Independent and Combined Effects of Aerobic and Resistance Training on Sarcopenic Indices and Its Associations with Peripheral and Central Blood Pressure

Duck-chul Lee, Elizabeth C. Schroeder

Iowa State University, Ames, IA

Objectives: To investigate the effects of aerobic and/or resistance training on sarcopenic indices and associations between changes in appendicular lean mass (ALM) and blood pressure (BP) and heart rate (HR).

Methods: This 8-week randomized controlled exercise intervention includes 69 adults aged ≥45 years (mean age 58) with pre/stage1 hypertension, overweight/obese, and sedentary individuals. Participants were randomly assigned in aerobic exercise, resistance exercise, a combination of both, and control group. Exercise participants exercised 3 days/week for 60 minutes/session. Sarcopenic indices include ALM, appendicular lean mass index (ALMI), total lean mass (TLM), and total lean mass index (TLMI) using multifrequency bioelectrical impedance (InBody 720). ALM was derived as the sum of the lean mass of the four limbs, and TLM as total lean mass. ALM and TLM were then normalized by dividing by body mass index (kg/m^2) to yield ALMI and TLMI. BP and HR were measured using the SphygmoCor device.

Results: ALM and TLM appeared to increase in all exercise groups, but decrease in control group. ALMI significantly increased in aerobic exercise group (p=0.03), and this increase was significantly different from the control group (p=0.03) after adjusting for age, sex, and baseline ALMI using linear mixed-effects model. We found a similar results in TLMI. In the analyses on the associations between changes in ALM and BP or HR, participants who increased ALM were more likely to decrease peripheral systolic, central systolic and diastolic BP, and HR. In multivariable linear regression, although not significant (p>0.05), participants who increased ALM appeared to decrease 1.5, 1.2, and 1.2 mmHg and 1.9 bpm in peripheral systolic, central systolic and diastolic BP, and HR, respectively, after adjusting for age, sex, baseline value of BP or HR, and weight change.

Conclusion: Aerobic exercise prevents sarcopenia, and increasing ALM appeared to reduce BP and HR.

Table 1. Baseline, Follow-up, and Changes in Sarcopenic Indices by Exercise Training Type

	No. of Partici-pants	Mean (SE)		Mean (95% Confidence Interval)		Pair-Wise P Value
		Baseline Values	Follow-up Values	Within-Group Changes	Between-Group Comparison vs Control Group Changes	
Appendicular Lean Mass (kg)						
Aerobic	17	23.90 (0.19)	24.11 (0.19)	0.20 (-0.32, 0.72)	0.39 (-0.35, 1.12)	0.30
Resistance	17	23.91 (0.19)	23.90 (0.19)	0 (-0.52, 0.52)	0.18 (-0.55, 0.92)	0.62
Combination	18	23.90 (0.18)	24.18 (0.18)	0.28 (-0.23, 0.78)	0.46 (-0.26, 1.18)	0.21
Control	17	23.90 (0.18)	23.71 (0.18)	-0.18 (-0.70, 0.33)		
Appendicular Lean Mass/BMI*						
Aerobic	17	0.742 (0.005)	0.760 (0.005)	0.017 (0.002, 0.032)	0.024 (0.002, 0.045)	0.03
Resistance	17	0.742 (0.005)	0.742 (0.005)	0 (-0.016, 0.015)	0.006 (-0.016, 0.028)	0.58
Combination	18	0.742 (0.005)	0.745 (0.005)	0.003 (-0.012, 0.018)	0.009 (-0.012, 0.031)	0.39
Control	17	0.742 (0.005)	0.735 (0.005)	-0.006 (-0.022, 0.009)		
Total Lean Mass (kg)						
Aerobic	17	50.60 (0.33)	50.94 (0.33)	0.34 (-0.64, 1.33)	0.49 (-0.90, 1.88)	0.49
Resistance	17	50.29 (0.32)	50.51 (0.32)	0.22 (-0.76, 1.20)	0.37 (-1.02, 1.75)	0.60
Combination	18	49.95 (0.31)	50.53 (0.31)	0.58 (-0.38, 1.53)	0.72 (-0.65, 2.09)	0.30
Control	17	50.20 (0.32)	50.06 (0.32)	-0.14 (-1.13, 0.84)		
Total Lean Mass Index/BMI*						
Aerobic	17	1.560 (0.010)	1.593 (0.010)	0.033 (0.005, 0.061)	0.039 (-0.001, 0.079)	0.06
Resistance	17	1.560 (0.010)	1.566 (0.010)	0.006 (-0.022, 0.034)	0.012 (-0.028, 0.052)	0.55
Combination	18	1.559 (0.010)	1.565 (0.010)	0.005 (-0.022, 0.033)	0.011 (-0.028, 0.050)	0.57
Control	17	1.558 (0.010)	1.552 (0.010)	-0.006 (-0.034, 0.022)		

Values are expressed as fitted mean and all are adjusted for age, sex, and baseline value

*Appendicular/Total Lean Mass Index based on the US Foundation for the National Institutes of health (FNIH) Sarcopenia Project definition

Table 2. Changes in Blood Pressure and Heart Rate by Appendicular Lean Mass Increase

	Peripheral Blood Pressure (mmHg)		Central Blood Pressure (mmHg)		Heart Rate (bpm)
	SBP	DBP	SBP	DBP	
Linear Regression*					
β coefficient (SE)	-1.46 (2.31)	0.58 (1.99)	-1.16 (2.04)	-1.16 (1.59)	-1.92 (1.83)
p-value	0.53	0.77	0.57	0.47	0.30

Values are means (SE).

*Adjusted for age, sex, baseline value, and weight change