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Hypertension in young university students: analysis of risk factors in medical students

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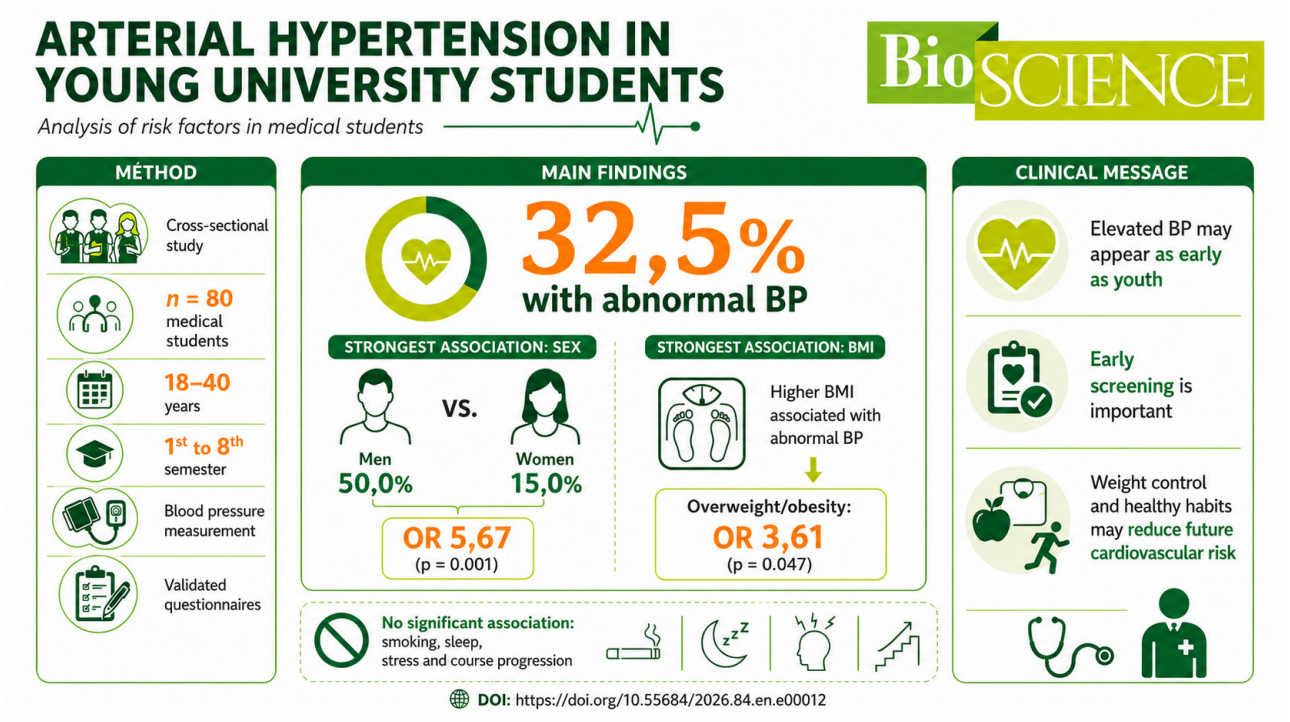

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Central Message
Hypertension is the main modifiable risk factor for global cardiovascular morbidity and mortality, although its investigation in young adults is still limited. In a cross-sectional study with medical students, a high prevalence of altered blood pressure levels (32.5%) was observed, with a significant association with male gender and high body mass index. The findings show that blood pressure changes are already present in a young population, traditionally considered to be at low risk, reinforcing the need for early surveillance.

Perspective
The significant presence of altered blood pressure in medical students suggests that cardiovascular risk factors may be underestimated in young populations. The association with male gender and high BMI reinforces the role of modifiable factors in the genesis of early hypertension. Although variables such as stress, smoking, and sleep quality did not show a significant correlation, the results support the importance of preventive strategies and lifestyle interventions from youth, with a potential impact on the future reduction of the incidence of cardiovascular diseases.

