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Original Article
Risk factors for cardiovascular diseases during medical academic training

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Abstract: Background: Cardiovascular diseases (CVDs) are the main cause of morbidity and mortality in the world. Previous studies disagree about the prevalence of cardiovascular risk factors (CVRFs) among medical students. Objectives: Determine the CVRFs prevalence in medical students. Compare the FRCVs percentage from initial and advanced course stages. Evaluate whether the CVRFs percentage was similar to that from population in the same age group, as previously described in another studies. Method: This is a cross-sectional observational study that evaluated the CVRFs prevalence in medical students using a semi-structured questionnaire, in addition to physical examination and laboratory tests. For statistical analysis, statistical package for the social science software (SPSS, version 22.0) was used. Results: 115 students were evaluated: 74.8%, female; mean age, 22.4±3.1 years. In the general sample was found altered dosages of total cholesterol (27.0%), high density lipoprotein cholesterol (HDL, 5.2%), triglycerides (12.2%), low density lipoprotein cholesterol (LDL, 8.7%), fasting glucose (4.3%), overweight (17.4%), obesity (5.2%), inadequate physical activity (45.2%), family history of cardiovascular disease (44.3%), stress (68.7%), anxiety (83.5%), insomnia (28.7%), sleep deprivation (60.0%), alcohol use (91.3%) and low cardiovascular risk (100.0%). The average score from PSS-14 questionnaire showed greater stress in the basic (27.0±6.7) and clinical cycle (28.3±7.1) and less stress in the internship (22.3±6.4). There was a statistical difference between the clinical cycle and internship ($P < 0.05$). During internship, there was a lower association between stress and graduation (33.3%), especially when compared to the clinical cycle (75.4%) ($P < 0.01$; ra=2.9). Conclusion: CVRFs exposure and the risk of negative cardiovascular outcomes are lower in medical students when compared to young adult population. Suggestive of medical training contributes to self-care, health promotion, stress reduction and disease prevention, reducing the cardiovascular diseases prevalence, especially in the internship.

Keywords: Endothelial dysfunction, education, medical undergraduate, life style, stress, cross-sectional study

Introduction

Cardiovascular diseases (CVDs) are the main cause of adult morbidity and mortality in the world [1]. In 2016, 17.9 million people died from CVDs (31% of global deaths) and most due to acute myocardial infarction and stroke [2].

The pathophysiological substrate of most CVDs is arterial hypertension and coronary atherosclerosis. Atherosclerotic disease (CAD) is a multifactorial chronic inflammatory disease, characterized by thickening and hardening of the arterial wall in response to endothelial aggression and mainly affects the intimal layer of medium and large caliber arteries [3].

In general terms, the most accepted hypothesis for CAD is that the aggression to the intimal vascular endothelium is caused by several cardiovascular risk factors (CVRF).

A risk factor is any clinical or laboratory element associated to the onset and progression of a disease over a variable period of time [4]. The main CVRFs are gender, race, age, genetic disorders, sedentary lifestyle, obesity, dyslipidemia, diabetes mellitus, hypertension, stress, anxiety, sleep disorders, smoking and alcoholism [5].

These FRCVs cause endothelial dysfunction and increased permeability to plasma lipoproteins, retaining them in the subendothelial space. An intense immune-mediated and inflammatory process occurs, with consequent proliferation of smooth muscle cells from the underlying tunica media that migrate to the tunica intima, forming part of the fibrous cap of the atherosclerotic plaque. Repeated cycles of damage and repair of the tunica intima are followed by the appearance of the initial core of atherosclerotic plaque [3].

These plaques cause difficulties in supplying cells with sufficient blood, oxygen and nutrients [3]. Stable atherosclerotic plaques result in blood flow restriction and stenosis, while unstable atherosclerotic plaques can erode and rupture causing thrombosis, followed by blood flow restriction and stenosis [6].

The consequences of these cardiovascular events include acute myocardial infarction, stroke, limb ischemia and death [3].

Many FRCVs are preventable and modifiable and lifestyle is essential in the development of coronary artery disease. Among medical students, studies indicate an increased prevalence of modifiable CVRFs [7, 8]. However, as future health professionals, it is possible that there will be a greater awareness of a healthy lifestyle and, consequently, a lower prevalence of CVRF.

Therefore, this study considered the CVRFs prevalence in medical students, aimed at comparing the percentage from initial and advanced course stages, and whether this percentage is higher or lower when compared to general population of the same age group, according to previously described.

Method

Study characterization

Cross-sectional analytical observational study, carried out in a Higher Education Institution (HEI), Rio do Sul city, Santa Catarina state, Brazil.

Participants were recruited in April and May 2022. The population consisted of medical students from the 1st to the 10th phase of the course. The researchers invited all the students in each class, allowing the participation of all interested parties. The sample was census.

The students were divided into three groups. The Basic Cycle was formed by first and second year students (1st to 4th phase), the Clinical Cycle was formed by third and fourth year students (5th to 8th phase) and the Internship brought together students from the fifth and sixth year of the course (9th to 12th phase), adding up a period of six years, as recommended by the national curricular guidelines of the undergraduate medical course in Brazil.

We did not include final year students (11th and 12th phase), because the 10th phase was the first medical class at the HEI. After dividing the groups, the eligibility criteria were applied. Students with paid secondary occupation, CVDs prior to the course, present incomplete data in the research instruments were excluded.

