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Relationship between anthropometric indicators and cardiovascular reactivity in second-year students of the medicine career

Alejandro Sueiro Garra, Eiglis Jeanette Bravet Smith, Claribel Plain Pazos *, Anays Santos Sánchez and Idalmis Rosabal Armenteros

Department of Basic Biomedical Sciences, Faculty of Medical Sciences of Sagua la Grande, University of Medical Sciences of Villa Clara, Cuba.

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Abstract

After years of controversy, cardiovascular hyper-reactivity has been proposed as a risk indicator for developing arterial hypertension. At the same time, anthropometric indicators associated with cardiovascular risk have also been proposed. The aim of this study was to characterize cardiovascular activity and reactivity and their relationship with anthropometric indicators in second-year medical students. A random sample of 33 second-year medical students between 19 and 20 years of age was taken. Anthropometric and other variables were studied to characterize cardiovascular activity and reactivity, determining the mean by sex and their respective correlations. Most individuals were normoreactive. There were no significant differences between the sexes or strong relationships between the variables, although the means were higher in the male sex and the greatest association was between mean arterial pressure and body mass index.

Keywords: Cardiovascular Reactivity; Risk Indicator; Arterial Hypertension; Anthropometric indicators

1 Introduction

Knowledge of the determining factors in the progression to established arterial hypertension (AHT) is fundamental for defining groups at greater risk and concentrating intervention efforts and resources focused on reducing cardiovascular risk on them.[1]

Several risk factors have been established that increase the probability of developing AHT, including increasing age, increased heart rate, increased baseline blood pressure, obesity, increased left ventricular mass in children, and genetic factors, among others. [2,3]

Cardiovascular hyper-reactivity (CHR) is defined as an exaggerated response of the cardiovascular system to physical or mental stimuli, measured mainly by blood pressure (BP) or heart rate (HR) values. This indicator has been proposed as a risk factor for HTN.[4,5] In this regard, several authors have found a correlation between anthropometric indicators and estimated cardiovascular risk.[6,7] The aim of this study was to characterize cardiovascular activity and reactivity and their relationship with anthropometric indicators in second-year medical students.

*Corresponding author: Claribel Plain Pazos

2 Materials and Methods

A cross-sectional descriptive correlational study was carried out in the Faculty of Medical Sciences of Sagua la Grande between December 2021 and April 2022. A random sample of 33 young second year medical students was taken, 20 females and 13 males, aged between 19 and 20 years.

The variables studied to characterize cardiovascular activity were: systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and heart rate (HR). The MAP was calculated using the formula$MAP = 2 \times DBP + SBP/3$. These variables were measured at baseline[8] and after performance of the sustained weight test (SWT) to assess cardiovascular reactivity. The PPS was performed according to the methodology of Paz et al[7] and the condition of cardiovascular hyperresponsiveness was determined for the individual with an increase in blood pressure above 140 mmHg systolic and/or 90 mmHg diastolic, after the application of the SWT. A differential variable was also constructed for each of the originals (Δ), being the difference between the value obtained by SWT minus the baseline value (ΔSBP, ΔDBP, ΔMAP and ΔHR).

The anthropometric variables studied were the body mass index (BMI), obtained by measuring height and weight using the formula$\text{BMI} = \frac{\text{weight(Kg)}}{\text{height(m)}^2}$ and the waist-to-hip ratio (W/H), which is the quotient between waist circumference and hip circumference.

Descriptive statistics (arithmetic mean and variance) were determined for each variable. For the comparison of means between both sexes, the Student's t-test was applied and the relationship between the variables was determined by Pearson's correlation test. Statistical processing was performed using SPSS vs 24 software for Windows.

3 Results and Discussion

Figure 1 shows that of the 33 young people studied, three were classified as hyper-reactive (9%), and one as hypertensive (3%) and the rest (88%) were classified as cardiovascular normoreactive. The first four were all male.

