

Simultaneity of behavioral risk factors for cardiovascular disease in university students

Simultaneidade de fatores de risco comportamentais para doença cardiovascular em estudantes universitários

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ABSTRACT: *Objective:* To analyze the prevalence and factors associated with clustering of four behavioral risk factors — physical inactivity, high fat intake, harmful use of alcohol and tobacco use — for cardiovascular diseases (CVD) among undergraduate students from Universidade Federal do Rio Grande, Rio Grande, Rio Grande do Sul, Brazil. *Methods:* Cross-sectional study. Socio-demographic variables, breakfast habits, satisfaction with body image, body mass index, and self-perceived general health were analyzed. The outcome evaluated was simultaneity of risk factors for CVD. Crude and adjusted analyses were carried out, stratified by gender, using ordinal logistic regression, extracting odds ratio with respective 95% confidence intervals (95%CI) and p values. *Results:* The sample was composed of 1,123 students (response rate: 66.0%); of these, 24.7% had two or more risk factors. In the adjusted analysis, the variables intermediate maternal education, absence of breakfast habit, and poor or regular self-perceived general health was significantly associated ($p < 0.05$) with the outcomes. *Conclusion:* The results indicate an important prevalence of two or more simultaneous risk factors among undergraduate students. It was possible to outline which groups are more susceptible to more risk factors. The association between absence of breakfast habit and poor/regular self-perceived general health are highlighted.

Keywords: Risk factors. Adults. Epidemiology. Behavior. Cardiovascular diseases. Lifestyle.

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RESUMO: *Objetivo:* Analisar a prevalência e os fatores associados à simultaneidade de quatro fatores de risco comportamentais — inatividade física, elevado consumo de gorduras, consumo abusivo de álcool e tabagismo — para as doenças cardiovasculares (DCV) em estudantes de graduação da Universidade Federal do Rio Grande, Rio Grande, Rio Grande do Sul, Brasil. *Métodos:* Estudo de delineamento transversal. Foram analisadas variáveis sociodemográficas, o hábito de tomar café da manhã, a satisfação com a imagem corporal, o índice de massa corporal (IMC) e a autopercepção de saúde. O desfecho foi a simultaneidade de fatores de risco para as DCV. Foi realizada regressão logística ordinal, extraíndo as razões de *odds* com os respectivos intervalos de confiança de 95% (IC95%) e valores *p*. *Resultados:* A amostra foi composta por 1.123 estudantes (taxa de resposta de 66,0%); desses, 24,7% apresentavam 2 fatores de risco ou mais. Na análise ajustada, apresentaram associação estatisticamente significativa ($p < 0,05$) com o desfecho as variáveis escolaridade materna intermediária, não ter o hábito de tomar café da manhã e autopercepção de saúde ruim/regular. *Conclusões:* Os achados deste estudo indicam uma importante prevalência de estudantes com simultaneidade de dois ou mais fatores de risco. Foi possível traçar quais são os grupos mais susceptíveis a apresentar maior número de fatores, ressaltando a associação com a falta de hábito de tomar café da manhã e a autopercepção de saúde ruim/regular.

Palavras-chave: Fatores de risco. Adultos. Epidemiologia. Comportamento. Doenças cardiovasculares. Estilo de vida.

INTRODUCTION

Cardiovascular diseases (CVD) have become the leading cause of mortality worldwide, accounting for about 30% of all deaths¹. In Brazil, a report issued by the World Health Organization (WHO) showed that ischemic heart disease was the leading cause of death —139,000 deaths—in 2012 and that CVD, along with diabetes, led the years lost to premature death, that is, earlier than expected by the average life expectancy of the population². According to the latest survey, in Brazil, the proportional mortality due to circulatory system diseases was responsible for 30.7% of deaths in 2011³.

In order to create a global and continuous movement against premature death largely caused by CVD, the United Nations (UN) has been focusing on four behavioral risk factors: tobacco use, inadequate diet, lack of physical activity, and harmful use of alcohol⁴. Evidence shows that these factors tend to be simultaneous, and there may be a multicausal network between exposure to one behavior and presence another⁵.

The literature lacks studies investigating the coincident distribution of these behaviors, especially among university students. In Brazil, only two studies evaluating this topic in this population were found: one conducted at Universidade Federal de Santa Catarina (UFSC)⁶ in 2008, and the other at Universidade Federal do Paraná (UFPR) in 2011⁷.

