THE EFFECT OF AN 8-WEEK HIGH- VS LOW-VELOCITY RESISTANCE EXERCISE ON VASTUS LATERALIS AND RECTUS FEMORIS CROSS-SECTIONAL AREA AND ECHO INTENSITY IN OLDER ADULTS

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Purpose

The purpose of this study was to examine the effect of a high- vs. low-velocity lower body resistance training (RT) program on *m. vastus lateralis* (VL) and *m. rectus femoris* (RF) cross-sectional area (CSA) and echo intensity (EI) in older adults (OA).

Methods

Nineteen OA volunteered to complete an 8-week RT program and were randomly assigned into a high- (HV; n=10; Age=70±6 y) or a low-velocity RT group (LV; n=9; Age=74±7 y). Movement speed for each training and testing repetition was assessed using a linear position transducer during the concentric phase of the belt squat movement. The HV and LV were required to move at a mean velocity above 0.7m/s and between 0.25-0.3 m/s, respectively. Load was adjusted to ensure movement speed was within appropriate ranges. Participants were provided velocity biofeedback of their concentric movement speed and encouraged to move the load as quickly as possible. One investigator recorded three panoramic ultrasound images of the RF and VL on the right thigh of each participant. Each muscle's CSA and EI were analyzed offline and averaged to determine RF (RF_{CSA}) and VL (VL_{CSA}) CSA. The CSA of each muscle was derived from outlining the muscle, excluding as much subcutaneous fat and fascia as possible from the US images. The EI of the RF (RF_{EI}) and VL (VL_{EI}) was determined from the CSA images using gray scale ultrasonography on a scale of 0-255. The EI value was then corrected for subcutaneous tissue thickness using the pre-established equation: Corrected EI = raw EI + (subcutaneous fat thickness (cm) × 40.5278). Separate 2 (condition) × 2 (time) repeated measures ANOVAs were run to examine any potential differences between groups and time points in RF_{CSA}, RF_{EI}, VL_{CSA}, and VL_{EI}. An independent samples t-test was run to examine the difference between average total exercise volume (repetitions/load) between groups (HV vs. LV). Hedges' *g* effect size was used to estimate effect size.

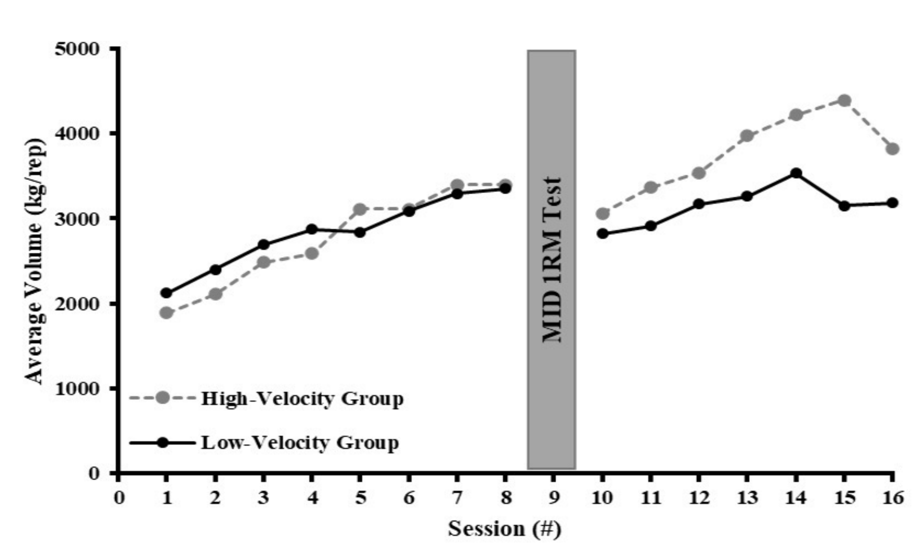

Figure 1. Volume completed by HV and LV groups over a 16-week period

Results

There were no Condition × Time interactions or main effects for time in RF_{CSA} (p=0.65), RF_{EI} (p=0.79), VL_{CSA} (p=0.73), VL_{EI} (p=0.92).