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ABSTRACT

Introduction: Although the harmful impact of hypertension is well known, most studies focus on high-risk populations or older people, leaving the evidence for young adults, traditionally considered low-risk, limited. Awareness and control of hypertension are low among young people, which becomes a significant concern since high blood pressure in youth can increase the risk of cardiovascular disease in adulthood.

Objective: To evaluate the blood pressure of medical students from the first to the eighth semesters.

Method: Cross-sectional observational study, in which 80 students enrolled from the first to the eighth semesters were randomly interviewed.

Results: 32.5% had altered blood pressure, with males being a significant risk factor for hypertension, with men being 5.67 times more likely to develop hypertension compared to women (p = 0.001). BMI was also a determining factor, with individuals with a higher index having a higher prevalence of altered blood pressure. There was a negative correlation between stress levels and systolic pressure (p = 0.019), indicating a slight reduction in blood pressure in more stressed students. Smoking and poor sleep did not show a significant correlation with blood pressure. In addition, throughout the academic periods, there was stability in the values without significant variations associated with progress in the course, with the exception of diastolic pressure, which decreased in the more advanced periods (p = 0.025).

Conclusion: Preventive actions should be adopted to change lifestyle even in younger populations so that, in the long term, these changes result in lower incidence and prevalence of cardiovascular diseases.

KEYWORDS: Hypertension. Risk factors. Cardiovascular diseases. Medical students.

INTRODUCTION

In 2023, the World Health Organization (WHO) published the Global Report on Hypertension: the Race Against a Silent Killer, presenting hypertension in the world or systemic arterial hypertension (SAH)1. This is a chronic condition that increases the risk of mortality from cardiovascular, renal or cerebral diseases, such as stroke2-5, infarction, kidney failure, among others, and is characterized by high blood pressure levels (BP ≥ 140 x 90 mmHg).[6]

In epidemiological terms, the global prevalence of SAH is estimated at [1.28] billion adults, aged 30-79 years, of whom 46% are unaware of having the condition, as some are asymptomatic.[1,7-9] In Brazil, according to the 2023 Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone Survey (Vigitel), the percentage of self-reported SAH prevalence between 2006 and 2023 increased from 22.6% to 24.3%.[7] These data are of concern when one considers that most hypertensive individuals do not have an adequate diagnosis or are not under treatment, increasing the risk of complications.

Risk factors for SAH are divided into modifiable and non-modifiable. Among the non-modifiable, age, sex and genetic predisposition prevail. Hypertension tends to manifest itself more frequently in people over 60 years of age, and this is associated with senility processes such as arterial stiffness, which contributes to the increase in blood pressure.[2] Regarding gender, males are considered a risk factor until middle age, while after menopause, women have a similar or even higher prevalence of hypertension.[10] Genetic predisposition also plays an important role, influencing individual susceptibility to elevated blood pressure (BP).[11,12]

Modifiable factors - such as inadequate diet, sedentary lifestyle, smoking, excessive alcohol consumption and stress - are determinants in the prevention and control of SAH.[1,13-18] For example, a diet rich in sodium and low in potassium, typical of urban populations, is also related to a higher prevalence of hypertension.

Although SAH is traditionally associated with older individuals, as we have seen, there is a significant increase in cases among young people and young adults. Studies show that the prevalence of hypertension has grown among university students, often associated with academic stress, irregular sleep patterns, inadequate diet and sedentary lifestyle.[19-21]

In view of these data, the present study aims to present the results of the evaluation of BP values in a population of medical students, from the first and eighth periods. We sought to know the relationship with lifestyle habits such as diet, sleep, stress, smoking, alcoholism, physical activity, body mass index (BMI) and progression of values between the academic periods addressed in this study.

METHOD

This was a cross-sectional observational study that included 80 medical students from the Mackenzie Evangelical College of Paraná, Curitiba, PR, Brazil, and randomly selected between the 1st and 8th semesters. Volunteers between 18 and 40 years of age were included, equally distributed between the sexes. Students outside the age group or non-volunteers were excluded. The project was approved by the Research Ethics Committee of the institution (Opinion No. 6,817,896), and all volunteers signed a free and informed consent form.

