

Hemodynamic Responses to Moderate and High Intensity Leg Press and Squat Resistance Exercise

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Introduction

Augmenting central and peripheral blood pressure (BP) is critical for delivery of oxygen and nutrients to skeletal muscle. However, the magnitude of response is an important consideration given that insufficient or exaggerated BP response to exercise may result in exercise intolerance or increased risk of cardiovascular events. Early research suggests exaggerated central and peripheral BP responses to high-intensity resistance exercise, resulting in conservative exercise prescription in adults with cardiovascular disease risk factors. The Valsalva maneuver seems to mediate the responses, resulting in recent data suggesting higher repetitions have a greater role in total pressure responses. However, these findings are inconsistent largely due to a lack of research comparing manipulation in training variables. The purpose of this study is to compare the differences in central and peripheral BP in response to moderate and high-intensity squat and leg press (LP) exercises in sedentary and active apparently healthy adults.

Methods

This study included 17 apparently healthy adults (Table 1). 6 trials were performed, the first two involved maximal strength tests (1RM) in both squat and leg press. The remaining four randomized trials, consisted of doing 15 reps at 60% 1RM and 8 reps at 80% on both leg press and squat. During all trials, measures of BP (AtCor's SphygmoCor) were taken at baseline, between each set, and following the exercise session. Sessions were separated by a 7-day period.

Results

Descriptive data for sedentary, active, women, and men are found in Table 1. As a whole, moderate intensity had a higher aSBP response than heavy (Figure 1). Subgroup analysis revealed a significant augmentation in summative aSBP from squat moderate compared to heavy LP and squat (Figure 2). Sex analysis revealed women have a significant augmentation in summative aSBP from squat and LP moderate (Figure 3) compared to heavy squat and LP.

Results

Table 1. Subject Characteristics

Variable	Sedentary (n=8)	Active (n=9)	Women (n=9)	Men (n=8)
Age (y)	24.0 ± 2.1	22.7 ± 2.3	22.7 ± 2.2	24.0 ± 2.2
Weight (kg)	88.2 ± 14.5	76.4 ± 17.4	74.5 ± 19.7	90.4 ± 6.3*
Height (m)	1.72 ± 0.10	1.73 ± 0.12	1.70 ± 0.11	1.75 ± 0.10
1RM Squat (kg)	80.1 ± 22.6	115.7 ± 48.7	75.0 ± 13.9	125.9 ± 46.9*
1RM:W Squat Ratio	0.94 ± 0.31	1.47 ± 0.40†	1.05 ± 0.24	1.41 ± 0.56
1RM LP (kg)	215.6 ± 52.8‡	277.5 ± 113.0‡	198.7 ± 31.4‡	304.3 ± 108.8*‡
1RM:W LP Ratio	2.51 ± 0.72‡	3.56 ± 0.99†‡	2.75 ± 0.42‡	3.42 ± 1.36‡

All data are presented as mean ± SD. 1RM, one-repetition max; LP, leg press. *P<0.05 significant difference between men and women; †P<0.05 significant difference between active and sedentary; ‡P<0.001 significant difference between LP and squat.