This study included students between the ages of 18 and 35 years old; with results of serum laboratory tests of total cholesterol (TC), high-density lipoprotein (HDL-C), triglycerides (TG) and fasting glucose in the last 6 months; concordant with the Free and Informed Consent Term (TCLE). Those with paid secondary occupation and CVDs prior to medical course were excluded and we determined that those who presented incomplete data from the research instruments would be excluded.

Data collection

After the selection of potentially students, the researchers applied a structured questionnaire containing eleven sections on Google Forms®. The students answered the questions, filled in the validated instruments and, subsequently, physically presented the results from their laboratory tests and an official document containing a photo. The researchers scheduled a physical assessment with the participants for determining anthropometric measurements and blood pressure values. The physical assessment was performed in the health units and in the health practice center at the HEI in a standardized way.

For assessing assessment, a digital scale placed on a hard and flat surface was used. After removing the shoes and other heavy objects from the body, the students got on the scale, remaining in an upright position in the center of the object until the weight to be recorded stabilized.

For measuring height, a tape measure fixed to the wall was used; the student was instructed to remain barefoot in an upright position, with the heels against the wall until the height was recorded. Therefore, the Body Mass Index (BMI) was calculated.

For assessing abdominal perimeter, it is conventional to position the body measuring tape at the midpoint between the last two ribs and the iliac crest. The student was instructed not to keep the abdomen tense.

Previously calibrated stethoscope and sphygmomanometer were used to measuring blood pressure. As a result, the researchers determined the cardiovascular risk stratification of each student, according to the responses collected.

Semi-structured questionnaire

The semi-structured questionnaire presented questions formulated by the authors (sections 1-6) and instruments standardized (sections 7-11), namely: (1) Identification; (2) Laboratory tests; (3) Past pathological history of CVDs; (4) Family history of early CVDs; (5) Physical activity and sedentary lifestyle; (6) Quality of sleep; (7) Perceived Stress Scale (PSS-14) [9]; (8) Hamilton Anxiety Scale (HAM-A) [10]; (9) Alcohol Smoking and Substance Involvement Screening Test (ASSIST-WHO) [11]; (10) Physical assessment; (11) Cardiovascular risk stratification [12].

It contained 11 sections and was appended as supplementary material (Supplementary Material 1).

Statistical analysis

Data were tabulated in Google Sheets® and later transferred to the IBM Statistical Package for the Social Sciences®, version 22.0 for statistical analysis.

For descriptive analysis, quantitative variables were expressed as mean and standard deviation (± SD) or median and interquartile range (IQR). For carrying out the statistical inference, these variables were analyzed regarding their distribution using the Kolmogorov-Smirnov normality test.

For comparing the quantitative variables between the 3 groups (Basic cycle, Clinical cycle and Internship) the parametric One-Way ANOVA test or the corresponding non-parametric Kruskal-Wallis H test was used.

Qualitative variables were expressed as absolute numbers (n) and percentages (%). For associations between qualitative variables, associations were observed using Pearson's chi-square test (x^2) (casella with frequency > 5) or Fisher's exact test (casella with frequencies < 5). When associations were significant, adjusted residuals (ra) analysis was performed, considering ra > 1.96 indicated to indicate higher prevalence.

In all analyses, a *p*-value of α=0.01 ($P < 0.01$) or α=0.05 ($P < 0.05$) was adopted for statistical significance. The tables were prepared in the Microsoft Word processor.

Ethical aspects

Study approved by the Ethics Committee for Research with Human Beings of the IES - Opinion 5,046,473. After clarification, the participants signed the TCLE and data collection began following Resolution 466/2012 of the National Health Council.

Results

From 318 medical students and considering inclusion and exclusion criteria, the final sample was composed by 115 students. More than half of the male students in the initial sample were excluded due to lack of

