Co-occurrence of insufficient physical activity, smoking, inadequate diet, and alcohol consumption in university students from Minas Gerais, Brazil

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Abstract:
The aim of this study was to estimate the prevalence and factors associated with the co-occurrence of insufficient physical activities, smoking, consumption of alcoholic beverages, and inappropriate eating habits in university. This is a cross-sectional study with a representative sample of students from the Federal University of Triângulo Mineiro, MG, Brazil. The information was obtained through a questionnaire and the risk criteria adopted were irregular consumption of fruits and vegetables, insufficient physical activity, smoking, and excessive consumption of alcoholic beverages. The independent variables were sex, age group, marital status, area of study and time of study. The outcomes were the co-occurrence of two and three/four risk factors. The association was measured using Odds Ratio (OR) and a multinominal logistic regression with a significance level of 5%. 1.110 university students participated. The prevalence of two and three/four risk factors was of 35.3% and 15.4%, respectively. College students with a partner were associated with lower chances for two risk factors (OR: 0.45; 95% CI: 0.21–0.98), and there was an association between three or four factors of behavioral risk with university students belonging to areas not related to health (OR: 1.90; 95% CI: 1.26–2.86). It was concluded that the prevalence of occurrence of two risk factors or more was high and that single students and those in fields unrelated to health were associated with the risk factors.
Keywords: Students, Risk factors, cross-sectional studies, health behavior.

Coocorrência da atividade física insuficiente, hábito de fumar, consumo alimentar e de bebidas alcoólicas inadequados em universitários de Minas Gerais, Brasil

Resumo:
O objetivo deste estudo foi estimar a prevalência e os fatores associados à coocorrência de atividades físicas insuficientes, hábito de fumar, consumo de bebidas alcoólicas e condutas alimentares inadequados em universitários. Trata-se de estudo transversal com amostra representativa de estudantes da Universidade Federal do Triângulo Mineiro, MG, Brasil. As informações foram obtidas via questionário, os critérios de risco adotados foram: consumo irregular de frutas e hortaliças, prática de atividade física insuficiente, hábito de fumar e consumo excessivo de bebidas alcoólicas. As variáveis independentes foram sexo, faixa etária, situação conjugal, área de estudo e período de estudo. Os desfechos foram a coocorrência de dois e três/quatro fatores de risco. A associação foi mensurada via Odds Ratio (OR), por meio de regressão logística multinominal com nível de significância de 5%. Participaram deste estudo 1.110 universitários. A prevalência de dois e três / quatro fatores de risco foi de 35,3% e 15,4%, respectivamente. Associaram-se com menores chances de coocorrência de dois fatores de risco, os universitários com companheiro (OR: 0,45; IC 95%: 0,21–0,98), e com maiores chances de coocorrência de três ou quatro fatores de risco comportamental com estudantes universitários pertencentes a áreas não relacionadas a saúde (OR: 1,90; IC 95%: 1,26-2,86). Concluiu-se que a prevalência de coocorrência de dois fatores de risco ou mais foi elevada e que os estudantes solteiros e de outras áreas de estudo não relacionadas à saúde foram associados aos fatores de risco.
Palavras-chave: Estudantes, fator de risco, estudos transversais, conduta de saúde.

Co-ocurrencia de actividad física insuficiente, tabaquismo, consumo inadecuado de alimentos y alcohol entre estudiantes universitarios en Minas Gerais, Brasil