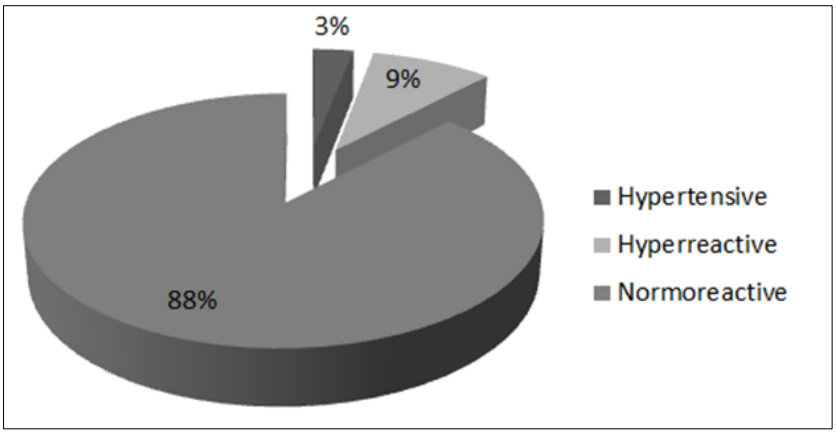

Figure 1 Cardiovascular characterization of the study group

As can be seen in Table 1, the mean values of SBP, DBP and MAP were higher in the male sex, although without statistically significant differences. These results coincide with the study by Santana et al[9] although they differ from the results obtained by Sánchez et al, who found a slight female superiority.[10] HR behaved inversely, with the female mean being higher than the male mean, also without statistically significant differences. As expected, the differential variable behaved in the same way, with the characteristic that in all cases the differences between females and males were statistically significant.

In this regard, it should be noted that the value that varied most in both sexes after SWT was SBP.

The mean values of the anthropometric variables did not show statistically significant differences between sexes. For both variables, the mean value of males was higher than that of females. In the case of BMI, this could be due to the greater development of muscle mass in men, particularly accentuated in this age group. With respect to the W/H index,

this could also be explained by the sexual dimorphism of adiposity, preponderant in the abdominal area in men and in the gluteal region in women.[11]

Table 1 Descriptive statistics by sex of the variables (Var) studied

Var	Arithmetic mean			Variance			T-Student
	Female	Male	Total	Female	Male	Total	
SBP	107.05	120.78	112.20	11.61	8.83	12.49	0.00
	117.40	130.33	122.25	10.45	10.22	12.02	0.00
	10.35	9.56	10.05	5.88	6.92	6.19	0.74
DBP	69.07	77.67	72.29	7.43	11.07	9.76	0.03
	76.75	88.83	81.28	7.45	9.79	10.16	0.00
	7.68	11.17	8.99	6.77	9.62	7.99	0.29
AMP	81.73	92.04	85.59	7.87	9.84	9.90	0.01
	90.30	102.67	94.94	7.38	9.65	10.17	0.00
	8.57	10.63	9.34	5.46	8.01	6.49	0.44
HR	77.95	65.17	73.16	7.37	12.76	11.43	0.01
	82.25	73.00	78.78	7.32	6.99	8.42	0.00
	4.30	7.83	5.63	4.74	11.58	8.02	0.33
BMI	20.04	22.34	20.90	2.85	3.00	3.07	0.04
W/H	0.75	0.84	0.78	0.04	0.05	0.06	0.00

Legend: for cardiovascular variables, the first value corresponds to baseline status, the second to SWT and the third value is the difference (Δ) between the second minus the first. The T-Student value corresponds to the significance level (α) of the test.

Table 2 Results of the Pearson correlation (ρ coefficient) between cardiovascular and anthropometric variables by sex

Variables	BMI	W/H
MAP_f	0.38	0.02
MAP_m	0.61	0.51
MAP_t	0.57	0.50
$MAP\text{-}SWT_f$	0.41	-0.20
$MAP\text{-}SWT_m$	0.50	0.44
$MAP\text{-}SWT_t$	0.55	0.47
HR_f	0.16	-0.04
HR_m	0.30	0.38
HRt	-0.03	-0.29
$HR\text{-}SWT_f$	-0.05	0.16
$HR\text{-}SWT_m$	0.24	0.42
$HR\text{-}SWT_t$	-0.15	-0.24

Legend: subscript f indicates female, subscript m indicates male and subscript t indicates total

Table 2 shows the results of the correlation tests between the cardiovascular variables MAP and HR and the anthropometric variables. Although no value of the ρ coefficient indicates a strong correlation between the variables

studied, it is notable that most of the correlations between MAP and the anthropometric variableswere considerably higher than those obtained between HR and the anthropometric variables. In this sense, a greater relationship was observed between MAP values and BMI.

4 Conclusion

Young males present mean values of higher blood pressure and lower heart rate than females. Most of the age group studied is cardiovascular normoreactive and there is a directly proportional relationship between body mass index and mean arterial pressure.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare the non-existence of conflict of interest in the research.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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