Validated questionnaires were applied: AUDIT-C (alcohol), DQ-Q (diet), Fagerström test (smoking)[22], PSQI (sleep quality)[23], EPS-10 (stress)[24] and IPAQ (physical activity).[25] These instruments enabled the multidimensional assessment of risk factors.

The interviewees were asked about the practice of physical exercise for 90 minutes, consumption of alcohol, coffee, food or cigarettes in the last 30 minutes, or if they had a full bladder. In case of positive responses to these factors, the students were

evaluated in another session, as these elements could affect BP values.

BP was measured in a reserved room, after a 10-minute rest, with the participants seated and with a calibrated electronic sphygmomanometer (OMRON HEM-7122).[3,7] The sphygmomanometer cuff was placed about 2-3 cm above the cubital fossa, with the rubber bag centered on the brachial artery. In case of failure in the measurement using an electronic sphygmomanometer, the aneroid could be replaced according to appropriate criteria for its use.

In this case, the sphygmomanometer cuff was placed in the same position, with the rubber bag centered on the brachial artery. Next, the radial pulse was palpated and the cuff inflated until the pulse disappeared, thus estimating systolic blood pressure (SBP); then, it was quickly deflated. The procedure was similar, but after 15-30 s, the stethoscope was placed in the brachial artery and the cuff inflated every 10 mmHg until it exceeded 20-30 mmHg above the estimated SBP. This would be recorded when the first sound manifested (Korotkoff phase I), and diastolic blood pressure (DBP) was recorded when the sound disappeared (Korotkoff phase V) or when there were no more audible sounds (Korotkoff phase IV).

In the evaluation, three BP measurements were taken in alternate arms, with 2-min intervals between them. If and when there was a difference greater than 4 mmHg between the last two SBP and/or DBP measurements, new measurements were taken until smaller differences were obtained. If the mean SBP was equal to or greater than 140 mmHg and/or DBP was equal to or greater than 90 mmHg, two more evaluations were performed at different weeks, following the same procedure. If the values persisted, students would be advised to seek a specialist; and if SBP was less than 140 mmHg and DBP was less than 90 mmHg, BP values would be considered acceptable and a second assessment would not be performed.

Statistical analysis

The data were tabulated in Microsoft Excel and analyzed in IBM SPSS Statistics v.29.0.0. Descriptive statistics, Student's t-test for independent samples (two groups) or the analysis of variance model (ANOVA) with one factor (more than two groups) were used. For the univariate and multivariate analyses, logistic regression models were adjusted. The Wald test was used to analyze the significance of each variable and the estimated measure of association was the Odds Ratio (OR) with 95% confidence intervals (95%CI). Statistical significance was set at < 0.05.

RESULT

The study evaluated 80 students, and ten volunteers were selected per academic period contemplated in the research (first to eighth periods). The sample had a mean age of 21.6 years (SD = 3.6), with equal distribution between genders. The mean BMI was 22.3 kg/m² (SD = 2.5). The mean systolic pressure was 119.[7] mmHg and the diastolic pressure was 77.8 mmHg.

Of the 80 students, 32.5% had altered blood pressure. Of these, 21.3% were classified as pre-hypertensive, 8.8% as stage 1, and 2.5% as stage 2. Males were significantly associated with altered blood pressure (OR = 5.7; p = 0.001), as well as high BMI (OR = 3.61; p = 0.047).

Regarding lifestyle habits, 12.5% reported smoking, with different levels of dependence. Although 50% of the smokers had altered blood pressure, the analysis did not find a statistically significant correlation between smoking and hypertension.

Alcohol consumption was low risk in 56.3% of the sample and increased or high risk in another 22.5%. Students classified as high or very high risk in relation to alcohol consumption had a prevalence of 44.4% linked to altered blood pressure, compared to 29% of students with low or medium increased risk.

Regarding sleep quality, approximately half (48.8%) indicated unsatisfactory sleep. The analysis revealed that students with unsatisfactory sleep had a slightly higher prevalence of altered blood pressure (33.3%) compared to students with satisfactory sleep (31.7%). However, this difference was not statistically significant (p = 0.877), which can be explained by the relative homogeneity of blood pressure and sleep results in this sample. In addition, participants who reported poor sleep had slightly higher stress levels, which may indicate an indirect correlation between sleep, stress, and BP.

