NEITHER BLOOD FLOW RESTRICTION NOR BIOLOGICAL SEX INFLUENCE NEUROMUSCULAR FATIGUE FOLLOWING LOW-LOAD RESISTANCE EXERCISE

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Introduction & Purpose

Blood flow restriction (BFR) is commonly used in rehabilitation settings with the goal of improving muscle function. Traditionally, BFR is used in conjunction with low-load resistance exercise and has been previously shown to have positive effects on muscle size and strength. However, the differences in neuromuscular fatigue between sexes during blood-flow restricted exercise remain unclear. **The purpose of this investigation was to examine sex-differences in neuromuscular function of the elbow flexors following an acute bout of traditional (TREx) or blood flow restricted (BFR) exercise.**

Methods

Fifteen males (Mean ± SD; Age: 23 ± 3 y) and 13 females (Age: 21 ± 2 y) completed this randomized and counterbalanced study, which consisted of one repetition maximum (1RM) elbow flexion testing and two experimental visits. All subjects had been participating in structured resistance training at least 2 times per week for a minimum of 6 months prior to enrollment in the study. For all visits, subjects arrived at the lab after abstaining from caffeine for a minimum of 8 hours and upper body exercise for at least 48 hours prior to the visit. During the experimental visits, subjects completed 4 sets (1x30, 3x15 repetitions) of elbow flexion exercise at 30% 1RM with BFR (BFR) or without BFR (TREx) with 30 seconds of rest between each set. All visits were separated by at least 48 hours and took place at the same time of day (±1 hour). For the BFR condition, the cuffs were rapidly inflated to 60% arterial occlusion pressure (AOP) and remained inflated throughout the entire exercise protocol. Prior to (PRE) and immediately following (POST) the exercise bouts, maximal voluntary isometric contraction (MVIC) strength of the participants' dominant arm was assessed, during which surface electromyography (EMG) of the biceps brachii was recorded. All force and EMG signals were processed offline to calculate peak force (PF), as well as EMG amplitude (EMG_{AMP}) and EMG median power frequency (EMG_{MDF}) at PF. Separate time (PRE/POST) × condition (BFR/TREx) × sex (M/F) repeated measured ANOVAs were run for each dependent variable. Alpha was set a-priori at 0.05 and all analyses were run in SPSS version 28.

Results

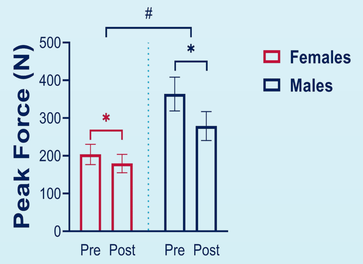

Figure 1. Mean ± 95% confidence intervals for peak force (PF) prior to (PRE) and immediately following (POST) exercise when collapsed across condition.
*Indicates significant decrease in PF across time within each sex
#Indicates significantly greater PF in males at each timepoint

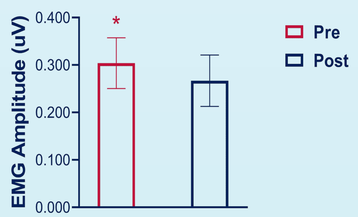

Figure 2. Mean ± 95% confidence intervals for EMG amplitude prior to (PRE) and immediately following (POST) exercise, when collapsed across both condition and sex.
*Indicates significantly greater EMG RMS at PRE

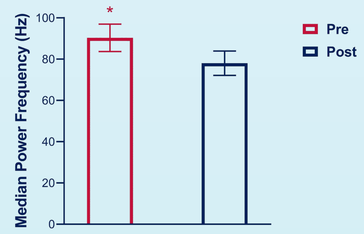

Figure 3. Mean ± 95% confidence intervals for EMG median power frequency (MDF) prior to (PRE) and immediately following (POST) exercise, when collapsed across both condition and sex.
*Indicates significantly greater EMG MDF at PRE

There were no 3-way interaction effects for any dependent variable (p=0.428-0.888). There was a time × sex interaction for PF (p<0.001). Post-hoc analyses indicated that when collapsed across condition, PF significantly declined from PRE to POST in both males (PRE: 363.68 ± 80.8 N; POST: 278.8 ± 69.3 N; p<0.001) and females (PRE: 204.8 ± 40. N; POST: 179.6 ± 40.1 N; p<0.001). Males were significantly stronger than females at both timepoints (p<0.001 for both). There were no additional two-way interaction effects for PF, EMG_{AMP}, or EMG_{MDF} (p>0.05 for all). However, there were simple main effects of time for EMG_{AMP} (p=0.034) and EMG_{MDF} (p<0.001). Post-hoc analyses indicated there was a significant decrease from PRE to POST in EMG_{AMP} (PRE: 0.304 ± 0.138 μV; POST: 0.267 ± 0.140 μV; p=0.034) and EMG_{MDF} (PRE: 90.3 ± 17.1 Hz; POST: 78.0 ± 15.2 Hz; p<0.001), when collapsed across condition and sex.

Conclusions

The results of the present investigation suggest that there are similar declines in neuromuscular function of the elbow flexors following low-load resistance exercise, with or without blood flow restriction. Importantly, our data suggests that biological sex does not mediate this response, as similar impairments in neuromuscular function were observed in both males and females.

Practical Applications

Contrary to previous findings, our data demonstrates that coaches and practitioners should expect similar acute responses to low-load elbow flexion exercise with or without blood flow restriction when prescribing exercise in young, resistance-trained individuals. However, future research is needed to further examine the role of BFR and biological sex on changes in neuromuscular function following exercise.

References & Funding

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