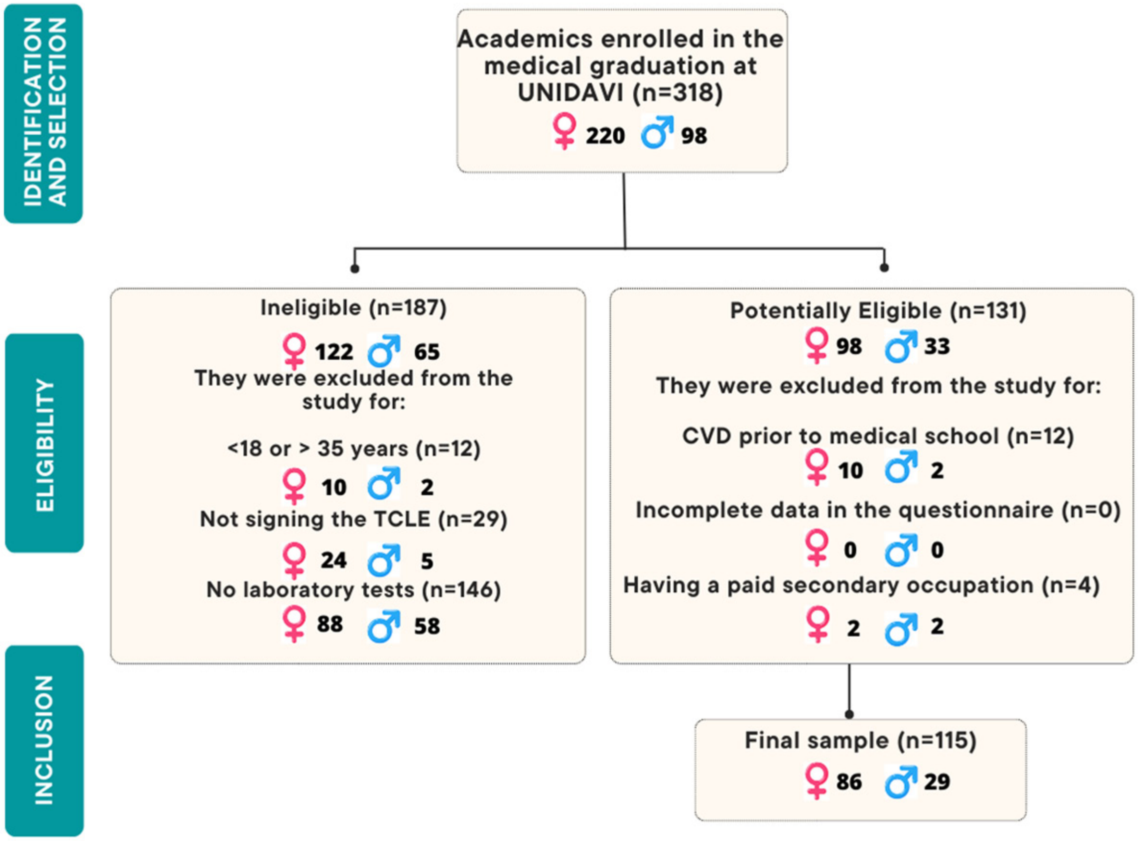

Figure 1. Participant enrollment flowchart, according to Strobe Guideline 5.12 Caption: >: bigger; CVD: Cardiovascular Disease; ♀: female; ♂: male gender; <: minor; TCLE: Term of Free and Informed Consent; Source: Authors. NOTE: We excluded 45.9% of students for lack of serum laboratory tests (n=146), resulting in a loss of 59.1% of men (n=58) and 40.0% of women (n=88) from the initial sample.

laboratory tests (n=58, 59.1%), as presented in **Figure 1**, according to Strobe Guideline 5 [13].

Identification and characterization of the sample

Most participants were women (74.8%), mean age 22.4±3.1 years old, mostly from the clinical cycle (49.6%), (**Table 1**).

Serum laboratory tests

Serum dosages followed the recommendations of the American Guidelines on Dyslipidemia and Prevention of Atherosclerosis and Diabetes, with a low prevalence of laboratory alterations. TC, HDL, LDL, TG and fasting glucose levels were considered acceptable in 84 (73.0%), 109 (94.8%), 105 (91.3%), 101 (87.8%) and 110 (95.7%) students, respectively [5, 14].

There was a lower prevalence of high levels as follow: CT (n=1, 8.3%); LDL-C (n=0, 0.0%); and TG (n=14, 12.2%) in internship when compared to basic and clinical cycle (**Table 2**).

Family history of cardiovascular disease

Significant percentages of first-degree family history of CVDs in the general sample (n=51, 44.3%) were found. In the clinical cycle, there was a statistically significant difference for higher prevalence of family history of CVDs (n=34) ($P < 0.01$; ra=3.0) when compared to the other cycles (**Table 3**).

Physical activity and sedentary lifestyle

In the general sample, 98 students practiced regular physical activity (85.2%); however, 52 practiced inadequate physical activity (45.2%), as recommended by the Guideline on Primary

Table 1. Sample identification and sociodemographic characterization

Variables	Total Sample Median (IIQ) or n (%) n=115 (100.0%)	Basic Cycle Median (IIQ) or n (%) n=46 (40.0%)	Clinical Cycle Median (IIQ) or n (%) n=57 (49.6%)	Boarding school Median (IIQ) or n (%) n=12 (10.4%)	p
Gender					
Masculine	29 (25.2)	13 (28.3)	14 (24.6)	2 (16.7)	0.70[a]
Feminine	86 (74.8)	33 (71.7)	43 (75.4)	10 (83.3)	
Age (years)	22.0 (20.0-24.0)	20.0[¥,¤] (19.0-21.0)	23 (21.5-24.0)	24 (23.2-30.7)	0.01[**,c]

IIQ: Interquartile range; n: Absolute number; %: Percentage; ¥: Statistically significant difference between basic and clinical cycle students; ¤: Statistically significant difference between basic and boarding students. Statistical Method Employed: a: Pearson's chi-square; c: Kruskal Wallis H test; **: P < 0.01.

Table 2. Serum laboratory tests

Variables	Total Sample Median (IIQ) or n (%) n=115 (100.0%)	Basic Cycle Median (IIQ) or n (%) n=46 (40.0%)	Clinical Cycle Median (IIQ) or n (%) n=57 (49.6%)	Boarding school Median (IIQ) or n (%) n=12 (10.4%)	p
TC classification					
Acceptable	84 (73.0)	32 (69.6)	41 (71.9)	11 (91.7)	0.30[a]
Increased	31 (27.0)	14 (30.4)	16 (28.1)	1 (8.3)	
HDL classification					
Acceptable	109 (94.8)	42 (91.3)	56 (98.2)	11 (91.7)	0.20[b]
Increased	6 (5.2)	4 (8.7)	1 (1.8)	1 (8.3)	
LDL rating					
Acceptable	105 (91.3)	39 (84.8)	54 (94.7)	12 (100.0)	0.20[b]
Increased	10 (8.7)	7 (15.2)	3 (5.3)	0 (0.0)	
TG rating					
Acceptable	101 (87.8)	40 (87.0)	49 (86.0)	12 (100.0)	0.40[a]
Increased	14 (12.2)	6 (13.0)	8 (14.0)	0 (0.0)	
Classification by Fasting Glycemia					
Euglycemic	110 (95.7)	44 (95.7)	55 (96.5)	11 (91.7)	0.60[b]
Pre-DM	5 (4.3)	2 (4.3)	2 (3.5)	1 (8.3)	