This study aimed to analyze the prevalence and factors associated with the simultaneity of four behavioral risk factors—physical inactivity, high fat intake, alcohol abuse and smoking—and CVD in a sample of university students from Southern Brazil.

METHOD

This cross-sectional population-based study is part of the study “Health of Students of a Public University in Southern Brazil”, carried out at Universidade Federal do Rio Grande (FURG). It was approved by FURG Health Research Ethics Committee (CEPAS), under Protocol No. 37/2015.

Currently, FURG has approximately 8,000 undergraduate students across 46 courses. The target population were undergraduate students aged 18 or over, enrolled in the first semester of 2015, and who had on-site classes at the *campi* in the city of Rio Grande. Students on leave of absence, dropped out of the course or with infrequent attendance at the time of collection were not considered eligible. Those who reported having CVD were excluded from the analyses and the disease was not questioned.

For the sample size calculation, the associated factor calculation was used, considering an exposed/unexposed ratio of 4:1, prevalence ratio of 1.7, 80% power and 5% significance level. Multiplying by 1.5 to compensate for the design effect and adding 15% for confounding factors, $n = 1,380$ was obtained.

The sampling process was carried out in a single stage, from listing all classes by means of systematic sampling. Considering that the same student could be in more than one class and that some were not yet aged 18, a 10% increase was added to the sample size, totaling 1,992 students. The average number of students per class (20 students) was calculated, and a total of 100 classes was necessary to compose the sample process. As sampling was systematized, a selection interval (“skip”) of 21 was calculated, based on the ratio of total number of classes offered by FURG ($n = 2,107$) and the number of classes required for this study ($n = 100$). All students in each class were interviewed to compose the final sample, regardless of the number of people in each of them. The number of students per class ranged from 1 to 73.

A self-administered, confidential questionnaire was used, being previously tested in a pilot study conducted at Universidade Federal de Pelotas (UFPeL). For the present study, information about four behavioral risk factors were accounted for and operationalized as follows:

1. Physical inactivity: students were classified as inactive if they did not perform any physical activity (< 10 minutes per week) in leisure time, with moderate to vigorous intensity. The leisure section of the International Questionnaire on Physical Activity (IPAQ), long version, was used⁸.
2. High fat intake: evaluated using the first block of the Block Screening Questionnaire for Fat and Fruit/Vegetable/Fiber Intake, which proposes to evaluate dietary fat based on the meat/snacks section. This section is comprised of 15 questions that generate a score according to respondents’ intake frequency (monthly or weekly). Students who scored more than 27 were classified as high-fat intake⁹.
3. Alcohol abuse: information collected following a pattern of questions from the Surveillance of Risk and Protection Factors for Chronic Diseases by Telephone Survey (VIGITEL)¹⁰. Men who had consumed five or more doses of alcohol and women who

had consumed four or more doses in the 30 days prior to the survey were classified as alcohol abusers.

4. Smoking: those who answered “yes” to the question “As for smoking, do you consider yourself a smoker?” were considered smokers.

The outcome evaluated was the simultaneity of risk factors for CVD, formed by the sum of them: none, one, two, three or four. Independent variables analyzed were:

1. gender: male; female;
2. age range: 18–19; 20–24; 25–29; 30 or older;
3. skin color: white, black, others;
4. total family income in the last month in Brazilian Reais (divided into tertiles);
5. living or not in Rio Grande, and the State they lived in before joining the university;
6. body mass index (BMI) in three categories: up to 24.0 kg/m²; from 25.0 to 29.9 kg/m²; 30 kg/m² or more (based on self-reported weight and height);
7. maternal education in years: from 0 to 4; from 5 to 11; 12 or more years;
8. habit of having breakfast: no/rarely; sometimes; always;
9. satisfaction with body image: no; yes;
10. self-perception of health: poor/regular; good/very good.

Data were collected in the first half of 2015. Students who agreed to participate in the study signed the Informed Consent Form. In case of refusals, the student’s age and gender were noted. Each class was visited at least twice; individuals who were not found at visits were considered “loss to follow-up”. The information collected was typed twice, using the free software EpiData 3.1.

A univariate analysis was performed to describe the sample (absolute and relative frequency of each variable), and, through the Fischer’s Exact Test, individuals who did not have at least one outcome information were assessed and compared to those who had. Bivariate analysis was performed with Fisher’s Exact Test and the χ^2 test, in order to calculate the prevalence of concurrency of risk factors. For crude and adjusted analysis, the ordinal logistic regression was used. Proportional odds ratio (OR) assumption was verified by the Brant test. The variables met the criteria ($p > 0.10$), except for maternal education, which violated only among male individuals, that is, OR obtained by the ordinal logistic regression was not linear for the number of risk factors (outcome).