Regarding physical activity, 92.5% were classified as active or very active. These had a lower prevalence of altered blood pressure values compared to those who were less active.

Regarding the relationship between BP and gender, men were 5.67 times more likely to develop hypertension than women (p = 0.001). While 50% of men had altered BP, only 15% of women had altered values, which reflects a significant difference between the sexes.

Based on the scores obtained from the questionnaires applied in the interviews, the stress variable had a mean of 16.3 points, with a standard deviation of 5.9, with a median of 16, with a range between 5-32 points. There was a negative correlation between stress and systolic pressure (r = –0.26, p = 0.019), indicating that students with higher levels of stress had a slight decrease in systolic pressure. Moderate stress levels were observed in 61.3% of the sample.

Regarding the diet, the mean was 9.5 points with a standard deviation of 2.7, median of 10, and the observed values ranged from 1 to 15 points. About 45% of the participants indicated that they consume a diet below the WHO recommendation. Although no statistically significant association was found between diet and blood pressure, students with inadequate diets were more likely to develop hypertension.

Throughout the academic periods, blood pressure was monitored, and the data showed that systolic

pressure remained stable throughout the periods (p = 0.583), and diastolic pressure values decreased in the later periods (p = 0.025, Table).

DISCUSSION

The prevalence of 32.5% of altered BP is higher than expected for the age group, indicating the impact of academic and behavioral factors. This result is in line with national and international studies that report rates between 20-35% among university students.[14,19,26]

The male gender was a significant associated factor10, corroborating studies that indicate a higher prevalence of SAH in young men due to lower hormonal protection and greater exposure to risk behaviors, such as alcohol and tobacco. High BMI also showed a strong association[17,18], reinforcing evidence that excess weight is a determinant for blood pressure elevation even at early ages.

Limitations of variables such as poor sleep, inadequate diet, and stress[13,16,27] did not present a statistically significant association in this sample, their high frequency suggests a relevant role in the medium and long term. It is likely that the sample size limited the detection of additional associations. The high proportion of students with poor sleep and moderate or high stress highlights the importance of

