Sex-Differences In Cognitive Function Following High-Intensity Resistance Training

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INTRODUCTION

Limited studies have examined sex differences in resistance exercise and cognitive function (CF). Previous studies showed that high-intensity resistance exercise elicited domain-specific changes in CF in males[1]. The correlation between sex differences remains unclear.

PURPOSE

The purpose of this study was to examine sex differences in CF in response to an upper and lower body resistance exercise protocol 6 sets of 10 repetitions with an intensity of 80% of their one-repetition max.

METHODS

Table 1. Participant Demographics

	Male	Female
Weight (kg)	86.0±12.6	70.1±10.6
Height (cm)	178.7±9.0	165.1±7.1
Age (years)	22.7±4.1	22.5±3.8
Resistance Training (min/week)	359.1±209.0	278.6±107.2
Aerobic Training (min/week)	118.6±81.7	207.3±174.7
Upper 1RM (kg)	113.2±21.8	50.8±10.0
Lower 1RM (kg)	151.4±41.6	88.8±19.0

Aerobic and resistance training were determined by self-reported estimated weekly time spent in exercise. Units for both were minutes/week

PROCEDURES

The participants performed bench press and squats at 6 by 10 at 80% of their 1RM with 2 minutes of rest between sets, using their nondominant limb before and after the protocol. This was done in random order on separate days. NIH Toolbox battery was done before and after the resistance exercise protocol.

Fatigue was assessed with 3 repetitions of 6-second maximal, voluntary, isometric contractions (MVICs) for upper and lower body arm and leg extension on their non-dominant limb. Pre- and post-resistance protocol.

Table 2. NIH Toolbox Description

Name of Test	Description
Dimensional Change Card Sort Test (DCCS)	Measures cognitive flexibility by having participants match test pictures to targets based on shifting criteria like color or shape. "Switch" trials test adaptability. Takes about four minutes to administer
Flanker Inhibitory Control and Attention Test (Flanker)	Assesses attention and inhibitory control by having participants focus on a central stimulus while ignoring distractions. Arrows used (ages 8-85), with congruent and incongruent trials. Take about three minutes to administer
Pattern Comparison Processing Speed Test (PC)	Measures processing speed by having participants quickly identify whether two pictures match. They respond to as many pairs as possible within 85 seconds. Takes about three minutes to administer.

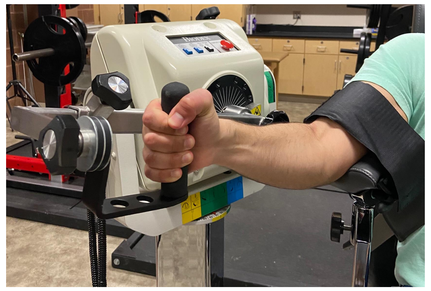

Image 1. Shows a participant using the Biodex System 4 Dynamometer for the upper body MVICs fatiguing task on their nondominant limb before and after the protocol.

Image 2. Demonstrates a participant using the Biodex System 4 Dynamometer for the lower body MVICs fatiguing task on their nondominant limb before and after the protocol.

RESULTS

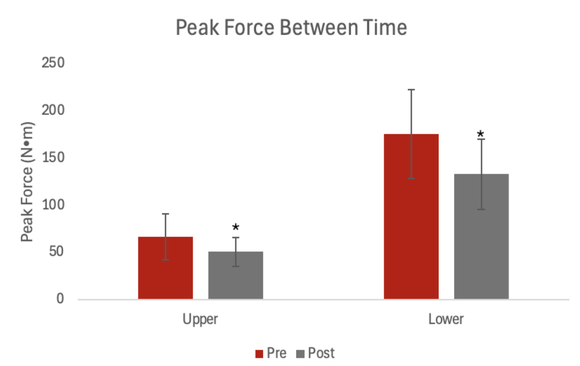

Figure 1. Mean ± Standard Deviation of the peak force value collapsed across sex during the MIVCs pre and post-fatiguing task. *Indicates a significant (p<0.05) lower values than the pre-fatiguing values.

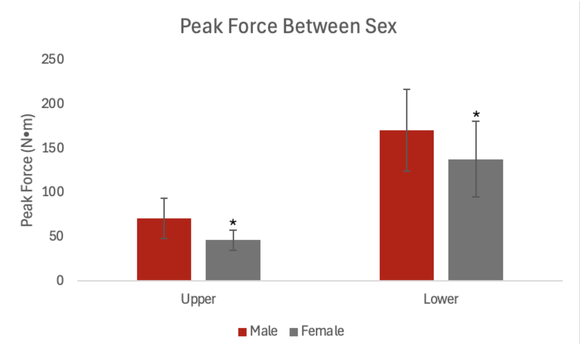

Figure 2. Mean ± Standard Deviation of the peak force value collapsed across time during the MVICs pre and post-fatiguing task. *Indicates a significant (p<0.05) lower value than the pre-fatiguing values.

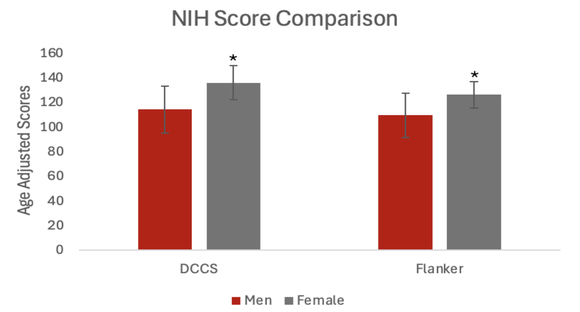

Figure 3. Mean ± Standard Deviation of NIH age-adjusted scores for the DCCS and Flanker collapsed across time.* Indicates a significant (p<0.05) greater value for the female score compared to males

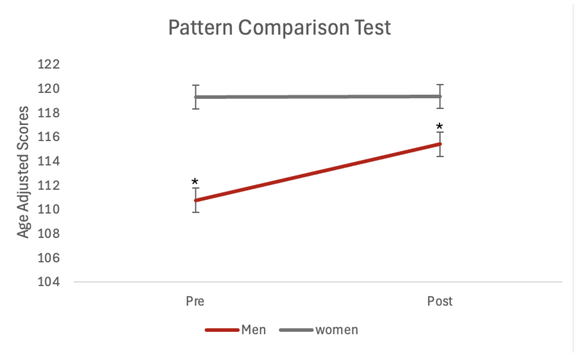

Figure 4. Mean ± Standard Deviation of NIH age-adjusted scores for the PC collapsed across time.* Indicates males had a significant (p<0.05) greater value than the pre-fatiguing values.

CONCLUSION

Upper and lower body exercise elicited muscular fatigue in males and females. Males exhibited a fatigue-induced performance improvement in the PC task, while females showed no significant change. Females scored higher on the DCCS and Flanker tasks but had no CF changes post-fatigue.

PRACTICAL APPLICATION

Under exercise-induced fatigue, CF remained largely unaffected, with males potentially exhibiting improved processing speed. Practitioners may use skill-based or strategic drills with high-intensity training to boost decision-making under fatiguing conditions.

CITATION

1. Anders JPV, Kraemer WJ, Newton RU, Post EM, Caldwell LK, Beeler MK, DuPont WH, Martini ER, Volek JS, Häkkinen K, Maresh CM, Hayes SM. Acute Effects of High-intensity Resistance Exercise On Cognitive Function. J Sports SCI Med. 2021 May 3;20(3): 391-397