

# EFFECT OF ISOMETRIC FATIGUING TASK MODALITY ON PERFORMANCE FATIGABILITY AND REACTIVE HYPEREMIA RESPONSES

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## INTRODUCTION

- Near-infrared spectroscopy combined with a vascular occlusion test (NIRS-VOT) has been established as a reliable, non-invasive technique for assessing reactive hyperemia-induced microvascular reactivity.
- Previous studies have demonstrated that resistance exercise training improves post-exercise microvascular reactivity.
- The effects of various isometric fatiguing task modalities on performance fatigability (PF) and reactive hyperemia (RH) responses have not been investigated.
- This study aimed to compare PF and RH responses following three distinct isometric fatiguing task conditions.

## METHODS



**14 Males**  
(22.6±4.9yr,  
178.2±6.2cm,  
78.6±9.9kg)

VS

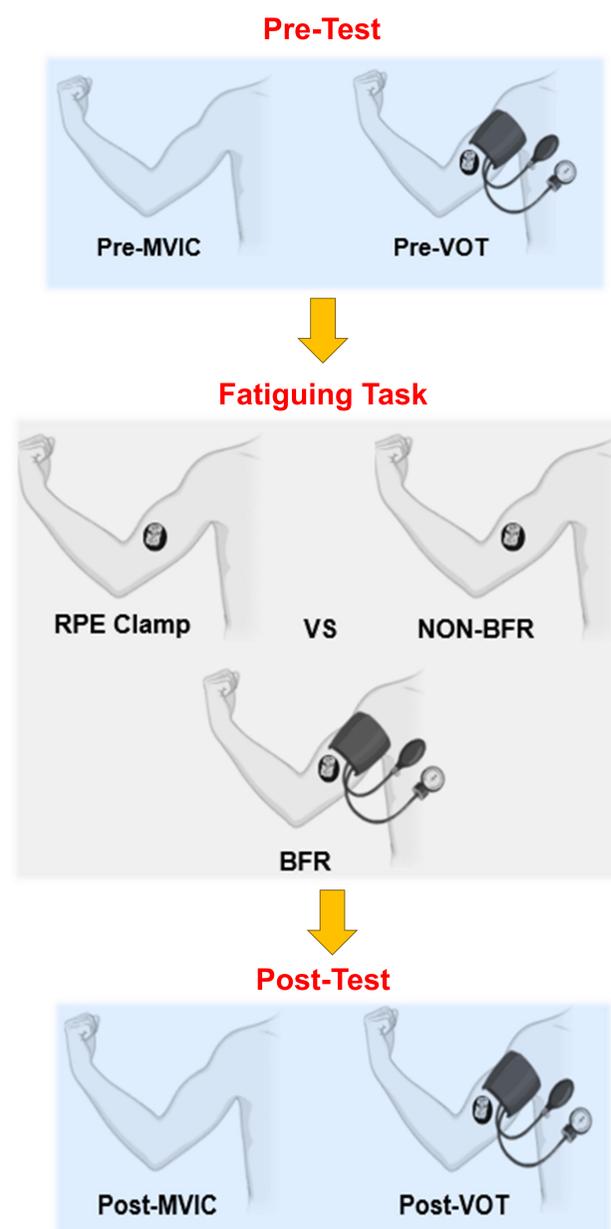


**14 Females**  
(22.7±4.5yr,  
163.0±6.3cm,  
62.5±10.2kg)

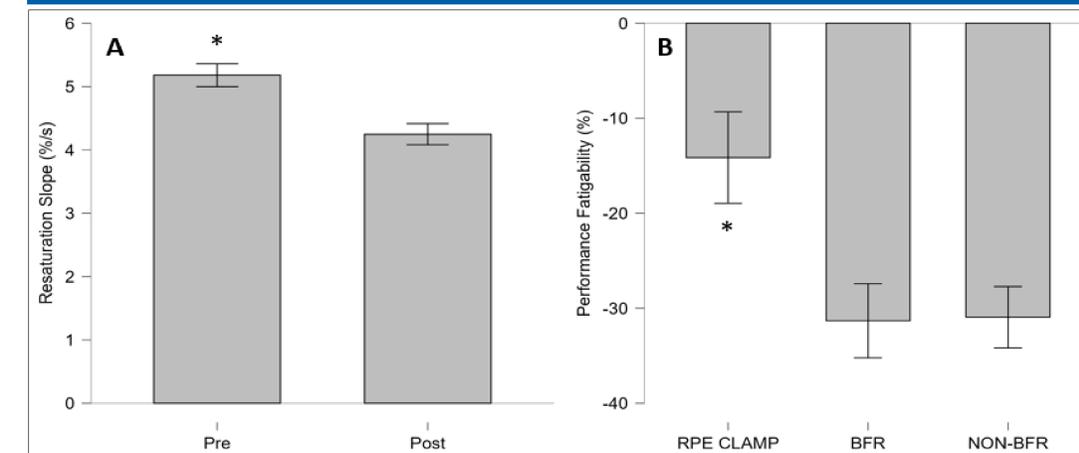
- Three isometric forearm flexion hold-to-failure tasks at an elbow joint angle of 100° were performed on separate days.

