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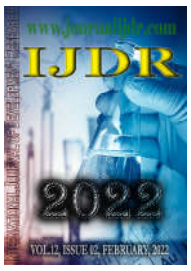

RESEARCH ARTICLE OPEN ACCESS

PREVALENCE OF CARDIOVASCULAR RISK FACTORS IN MEDICAL STUDENTS OF THE FEDERAL UNIVERSITY OF GOIÁS

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ABSTRACT

Introduction: The beginning of academic life impacts the lifestyle of medical students, bringing social, psychological, and physical consequences, with emphasis on the development of cardiovascular risk factors (CVRF). **Objectives:** To determine the prevalence and factors associated with CVRF in 1st, 3rd, and 6th-year medical students at the Federal University of Goiás. **Method**: Cross-sectional observational study. The students performed capillary blood glucose, bioelectrical impedance and underwent a physical examination. **Results:** 177 students participated in the study, 67.2% male. The mean Body Mass Index (BMI) was 23.42 kg/m2, being 5% obese and 26% overweight. 79.4% had a fat percentage above healthy, and 10.17% had CVRF. The consumption of fruits and vegetables was lower than recommended by 71.76% and 80.22%, respectively. A significant difference was observed in the multivariate statistical analysis between academic periods, demonstrating a worsening progression of health indicators throughout college years. **Conclusion**: Medical Students have a high percentage of body fat even with a normal BMI, have poor eating habits, and have progressively worsened health indicators throughout their college years. Given this scenario, the university must develop health promotion actions focused on the struggle against CVRF.

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INTRODUCTION

Full-time courses, such as medicine, require students to change their routines significantly. In addition, new responsibilities related to academic life require a lot of dedication that impacts the lifestyle (sleep, feeding, and physical activity), bringing physical, social, and psychological consequences(Loureiro *et al*, 2008).Among the possible physical consequences, we highlighted the development of cardiovascular risk factors (CVRF), represented in this study by metabolic syndrome (MS). Metabolic syndrome is defined by a set of related disorders involving pathophysiological, biochemical, clinical, and metabolic factors of cardiovascular risk, as arterial hypertension, insulin resistance, hyperinsulinemia, glucose intolerance or type 2 diabetes mellitus, central obesity, dyslipidemia (high LDL-cholesterol, high triglycerides and low HDL-cholesterol)(Kaur, J.,2014 and Lam *et al*, 2000). Its prevalence varies from 10 to 84%, according to the characteristics of the population and the criteria used (Melo, M.E., 2010). However, regardless of the appropriative criterion, it is a consensus that the prevalence of SM has increased in most countries and rises every decade, by which researchers have demonstrated increases in cases of SM in children, adolescents, and young obese people (Belva *et al*, 2018 and Ranasinghe *et al*, 2017). In 1765, Giovanni Battista Morgagni described visceral obesity, hypertension, hyperuricemia, atherosclerosis, and obstructive sleep apnea. However, the "metabolic syndrome" term was suggested only in 1921 by physicians Karl Hitzenberger and Martin Richter-Quittner in Vienna (Sarafidis *et al*, 2006). Currently, there are three widely used criteria for its characterization: National Cholesterol Education Program's Adult Treatment Plan III (NCEP-ATP III or ATP III), the International Diabetes Federation (IDF), and the World Health Organization (WHO). The classification proposed by the ATP III in 2001, used to be for a long time the most applied in daily clinical practice (NCEP, 2001). In 2005, the IDF classification became one of the most used definitions in the world (Alberti *et al*, 2006). It is based on the concept that visceral fat (estimated by waist measurement) is the essential and determining factor for all other components of MS. By stratifying values by ethnicity, the IDF strengthens the concept that different world populations have different body proportions. In addition to considering the waistline as an essential diagnostic factor, the IDF already incorporates blood glucose levels ≥ 100 mg/dl as