Table — Data collected from the 80 students

Variable	Classification	Total	BP				p*	OR (95%CI)
			Unchanged		Changed			
			n	%	n	%		
Course period	1	10	5	50.0%	5	50.0%		
	2	10	7	70.0%	3	30.0%		
	3	10	5	50.0%	5	50.0%		
	4	10	7	70.0%	3	30.0%		
	5	10	5	50.0%	5	50.0%		
	6	10	10	100.0%	0	0.0%		
	7	10	8	80.0%	2	20.0%		
	8	10	7	70.0%	3	30.0%	-	-
Course year (4cl)	1 (ref)	20	12	60.0%	8	40.0%		
	2	20	12	60.0%	8	40.0%	0.999	1.00 (0.28 - 3.54)
	3	20	15	75.0%	5	25.0%	0.315	0.50 (0.13 - 1.93)
	4	20	15	75.0%	5	25.0%	0.315	0.50 (0.13 - 1.93)
Course year (2cl)	1 to 4 (ref)	40	24	60.0%	16	40.0%		
	5 to 8	40	30	75.0%	10	25.0%	0.155	0.50 (0.19 - 1.30)
Age (years)	[average ± SD]		21.7 ± 3.6		21.3 ± 3.5		0.595	0.96 (0.83 - 1.11)
Gender	Female (ref)	40	34	85.0%	6	15.0%		
	Male	40	20	50.0%	20	50.0%	0.001	5.67 (1.95 - 16.5)
BMI (kg/m2)	[average ± SD]		21.9 ± 2.5		23.2 ± 2.3		0.028	1.25 (1.02 - 1.53)
BMI classification	Below normal	1	1		0			
	Normal weight	67	48	71.6%	19	28.4%		
	Overweight	11	4	36.4%	7	63.6%		
	Obesity grade I	1	1	100.0%	0	0.0%	-	-
BMI classification	Below/normal (ref)	68	49	72.10%	19	27.9%		
(agrup)	Overweight/ obesity I	12	5	41.70%	7	58.3%	0.047	3.61 (1.02 - 12.8)
Smoking	No (ref)	70	49	70.0%	21	30.0%		
	Yes	10	5	50.0%	5	50.0%	0.216	2.33 (0.61 - 8.92)
Sleep	Unsatisfactory (ref)	39	26	66.7%	13	33.3%		
	Satisfactory	41	28	68.3%	13	31.7%	0.877	1.08 (0.42 - 2.75)
Alcohol	Low risk	45	32	71.1%	13	28.9%		
	Increased risk	17	12	70.6%	5	29.4%		
	High risk	10	5	50.0%	5	50.0%		
	Very high risk	8	5	62.5%	3	37.5%	-	-
Alcohol (group)	Low/Increased Risk (ref)	62	44	71.0%	18	29.0%		
	High/very high risk	18	10	55.6%	8	44.4%	0.223	1.96 (0.67 - 5.76)
Physical activity	Sedentary	2	1	50.0%	1	50.0%		
	Irregularly active A	3	3	100.0%	0	0.0%		
	Irregularly active B	1	1	100.0%	0	0.0%		
	Active	32	25	78.1%	7	21.9%		
	Very active	42	24	57.1%	18	42.9%	-	-
Stress (score)	[median (min-max)]		16 (5 - 32)		15 (5 - 24)		0.248	0.95 (0.88 - 1.04)
Classification	Low level (ref)	27	18	66.7%	9	33.3%		
	Moderate level	49	32	65.3%	17	34.7%		
	High level	4	4	100.0%	0	0.0%	-	-
Stress (group)	Low level (ref)	27	18	66.7%	9	33.3%		
	Moderate/high level	53	36	67.9%	17	32.1%	0.910	0.94 (0.35 - 2.53)
Diet (score)	[median (min-max)]		10 (1 - 14)		9.5 (4 - 15)		0.954	1.01 (0.84 - 1.20)
Diet (classification)	Average recom (ref)	12	11	91.7%	1	8.3%		
	Below average recom	36	23	63.9%	13	36.1%	0.097	6.22 (0.72 - 53.8)
	Above average recom	32	20	62.5%	12	37.5%	0.088	6.60 (0.76 - 57.7)

institutional policies aimed at academic well-being. The literature indicates that interventions in sleep quality, stress reduction, and promotion of physical activity are effective in reducing blood pressure levels in young people.[28-31] Longitudinal studies have shown that high blood pressure levels in young people are associated with a higher risk of future cardiovascular outcomes.[21,28,30,32]

CONCLUSION

Although most of the variables explored referring to modifiable risk factors did not present statistical significance with the altered BP values, it is concluded that there was also no statistically significant correlation between the progression of academic periods and altered blood pressure among medical students, which suggests that the advancement in the course, between the first and eighth periods, it was not a determining factor for the increase in blood pressure. However, a positive association was evidenced between variables such as BMI and gender and changes in blood pressure values, reinforcing the importance of weight control as a preventive measure for hypertension. In addition, other risk factors, such as alcohol consumption and physical activity, showed relevant trends, highlighting the need for greater attention to cardiovascular health among the young population and their lifestyle habits during academic life and after the training period. These findings highlight the importance of preventive interventions from the beginning of academic life, aiming to reduce the impact of modifiable risk factors and promote healthy lifestyle habits.