For the multivariate analysis, a hierarchical conceptual analysis model was elaborated in three levels, establishing adjustment for possible confounding factors, controlling same or higher-level variables. First-level variables were gender, age, skin color, total income, State of residence, and maternal education in years; second-level was breakfast habit; third-level were satisfaction with body image, BMI, and self-perceived health. The cut-off point for variables to remain in the model was $p < 0.20$. The design effect was considered in all analyzes, and the threshold of statistical significance was 5%. The analyses were performed using the Stata IC 13.1 software.

RESULTS

A total of 1,423 students answered the questionnaire, with 15.6% of losses ($n = 270$) and 2.5% of refusals ($n = 43$). Over half the students who refused to answer were males (60.6%) and had mean age of 26.4 years. Of the 1,423 respondents, 45 were excluded because they declared previous CVD and 255 because they did not fulfill the questions related to the outcome. Thus, 1,123 students (66% of 1,691 eligible for the study) were included in the analyses. The specific losses related to the outcome were higher for subjects aged 30 years or more ($p < 0.01$) who reported maternal education to be less 4 years of study or more ($p = 0.04$) and who were satisfied with their body image compared to their peers ($p = 0.02$). The design effect for the study outcome was 1.22, with intraclass correlation coefficient being 0.02.

The sample consisted of female individuals (51.4%), mostly white-skinned (79.5%), aged between 20 and 24 years (48.9%), median income of BRL 3,000.00 (interquartile range of BRL 1,500.00 to BRL 5,770.00), maternal education of 12 years or more (46.7%), who had lived in Rio Grande do Sul before joining the university (84.1%) and who reported good/very good health self-perception (63.5%). Just over half of students stated that they always ate breakfast (53.6%) and were satisfied with their body image (55.8%); 40.6% of them had a BMI of 25.0 kg/m² or more.

Figure 1 shows the prevalence of risk factors. Alcohol abuse was the most prevalent risk factor (44.2%), being more frequent among men ($p < 0.01$). Physical inactivity was the second one (38.2%), prevailing among women ($p < 0.01$). High fat intake was reported by 21.9% of the students, with no significant difference between men and women ($p = 0.79$), as well as smoking ($p = 0.30$), with a 7.5% prevalence. Considering the combination of risk factors, 24.3% of the students had two or more risk factors (95%CI 21.8 – 26.8), and 26.7% (95%CI 24.1 – 29.3) had none.

Table 1 presents the prevalence of zero, one, two, three and four risk factors for each independent variable. Maternal education, breakfast habit, and self-perceived health were associated with the outcome. The group with one risk factor held a majority of students whose mothers studied for 12 years or more; for those with three or four risk factors, the most mothers had between 5 and 11 years of study. Considering the group with no factors related to breakfast habit, prevalence was those who reported having this meal. Groups with two, three and four risk factors mostly held respondents who perceived their health as bad or regular.

Table 2 shows the results of the ordinal logistic regression (crude and adjusted analyses) of the whole sample. In the adjusted analysis, the following variables had a significant association ($p < 0.05$) with the outcome (having one more risk factor than the comparison group): maternal education in years (between 5 and 11), absence of breakfast habit, and poor or regular self-perception of health. The variable breakfast habit had a linear trend $p \leq 0.01$, suggesting that, as the habit of this meal becomes more frequent, the number of risk factors decreases when compared to subjects who never have this meal.

DISCUSSION

The present study found that more than two-thirds (73%) of university students had at least 1 of the 4 behavioral risk factors evaluated, with about 1 in 4 (24%) presenting more than one risk factor. Considering that such factors can coexist, that is, occur simultaneously, the present study was developed aiming to investigate the groups most likely to have accumulation of risk factors.

The prevalence of alcohol abuse among college students (44.2%) was higher compared to findings by Vigitel¹¹ in 2015 (17.2%), which analyzed this consumption among adults from Brazilian capitals. When considering this consumption stratified by gender, results were similar: men use alcohol more than women do. The percentage of physical inactivity among Brazilians is 16%, with no difference between men and women¹¹; among university students, this prevalence was 38.2%, predominantly among women.

In the present study, 24.3% of students were exposed to two or more factors. The prevalence found was lower than that reported among UFSC students (40.7%) in 2008⁶, and among adults in Pelotas, Rio Grande do Sul (66.6%), in 2010¹².