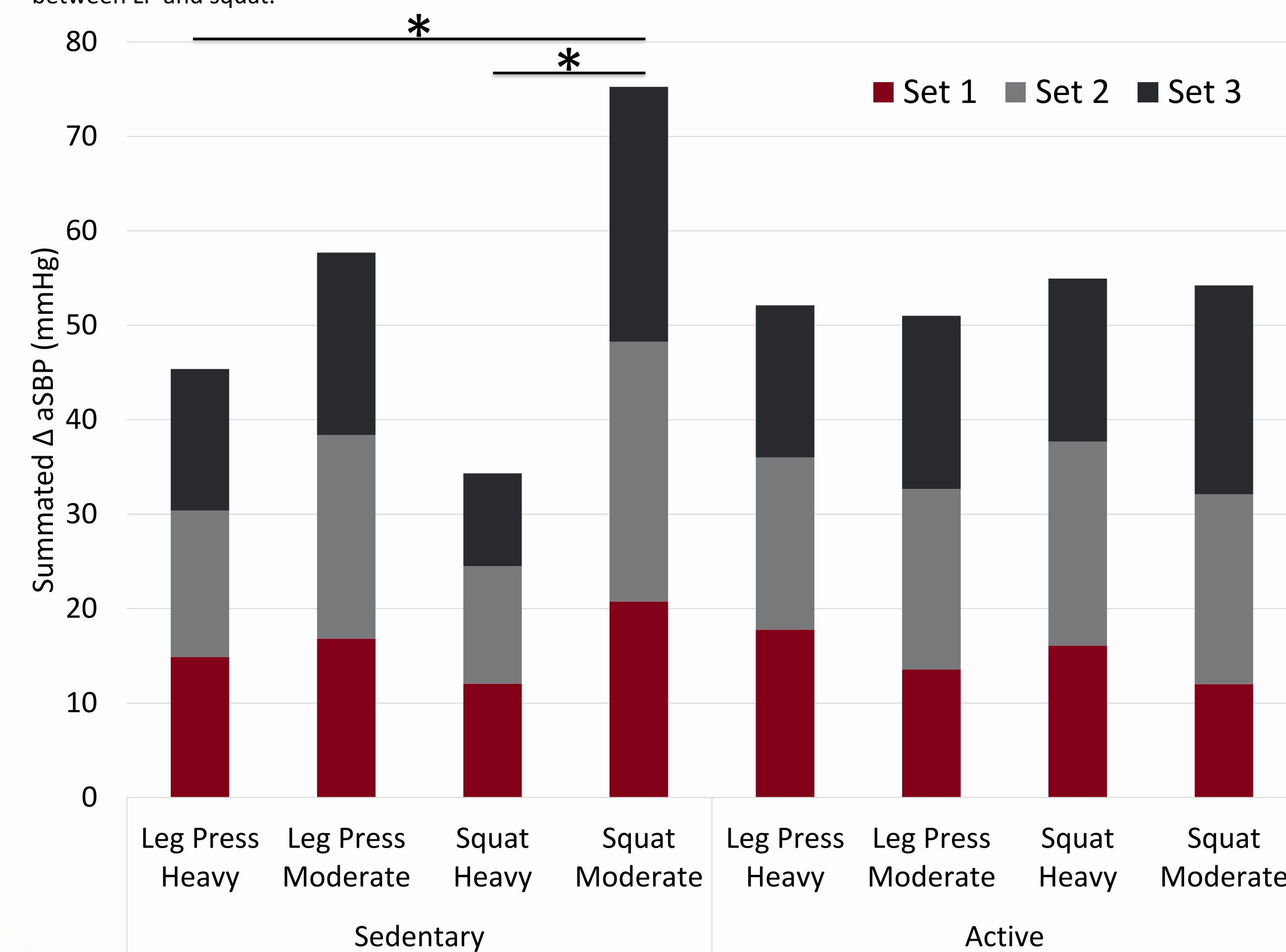


Figure 1. Summated aortic systolic blood pressure (aSBP) responses in sets 1, 2, and 3 to heavy and moderate leg press and squat exercises in sedentary and active adults.

