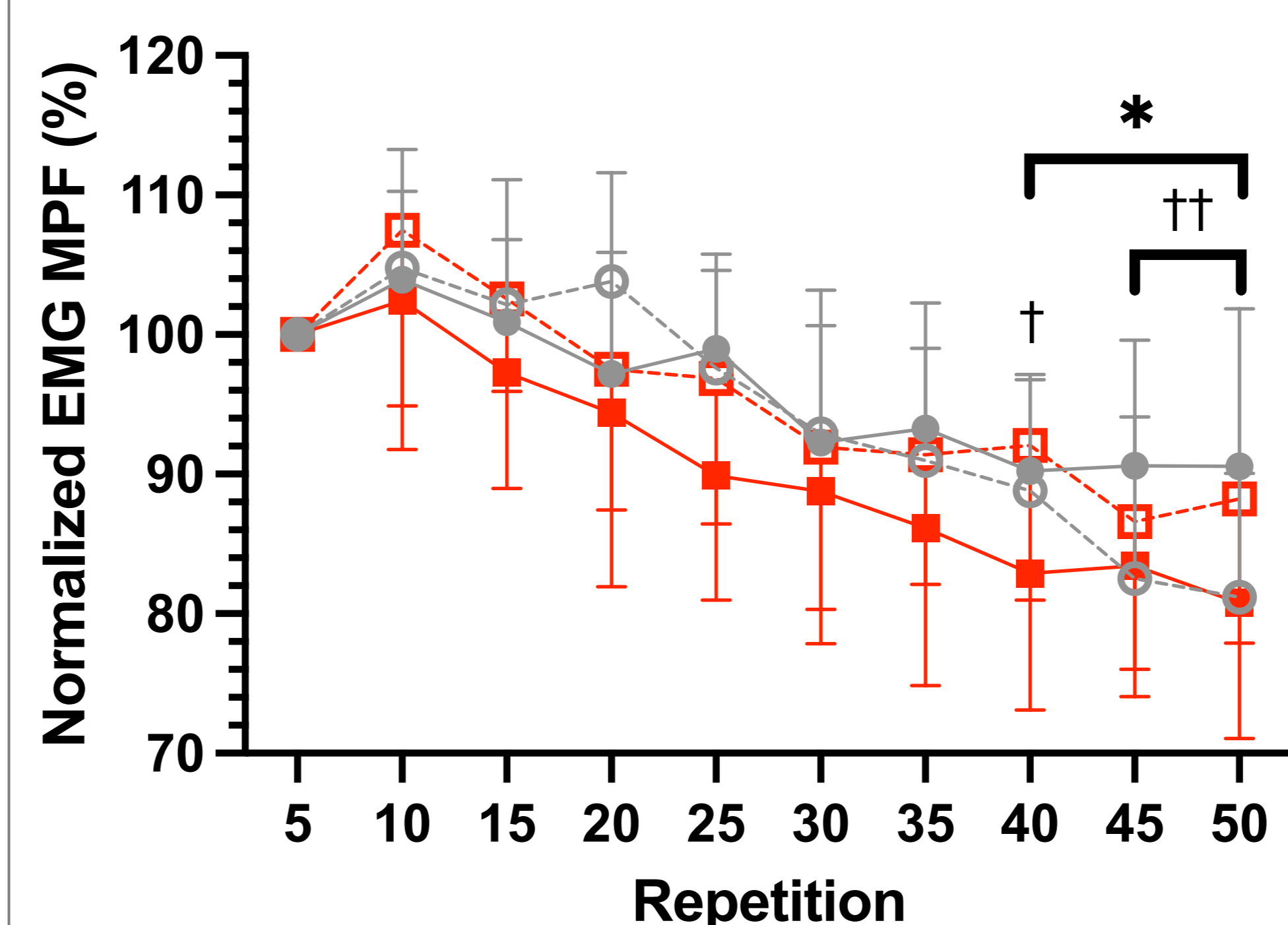


Figure 4. Mean ± SD for normalized electromyographic mean power frequency (EMG MPF) across the fatiguing tasks. Compared to repetition 5: * indicates the UL condition exhibited significantly lower values at repetitions 40-50; † indicates the BL condition exhibited a significantly lower value for repetition 40; and †† indicates the BLUL exhibited significantly lower values at repetitions 45-50.

RESULTS (cont.)

- The results for peak force, EMG AMP, and EMG MPF exhibited significant Condition by Repetition interactions ($p < 0.001-0.027$; $\eta^2_p = 0.141-0.370$). Follow-up analysis compared the values to the value at repetition 5.
- Peak Force: UL exhibited declines from 25-50; UL to BL exhibited declines at repetitions 20-50; BL exhibited declines at repetitions 20 and 35; BLUL exhibited declines at repetitions 45-50.
- EMG AMP: UL exhibited an increase at repetition 15; ULBL exhibited no changes; BL exhibited an increase at repetition 50; and BLUL exhibited increase at repetitions 15 and 30-45.
- EMG MPF: UL exhibited declines at repetitions 40-50; ULBL exhibited no declines; BL exhibited a decline at repetition 40; and BLUL exhibited declines at repetitions 45-50.

CONCLUSIONS

- These findings suggested that the UL and ULBL modalities exhibited earlier and greater exercise-induced fatigability than the BL and BLUL modalities.
- Compared to the BL condition, the BLUL exhibited a sustained decline in peak force. These differences were also associated with differences in the patterns of response for EMG AMP and EMG MPF.
- It remained unclear whether differences between the UL and BL modalities were associated with IHI.

PRACTICAL APPLICATIONS

- These findings provide practitioners insights regarding differences between training modalities, characterized by the UL modality eliciting a greater exercise-induced fatigability than the BL modality. Practitioners working with novice athletes, whose adaptations are initially associated with neuromuscular adaptations, should consider the implementation of both BL and UL modalities due to their generally similar patterns of neuromuscular excitation.