Resumen:
El objetivo de este estudio fue estimar la prevalencia y los factores asociados a la coexistencia de actividad física insuficiente, tabaquismo, consumo de alcohol y hábitos alimentarios inadecuados en estudiantes universitarios. Se trata de un estudio transversal con una muestra representativa de estudiantes de la Universidad Federal de Triângulo Mineiro, MG, Brasil. La |información se obtuvo a través de un cuestionario, los criterios de riesgo adoptados fueron: consumo irregular de frutas y verduras, actividad física insuficiente, tabaquismo y consumo excesivo de bebidas alcohólicas. Las variables independientes fueron sexo, grupo de edad, estado civil, campo de estudio y período de estudio. Los resultados fueron la co-ocurrencia de dos y tres / cuatro factores de riesgo. La asociación se midió mediante Odds Ratio (OR), mediante regresión logística multinominal con un nivel de significancia del 5%. En este estudio participaron 1.110 estudiantes universitarios. La prevalencia de dos y tres / cuatro factores de riesgo fue 35,3% y 15,4%, respectivamente. Los estudiantes universitarios con un compañero se asociaron con menores posibilidades de coexistencia de dos factores de riesgo (OR: 0,45; IC del 95%: 0,21–0,98) y con mayores posibilidades de coexistencia de tres o cuatro factores de riesgo. estudiantes universitarios de áreas no relacionadas con la salud (OR: 1,90; IC 95%: 1,26-2,86). Se concluyó que la prevalencia de co-ocurrencia de dos o más factores de riesgo era alta y que los estudiantes solteros y los estudiantes de otras áreas de estudio no relacionadas con la salud estaban asociados con factores de riesgo.
Palabras clave: Estudiantes, factor de riesgo, estudios transversales, conducta de salud.

INTRODUCTION

Chronic non-communicable diseases (NCDs) are considered the main causes of morbidity and mortality in the world and were responsible for 71% of deaths in 2016 (WORLD HEALTH ORGANIZATION – WHO, 2018). In Brazil, NCDs are a public health problem, leading to cases of cardiovascular diseases, cancer, respiratory diseases and, diabetes (MALTA *et al.*, 2019a). Evidence indicates that behavioral risk factors are potential causes of NCDs, such as alcohol abuse, tobacco use, physical inactivity, and inadequate diet (DODD *et al.*, 2010; NOBLE *et al.*, 2015; MALTA *et al.*, 2019b).

In a study with university students from an institution in the state of Bahia, a high prevalence of alcohol consumption (41.3%), lower levels of physical activity during leisure time (54.1%), irregular fruit (81, 2%) and vegetable (57.0%) consumption were observed (SOUSA; JOSÉ; BARBOSA, 2013). Other studies with this population also showed a high prevalence of alcohol consumption (79.8%) (BARROS; COSTA, 2019), low consumption of fruits and vegetables (98.1%) (LIMA *et al.*, 2017), insufficient physical activity (59.3%) (TAKENAKA *et al.*, 2016) and smoking (18.7%) (FERRAZ *et al.*, 2017).

On the other hand, evidence indicates that these behaviors tend to take place together, considering that the exposure to one risk factor can influence the presence of another (KELLER *et al.*, 2007; ALAMIAN; PARADIS, 2009; VERAS *et al.*, 2012). It is noteworthy that the co-occurrence of these risk factors can increase the chances of the appearance of NCDs, thus favoring mortality rates (PRIOR *et al.*, 2016).

In a survey of university students in Germany, the interrelation and aggregation of risky behaviors were analyzed, and it was evident that there was a predominance of university students with three simultaneous risky behaviors (34.8%), followed by two (34.5%), and up to four (18.2%) (KELLER *et al.*, 2008). In another study conducted in Brazil with university students from the state of Santa Catarina, it was observed that 29% had two simultaneous risk behaviors, 11.7% had three or four, and those with no risk behavior were 20.2% (SILVA; PETROSKI, 2012).

In another study with Brazilian university students, it was shown that women, those with more university time, and older students were associated with the co-occurrence of two or more health risk factors (SOUSA *et al.*, 2021). In the study of Paulitsch, Dumith e Susin

(2017), found the association of the co-occurrence of two or more risk factors with the habit of not drinking coffee, poor or regular self-rated health, and intermediate maternal education level, from five to eleven years of study. However, in the study by Crepaldi *et al.* (2016), an association was presented for the co-occurrence of up to three risk factors between men and students not belonging to the health study area.