DM: Diabetes Mellitus; HDL: High-Density Lipoprotein; IIQ: Interquartile range; LDL: Low-Density Lipoprotein; n: Absolute number, %: Percentage; TC: Total Cholesterol; TG: Triglycerides. Statistical Method Employed: a: Pearson's chi-square; b: Fisher's Exact Test.

Table 3. Family history of cardiovascular disease

Variables	Total Sample Median (IIQ) or n (%) n=115 (100.0%)	Basic Cycle Median (IIQ) or n (%) n=46 (40.0%)	Clinical Cycle Median (IIQ) or n (%) n=57 (49.6%)	Boarding school Median (IIQ) or n (%) n=12 (10.4%)	p
Yes	51 (44.3)	11 (23.9)	34 (59.6) ra=3.0	6 (50.0)	0.01[**,a]
No	64 (55.7)	35 (76.1) ra=3.6	23 (40.4)	6 (50.0)	

IIQ: Interquartile range; n: Absolute number; %: Percentage; ra: adjusted residuals analysis. Statistical Method Employed: a: Pearson's chi-square; **: P < 0.01.

Prevention of Cardiovascular Diseases [5]. Unlike the basic cycle and internship, in the clinical cycle, only 10 students (21.3%) performed associated aerobic activities and bodybuilding (**Table 4**).

Stress and anxiety

Most students in the basic cycle (n=32, 69.6%) and clinical (n=43, 75.4%) consider themselves stressed and associate stress to college (n=33,

Table 4. Physical activity and sedentary lifestyle

Variables	Total Sample Median (IIQ) or n (%) n=115 (100.0%)	Basic Cycle Median (IIQ) or n (%) n=46 (40.0%)	Clinical Cycle Median (IIQ) or n (%) n=57 (49.6%)	Boarding school Median (IIQ) or n (%) n=12 (10.4%)	p
Physical activity					
Yes	98 (85.2)	40 (87.0)	47 (82.5)	11 (91.7)	0.60[a]
No	17 (14.8)	6 (13.0)	10 (17.5)	1 (8.3)	
Type of Physical Activity (n=98)					
A	14 (14.3)	4 (10.0)	10 (21.3)	0 (0.0)	0.10[b]
B	36 (36.7)	14 (35.0)	20 (42.6)	2 (18.2)	
A + B	48 (49.0)	22 (55.0)	17 (36.1)	9 (81.8)	
Physical Activity Time in minutes (n=98)					
15-30	2 (2.0)	0 (0,0)	2 (4.3)	0 (0.0)	0.60[b]
30-45	18 (18.4)	6 (15.0)	9 (19.1)	3 (27.3)	
45-60	60 (61.2)	24 (60.0)	30 (63.8)	6 (54.5)	
> 60	18 (18.4)	10 (25.0)	6 (12.8)	2 (18.2)	
Weekly Frequency of Physical Exercises (n=98)					
1-2 days	15 (15.3)	6 (15.0)	9 (19.1)	0 (0.0)	0.20[b]
3-4 days	54 (55.1)	18 (45.0)	29 (61.7)	7 (63.6)	
5-6 days	28 (26.6)	15 (37.5)	9 (19.1)	4 (36.4)	
> 6 days	1 (1.0)	1 (2.5)	0 (0.0)	0 (0.0)	
Tiredness, tachycardia or tachypnea after physical exercise (n=98)					
Yes	72 (73.5)	29 (72.5)	37 (78.7)	6 (54.5)	0.30[a]
No	26 (26.5)	11 (27.5)	10 (21.3)	5 (45.5)	
Inadequate physical activity					
Yes	52 (45.2)	19 (41.3)	27 (47.4)	6 (50.0)	0.50[a]
No	63 (54.8)	27 (58.7)	30 (52.6)	6 (50.0)	

A: Aerobic; B: Bodybuilding; >: Bigger then; IIQ: Interquartile range; n: Absolute number; %: Percentage. Statistical Method Employed: a: Pearson's chi-square; b: Fisher's Exact Test.

71.7%) and (n=43, 75.4%). This did not occur during internship, there was a statistical difference for these data (n=8, 33.3%) (P < 0.05; ra=2.8) and (n=8, 33.3%) (P < 0.05; ra=2.9), respectively. The average score of the PSS-14 questionnaire showed greater stress in the basic (27.0±6.7) and clinical cycle (28.3±7.1) and less stress in the internship (22.3±6.4). There was a statistical difference between the clinical cycle and internship (P < 0.05). 83.5% of medical students are considered anxious by self-report (n=96). Of these, 55.7% were classified for pathological anxiety in the HAM-A (n=64), (**Table 5**).

Sleep quality

There was a high prevalence of sleep disorders among medical students, 76.5% agreed that graduation influenced the development of these disorders (n=88) and 73.0% reported tiredness and sleepinerss during the next day (n=84), (**Table 6**).