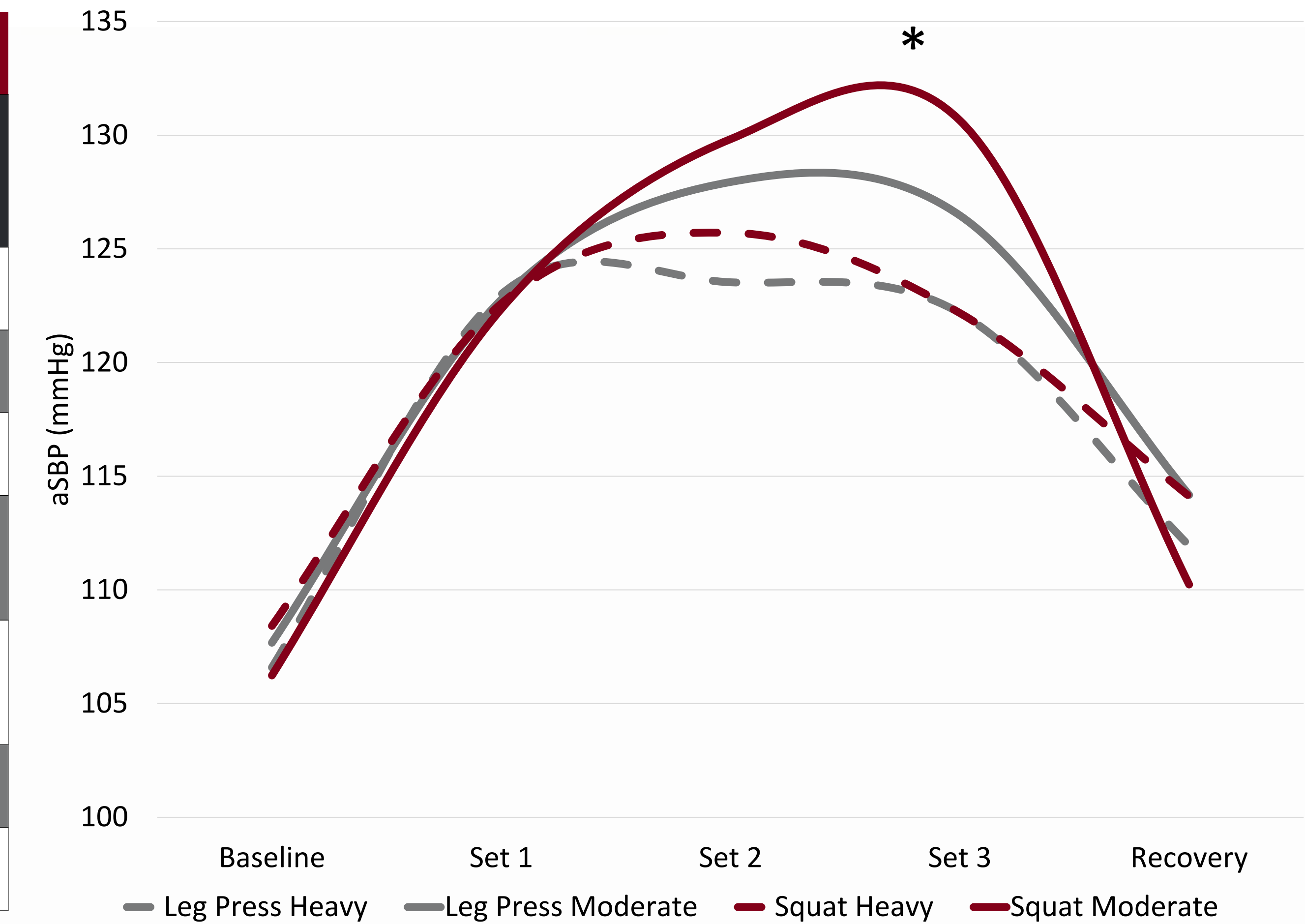


Figure 1. Aortic systolic blood pressure (aSBP) responses to leg press heavy, leg press moderate, squat heavy, and squat moderate at baseline, after sets 1, 2, and 3, and 10-minutes post exercise recovery.

