LACK OF NON-LOCAL MUSCLE FATIGUE ACROSS HIGH- AND LOW-LOAD RESISTANCE EXERCISE

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Purpose

The purpose of this study was to examine the non-local muscle fatigue response of the lower body following high- and low-load resistance exercise to failure in resistance-trained males and females.

Methods

Twenty-six (M/F: 12/14) healthy, resistance-trained individuals volunteered to participate in this study in which participants completed 80% (high-load; HL) or 30% (low-low; LL) of their 1 repetition maximum unilateral leg extension to volitional failure across 2 visits. Each visit was separated by 24 hours and the order of the conditions was randomized and counterbalanced across each sex. The subject's dominant leg was utilized for the exercise protocol (EX) during the first visit and the non-dominant leg for the second visit. The opposite leg served as the control (CON). Each exercise bout consisted of 3 sets of unilateral leg extension to volitional failure with 2 minutes of rest between each set. Prior to and immediately following each exercise bout, maximum voluntary isometric contraction (MVIC) strength of each leg was obtained via a load cell attached to the base of the leg extension machine. Peak force of each measurement was obtained from a 500 ms window of each contraction. A time (PRE/POST) × condition (HL/LL) × leg (EX/CON) repeated measures ANOVA was run to examine changes in MVIC strength. All analyses were completed in SPSS and the alpha was set a-priori at 0.05.

Results

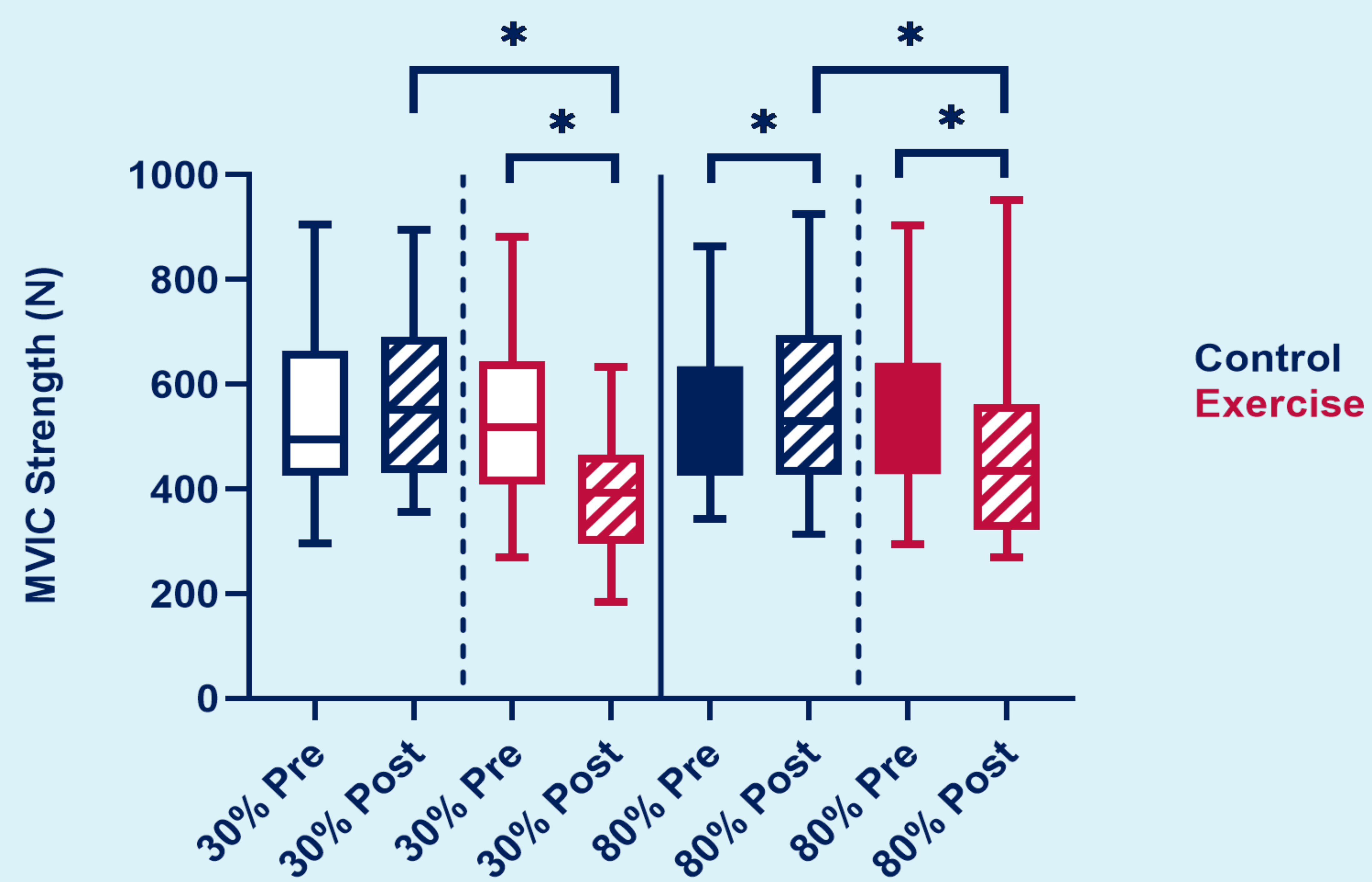

Figure 1. Means (±SD) for MVIC strength (N) for each low-load (30%) and high-load (80%) at each time point for the control (CON) and exercise (EX) legs.

*Indicates significant difference in MVIC strength ($p<0.05$)

There was a significant time × condition × leg interaction effect for MVIC strength ($p<0.001$). Post-hoc analyses indicated that in both the HL and LL conditions, MVIC strength of EX significantly decreased from PRE to POST (LL: -167.8 ± 107.0 N; HL: -88.7 ± 69.8 N; $p<0.001$) for both, with LL exhibiting a significantly larger decrease in MVIC strength ($p<0.001$). Conversely, MVIC strength of CON non-significantly increased from PRE to POST in LL (+26.8 ± 67.6 N; $p = 0.054$) and significantly increased from PRE to POST in HL (+26.8 ± 64.1 N; $p = 0.043$). Subsequently, MVIC strength of CON was significantly greater than EX at POST in both the LL (+176.6 ± 93.2 N; $p<0.001$) and HL (+118.2 ± 95.0 N; $p<0.001$) conditions.

Conclusion

Our results indicate a lack of non-local muscle fatigue of lower body across LL and HL resistance exercise to volitional failure. Interestingly, the present data indicates a significant enhancement in MVIC strength of the CON limb in the HL condition, suggesting that load may mediate this effect. Additionally, there was a non-significant increase in the CON leg following LL, despite significantly greater decrements in the MVIC strength in EX during the LL condition. Future research is needed to explore the mechanisms behind this effect.

Practical Applications

The present data suggest a lack of non-local muscle fatigue in the contralateral limb following unilateral leg extension exercise failure in resistance trained men and women. Thus, coaches and practitioners can expect minimal interference, and possibly even a slight enhancement of maximal strength of the contralateral limb when prescribing unilateral exercise of the lower body. However, further research is needed to understand the mechanism of this effect. Further, future investigations should examine the etiology of the greater decrements in maximal strength observed following LL exercise.