Regarding maternal education, students who declared that their mothers had 5 to 11 years of education were more likely to have one more risk factor than those who declared education for 12 years or more. Those whose mothers studied up to four years had protection. These findings are noteworthy since, supposedly, mothers with higher levels of education

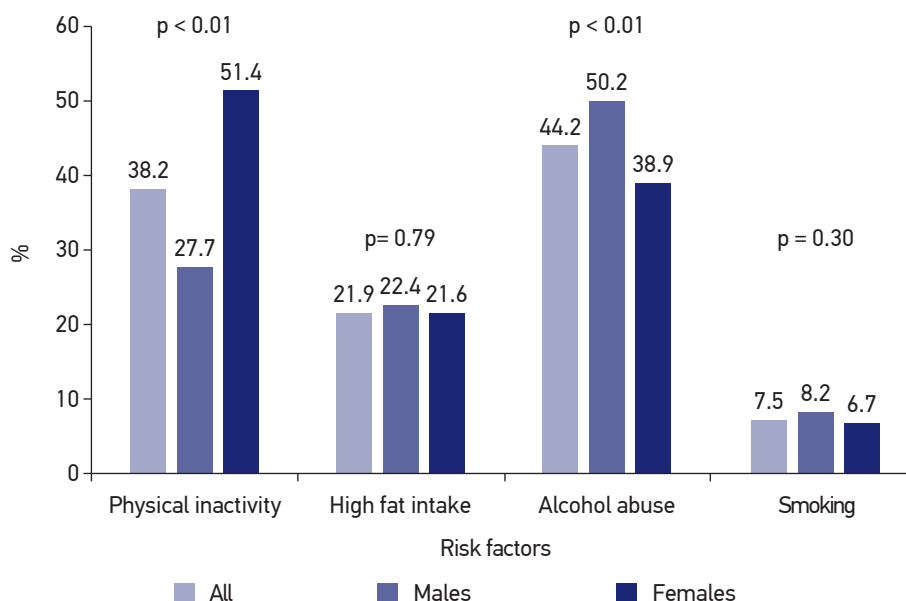


Figure 1. Prevalence of risk factors for cardiovascular diseases in students of Universidade Federal do Rio Grande, Rio Grande, 2015 (n = 1,123).

Table 1. Distribution of characteristics by risk factors for cardiovascular diseases. Undergraduate students from Universidade Federal do Rio Grande, Rio Grande, 2015 (n = 1,123).

Variables	Simultaneity of risk factors					p-value
	0 FR	1 FR	2 FR	3 FR	4 FR	
	(n = 300)	(n = 550)	(n = 188)	(n = 78)	(n = 7)	
	%	%	%	%	%	
Total sample	26.7	49.0	16.7	7.0	0.6	
Sex						
Male	50.5	51.1	41.4	41.0	42.9	0.11
Female	49.5	48.9	58.6	59.0	57.1	
Age (years)						
18 to 19	17.9	14.4	20.7	18.8	–	0.10*
20 to 24	43.6	53.9	46.4	40.7	57.1	
25 to 29	16.4	16.9	17.3	15.9	14.3	
≥ 30	22.1	14.8	15.6	24.6	28.6	
Skin color						
White	79.5	78.3	84.5	79.2	42.9	0.07
Black and others	20.5	21.7	15.5	20.8	57.1	
Total income in tertiles						
1 (lowest)	37.8	31.4	36.4	40.3	57.1	0.53*
2	30.2	32.8	30.1	31.9	28.6	
3 (highest)	32.0	35.8	33.5	27.8	14.3	
State of residency before college						
Rio Grande do Sul	86.6	84.3	83.1	75.6	85.7	0.21
Others	13.4	15.7	16.9	24.4	14.3	
Maternal education in years						
0 to 4	12.4	10.6	7.8	6.6	–	< 0.01*
5 to 11	43.1	37.3	49.7	61.8	100.0	
≥ 12	44.5	52.1	42.5	31.6	–	
Eats breakfast						
No/rarely	15.8	24.5	25.3	33.7	14.3	< 0.01*
Sometimes	20.5	22.9	29.0	27.3	14.3	
Always	63.7	52.6	45.7	39.0	71.4	
Satisfaction with body image						
No	39.9	44.4	44.7	56.4	57.1	0.11*
Yes	60.1	55.6	55.3	43.6	42.9	
BMI (kg/m ²)						
Up to 24.9	60.9	60.8	56.7	50.0	57.1	0.13*
25.0 – 29.9	30.7	26.4	27.6	32.0	14.3	
≥ 30.0	8.4	12.8	15.7	18.0	28.6	
Self-perceived health						
Bad/regular	27.2	33.4	52.2	55.4	71.4	< 0.01
Good very good	72.8	66.6	47.8	44.6	28.6	

RF: risk factors; * χ^2 test; BMI: body mass index.