Considering these divergences in the prevalence and characteristics associated with the co-occurrence of risk factors, the relevance of analyzing this information in this group stands out, since, in recent years, the offer of higher education has grown, and from 2008 to 2018, there was a 44.6% increase in students entering higher education throughout Brazil (BRASIL, 2018). With the admission to the university, the lifestyle undergoes significant changes, since this is a stage of transition among young people, with changes in routines and habits, which can favor negative health behaviors. Therefore, the adoption of care practices is fundamental to reduce the risk of NCDs (SÁNCHEZ-OJEDA; DE LUNA-BERTOS, 2015). Considering that the majority of the university population is young people, the risks for co-occurring risky behaviors may be higher (SPRING; MOLLER; COONS, 2012), and habits adopted in younger stages of life tend to persist in the adult life (COSTA *et al.*, 2017).

The university can be a favorable environment for the creation of strategies for health promotion, prevention, and even disease control, and can influence university students in adopting a healthy lifestyle. The aim of this study was to estimate the prevalence and factors associated with the co-occurrence of insufficient physical activity, smoking, consumption of alcoholic beverages, and inappropriate eating habits in university students at an educational institution in the state of Minas Gerais, Brazil.

METHODS

This is a cross-sectional study, derived from the first survey of the research "Profile of the lifestyle and quality of life of students at the Federal University of *Triângulo Mineiro*", carried out in 2018. This study was approved by the Research Ethics Committee of the Federal University of *Triângulo Mineiro* (UFTM), CAAE 77869617.1.0000.5154, and the volunteers previously signed a free and informed consent form for participation.

The population comprised university students from on-campus undergraduate courses at UFTM, Uberaba, Minas Gerais (MG), enrolled in the first semester of 2018 (N = 5,952). To determine the sample size, the equation proposed by Luiz and Magnanini (2000) was used, considering a 95% confidence level, an acceptable sampling error of 3 pp (percentage points), a prevalence of 50% (considering the survey of different health outcomes), plus an additional 20% for losses and another 10% for controlling confounding factors in association studies. Thus, the sample considered included 1,195 university students. It was foreseen to replace the refusals (university students found, but who were not interested in participating).

The sample was distributed proportionally by each graduation course according to the number of students in the institution's 25 courses. Students with 18 years or more, who signed the informed consent form, regardless of gender and physical condition, were included. After possible participants were tabulated, the distance learning courses university students, students with higher education degrees who enrolled in undergraduate courses, and those from technical courses and who did not study in the campus in Uberaba, Minas Gerais, were excluded, since they could present different sociodemographic and health-related behaviors.

To conduct data collection, a training session was conducted with the team, in March 2018. The team was formed by 11 examiners, formed by university, students and postgraduate students in Physical Education at UFTM. Data collection took place from April to July 2018. The instrument was applied in classrooms, individually or in groups of up to 30 university students, with the presence and assistance of an examiner, taking an average of 15 minutes to complete.

Information was acquired using a questionnaire, which was formed using questions from the questionnaire *Indicadores de Saúde e Qualidade de Vida de Acadêmicos* (ISAQ-A), validated for the application in university students (SOUSA *et al.*, 2013), in addition to the International Physical Activity Questionnaire (IPAQ), brief version (MATSUDO *et al.*, 2001), and sociodemographic and link with the program University questions. In this study, the following behaviors were analyzed: consumption of fruits and vegetables, physical activity, smoking, and excessive alcohol consumption.

The risk criteria adopted were a) irregular consumption of fruits and vegetables, referring to consumption for up to 4 days/week of both (JAIME *et al.*, 2009); b) insufficient physical activity, by reporting up to 149 minutes per week, in moderate to vigorous intensity, obtained by multiplying the days of practice as a function of the average time of practice per day for walking, moderate physical activities, and physical activities of vigorous intensity (WHO, 2020). The minutes of vigorous physical activities were multiplied by two (HALLAL *et al.*, 2003); c) the cigarette consumption, related to the conduct of smoking one or more cigarettes per day (SOUSA *et al.*, 2013); d) excessive consumption of alcoholic beverages on one occasion, referring to the intake of four doses or more for women and five doses or more for men, in the last 30 days, with the dose considered: half a bottle of beer, or a can of beer, or a glass of wine or a shot of whiskey, cognac, cachaça or vodka (DAWSON, 2011).