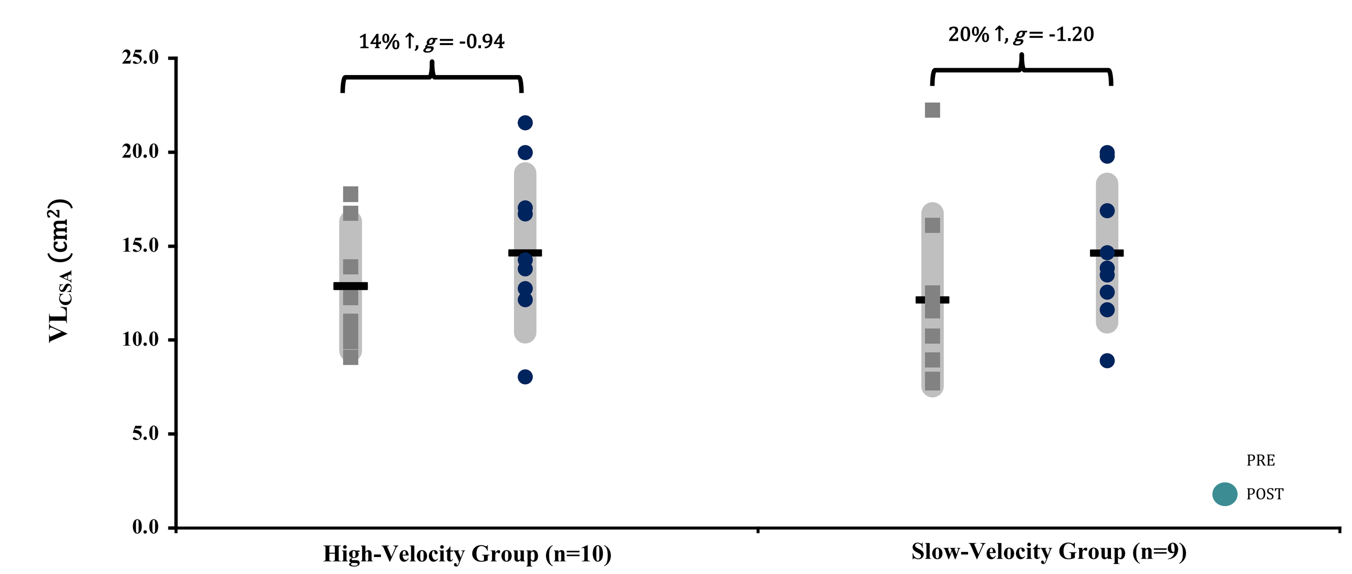

Figure 2. Cross-sectional area changes of VL in HV and LV training groups from PRE to POST.

However, there was a significant main effect for time in VL_{CSA} (PRE: 12.53 ± 3.93 cm^2 vs POST: 14.64 ± 3.87 cm^2, p=0.03, g = -1.07) (Figure 2). Further, medium to large effect sizes were observed in the HV in RF_{CSA} (PRE: 8.02 ± 1.73cm^2 vs POST: 8.36 ± 1.50 cm^2, g = -0.42) (Figure 3), VL_{CSA} (PRE: 12.87 ± 3.43cm^2 vs POST: 14.64 ± 4.22 cm^2, g = -0.94), and VL_{EI} (PRE: 89.80 ± 30.12 au vs POST: 80.85 ± 18.51 au, g = 0.73) (Figure 5).

