SIMILAR NEUROMUSCULAR FATIGUE ACROSS REPEATED BOUTS OF HIGH- AND LOW-LOAD RESISTANCE EXERCISE

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Purpose

The purpose of this study was to examine the influence of biological sex on the repeatability of lower body fatigue during high- or low-load resistance exercise to volitional failure.

Methods

- Twenty-five healthy, resistance-trained individuals volunteered to participate in this study in which they were randomly assigned to either a high-load (HL; M/F = 6/7) or low-load (LL; M/F = 5/7) group.
- Each group completed two visits separated by 72 hours (±1 hr.) in which participants completed 3 sets of unilateral leg extension exercise to failure using either 80% (HL) or 30% (LL) of their 1 repetition maximum (1RM) during both visits.
- The dominant leg of each subject was used during both visits and 2 minutes of rest was given between each set. 1RM testing was done at the beginning of each visit to determine the load utilized for that visit. Maximal voluntary isometric contraction (MVIC) strength was assessed prior to and immediately following each set using a load cell fixed to the base of the leg extension machine.
- A time (PRE/POST SET 1/POST SET 2/POST SET 3) × group (HL/LL) × sex (M/F) × visit (1st/2nd) repeated measures ANOVA was run to examine change in MVIC strength, and the alpha was set a-priori at 0.05.

Results

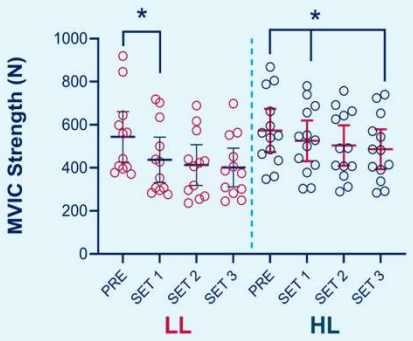

Figure 1. Individual subject plots and mean (±95% CIs) for Maximum Voluntary Isometric Contraction (MVIC) strength during low- (LL) and high-load (HL) knee extension at each time point when collapsed across sex and visit.

*Indicates significant decrease in MVIC strength across time points

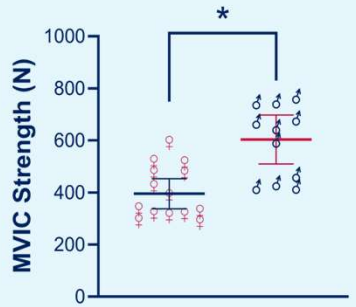

Figure 2. Individual subject plots and mean (±95% CIs) for Maximum Voluntary Isometric Contraction (MVIC) strength for males and females when collapsed across all factors.

*Indicates significantly greater MVIC strength in males when compared to females

There were no significant 4-way or 3-way interaction effects ($p = 0.398$-0.729). However, there was a significant condition × time interaction ($p < 0.014$) for MVIC strength. Post-hoc analysis revealed that when collapsed across sex and visit, MVIC strength significantly declined from PRE (543.6 ± 184.3 N) to POST SET 1 (436.7 ± 166.0; $p < 0.001$) but did not decline any further across the remaining sets ($p = 0.051$-0.443) during the LL condition. For HL, MVIC strength significantly declined from PRE (576.2 ± 173.6) to POST SET 1 (525.1 ± 163.5; $p < 0.001$) and further declined POST SET 3 (486.0 ± 159.8 N; $p = 0.006$). There were no other significant differences between any other time points ($p = 0.287$). Additionally, there was no main effect for visit ($p = 0.092$). However, there was a significant main effect for sex ($p < 0.001$), in which post-hoc analysis indicated that males were significantly stronger than females when collapsed across all other factors.

Conclusions

The present data indicate that HL and LL exercise exhibit different time-courses of changes in MVIC strength. Specifically, our results suggest that HL accumulated more pronounced fatigue over multiple sets when compared to LL. However, the specific time-course within each load appears to be consistent across multiple bouts. Importantly, biological sex does not appear to factor into the responses seen in the present data.

Practical Applications

The present data emphasizes the effects of load intensity on fatigue development during resistance exercise. Our study highlights the differing effects of resistance exercise load on fatigue and the repeatability of this across multiple bouts of exercise. Coaches and practitioners should take this into consideration when prescribing resistance exercise, particularly when the goal is to mitigate fatigue. Furthermore, the present data suggest that biological sex did not influence the response to either high- or low-load exercise. Thus, additional research is needed to determine the role of biological sex impact on exercise performance to optimize training programs for improved performance and fitness outcomes.