abnormal and considers references to the existence of treatment for the associated conditions. The WHO definition covers changes related to two or more of the following criteria: high waist/hip ratio (>0.90 for men and 0.85 for women) and/or body mass index (BMI) > 30 kg/m^2, presence of diabetes mellitus (DM), insulin resistance, glucose intolerance or impaired fasting glucose, elevated serum triglycerides (≥ 150 mg/dl) and/or decreased HDL cholesterol (< 35 mg/dl for men, < 39 mg/dl for women), systemic arterial hypertension (Blood Pressure "BP" ≥ 140/90 mmHg or use of antihypertensive medication) and microalbuminuria (albumin excretion rate ≥ 20 µg/min) (World health organization (WHO), 1999). Medical students spend most of their time away from their homes, dividing themselves into academic and work obligations, leading to the inclusion of fast foods rich in fat and sugars in their diet. Poor eating habits associated with a sedentary lifestyle can lead to the installation of MS that precedes serious health problems such as cardiovascular diseases and DM2 ((Loureiro *et al*, 2008). Therefore, it is essential to identify the risk of developing MS among medical students.

Objectives: This study aimed to determine the prevalence of CVRF components of MS in 1st, 3rd and 6th-year medical students of the Federal University of Goiás (UFG) - Brazil; verify the association of CVRF with eating habits, personal and family history for obesity, diabetes mellitus, acute myocardial infarction, systemic arterial hypertension, and dyslipidemia, and compare the results found according to by the current academic year.

METHODS

Study Design: This is an observational cross-sectional study, conducted in the city of Goiânia, state of Goiás (GO), Brazil, from June of 2019 to March of 2020. The project was submitted and approved by the Ethics and Research Committee of UFG (CAE 09832019.1.0000.5083). All participants signed an informed consent form. The research participants were students from the 1st, 3rd and 6th years of the Medical School at UFG Campus Goiânia. Demographic, socioeconomic, and eating habits data were evaluated through the application of questionnaires. The students performed capillary blood glucose measurements, bioelectrical impedance evaluation and underwent a physical examination for anthropometric assessment and BP measurements.All assessments were performed by three trained researchers with previously calibrated instruments.

Questionnaire application: The questionnaireraised the personal and family history of obesity, diabetes mellitus, acute myocardial infarction, systemic arterial hypertension, and dyslipidemia. Students also answered about their usual consumption of fruits, vegetables and soft drinks/artificial juices according to the WHO recommendation (Kenned *et al*, 1995 and WHO, 2004).

Anthropometric evaluation: Bodyweight and height were measured using a digital scale with an accuracy of 1 gram and a stadiometer with an accuracy of 0.1 µg to 0.1 mm, and 0.01 to 1 mm, respectively; following the techniques recommended by Heyward and Stolarczyk11. TheBMI was obtained by the weight/height (Lam *et al*, 2000) quotient, with bodyweight expressed in kilograms (kg), and height in meters (m). Waist circumference (WC) was measured at the midpoint between the anterosuperior iliac crest and the last rib, using an inelastic measuring tape measuring 2.0 m in length and accurate to 1 mm. The interpretation of BMI and abdominal adiposity values followed the WHO recommendations (WHO, 1998).

Arterial Blood Pressure: The assessment of systolic and diastolic blood pressure was performed using the auscultatory technique, using a calibrated aneroid sphygmomanometer, following the IDF standards (Alberti *et al*, 2006). Blood pressure was measured with the participant at rest, sitting upright, legs uncrossed, and feet flat on the floor. During the time of measurement, the size of the cuff used varied according to the diameter of each arm in a width/length ratio of 1:214.

Bioelectrical Impedance: The percentage of fat was obtained using the OMRON Body Control Scale, which estimates the percentage of body fat using the bioelectrical impedance method. Muscles, blood, bones, and body tissues that contain high amounts of water efficiently conduct electricity. On the other hand, body fat does not store much water; therefore, it has negligible electrical conductivity. The OMRON Body Control Scale sends a feeble electrical current of 50 kHz and 500 µA through your body to determine the amount of water in each tissue (Petribú *et al*, 2012).