Drug use and abuse

Alcohol was the most used licit drug in the last 3 months (n=105, 91.3%). According to the ASSIST-WHO questionnaire, most uses were considered low risk (**Table 7**).

Physical assessment

By evaluating the Body Mass Index (BMI), 17.4% of the students were overweight (n=20); 5.2%, obese (n=6). BMI and waist circumference values followed the Guidelines for the Treatment of Overweight and Obesity in Adults [15]. The concern to acceptable society's "healthy" beauty standards was reported by more than half of the students (n=67, 58.3%), (**Table 8**).

Table 5. Stress and anxiety

Variables	Total Sample Median (IIQ) or n (%) n=115 (100.0%)	Basic Cycle Median (IIQ) or n (%) n=46 (40.0%)	Clinical Cycle Median (IIQ) or n (%) n=57 (49.6%)	Boarding school Median (IIQ) or n (%) n=12 (10.4%)	p
STRESS					
Yes	79 (68.7)	32 (69.6)	43 (75.4)	4 (33.3)	0.02[#,a]
No	36 (31.3)	14 (30.4)	14 (24.6)	8 (66.7) ra=2.8	
Graduation contributes to stress					
Yes	80 (69.6)	33 (71.7)	43 (75.4)	4 (33.3)	0.01[**,a]
No	35 (30.4)	13 (28.3)	14 (24.6)	8 (66.7) ra=2.9	
PSS-14 Score	27.1 (7.1)	27.0 (6.7)	28.3 (7.1)[£]	22.3 (6.4)	0.03[#,d]
ANXIETY					
Yes	96 (83.5)	36 (78.3)	51 (89.5)	9 (75.0)	0.20[a]
No	19 (16.5)	10 (21.7)	6 (10.5)	3 (25.0)	
Relationship of Anxiety with College					
Not answered	7 (6.1)	3 (6.5)	3 (5.30)	1 (8.3)	0.50[b]
Yes	91 (79.1)	34 (73.9)	48 (84.2)	9 (75.0)	
No	16 (13.9)	9 (19.6)	5 (8.8)	2 (16.7)	
Perhaps	1 (0.9)	0 (0.0)	1 (1.8)	0 (0.0)	
Score on HAM-A	12.8 (8.5)	12.26 (8.09)	14.1 (9.1)	8.7 (5.1)	0.50[b]
Classification in HAM-A					
Normal anxiety	51 (44.3)	21 (45.7)	23 (40.4)	7 (58.3)	0.60[b]
Mild pathological anxiety	26 (22.6)	10 (21.7)	12 (21.1)	4 (33.3)	
Moderate pathological anxiety	25 (21.7)	12 (26.1)	12 (21.1)	1 (8.3)	
Severe pathological anxiety	13 (11.3)	3 (6.5)	10 (17.5)	0 (0.0)	

HAM-A: Hamilton Anxiety Scale; IIQ: Interquartile range; n: Absolute number; %: Percentage; PSS-14: Perceived Stress Scale 14; ra: Adjusted residuals analysis; £: Statistically significant difference between clinical and internship students. Statistical Method Employed: a: Pearson's chi-square; b: Fisher's exact test; d: One Way-ANOVA; #: $P < 0.05$; **: $P < 0.01$.

Table 6. Sleep quality

Variables	Total Sample Median (IIQ) or n (%) n=115 (100.0%)	Basic Cycle Median (IIQ) or n (%) n=46 (40.0%)	Clinical Cycle Median (IIQ) or n (%) n=57 (49.6%)	Boarding school Median (IIQ) or n (%) n=12 (10.4%)	p
Insomnia					
Yes	33 (28.7)	12 (26,1)	20 (35.1)	1 (8.3)	0.30[b]
No	77 (67.0)	32 (69.6)	34 (59.6)	11 (91.7)	
Sometimes	5 (4.30)	2 (4.30)	3 (5.30)	0 (0.00)	
Sleep Restriction					
Yes	69 (60.0)	29 (63.0)	37 (64.9)	3 (25.0)	0.09[b]
No	28 (24.3)	11 (23.9)	11 (19.3)	6 (50.0)	
Sometimes	18 (15.7)	6 (13.0)	9 (15.8)	3 (25.0)	
College influences these sleep disorders					
Yes	88 (76.5)	36 (78.3)	46 (80.7)	6 (50.0)	0.50[b]
No	20 (17.4)	9 (19.6)	6 (10.5)	5 (41.7)	
Sometimes	7 (6.1)	1 (2.2)	5 (8.8)	1 (8.3)	
Drowsiness or tiredness the next day					
Yes	84 (73.0)	31 (67.4)	45 (78.9)	8 (66.7)	0.40[b]
No	18 (15.7)	7 (15.2)	8 (14.0)	3 (25.0)	
Sometimes	13 (11.3)	8 (17.4)	4 (7.0)	1 (8.3)	

IIQ: Interquartile range; n: Absolute number; %: Percentage; Statistical Method Employed: b: Fisher's exact test.