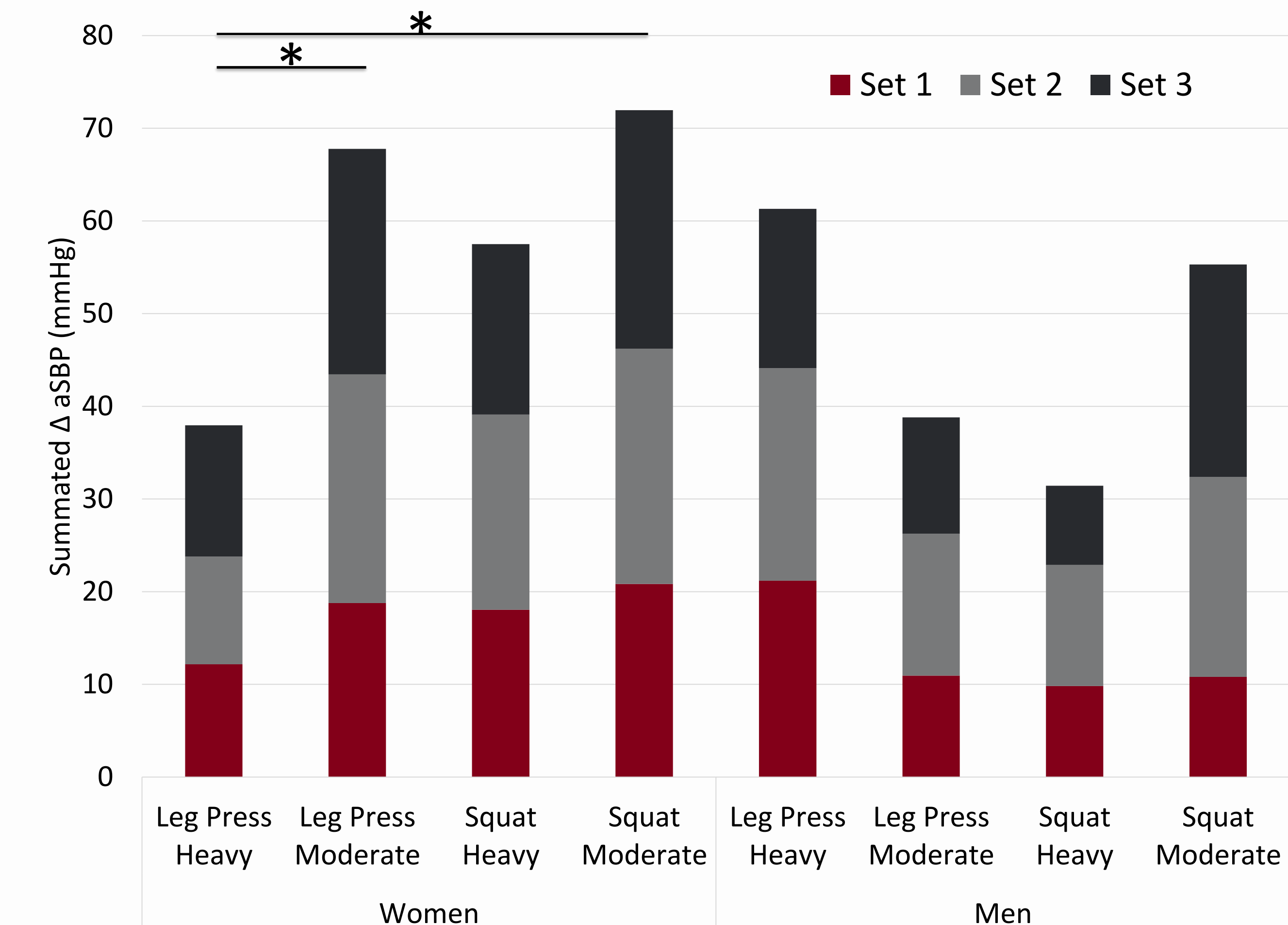


Figure 2. Summated aortic systolic blood pressure (aSBP) responses in sets 1, 2, and 3 to heavy and moderate leg press and squat exercises in women and men.

Conclusion

The study revealed that doing resistance training at a light to moderate intensity with high reps caused a larger BP response in the body, particularly in untrained adults and women. Although common practice is to prescribe light-moderate resistance exercise for untrained adults, from a vascular standpoint, these data contradicts conventional procedure as these pressures over time may result in increasing arterial stiffness, left ventricular afterload, and ultimately detrimental cardiac morphology. The mechanism in which women are more affected is unknown, perhaps due to low sample size, and will require further research.