Capillary glycemia: To assess capillary blood glucose, a drop of capillary blood was collected from each participant. A disposable biosensor strip containing glucose dehydrogenase or oxidase, coupled to a medical device (glucometer) allowed the analysis. The test was based on the glucose-oxidase/peroxidase reaction, which, associated with the presence of dyes, generates a change in the strip's color, which is proportional to the concentration of glucose present in the sample collected from capillary blood vessels(Coster *et al*,2000).

RESULTS

This research had the participation of 177 medical students. Of these, 67.2% were men (n=119) and 32.8% were women (n=58). The age ranged from 18 to 35 years, with a mean of 22.1 years (SD 2.96). Of the total number of students, 57 were 1st year students, 60 were from the 3rd year and 60 from the 6th year of graduation. The nutritional assessment status showed that 26% of students were overweight and 5.1% were obese. The mean BMI was 23.42 kg/m2, a value characterized as normal weight, with a body fat percentage above the mean in 79.6% of the participants (Table 1). The variables related to age, BMI, and percentage of body fat and abdominal (AC) circumference are described in Table 1.

Table 1. Nutritional diagnosis and presence of CVRF components of MS according to the NCEP ATP III criteria in UFG medical students

FEATURE	n (%)
NUTRITIONAL DIAGNOSIS	
Obesity	9 (5.1)
Overweight	46 (26)
Eutrophy	112 (63.3)
Thinness	10 (5.6)
Obesity	9 (5.1)
FAT PERCENTAGE	
High Percentage	119 (67.2)
Overweight	22 (12.4)
Average	17 (9.6)
Lean	19 (10.7)
ABDOMINAL CIRCUMFERENCE	
Normal	167 (94.4)
High	10 (5.6)
BLOOD PRESSURE	
Normal	169 (95.5)
High	8 (4.5)
CAPILLARY BLOOD	
Normal	177 (100)
High	0 (0)

n = absolute frequency; % = relative frequency

By the NCEP ATP III criteria, which advocates the need for at least three factors to define the diagnosis of MS, it was noted that isolated components that cover this criterion are present in 10.17% of university students (n=18). The factors evaluated were AC, blood pressure ≥ 130/80 mmHg, and capillary blood glucose level. Waist circumference had its values increased in 5.6% of the sample. Blood pressure with values ≥ 130/85 mmHg was present in 4.5% of the students, and capillary blood glucose performed at random showed values ≤ 200 mg/dl (normal) in all tests performed. Data are shown in Table 1. Table 2 shows the fruit consumption frequency, as well as of vegetables and sodas. In 71.76%, fruit consumption was lower than recommended. Only 28.24% ingested the recommended amount.

Table 2. Eating habits of UFG medical students according to the WHO recommendation

Description of the habits of all students			
Foods	**Food portions consumed**	**n**	**%**
FRUITS			
Less than recommended	Never	2	1.12
	2-4x/week	35	19.77
	5-6x/week	45	25.42
	1x/day	45	25.42
Recommended	≥ 2x/day	50	28.24
VEGETABLES			
Less than recommended	Never	1	0.56
	2-4x/week	34	19.20
	5-7x/week	59	33.33
	1x/day	48	27.11
Recommended	≥ 2x/day	35	19.95
SOFT DRINKS			
Higher than recommended	1x/week	61	34.46
	2-4x/week	51	28.81
	5-7x/week	35	19.77
Recommended	Never	30	16.95

Comparative evaluation of eating habits according to the year attended				
Grade				
	1° Grade	3° Grade	6° Grade	p
Average consumption				
Fruit Weekly frequency	4.30 ± 2.11	4.73 ± 2.22	4.37 ± 2,10	0.42*
Servings/day	1.68 ± 1.12	1.60 ± 0.96	1.64 ± 0,83	0.91*
Vegetables Weekly frequency	5.74 ± 1.69	5.72 ± 1.84	5.83 ± 1.70	0.97*
Servings/day	1.33 ± 0.51	1.40 ± 0.53	1.52 ± 0.54	9.14*
Soft drinks Weekly frequency	3.39 ± 2.37	2.58 ± 2.09	3.03 ± 2.15	0.18*

