

## Combination of Upper- and Lower-Body Resistance Exercise on Hemodynamics in Young Women

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### ABSTRACT

Hemodynamic responses are different between upper- and lower-body resistance exercise (RE). However, different orders of combined upper- and lower-body RE on hemodynamic responses are unknown.

**PURPOSE:** To evaluate the effects of different orders of upper- and lower-body RE on hemodynamics in young healthy women. **METHODS:** Seven young healthy women (22±2 years old) volunteered in the study. Heart rate (HR), mean arterial pressure (MAP), cardiac output (CO), stroke volume (SV), and total peripheral resistance (TPR) were assessed using photoplethysmography at rest, 15-20 (Rec1), and 25-30 (Rec2) minutes after completion of either upper- first then lower-body RE (U-L) or lower- first then upper-body RE (L-U) for 3 sets of 10 repetitions at 75% 1-repetition maximum with 1.5-minute and 2-minute rests between sets and exercises, respectively. The upper- and lower-body RE consisted of latissimus pulldown and inclined chest press, and leg extension and leg curl, respectively. A repeated measures ANOVA was used to evaluate the conditions (U-L, L-U) across time (rest, Rec1, Rec2) on hemodynamics. **RESULTS:** There were time-by-condition interactions ( $p=0.049$ ) for TPR such that TPR was significantly decreased at Rec1 compared to rest and Rec2 after L-U (U-L: rest:  $0.86\pm 0.33$  mmHg•min/L; Rec1:  $0.62\pm 0.26$  mmHg•min/L; Rec2:  $0.66\pm 0.20$  mmHg•min/L; and L-U: rest:  $0.99\pm 0.32$  mmHg•min/L; Rec1:  $0.59\pm 0.15$  mmHg•min/L; Rec2:  $0.73\pm 0.16$  mmHg•min/L). There were main effects of HR and CO such that HR (U-L: rest:  $67\pm 4$  bpm; Rec1:  $92\pm 12$  bpm; Rec2:  $86\pm 11$  bpm; and L-U: rest:  $65\pm 6$  bpm; Rec1:  $90\pm 7$  bpm; Rec2:  $80\pm 5$  bpm) and CO (U-L: rest:  $6.82\pm 1.26$  L/min; Rec1:  $8.87\pm 1.44$  L/min; Rec2:  $8.38\pm 1.21$  L/min; and L-U: rest:  $6.46\pm 1.12$  L/min; Rec1:  $8.83\pm 1.47$  L/min; Rec2:  $7.74\pm 0.87$  L/min) were significantly increased at Rec1 compared to rest and Rec2 after both conditions. However, there was no change for MAP or SV. **CONCLUSION:** These data suggest that the combination of upper- and lower-body resistance exercise significantly alters heart rate, cardiac output, and total peripheral resistance regardless of the order.