Table 7. Drug use and abuse

Variables	Total Sample Median (IIQ) or n (%) n=115 (100.0%)	Basic Cycle Median (IIQ) or n (%) n=46 (40.0%)	Clinical Cycle Median (IIQ) or n (%) n=57 (49.6%)	Boarding school Median (IIQ) or n (%) n=12 (10.4%)	p
ASSIST-WHO Questionnaire					
Alcoholism					
Yes	105 (91.3)	41 (89.1)	54 (94.7)	10 (83.3)	0.50[b]
No	10 (8.7)	5 (10.9)	3 (5.3)	2 (16.7)	
WHO ASSIST Classification for Alcoholism					
LR	87 (78.4)	33 (75.0)	45 (80.4)	9 (81.8)	0.60[b]
MR	22 (19.8)	9 (20.5)	11 (19.6)	2 (18.2)	
HR	2 (1.8)	2 (4.5)	0 (0.0)	0 (0.0)	

IIQ: ASSIST-WHO: Alcohol Smoking and Substance Involvement Screening Test; HR: High Risk; IIQ: Interquartile range; LR: Low Risk; MR: Moderate Risk; n: Absolute number; %: Percentage; Statistical Method Employed: b: Fisher's exact test.

Table 8. Physical assessment and cardiovascular risk

Variables	Total Sample Median (IIQ) or n (%) n=115 (100.0%)	Basic Cycle Median (IIQ) or n (%) n=46 (40.0%)	Clinical Cycle Median (IIQ) or n (%) n=57 (49.6%)	Boarding school Median (IIQ) or n (%) n=12 (10.4%)	p
BMI classification					
Low weight	4 (3.5)	2 (4.3)	1 (1.8)	1 (8.3)	0.40[c]
Eutrophic	85 (73.9)	33 (71.7)	44 (77.2)	8 (66.7)	
Overweight	20 (17.4)	9 (19.6)	9 (15.8)	2 (16.7)	
Obese	6 (5.2)	2 (4.3)	3 (5.3)	1 (8.3)	
Abdominal Perimeter Classification					
Acceptable	84 (74.3)	35 (76.1)	39 (69.6)	10 (90.9)	0.40[c]
Increased	29 (25.7)	11 (23.9)	17 (30.4)	1 (9.1)	
Pressure by Beauty Standard (n=67)					
Yes	67 (58.3)	28 (60.9)	37 (64.9)	2 (16.7)	0.10[a]
No	48 (41.7)	18 (39.1)	20 (35.1)	10 (83.3)	
If so, does it take care of health more or less (n=65)					
More	60 (92.3)	27 (96.4)	31 (83.8)	2 (100.0)	0.40[b]
Any less	5 (7.7)	1 (3.6)	4 (10.8)	0 (0.0)	
Blood Pressure Classification					
Normotensive	99 (85.2)	40 (87.0)	47 (82.5)	11 (91.7)	0.20[c]
Pre-Hypertensive	11 (9.6)	5 (10.9)	5 (8.8)	1 (8.3)	
Hypertensive	6 (5.2)	1 (2.2)	5 (8.8)	0 (0.0)	
Absolute, Relative and Lifetime Cardiovascular Risk Stratification					
Low risk	115 (100.0)	46 (100.0)	57 (100.0)	12 (100.0)	-

BMI: Body Mass Index; IIQ: Interquartile range; n: Absolute number; %: Percentage; Statistical; -: No statistical variation. Statistical Method Employed: a: Pearson's chi-square; b: Fisher's exact test; c: Kruskal Wallis H test.

Arterial hypertension and cardiovascular risk

Blood pressure was classified according to the Hypertension Guidelines [16], 85.2% of the students were normotensive (n=99). The final sample presented low absolute, relative and lifetime cardiovascular risk (n=115, 100.0%), (**Table 8**).

Discussion

Barbosa also identified low demand for Primary Health Care (PHC) services and low performance of routine exams in adult men, related to their lack of concern with health promotion and prevention actions and cultural and social factors [17]. That is, in males, in addition to the greater risk for atherosclerotic disease related to variations in the Y chromosome, there is a greater lack of health care leading to late disease intervention [17, 18].

There was a low prevalence of laboratory alterations in our sample. These data differ from those found for young adults in the general population, according to Talpur. In this, inadequate serum levels of lipids were more frequent, with a lower prevalence of laboratory alterations among medical students [19]. The greater knowledge about CVRFs, health promotion and prevention measures may be associated. As well as Nasir, this study found a lower prevalence of high levels of TC, LDL-C and TG in medical students in the advanced stages [20].

A significant percentage of family history for CVDs was found, but the incremental predictive value of family history on an established risk score appears to be small [1].

Most medical students practiced inadequate regular physical exercise [5]. Anderson defined inadequate physical activity as insufficient and grouped it with sedentary lifestyle, obtaining 25% of physical inactivity in young adults [21]. Similarly, Guthold reported an overall prevalence of insufficient physical activity in 27.5% of the sample [22]. At first, it seems contradictory that medical students have more adequate laboratory tests, being more inactive than the rest of the young adult population.

However, the same study by Guthold, identified 47.0% of insufficient physical activity in Brazil, which is considered the worst percentage among Latin American and Caribbean countries [22]. In our study, the prevalence of inadequate physical activity was similar to the Brazilian national category, being considered 1.7 times higher than the global average. Studies suggest that aerobic training should be combined with bodybuilding to combine cardiorespiratory benefits, avoiding loss of lean mass and bone fragility related to resistance exercises [23]. Only in the basic cycle and boarding school this combination was found.

Although there are definitions regarding what would be an effective physical activity, it is noteworthy that doing some physical activity is better than doing nothing [24].

Bergmann evaluated medical students and proposed that the beginning of academic studies can be stressful due to the emergence of social, personal and organizational challenges. On the other hand, students in advanced stages mentioned that mastering medical studies can contribute to a sense of self-esteem, self-efficacy and resilience, reducing stress [25].