*Kruskal-Wallis test; n = absolute frequency; % = relative frequency

Table 3. Comparison of continuous variables of students' demographic and metabolic profile from the 1st, third and sixth years of the UFG medical course

	Grade			
	1° Grade	3° Grade	6° Grade	
Variables	Average ± SD	Average ± SD	Average ± SD	p
Age (Years)	19.74 ± 1.90a	21.98 ± 2.65b	24.45 ± 2.15c	<0.001*
BMI (kg/m$^{2)}$	23.02 ± 3.91	23.06 ± 3.22	24.14 ± 3.74	0.13*
Muscle (%)	36.00 ± 7.17	34.85 ± 6.61	35.60 ± 5.68	0.59*
SBP (mmHg)	114.04 ± 7.04a	113.27 ± 17.12a	117.53 ± 7.69b	0.03*
DBP (mmHg)	80.26 ± 8.04	79.73 ± 8.13	76.92 ± 11.28	0.11*
Blood glucose (mg/dL)	102.23 ± 10.78a	96.27 ± 13.80b	102.65 ± 14.64a	0.002*

*Kruskal-Wallis Test; *Posthoc*Nemenyi represented by the letters,SD: standard deviation

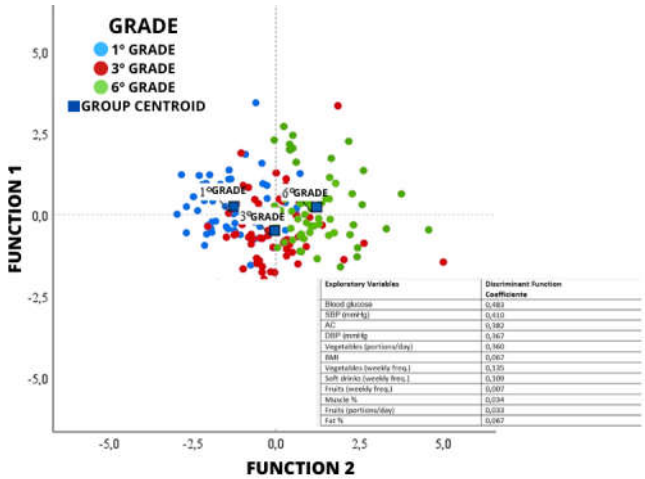
Table 4. Comparison of categorical variables of students' demographic and metabolic profile from the 1st, third and sixth years of the UFG medical course

	Grade			
	1º Grade	3° Grade	6° Grade	
Variables	N (%)	N (%)	N (%)	p
Gender				
Feme	16 (28.1)	25 (41.7)	17 (28.3)	0.19**
Male	41 (71.9)	35 (58.3)	43 (71.7)	
%Fat				
High	35 (61.4)	40 (66.7)	44 (73.3)	0.55**
Overweight	7 (12.3)	7 (11.7)	8 (13.3)	
Average	6 (10.5)	8 (13.3)	3 (5.0)	
Lean	9 (15.8)	5 (8.3)	5 (8.3)	
Abdominal C.				
Changed	4 (7)	3 (5)	3 (5)	0.86**
Normal	53 (93)	57 (95)	57 (95)	
Nutritional Diagnosis				
Obesity	4 (6.66)	1 (1.66)	4 (6.66)	0.15**
Overweight	9 (16.6)	19 (31.6)	18 (30)	
Eutrophy	38 (66.6)	36 (60)	38 (63.3)	
Thinness	6 (10)	4 (6.66)	0 (0)	
TOTAL	57 (100)	60 (100)	60 (100)	