The four variables were added and classified into 0 to 1 risk factor, 2 risk factors, and 3 or 4 risk factors, with the last two categories being the outcomes of this study. The independent variables were gender (male and female); age group in complete years (18 to 24 years and 25 years or more); marital status of being with a partner (married or living with partners) and without a partner (separated or divorced, widowed or single); study area, classified in Health and Other Sciences (Exact and Earth Sciences, Biological Sciences, Engineering, Agrarian Sciences, Social and Applied Sciences, Human Sciences and Language Studies) (BRASIL, 2017); study period, dichotomized in the daytime (morning, afternoon, full time) and nighttime; and university time in years (up to 2 years and 3 years or more).

The information was tabulated in the software Excel, version 2013, and the data analysis was performed in the SPSS software for Windows, version 24. Analyses of absolute and relative frequencies were used, together with an estimate of the mean (standard deviation), minimum, and maximum values. The association between the exploratory variables in relation to the co-occurrence of risk factors was carried out via Odds Ratio (OR), with the 95% confidence intervals (95%CI), through multinomial logistic regression, considering crude and adjusted analyzes. The reference category was 0 and 1 risk factors. In the adjusted analysis, all variables were included and selected to remain in the adjustment using the backward method, the one with a value of $p < 0.20$ in the likelihood ratio test. The association was determined by the Wald test, with a significance level of 5%.

RESULTS

A total of 1156 university students participated in this study. Three students were excluded for informing that they were under the age of 18 and 43 for entering the university having a previous college degree, leading to a final sample of 1,110 university students. According to the number of university students participating in each course, there was no statistical difference between the sample and the target population (data not shown).

Among the students, 61.8% (n = 683) were female. Their mean age was 21.5 years (SD = 4.2; minimum of 18; maximum of 56). As for their marital situation, 96.1% lived without a partner, 68.6% were from other study areas not related to the health sciences, and 73.7% studied during the day. Regarding behavioral risk factors, 47.8% reported consuming fruits and vegetables up to four days a week, 10.3% reported being smokers, and 27.7% were considered insufficiently active. Regarding alcohol consumption, the majority, 68.6%, reported having consumed alcohol, as shown in Table 1.

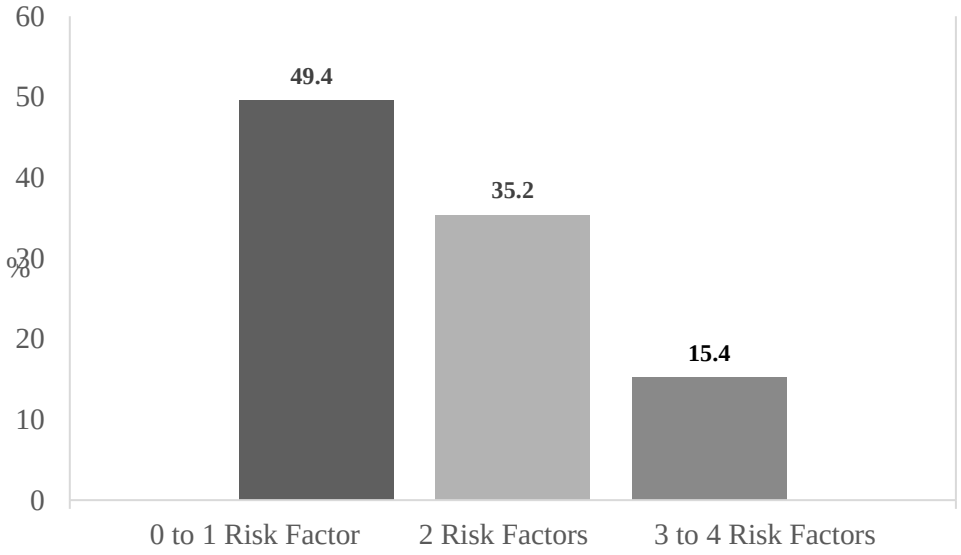
Table 1 – Characterization of the sample according to the sociodemographic, educational, and behavioral variables of university students in Uberaba, MG, 2018.