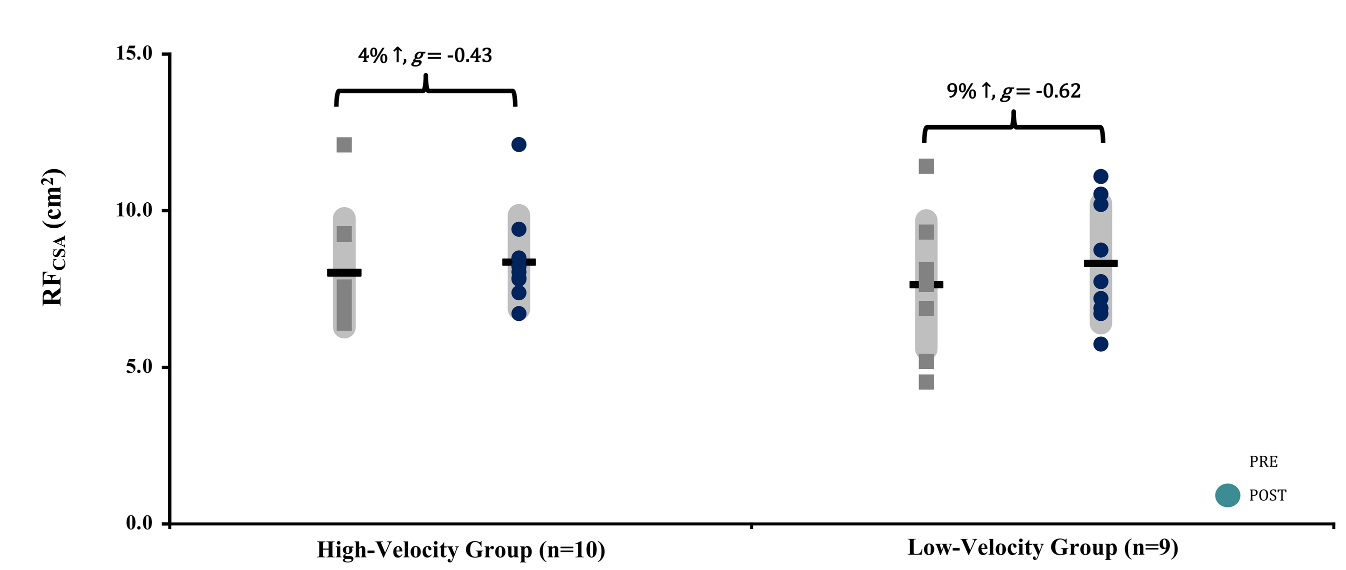

Figure 3. Cross-sectional area changes RF in HV and LV training groups from PRE to POST.

Medium to large effect sizes were observed in the LV in RF_{CSA} (PRE: 7.64 ± 2.36 cm^2 vs POST: 8.31 ± 2.11 cm^2, g = -0.62) (Figure 3), VL_{CSA} (PRE: 12.14 ± 4.60 cm^2 vs POST: 14.63 ± 4.00 cm^2, g = -1.20). Volume completed between groups were not significantly different (HV = 47,490.25 ± 10,888 vs LV = 45,705.93 ± 16171.50, p = 0.81, g = 0.27).