**Chi-squared of Pearson; n = absolute frequency; % = relative frequency

When analyzing the consumption criterion of vegetables, it is noticed that 80.23% ate smaller portions than recommended, only 19.77% consumed adequate frequency of vegetables. In the soft drink criterion, 83.05% consumed more often than recommended by WHO (Kaur, 2014). There was no significant variation in eating habits according to the current year. As for the personal history, no student reported previous myocardial infarction occurrence, 1 (0.6%) reported glycemic changes, 3 (1.7%) hypertension, 14 (7.9%) dyslipidemia, and 13 (7.3%) obesity history. Habitual smoking was reported by 13 students (7.9%). 55 (31.1%) students reported the history of obesity in a first-degree relative. Tables 3 and 4 show the comparative analysis between the evaluated graduation years: 1st, 3rd and 6th years. Age showed a significant variation, which was expected due to the difference between the academic periods: students in the 6th year of graduation were considerably older than those analyzed in the 3rd year, which was subsequently older than those in the 1st year of graduation. No significant differences were found regarding sex distribution, BMI, waist circumference, body fat percentage, and muscle mass between the three groups of students studied. Although we did not observe any difference in the BMI of the three groups studied, there was an increase in high fat percentage (1st year: 61.4%, 3rd year: 66.7%, and 6th year: 73.3%), which was not statistically significant. In addition, a minimal number of students, 5.6% (n=10) had altered waist circumference, which refers to a higher content of subcutaneous and non-visceral fat.

Regarding blood pressure, it was found a significantly higher levels in the 6th-grade students when compared to those of the 1st and 3rd school year students (p=0.03). In addition, in the analysis of blood glucose, a significantly lower mean was observed over the 3rd year students. Regarding the personal history, there was no statistically significant difference between the three evaluated periods. A history of Hypertension was present in 3.5% of the students who recently entered college, in 1.7% of the students from the 3rd year of graduation, and none from the 6th year presented such criteria. Dyslipidemia was reported by 10.5% of the 1st year students, 8.3% from the 3rd year, and 5% from 6th year students. Smoking habit was present in 7% of students in the 1st year, in 6.7% in the 3rd year, and 8.3% in the 6th year. In the item "history of obesity", there was a lower percentage in 1st-year students (5.3%) than in third and 6th-year undergraduate students, both with 8.3%. As for the personal history of obesity and the history in first-degree relatives, the frequency of obese family members was lower in the 1st year group, 24.6%, and very similar between the 3rd and 6th year undergraduate classes, which presented respectively with 33.3% and 35% of the sample. This factor can be related to the percentage of students with a history of obesity observed in these same groups: 5.3% in the 1st year, and 8.3% in the 3rd and 6th years; however, no statistical difference was observed between these groups.



Caption: AC: Abdominal Circumference; BMI: Body Mass Index; DBP: Diastolic Blood Pressure; SBP: Systolic Blood Pressure.

Figure 1. Scatter plot of exploratory variable scores generated from the analysis of the canonical discriminant function

Figure 1 shows the degree of significance of each variable analyzed simultaneously – multivariate analysis, which discriminates whether there is a significant difference between students from different years. A summary (vector) value was created for each variable and then plotted on the graph shown. As a result, the central value (centroid) of each academic year (indicated by the blue squares) could discriminate the difference between the analyzed periods. Unlike what was shown in the previous tables, where there was no significant difference in the variables analyzed separately over the years, we noticed that when analyzing all the variables simultaneously, there was a significant difference between the academic periods. Thus, the data presented worsening health indicators with the years attended at college, shown in Figure 1.

