Impact of a Family History of Hypertension and Physical Activity on Left Ventricular Mass

NCT05334355

3/14/2023

Participants:

The experimental protocols and the process for obtaining informed consent conformed with the Declaration of Helsinki and were approved by the Institutional Review Board of Montclair State University. Informed consent was obtained from all participants included in the study prior to the start of data collection. All participants were recruited in and around the Department of Exercise Science and Physical Education. Participants were separated into two groups dependent on their self-reported FHH status. Participants also self-reported physical activity behavior. Physical activity was reported as the number of days per week performing moderate and/or vigorous physical activity for at least 10 minutes for recreation. Participants were excluded from the study if they reported any prior cardiovascular diagnoses.

Experimental Protocol

Participants were asked to fast (water allowed) for 4hr, abstain from caffeine for 12hr, and avoid alcohol, over-the-counter drugs, and exercise 24hrs prior to data collection. During this visit, BP, heart rate (HR), and mean arterial pressure (MAP) were recorded (Omron BP785N Blood pressure monitor, Lake Forest, IL, USA). The average of three measurements was recorded after ≥5 minutes of rest in the supine position. Height and weight were collected (Detectco, Webb City, MO, USA) and used to calculate BSA; BSA = 0.007184 x $weight_{kg}^{0.425}$ x $height_{cm}^{0.725}$ (Du Bois, 1916).

Echocardiographic assessments were made while participants rested in the left lateral decubitus position. All measurements were made using a GE Vivid i Ultrasound (GE healthcare, Jiangsu, China) with a 2-5-MHz cardiac transducer. Participants underwent an echocardiogram using the parasternal long axis view, apical four chamber, and apical two chamber views according to the American Society of Echocardiography [2,3]. Briefly, the parasternal long axis view was done with the probe placed near the 3rd intercostal space adjacent to the sternum. Linear measurements of wall thicknesses and ventricular chamber diameter were measured using two-dimensional brightness mode ultrasound and were assessed just below the level of the mitral valve leaflet tips perpendicular to the LV long axis. End-diastole was defined as the first frame after the mitral valve closes. End systole was defined as the last frame before the mitral valve opened. LVM was calculated at end-diastole as LVM = 0.8 x 1.04 x [(IVS + LVID + PWT)^3 – LVID^3] + 0.6; where IVS is interventricular septum, PWT is posterior wall thickness, and LVID is left ventricular internal diameter [3]. Relative wall thickness (RWT) at end-diastole was calculated as RWT = (2 x PWT) / LVID [3]. Percentage fractional shortening (FS) was calculated as 100 x [($LVID_{Diastole}$

– $LVID_{Systole}$) / $LVID_{Diastole}$] [3]. Aortic diameter was measured at the aortic annulus during peak systole in the parasternal long axis view and was used to estimate aortic area using the following formula: CSA = D^2 x 0.785 [2]. Apical views were done with the probe placed near the 5^{th} or 6^{th} intercostal space on the body's flank. Left ventricular volumes at end-diastole and end-systole were assessed using the modified Simpson's method of biplane disk summation [3]. Ejection fraction (EF) of the left ventricle was calculated as EF = [(EDV – ESV) / EDV] x 100; where EDV is end-diastolic volume, and ESV is end-systolic volume [3]. Stroke volume (SV) was calculated as SV = EDV – ESV. Cardiac output (Q) was calculated as Q = $SV_{L/min}$ x HR. MAP was calculated as MAP = [(1/3) x SBP] + [(2/3) x DBP]; where SBP is systolic blood pressure, and DBP is diastolic blood pressure. Total peripheral resistance (TPR) was calculated as TPR = MAP / Q.

Statistical Analysis

Normality was tested using the Shapiro-Wilk test where significance ($p<0.05$) indicated a non-normal distribution. Both LVM and LVM/BSA violated the Shapiro-Wilk test of normality. Simple bivariate comparisons between groups were made using unpaired t-tests for normally distributed variables, and Mann-Whitney tests when normality was violated. Effect sizes for bivariate comparisons were estimated using Cohen's d with 95% confidence intervals. Spearman's rank correlations coefficient (rho) was used to examine relationships within each group and for all participants and variables of interest vs. LVM and LVM/BSA. ANCOVA tests were used to examine LVM and LVM/BSA compared between groups while statistically controlling for covariates of interest. LVM and LVM/BSA were logarithmically transformed prior to the ANCOVA investigations. The ANCOVA models were as follows. In model 1, age, SBP and sex were selected as common participant characteristic covariates that impact LVM and LVM/BSA. Model 2 accounted for the days per week of moderate-intensity exercise. Model 3 accounted for the days per week of vigorous-intensity exercise. Model 4 covariates included EDV and TPR as indices of preload and afterload. A significant probability value ($p<0.05$) within the ANCOVA model for FHH status was interpreted as finding between-group differences when statistically controlling for the covariate variables. A lack of FHH significance in the model was interpreted as FHH status does not impact LVM or LVM/BSA independently of the covariate variable(s) within the model. Data is expressed as mean±SD. The alpha level for significance was set at $p<0.05$. All statistical tests were performed using JASP version 0.14.1 (University of Amsterdam, Amsterdam, The Netherlands).

Data Availability

Data is available on the Montclair State University Digital Commons website at:

https://digitalcommons.montclair.edu/data/10

References

1. Du Bois D. Clinical Calorimetry. Arch Intern Med. 1916;XVII:863.

2. Quiñones MA, Otto CM, Stoddard M, Waggoner A, Zoghbi WA. Recommendations for quantification of Doppler echocardiography: A report from the Doppler quantification task force of the nomenclature and standards committee of the American Society of Echocardiography. J Am Soc Echocardiogr [Internet]. 2002;15:167–84. Available from: http://linkinghub.elsevier.com/retrieve/pii/S089473170245599X

3. Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L, et al. Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr [Internet]. 2015;28:1-39.e14. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0894731714007457