Variables	n	%
Gender		
Male	422	38.2
Female	683	61.8
Age group in years		
18 to 24 years	978	88.1
25 years or more	132	11.9
Marital status		
With partner	43	3.9
Without partner	1067	96.1
Study area		
Other sciences	761	68.6
Health sciences	249	31.4
Period of study		
Nighttime	291	26.2
Daytime	818	73.8
University time in years		
Up to 2 years	566	51.1
3 years or more	541	48.9
Consumption of fruits and vegetables ≤ 4 days a week	527	47.8
Smoking	114	10.3
Excessive alcohol consumption	759	68.6
Insufficient physical activity	301	27.7

%: Frequencies.
Source: Farias *et al.* (2023).

The figure 1 shows the prevalence of co-occurring behavioral risk factors. It was observed that the prevalence of two risk factors was approximately 35,0 %, and 15.4% had three or four risk factors.

Figure 1. Prevalence of co-occurring behavioral risk factors in university students in Uberaba, MG. 2018.



Source: Farias *et al.* (2023).

The prevalence of co-occurring behavioral risk factors, according to their exploratory characteristics, is shown in Table 2. It was observed, in relation to the co-occurrence of two risk factors, that 37.5% were male, 36.5% were university students aged 25 years or more, without partners (35.6%), from study areas not related to health (36.2%), studying during the day (35.7%) and who were in university for three years or more (37.3%).

Table 2 – Prevalence of co-occurring behavioral risk factors according to exploratory characteristics in university students in Uberaba, MG. 2018.

Variables	0 and 1 RF (n) %	2 RF (n) %	3 or 4 RF (n) %
Gender			
Male	(185) 45.0	(154) 37.5	(72) 17.5
Female	(350) 52.1	(227) 33.9	(93) 13.9
Age group in years			
18 to 24 years	(473) 49.4	(336) 35.0	(150) 15.6
25 years or more	(63) 50.0	(46) 36.5	(17) 13.5
Marital status			
With partner	(27) 65.8	(10) 24.4	(04) 9.8
Without partner	(509) 48.8	(372) 35.6	(163) 15.6
Study area			
Other sciences	(341) 46.3	(267) 36.2	(129) 17.5
Health sciences	(195) 56.1	(115) 33.0	(38) 10.9
Period of study			
Nighttime	(136) 49.7	(93) 33.9	(45) 16.4
Daytime	(400) 49.4	(289) 35.7	(121) 14.9
University time in years			
Up to 2 years	(275) 49.7	(184) 33.2	(95) 17.1
3 years or more	(261) 49.4	(197) 37.3	(70) 13.3

RF: Risk Factors.
Source: Farias *et al.*, (2023).

Table 3 shows the association in the crude and adjusted analyses, between the sociodemographic and study characteristics, and the co-occurrence of behavioral risk factors. In the crude analyses, for two risk factors, there was an association between students from other study areas when compared to those in the area of Health sciences (OR: 1.35; 95%CI: 1.02-1.79); in relation to three or four risk factors, an association was observed for male students (OR: 1.44; 95%CI: 1.01-2.06) and from other study areas not related to Health sciences (OR: 1.90; 95%CI: 1.27-2.83).

In the adjusted analyses (Table 3), there was an association of university students with partners (OR: 0.45: 95%CI: 0.21-0.98) in relation to two simultaneous risk factors, and an association between students from study areas not related to health sciences for three or four risk factors (OR: 1.90; 95%CI: 1.26 - 2.86).

Table 3 – Association between sociodemographic and study characteristics and the co-occurrence of behavioral risk factors in university students in Uberaba, MG. 2018.