DISCUSSION

The present study demonstrated that UFG medical students have a high percentage of body fat even with a normal BMI, have poor eating habits, and have progressively worsened health indicators throughout their college years. College students had a normal mean BMI but with a high body fat percentage: 67.2% had high adiposity values, and 12.4% were categorized as overweight according to the fat percentage criteria. It is noted that students already start graduation with an average BMI very close to the normal limit (23.42 Kg/m^2), which is perpetuated throughout the formation, reaching the highest value at the end of the course. The 6th-grade students had a higher borderline BMI of 24.14 Kg/m^2; that is, they were close to reaching levels of overweight. These BMI levels were found to correlate with the percentage of fat present in the sample. College students start the course with already high-fat percentages: 77.7% already have high adiposity in the first year, increasing during the academic years, with a peak of 86.6% in the sixth year. These data can be justified by the reported inadequate intake of fruits and vegetables. It is known that bad eating habits not only do not provide the necessary micronutrients, can also favor the development of MS and the consequent evolution to critical health problems such as DM2 and cardiovascular diseases (Freire *et al*, 2017). A study by Azevedo *et al*. showed that inadequate diets are associated with an increase in cardiovascular disease, cancer, respiratory diseases, and diabetes, which are the leading causes of mortality worldwide and affect the quality of life by limiting the life´s quality, work activities and hobbies(Azevedo *et al*, 2014). It is assumed that the eating habits described by the students may be the result of long periods away from their homes to carry out academic and work assignments, a situation that favors the inclusion of fast-food preparations rich in fat and sugar in their portions. Another aspect to consider for the worsening health of students is stress. Entering university brings significant challenges to the student, who experiences significant changes in their routine, impacting habits and social life, bringing outstanding amounts of stress. These aspects are intensified among academics in the third year of graduation, marked by the beginning of the clinical cycle, which associates a high workload of theoretical classes with prolonged periods of care in outpatient clinics.

The stress becomes even more accentuated among academics before completion of their graduation. Sixth-year students must reconcile a large workload of internships, night shifts, theoretical classes, and studying to take the medical residency tests. These factors translate into a high load of stress: physical and mental fatigue added to little rest and inadequate eating habits, a combination that favors the development of CVRF. Thus, both high BMI and adiposity are related to eating habits and changes in the circadian rhythm attributed to the work schedule that intensifies in the clinical cycle. When comparing the BMI with the percentage of body fat of the students, 67.79% were eutrophic according to BMI, but showed an increase in the percentage of adiposity of 79.6%. This corroborates a common criticism of the use of BMI for the diagnosis of nutritional status, is considered a poor indicator from an individual point of view, as it does not assess body composition (proportion of muscle mass and adipose tissue), once it uses only weight and height values, not taking skinfolds into account (Hastuti *et al*, 2017 and Lohman, 1992). The research by Carrasco

and collaborators evaluated BMI, and fat percentage detected high average fat percentage (men ≥24% and women ≥35%) in the eutrophic group. Among the group classified as normal in the category of fat percentage, the average BMI denoted overweight (Carrasco *et al*, 2004). In an analysis carried out in Hong Kong, it was found that the BMI found in participants with increased body fat (women: ≥30% and men ≥20% of adipose tissue) was 22.5Kg/m^2 and 23.1Kg/m^2 in adult women and men, respectively; BMI values still in the normal range (Ko *et al*, 2001). In another survey conducted in Indonesia, the reference levels to characterize obesity based on the percentage of body fat (above 35% in women and 25% in men ≥ 25%) were already present in people with "normal" BMI: 21 ,9 kg/m2 and 23.6 kg/m2 for women and men, respectively (Petribú *et al*, 2012). When comparing the percentage of mean body fat, estimated by the results classified according to Lohman (1992), students in the last year of graduation showed an average value of 23% higher than those entering. Excess body fat is a chronic-degenerative disease closely related to increased morbidity and mortality in adults, leading to increased risk for cardiovascular disease, diabetes, decreased respiratory capacity, and even cancer (Perez, 2014). A study carried out in Chile showed similar results; when they analyzed the percentage of body fat in 433 women and 264 men over 18 years of age, it was noted that 60.4% of women and 23.6% of men with BMI <30Kg/m2 had body fat levels above 30% and 25%, respectively (Rezende *et al*, 2007). In the present study, it was observed that students entered college with inadequate consumption of daily fruits and vegetables, perpetuating throughout the course. A picture was very similar to that found in the study by Dare *et al*., in which they concluded that Brazilian and European university students had reduced consumption of fruits and vegetables[7]. In the analysis, it was noticed that about 74% of European university students consumed a reduced daily portion of vegetables, whereas, among Brazilian students, the percentage reached 86%. When evaluating the daily consumption of fruits, 73.9% of European students and 84% of Brazilians did not eat as recommended (Dare *et al*, 2017). Although Brazil has a large availability of fruits and vegetables, we observed that their consumption was inadequate in the three groups of students, a fact described in other studies carried out in the country (Ramalho *et al*, 2012). The determination of abdominal circumference (AC)is characterized as an effective measure in determining metabolic risk. A high index, regardless of the presence of overweight, indicates the presence of abdominal/visceral fat and is considered a risk factor for chronic diseases, especially for cardiovascular diseases (Petribú *et al*, 2012 and Rezende *et al*, 2007). In the present study, most students of the three years analyzed had AC within normality parameters, but about 17% of university students had high values.