Kam also applied the PSS-14 to medical students, and showing a higher prevalence of perceived stress in the initial cycles [26]. A meta-analysis by Tian-Ci Quek, carried out in 2019, before the coronavirus pandemic, analyzed the global anxiety prevalence among medical students, and found overall anxiety prevalence in 33.8% of students [27].

Costa evaluated young adults and observed a lower prevalence of anxiety disorders in the general population (27.4%) [28]. Suggesting an association between anxiety and graduation in medicine. We found much higher percentages of anxiety, but considering the global call of the World Health Organization in 2022, which predicts a 25.0% increase in the prevalence of post-pandemic anxiety and depression; this may be the reason for finding such different values [29].

Also, Jahrami found a high prevalence of sleep disorders among medical students: 55.0% reported poor sleep quality (Pittsburgh Sleep Quality Index); 31.0%, excessive daytime sleepiness (Epworth Sleepiness Scale) [30]. Insomnia and sleep deprivation were more prevalent in the clinical cycle, demonstrating less effectiveness in sleep care.

Candido analyzed drug use in medical students. There was a growing prevalence of drug use, which may be a result of the intrinsic stress from course activities [31]. Like our study, alcohol was considered the most widely used licit drug.

Barros analyzed the overweight and obesity in university students in 20.2% and 7.6%, respectively [32]. Comparatively, we identified lower rates of overweight and obesity among medical students. Barros as well refer to the influence of social pressure on health professionals for maintaining a standard of "health", mainly related to proper weight [32].

In a different way, Alwabel found a high prevalence of prehypertension and hypertension among medical students, most of which are underdiagnosed [33].

In the general population, Berger found that the CVDs risk during the course of life for people aged around 50 years old is 52.0% for men and 39.0% for women [34]. Our sample showed low absolute and relative cardiovascular risk up to 10 years, with low lifetime risk forecast, that is, risk less than 10% for cardiovascular events up to 20 years. If our medical students maintain less exposure to FRCVs in the coming years, there will probably be less morbidity and mortality from CVDs.

Considering an adult population between 18 and 35 years old, asymptomatic and without a previous diagnosis of CVDs, it can be seen that primary prevention based on the identification and early treatment of CVRFs is essential to reduce the incidence of CVDs [35].

The traditional approach for reducing the CVDs risk consists of screening the healthy population for CVRFs and determining interventions with non-pharmacological or pharmacological approaches in those whose measurements are above a value defined as "normal" for a group with similar characteristics [35].

In the university environment, one way of discovering the main CVRFs is to invest in observational studies like this one, which make it possible for recognizing the general characteristics of the population and the CVRFs prevalence in the individuals in the sample. For this, data collected through anamnesis, physical examination and laboratory tests are used.

As the pathophysiological substrate of most CVDs is arterial hypertension and coronary atherosclerosis [3], a simple and objective screening of the blood pressure of university students can be carried out, with the aim at diagnosing systemic arterial hypertension and the Framingham Score can be applied for determining the percentage risk of individuals developing CAD and coronary disease in the next decade of life.

The Framingham Score emerged together with the 1st long-term cohort on the cardiovascular system, the Framingham Heart Study, and takes into account age, biological sex, systolic and diastolic blood pressure, previous diagnosis of DM, smoking and serum levels of HDL-c and LDL-c [36]. However, we must not forget that it does not include modifiable risk factors such as obesity, sedentary lifestyle, stress, anxiety and drug use, which also need to be addressed.

Based on knowledge from CVRFs prevalence in universities, it is possible to initiate primary prevention campaigns aimed at changing lifestyle habits, promoting health and directing investment with the objective of enabling students to have access to healthy food, physical activity, activities practices, psychology services, and medical counseling referrals.

This study emphasizes the high student participation who met the eligibility criteria at the HEI, as well as the concern about the training of future professionals able of caring and serving as an example for others.

Limitations include the small student number representing the boarding school, justified because the 10th phase was the first class at the HEI, with only two classes in the boarding school and due to lack of resources, it was not possible to standardize the performance of laboratory tests in the same laboratory; however, the team of researchers is aware that this may characterize a research bias.

Conclusion

This study found a lower CVRFs prevalence in medical students when compared to the general population of young adults. The risk of negative short- and long-term cardiovascular outcomes is also reduced in this group.

Exposure to FRCVs is even lower in the more advanced course stages, suggesting that better medical knowledge about health promotion and prevention/education measures can reduce the prevalence of CVDs and improve the health of the general population.

Disclosure of conflict of interest

None.

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Supplementary Material 1. Semi-structured questionnaire

Identification data (Section 1)

Name:

Biological sex

( ) M
( ) F

Age:

Course phase:

Course cycle:

Do you have a paid secondary occupation?

( ) Yes
( ) No

Contact phone or cell phone:

Laboratory tests (Section 2)

Exam Date:

Total Cholesterol (mg/dl):

HDL - Cholesterol (mg/dl):

Triglycerides (mg/dl):

LDL-Cholesterol (mg/dl) - Friedewald formula:

1st Fasting Glycemia Test (mg/dl):

If changed, 2nd Fasting Glycemia Confirmatory Test (mg/dl):

Past pathological history of cardiovascular diseases (Section 3)

Check the diseases you already have or had a previous diagnosis:

( ) Systemic Arterial Hypertension
( ) Diabetes Mellitus
( ) Hypercholesterolemia
( ) Hypertriglyceridemia
( ) Coagulation Disorders
( ) Inflammatory Disorders
( ) Rheumatic disorders
( ) None of those mentioned above

Family history of cardiovascular disease (Section 4)

Do you have any 1st degree relative (father, mother, siblings or children) who already had any of these early cardiovascular diseases? Early disease is considered in women under 65 years old and men under 60 years old.