Table 2. Crude and adjusted association between number of risk factors (zero to four) for cardiovascular diseases and independent variables. Undergraduate students from Universidade Federal do Rio Grande, Rio Grande, 2015 (n = 1,123).

Variable	n	Crude analysis	p-value	Adjusted analysis	p-value
		OR (95%CI)		OR (95%CI)	
Sex					
Male	538	1.00	0.05	1.00	0.07
Female	570	1.26 (1.00 – 1.59)		1.25 (0.99 – 1.59)	
Age (years)					
18 to 19	172	1.00	0.55	1.00	0.64
20 to 24	506	0.98 (0.69 – 1.39)		0.93 (0.61 – 1.41)	
25 to 29	173	0.99 (0.62 – 1.60)		0.90 (0.51 – 1.57)	
≥ 30	183	0.81 (0.52 – 1.26)		0.75 (0.45 – 1.26)	
Skin color					
White	888	1.00	0.73	1.00	0.86
Black and others	229	0.96 (0.74 – 1.24)		1.03 (0.78 – 1.35)	
Total income in tertiles					
1 (lowest)	361	1.05 (0.78 – 1.42)	0.94	1.06 (0.79 – 1.43)	0.88
2	328	1.03 (0.77 – 1.42)		1.07 (0.79 – 1.44)	
3 (highest)	350	1.00		1.00	
State of residency before college					
Rio Grande do Sul	922	1.00	0.06	1.00	0.23
Others	174	1.34 (0.99 – 1.82)		1.21 (0.85 – 1.73)	
Maternal education in years					
0 to 4	109	0.78 (0.53 – 1.14)	0.02	0.77 (0.52 – 1.12)	0.01
5 to 11	456	1.30 (1.02 – 1.65)		1.30 (1.02 – 1.64)	
≥ 12	495	1.00		1.00	
Eats breakfast					
No/rarely	254	1.85 (1.44 – 2.38)	< 0.01	1.84 (1.41 – 2.41)	< 0.01
Sometimes	261	1.60 (1.19 – 2.16)		1.68 (1.23 – 2.28)	
Always	585	1.00		1.00	
Satisfaction with body image					
No	494	0.78 (0.62 – 0.99)	0.04	0.98 (0.77 – 1.26)	0.90
Yes	624	1.00		1.00	
BMI (kg/m²)					
Up to 24,9	658	1.00	0.01	1.00	0.11
25,0 – 29,9	311	1.01 (0.76 – 1.36)		0.99 (0.73 – 1.36)	
≥ 30	139	1.68 (1.20 – 2.34)		1.47 (1.03 – 2.09)	
Self-perceived health					
Bad/regular	405	2.23 (1.70 – 2.91)	< 0.01	1.94 (1.43 – 2.63)	< 0.01
Good very good	703	1.00		1.00	

OR: odds ratio; 95%CI: 95% confidence interval; BMI: body mass index.

would be the ones with the best conditions to support their children¹³. A study with adolescents from Pernambuco also found an association between intermediate maternal education (9–11 years) and increase in the simultaneity of risk behaviors, raising the hypothesis that mothers with higher levels of education spend more time working outside and, therefore, dedicating less time to their children¹³. It is noteworthy that the majority of young people who did not complete the questions related to the outcome of this study declared maternal education of up to four years. These youngsters could present more risk factors, which would raise the hypothesis of no differences between them and university students whose mothers studied between 5 and 11 years.

The habit of not having breakfast every day was associated with the chance of having one more risk factor than those who eat this meal every day, indicating that this habit may be a marker of healthy behavior. A Finnish study that evaluated five cohorts of adolescent twins born between 1975 and 1979 and their parents¹⁴ came to similar conclusions, indicating that this habit is related to a healthier lifestyle—a view shared by another review on the subject¹⁵. It is known that with the changes in lifestyle of society led this habit to diminish, mainly due to the lack of time to have breakfast and to the fact that many people lived alone¹⁶.