- (1) **RPE Clamp**: an exercise anchored to a rating of perceived exertion of 3 out of 10.
- (2) **NON-BFR**: an exercise anchored to a constant torque corresponding to the first 1-sec torque level ( $T_{1\text{sec}}$ ) during the RPE Clamp trial (i.e., non-blood flow restriction [BFR]).
- (3) **BFR**: an exercise performed at the same torque level as NON-BFR trial but with BFR at 40% arterial of occlusion pressure.

- VOTs and maximal voluntary isometric contractions (MVICs) were assessed pre- and post-exercise to evaluate RH and PF, respectively.
- The VOTs included a 5-min of complete occlusion, followed by a 3-min reperfusion phase.
- RH was assessed as the resaturation slope ( $\% \cdot \text{s}^{-1}$ ) within the first 10-sec after cuff deflation during reperfusion phase.
- PF was quantified as the percent change in MVIC from pre- to post-test.
- Separate, mixed factorial ANOVAs were used to examine RH (condition x sex x time) and PF (condition x sex), with Bonferroni post hoc t-tests.
- An independent t-test compared  $T_{1\text{sec}}$  between males and females.



## RESULTS



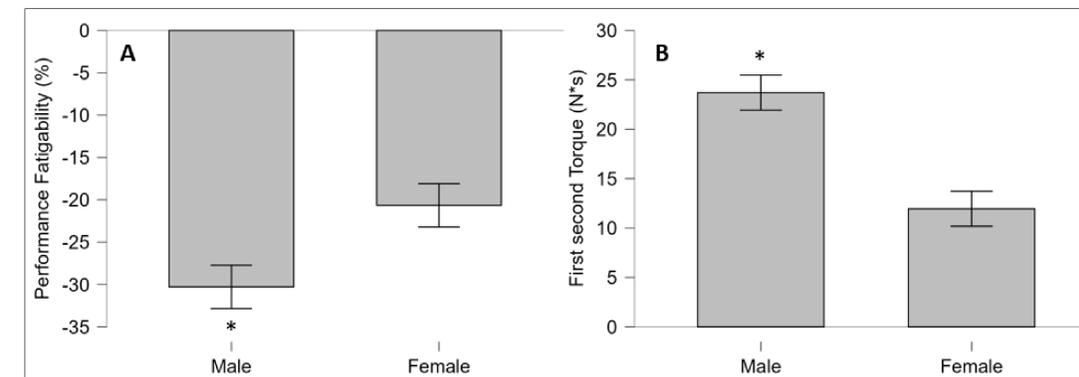
**Figure 1. (A)** The comparison of resaturation slope ( $\%/s$ ) from pre- to post-vascular occlusion test (VOT), collapsed across condition and sex.

\* Indicates significantly greater resaturation slope in pre-VOT than post-VOT.

**(B)** The comparison of performance fatigability (PF) between conditions, collapsed across sex.

\* Indicates significantly lower PF in RPE Clamp, compared to BFR and NON-BFR.

Data are presented using means (box) and standard error (error bars).



**Figure 2. (A)** The comparison of performance fatigability (PF) between males and females, collapsed across condition.

\* Indicates significantly greater PF in males than females.

**(B)** The comparison of first second torque ( $T_{1\text{sec}}$ ) between males and females.

\* Indicates significantly greater  $T_{1\text{sec}}$  in males than females.

Data are presented using means (box) and standard error (error bars).

## CONCLUSIONS

- The ability to adjust torque to maintain an “easy” perceptual intensity during RPE Clamp exercise likely resulted in the lower PF compared to constant-force conditions (both BFR and non-BFR).
- The greater absolute torque ( $T_{1\text{sec}}$ ) in males than females likely led to greater intramuscular pressure, blood flow restriction, and increased metabolite accumulation, ultimately resulting in greater PF.
- Regardless of the exercise intervention, the decreased resaturation slope in post-VOT compared to pre-VOT may reflect the distinct characteristics of isometric fatiguing exercise. Reperfusion restriction throughout the tasks, thereby continuously trigger the metaboreflex, leading to increased sympathetic activity, vasoconstriction, and peripheral resistance.

## PRACTICAL APPLICATIONS

- Different isometric fatiguing exercise modalities may elicit varying levels of fatigability depending on sex and task modality, but they may not necessarily improve post-exercise microvascular reactivity.
- It should be noted that the adipose tissue thickness of individuals may blunt the oxygen resaturation response.