REFERENCES

1. World Health Organization (2023). Global report on hypertension: the race against a silent killer [Internet]. New York: World Health Organization; Sept. 291 p. https://www.who.int/publications/i/item/9789240081062
2. Feitosa ADM, Barroso WKS, Mion Junior D, Nobre F, Mota-Gomes MA, Jardim PCBV, et al. Diretrizes Brasileiras de Medidas da Pressão Arterial Dentro e Fora do Consultório – 2023. Arq. Bras. Cardiol. 121(4):e20240113. https://doi.org/10.36660/abc.20240113i
3. O'Brien E, Petrie J, Littler W, De Swiet M, Padfield PL, Dillon MJ, et al. Blood pressure measurement: an overview. Journal of Hypertension, 1991;9(4):355-67. https://doi.org/10.4414/smw.2012.13517
4. Magder S. The meaning of blood pressure. Crit Care. 2018;22(1):257. https://doi.org/10.1186/s13054-018-2171-1
5. Parati G, Stergiou GS, Dolan E, Bilo G. Blood pressure variability: clinical relevance and application. J Clin Hypertens (Greenwich). 2018;20(7):1133-7. https://doi.org/10.1111/jch.13304
6. Campbell NRC, Burnens MP, Whelton PK, Angell SY, Jaffe MG, Cohn J, et al. Diretrizes de 2021 da Organização Mundial da Saúde sobre o tratamento medicamentoso da hipertensão arterial: repercussões para as políticas na Região das Américas. Rev Panam Salud Publica. 2022;(46):1-10. https://doi.org/10.26633/RPSP.2022.55
7. Brasil. Ministério da Saúde. (2023). Vigitel Brasil 2023: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2023. Brasília: Ministério da Saúde; 131 p.
8. Guimarães F.J., Lessa I, Costa e Silva VL. Epidemiologia da hipertensão arterial sistêmica e da insuficiência cardíaca no Brasil. Revista Brasileira de Hipertensão, 2011;18(3):118-26.
9. Bloch KV, Rodrigues CS, Roberto F. Epidemiologia dos fatores de risco para hipertensão arterial: uma revisão crítica da literatura brasileira. Rev. bras. Hipertens. 2006;13(2)134-43.
10. Connelly PJ, Currie G, Delles C. Sex Differences in the Prevalence, Outcomes and Management of Hypertension. Curr Hypertens Rep. 2022;24(6):185-92. https://doi.org/10.1007/s11906-022-01183-8
11. Pinheiro DS, Santos RS, Jardim PCBV, Silva EG, Reis AAS, Pedrino GR, et al. The combination of ACE I/D and ACE2 G8790A polymorphisms revels susceptibility to hypertension: A genetic association study in Brazilian patients. PLoS One. 2019;14(8):e0221248. https://doi.org/10.1371/journal.pone.0221248
12. Egan BM. Defining Hypertension by Blood Pressure 130/80 mm Hg Leads to an Impressive Burden of Hypertension in Young and Middle-Aged Black Adults: Follow-Up in the CARDIA Study. J Am Heart Assoc. 2018;7(14):e009971. https://doi.org/10.1161/jaha.118.009971
13. Oliveira G, da Silva TLN, da Silva IB, Coutinho ESF, Bloch KV, de Oliveira ERA, et al. Agregação dos fatores de risco cardiovascular: álcool, fumo, excesso de peso e sono de curta duração em adolescentes do estudo ERICA. Cadernos de Saúde Pública, 2019;35(12):e00223318. https://doi.org/10.1590/0102-311X00223318
14. Palomo I, Torres GI, Alarcón MA, Maragano PJ, Leiva E, Mujica V. Alta prevalência de fatores de risco cardiovascular clássicos em uma população de estudantes universitários da Região Centro-Sul do Chile. Rev Esp Cardiol. 2006;59(11):1099-105. https://doi.org/10.1157/13095778
15. Cervato AM, Mazzilli RN, Martins IS, Marucci M de FN. Dieta habitual e fatores de risco para doenças cardiovasculares. Arquivos Brasileiros de Cardiologia, 1997;31(3):227-35. https://doi.org/10.1590/S0034-89101997000300003
16. Polacow VO, Lancha-Junior AH. Dietas hiperglicídicas: efeitos da substituição isoenergética de gordura por carboidratos sobre o metabolismo de lipídios, adiposidade corporal e sua associação com atividade física e com o risco de doença cardiovascular. Arq Bras Endocrinol Metab.2007;51(3):389-400. https://doi.org/10.1590/S0004-27302007000300006
17. Rezende FAC, Rosado LEFP, Ribeiro RCL, Vidigal FC, Vasques ACJ, Bonard IS, et al. Índice de Massa Corporal e Circunferência Abdominal: Associação com Fatores de Risco Cardiovascular. Arquivos Brasileiros de Cardiologia, 2006;87(6):728-34. https://doi.org/10.1590/S0066-782X2006001900008
18. Mazur EK, Grein Neto H, Bíscaro SSP, Moraes BHS, Palma IB, Guimarães LEL, Garcia AC. Efeitos das mudanças climáticas na saúde cardiovascular: um enfoque nos extremos de temperatura. BioSCIENCE. 2025;83(S2):e00001. https://doi.org/10.55684/2025.83.S2.e00001
19. Custódio B, Silva D, Theodoropoulos, D. Prevalência de hipertensão arterial sistêmica em estudantes de medicina de uma instituição privada. Bras Hipertens. 2019;26(2):71 –76
20. Toyama H, Hasegawa Y, Ejima Y, Kurosawa S, Sanada S, Hatano R, et al. Characteristics of young-onset white coat hypertension identified by targeted screening for hypertension at a university health check-up. Hypertens Res. 2008;31(6):1063-8. https://doi.org/10.1291/hypres.31.1063
21. Juan-Salvadores P, Olivas-Medina D, de la Torre Fonseca LM, Veiga C, Campanioni S, Caamaño Isorna F, et al. Clinical features and long-term outcomes in patients under 35 years with coronary artery disease: Nested case-control study. Rev Port Cardiol. 2025;44(1):13-21. https://doi.org/10.1016/j.repc.2024.06.004
22. Nogueira GN, de Mendonça LLP, Máximo CSGK, Gonçalves RF, Isolan GR. Como a inteligência artificial, usando monitorização multimodal, pode predizer acidente vascular encefálico e infarto agudo do miocárdio. BioSCIENCE. 2025;83:e00023. https://doi.org/10.55684/2025.83.e00023
23. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193-213. https://doi.org/10.1016/0165-1781(89)90047-4

24. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. Journal of Health and Social Behavior, 1983;24(4):385-96. https://www.jstor.org/stable/2136404

25. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003;35(8):1381-95. https://doi.org/10.1249/01.mss.0000078924.61453.fb

26. Kubrusly LF, Kubrusly FB, Rechetello HEL, Piovesan JL, Cuenca RM, Torres OJM, Andreollo NA. Prevalência de regurgitação paravalvar após implante transcateter de válvula aórtica. BioSCIENCE 2023; 81(2):6-9. https://doi.org/10.55684/81.1.5

27. Pedrosa AAS, Camacho LAB, Passos SRL, Oliveira RVC. Consumo de álcool entre estudantes universitários. Cadernos de Saúde Pública, 2011;27(8):1611-21. https://doi.org/10.1590/S0102-311X2011000800016

28. Lapidaire W, Forkert ND, Williamson W, Huckstep O, Tan CM, Alsharqi M, et al. Aerobic exercise increases brain vessel lumen size and blood flow in young adults with elevated blood pressure. Secondary analysis of the TEPHRA randomized clinical trial. Neuroimage Clin. 2023;37:103337. https://doi.org/10.1016/j.nicl.2023.103337

29. Cassiano A do N, da Silva TS, do Nascimento CQ, Wanderley EM, Prado ES, Santos TM de M. Efeitos do exercício físico sobre o risco cardiovascular e qualidade de vida em idosos hipertensos. Revista Brasileira de Medicina do Esporte, 2020;25(6):2203-12. http://doi.org/10.1590/1413-81232020256.27832018

30. Constantine R, Brownstein JN, Hoover S, Wordlaw-Stinson L, Orenstein D, Jones P, et al. Strategies for controlling blood pressure among low-income populations in Georgia. Prev Chronic Dis. 2008;5(2):A52.

31. Didier MT, Guimarães AC. Otimização de recursos no cuidado primário da hipertensão arterial. Arq. Bras. Cardiol. 2007;88(2):193-98

32. Yan Y, Ma Q, Liao Y, Chen C, Hu J, Zheng W, et al. Blood pressure and long-term subclinical cardiovascular outcomes in low-risk young adults: Insights from Hanzhong adolescent hypertension cohort. J Clin Hypertens (Greenwich). 2021;23(5):1020-9. https://doi.org/10.1111/jch.14225