Resting Systolic Blood Pressure and Body Mass Index but Not Aortic Stiffness Independently Predict Systolic Blood Pressure Response to Maximal Exercise in Healthy Adults

Abbi D Lane-Cordova[1], Lyndsey E Dubose[1], Kaitlyn Dubishar[1], Michelle W Voss[2], Maggie Swift[2], Gardar Sigurdsson[3], Philip G Schmid[3,6], Gary L Pierce[1,4,5,6]

[1]Departments of Health And Human Physiology, [2]Psychology, [3]Internal Medicine, and the [4]Fraternal Order of Eagles Diabetes Research Center, [5]Center for Hypertension Research, [6]Abboud Cardiovascular Research Center, University of Iowa, Iowa City, IA

Objectives: Exaggerated systolic blood pressure (BP) response to maximal exercise is associated with incident hypertension and cardiovascular disease (CVD) death. Aortic stiffness, measured by carotid-femoral pulse wave velocity (cfPWV), is a robust predictor of CVD and is related to systolic BP at the 2nd stage of a graded exercise treadmill test. However, because stage 2 of a graded exercise test represents a different relative workload (% of maximal exercise oxygen uptake, VO2max) for each participant, differences in submaximal exercise systolic BP response may be related to variation in VO2max rather than cfPWV. Therefore, we hypothesized that systolic BP at maximal exercise would be associated with cfPWV independent of VO2max in healthy adults. **Methods:** Heart rate (HR, 12-lead ECG) and systolic BP (measured by an experienced exercise physiologist) were assessed during a maximal graded exercise test (cycle ergometer), and cfPWV was measured via applanation tonometry at rest in 37 healthy adults (11M/26F; age=46 ± 3 yrs; range: 19-71 yrs). **Results:** Peak exercise systolic BP was associated with age (r=0.30, P=0.046), body mass index (BMI, r=0.49, P=0.001), cfPWV (r=0.44, P=0.005), and resting systolic BP (r=0.73, P<0.001), but not maximal exercise HR (r=-0.15, P=0.33) or VO2max (r=-0.24, P=0.16). In a hierarchical multiple regression model including age, sex, BMI, VO2max, peak HR and cfPWV (model 1), only BMI predicted maximal exercise systolic BP (β=0.370, Model R2=0.38, P=0.02). Adding resting systolic BP to the model (model 2), significantly improved the overall R2 by 31% and resting systolic BP (β=0.700, P<0.01) and BMI (β=0.278, P=0.03) both predicted maximal exercise systolic BP (Model R2=0.69, P<0.01, Table 1). **Conclusions:** resting systolic BP and BMI, not cfPWV, predict the systolic BP response to maximal exercise. Reducing resting BP and adiposity may decrease the risk of hypertension and CVD in part by attenuating repeated exaggerated BP responses to physical exertion.

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Table 1. Hierarchical Regression Analysis: Determinants of Peak Exercise SBP.

Model	Predictor	Coefficients for Individual Predictors				Model Coefficients (*p*-value)	
		B (SE)	β	Partial *r*	*p*-value	Model R^2	ΔR^2 from Previous
1						0.38 (0.020)	0.38 (0.020)
	Age *(yr)*	0.715 (0.444)	0.412	0.282	0.118		
	Sex	-0.035 (14.046)	-.001	-.001	0.997		
	BMI *(kg/m^2)*	3.649 (1.623)	0.370	0.380	0.032		
	VO_2max*(ml/kg/min)*	-0.49 (0.742)	-.012	-.012	0.948		
	Peak HR *(bpm)*	0.611 (0.409)	0.311	0.263	0.146		
	cfPWV*(cm/s)*	0.36 (0.32)	0.237	0.200	0.273		
2						0.69 (0.012)	0.31 (<0.001)
	Resting SBP*(mmHg)*	1.762 (0.330)	0.700	0.704	0.000		
	Age *(yr)*	0.193 (0.335)	0.111	0.106	0.570		
	Sex	12.692 (10.425)	0.167	0.220	0.233		
	BMI *(kg/m^2)*	2.739 (1.185)	0.278	0.394	0.028		
	VO_2max*(ml/kg/min)*	0.312 (540)	0.079	0.107	0.568		
	Peak HR *(bpm)*	0.410 (298)	0.209	0.248	0.179		
	cfPWV*(cm/s)*	0.025 (0.023)	0.167	0.197	0.288		

Table Legend. "B" = Unstandardized Coefficient, "SE" = Standard Error, "β" = Standardized Coefficient.