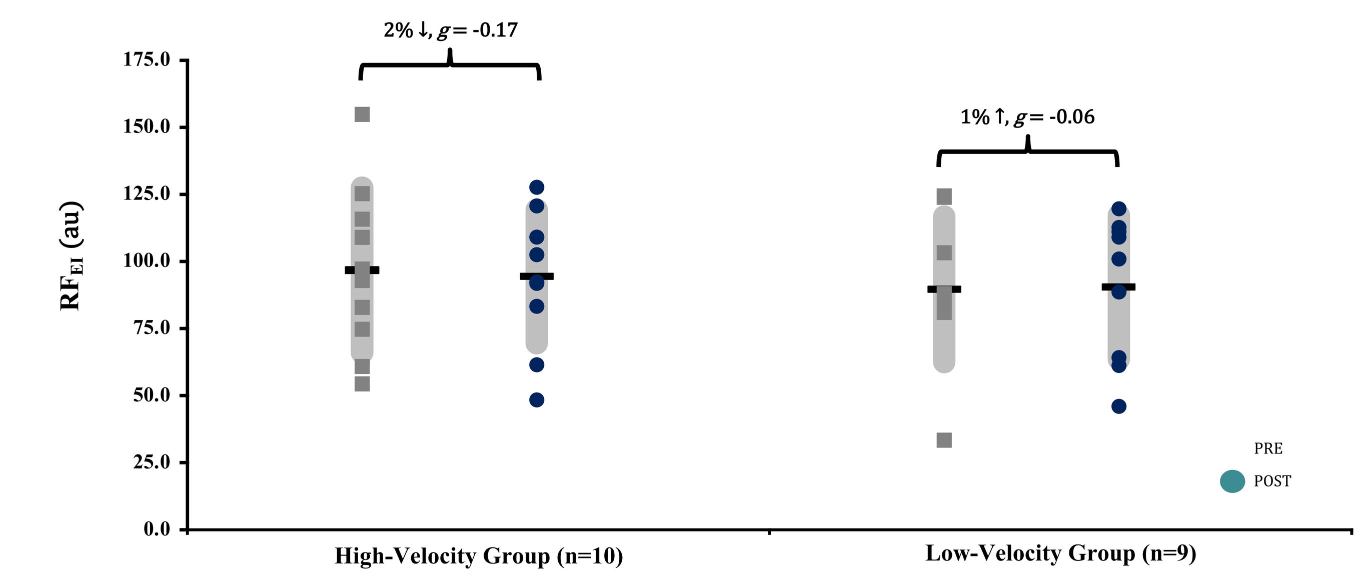

Figure 4. Changes in echo intensity of RF in HV and LV training groups from PRE to POST.

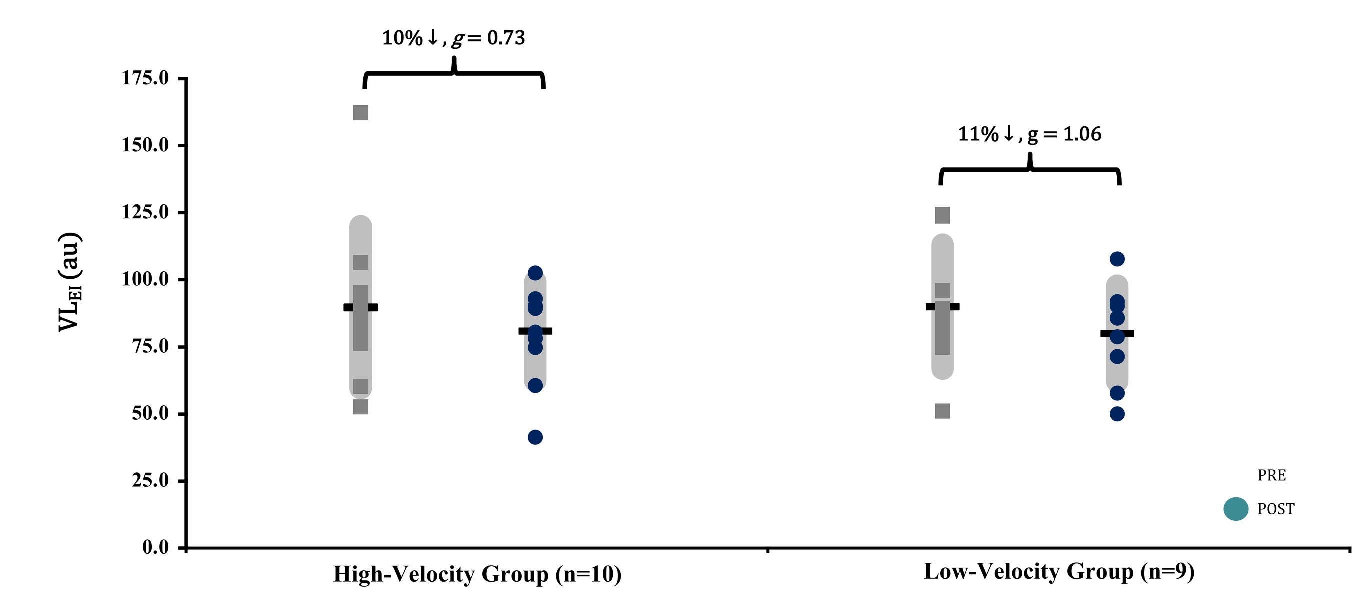

Figure 5. Changes in echo intensity of VL in HV and LV training groups from PRE to POST.

Conclusions

Improvements in RF and VL CSA were discovered in both groups, with a significant increase in VL_{CSA} when collapsed across groups between PRE and POST intervention. Additionally, the reduction in Vlei in the HV and LV from pre to post suggest the increase in VL_{CSA} could be due to an increase in muscle tissue

Practical Applications

Clinicians, coaches, and practitioners can incorporate both HV and LV training techniques in exercise programing for older adults to produce an increase in lower body CSA and muscle size.

Acknowledgements

This study was supported by the Young Investigator Grant from the National Strength and Conditioning Association Foundation awarded to M.A.M

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