Body image represents how individuals think, feel, and behave about their physical attributes¹⁷. In adolescents from a municipality in the countryside of Santa Catarina¹⁸, health was the factor that most influenced the dissatisfaction with self-perceived body image. In the present study, only the crude analysis showed association of this variable with the outcome, which was lost in the adjusted analysis, suggesting that dissatisfaction with body image may not independently influence modifiable risk behaviors.

College students who declared poor/regular self-rated health were more likely to have a higher risk factor compared to those who declared it as good/very good. This finding agrees with research conducted with adults from the Brazilian city of Pelotas¹² and from The Netherlands⁵, suggesting that students who rate their health as positive would be the same ones who adopt a healthier lifestyle. In this way, self-perception of health may be referred to as a health indicator¹⁹. This relationship is complex, since it is not known which event precedes the other, that is, having more risk factors causes individuals to perceive their health as worse¹².

In the present study, women were 26% more likely to have one more risk factor than men (gross analysis), but after adjusting for confounders, this association was not maintained. In a study conducted with UFSC students⁶, women were more likely to have three or more risk factors than men. National surveys carried out with adults living in Porto Alegre, in the State of Rio Grande do Sul²⁰, and Salvador, in the State of Bahia²¹, did not find associations, agreeing with our findings. One hypothesis to be considered for the results of this study being different from the one found in UFSC⁶ is the different data collection methods for dependent variables.

Overweight and obesity in the Brazilian population are known to be associated with cardiovascular risk factors²². In this study, BMI was used to verify the association of overweight and obesity with the simultaneity of CVD risk factors. The association was significant in

the crude analysis, but not in the adjusted analysis, suggesting that BMI does not influence the outcome. A possible reverse causality effect should be considered. Overweight or obese individuals may, from this condition, seek to change their habits by adjusting their diet or practicing physical activity.

Some limitations of this study need to be taken into consideration. As this is a cross-sectional study, one cannot infer causality between modifiable variables and the outcome, leading to a reverse causality bias. Regarding BMI, we highlight that it may be the consequence of behaviors that make up the outcome, and there is a reverse causality effect. However, since the purpose of the study was to assess the existence of associations—and not whether they were causal—it was included in the analyses. Considering the extrapolation of results to university students in general, caution should be exercised, as the sample was composed exclusively of FURG students. Information about the four risk factors were collected by self-report, which may lead to overestimation of physical activity and underestimation of alcohol and tobacco use or fat intake. This is because university students, for the most part, are already aware of the ideal practice for such factors.

It is important to emphasize that the methods for collecting variables differ between the studies, as well as the set of these variables and the type of analysis, which makes the comparison of results difficult. Another limitation is that weight and height were self-reported, and may not reflect reality. The response rate of this study was 66%, which may lead to possible selection bias. However, in studies with this population, similar or even lower response rates have been observed^{23,24}. Students who did not answer only questions related to the outcome of the present study ($n = 255$) differed from those who answered ($n = 1,123$) only for the independent variables age, maternal education in years, and body satisfaction. Most of these students were aged 30 years or older, declared maternal education from zero to four years, and were satisfied with their body image.

One of the strengths of this study was that it added new evidence to the limited body of knowledge about the prevalence and factors associated with the risk factors for CVD among university students, since there are few studies with university students from Brazil^{6,7} and around the world^{25,26}. Since this population is characterized, for the most part, by young adults, this becomes important so that the presence of these factors is known as early as possible, so more prevention work can be carried out. Another important factor to consider is that we have analyzed behaviors simultaneously, since it is known that negative behavior is associated with other unhealthy conducts, creating a network between them.

For purposes of analysis, we used the ordinal logistic regression. This form of analysis is still scarce in the public health field²⁷, which demonstrates the innovative and differentiated character of this research, since we could lose information when categorizing outcomes. By choosing this form of analysis, one gains in sensitivity and power, in addition to generating a single measure of association that expresses a linear effect between exposure and outcome.

The conduction of new studies on the simultaneity of these behaviors in young adults in Brazil is necessary, since, according to the region of the country, the characteristics of

the populations and the simultaneity of risk factors can be different. In addition, a global effort is required to establish cutoff points and standardized ways of collecting data regarding the four modifiable risk factors analyzed, thus generating data that can be compared to different studies conducted in several regions of Brazil and the world.

CONCLUSION

The findings of this study allowed us to identify which groups of students are more likely to present a larger number of CVD risk factors: intermediate maternal education, not having breakfast and negative self-perceived health. Universities are places with potential for health promotion actions among young people.

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