Systemic Arterial Hypertension

( ) Yes
( ) No

Acute Myocardial Infarction

( ) Yes
( ) No

Stroke

( ) Yes
( ) No

Hypercholesterolemia

( ) Yes
( ) No

Hypertriglyceridemia

( ) Yes
( ) No

Diabetes Mellitus

( ) Yes
( ) No

I have no family history of these diseases

( ) Yes
( ) No

Physical activity and sedentarism (Section 5)

Do you practice physical activity?

( ) Yes
( ) No

If YES to the previous question, what type of physical activity?

( ) Aerobic activity
( ) Bodybuilding
( ) Aerobic activity and weight training
( ) Others. Cite “other”: ___________

If you practice physical activity, how much time of activity do you practice per day?

( ) 15-30 minutes
( ) 30-45 minutes
( ) 45-60 minutes
( ) More than 60 minutes
( ) I do not practice physical activity

If you practice physical activity, how many times a week do you exercise?

( ) 1-2 times a week
( ) 3-4 times a week
( ) 5-6 times a week
( ) Every day of the week
( ) I do not practice physical activity

During the above-mentioned exercise, do you feel tired, with a faster heart rate or an increased breathing rate?

( ) Yes
( ) No
( ) I do not practice physical activity

Do you feel pressured to fit society's standards of beauty?

( ) Yes
( ) No

If yes to the previous question, does that make you take more or less care of your health?

( ) More
( ) Any less
( ) Does not change my care

SLeep quality assessment (Section 6)

On average, how many hours a day do you sleep?

( ) 3 hours
( ) 4 hours
( ) 5 hours
( ) 6 hours
( ) 7 hours
( ) 8 hours or more

Do you have insomnia (difficulty falling or staying asleep or poor sleep quality)?

( ) Yes
( ) No

Do you practice sleep deprivation (sleeping less than 6 hours)? [16]

( ) Yes
( ) No
( ) Sometimes

Is college related to your insomnia or sleep deprivation?

( ) Yes
( ) No
( ) Sometimes

Do you feel tired or sleepy during the day?

( ) Yes
( ) No
( ) Sometimes

Stress assessment (Section 7)

Do you consider yourself a stressed person?

( ) Yes
( ) No

If you answered YES to the previous question, does the medical degree contribute in any way to this stress?

( ) Yes
( ) No
( ) Perhaps

If you think that a medical degree contributes in some way to this stress, please explain, otherwise, go on to the next question;

Mark the factors that usually make you more stressed. More than one factor can be assigned;

( ) Pain
( ) Fear
( ) Anxiety
( ) Self-billing
( ) Anguish
( ) Social Pressure
( ) Others
( ) I am not stressed

If any other factor not mentioned above tends to make you stressed, mention it. Otherwise, move on to the next question.

Now fill in the questions below, related to the **Perceived Stress Scale (PSS-14)**, according to how often this happens in your life [9].

PSS-14 score: __________

Anxiety assessment (Section 8)

Do you consider yourself an anxious person?

( ) Yes
( ) No

If YES to the question above, do you think this anxiety could be related to college?

( ) Yes
( ) No
( ) Perhaps

If you think that your degree in Medicine contributes in some way to your anxiety, please explain. Otherwise, move on to the next question.

Check the factors that usually make you more anxious;

( ) Pain
( ) Fear
( ) Self-billing
( ) Anguish
( ) Social Pressure
( ) Others
( ) Nothing makes me feel anxious

If any "other" factor not mentioned above tends to make you stressed, mention it. Otherwise, move on to the next question.

Now fill in the questions below, related to the **Hamilton Anxiety Scale (HAM-A)**, according to how often these things happen in your life [10].

HAM-A score: ___________

Classification according to HAM-A score:

( ) Normal anxiety (<12)
( ) Mild pathological anxiety (>12 and <18)
( ) Moderate pathological anxiety (> 18 and <25)
( ) Severe pathological anxiety (>25)

Drug use and abuse (Section 9)

Now fill in the questions below, related to the **Alcohol Smoking and Substance Involvement Screening Test Questionnaire - ASSIST (World Health Organization)**, about drug use and abuse [11];

Classification according to ASSIST-OMS score for each drug:

( ) Low risk
( ) Moderate risk
( ) High risk

Physical assessment (Section 10)

Weight (kg):

Height (m):

Body Mass Index-BMI (kg/m^2):

Abdominal circumference (cm):

Systolic blood pressure (mmHg):

Diastolic Blood Pressure (mmHg):

• The evaluation of anthropometric data was performed in a standardized way.

• For weight assessment, an adult electronic anthropometric scale was used, waist circumference and height were measured with a tape measure. Then, the Body Mass Index was calculated. Blood pressure measurement followed the recommendations of the American College of Cardiology and American Heart Association [16].

Stratification of absolute, relative and lifetime cardiovascular risk (Section 11)

• For evaluation, the Cardiovascular Risk Stratification Calculator was used [12].