This increase in AC still in youth is worrisome, as, over time, it becomes a significant risk factor for the development of cardiovascular diseases. Thus, it is crucial to advocate the reduction of AC, and as a consequence, visceral fat, which would improve insulin sensitivity, reduce plasma concentrations of glucose and triglycerides and favor an increase in HDL-cholesterol culminating in a significant reduction in risk factors for DM2 and cardiovascular diseases (Petribú *et al*, 2012). The analysis of blood pressure and capillary blood glucose was within normal limits in all the three groups evaluated. These results are very positive since hypertension and DM2 are criteria for the diagnosis of MS, and have a close correlation with the risk of developing cardiovascular diseases. According to Machado *et al*., the change in blood pressure levels can be characterized as a potential cause of cardiovascular diseases, a correlation noted even in cases of mild hypertension (Machado *et al*, 2010). On the other hand, Hypertension may be secondary to excess adiposity, mainly due to the accumulation of abdominal fat (Machado *et al*, 2010 and Sharma, A. M. 2002). Regarding the lifestyle habits of the evaluated university students, there is a prevalence of 7% of smokers. These values are higher than those found among students in the United States (3.3%), but they are lower than the current Brazilian prevalence of smoking, which ranges from 10% to 20% in the overall population (Scheffer *et al* 2013). Researches has proven that smoking favors oxidative and inflammatory damage, which can lead to circulatory changes due to tobacco toxicity. Furthermore, the presence of subclinical inflammatory conditions induced by smoking is a predisposing factor for MS and other chronic diseases, especially for cardiovascular diseases (Rosine *et al*, 2007). When analyzing family factors such as a history of obesity, high values were noted in the three groups analyzed, with percentages ranging from 24% to 35%. According to data from the second volume of the National Health Survey (NHS) of 2019, released by the Brazilian Institute of Geography and Statistics, the Brazilian population with excess weight reached 61.7%, representing about two thirds of the Brazilians, which reflects the poor quality of nutritional assessment and sedentary lifestyle, these associated factors contribute to the increased prevalence of cardiovascular diseases, which consequently considerably reduces life expectancy (IBGE, 2019). The study noted a predominance of male participants. Previous research differs from our result, as according to a study carried out by Scheffer and Cassenote, over the last decade, there was a significant increase in women entering medical school (Scheffer *et al*, 2013). According to official data on students enrolled in the medical course at UFG, there are 346 men and 226 women, in which the female population is still a minority, representing around 40% of medical students at the institution. Some limitations of the present study must be considered. Every study based on questionnaires, even those with international validity, may suffer from the bias of self-report that is not always in line with reality once it is up to the participant to fill in the data. This research also showed limitations regarding the impossibility of measuring lipids due to lack of funds and the lack of a questionnaire on sleep assessment and physical exercise.

CONCLUSION

Our study showed that a significant portion of UFG medical students have FRCV associated with the development of MS: a high percentage of body fat despite eutrophic BMI; they have poor eating habits and show a progressive worsening in health indicators throughout their college years. Therefore, university students must improve their lifestyle habits, which is expected to improve body composition and prevent chronic diseases in the future. This scenario indicates the need for multidisciplinary intervention aimed at the medical students at UFG, with health promotion measures based on combating CVRF. Educational Institutions must recognize the characteristics of the diseases described in this study and other research to promote relevant prevention and assistance actions for students in all phases of the medical course. More studies are needed to confirm the data from this research. In addition, the research team will carry out the longitudinal follow-up of students and include data on sleep and physical activity, which will contribute to a better understanding of the health status of medical students.

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