Variables	2 RF		3 or 4 RF	
	Crude	Adjusted	Crude	Adjusted
	OR (CI95%)	OR (CI95%)	OR (CI95%)	OR (CI95%)
Gender				
Male	1.28 (0.97-1.68)	1.23 (0.93-1.62)	**1.46 (1.02-2.09)**	1.34 (0.93-1.92)
Female	1.00	1.00	1.00	1.00
Age group in years				
18 to 24 years	0.97 (0.64-1.45)	0.93 (0.60-1.44)	1.17 (0.66-2.07)	1.05 (0.58-1.92)
25 years or more	1.00	1.00	1.00	1.00
Marital status				
With partner	0.51 (0.24-1.06)	**0.45 (0.21-0.98)**	0.46 (0.16-1.34)	0.46 (0.16-1.34)
Without partner	1.00	1.00	1.00	1.00
Study area				
Other sciences	**1.33 (1.02-1.75)**	1.30 (0.98-1.72)	**1.94 (1.29-2.90)**	**1.90 (1.26-2.86)**
Health sciences	1.00	1.00	1.00	1.00
Period of study				
Nighttime	0.94 (0.70-1.28)	0.87 (0.62-1.22)	1.09 (0.73-1.62)	0.87 (0.56-1.34)
Daytime	1.00	1.00	1.00	1.00
University time in years				
Up to 2 years	0.88 (0.68-1.15)	0.89 (0.69-1.17)	1.28 (0.91-1.84)	1.28 (0.89-1.82)
3 years or more	1.00	1.00	1.00	1.00

RF: Risk Factors; OR: Odds Ratio; 95%CI: 95% Confidence Interval. Adjusted at the end for sex, marital status, area of study, and university time in years with p values of the likelihood ratio test <0.20. OR and CI95%, when bold, represent an association with Wald's test p-value < 0.05.

Source: Farias *et al.* (2023).

DISCUSSION

The present study showed a high prevalence of two or more risk factors among university students. There was a low-effect association of university students with a partner and two health risk factors. University students from fields other than Health sciences, an association was observed with the co-occurrence of three or four behavioral risk factors.

It was observed that more than half of the university students (50.6%) presented two or more risk factors simultaneously. This result is similar to study carried out with university students in Asia (49%). However, behavioral risk factors were measured, such as lower levels of physical activity, and other biological markers, through the analysis of blood glucose, lipid profile, and body mass index (GHARAIBEH *et al.*, 2012). Higher proportions (87.7%) were shown in a study with university students in Germany regarding the co-occurrence of two or more behavioral risk factors (smoking, alcohol abuse, low levels of physical activity, and inappropriate eating habits) (KELLER *et al.*, 2008). In our study, the behavior that favored the high prevalence of co-occurring risk factors was alcohol abuse. The habit of excessive drinking represents a risk and is a prevalent behavior in university students (FERRAZ *et al.*, 2017). A high prevalence of alcohol consumption in this population could be expected since there are numerous opportunities for consuming alcoholic beverages that attract this audience.

In comparison with other national studies, carried out in institutions in the South of Brazil, a higher prevalence of two or more health risk factors (78,5%) was observed at the Federal University of *Santa Maria* (CUREAU; DUARTE; TEIXEIRA, 2019), on the other hand, a lower prevalence (40.7%) was found in students from the Federal University of *Santa Catarina* had a prevalence of 40.7% for two or more risk factors (SILVA; PETROSKI, 2012). lower prevalences were presented in a study conducted with university students from the Federal University of *Rio Grande do Sul*, a lower prevalence (24.3%) was observed, by estimating the high consumption of fats, physical inactivity, alcohol consumption, and smoking (PAULITSCH; DUMITH; SUSIN, 2017). The divergences between the studies were mainly due to the analysis of different characteristics, but all results show that the prevalence of co-occurring risk factors in this group was high, increasing the chances of early NCDs (CRUZ *et al.*, 2017; FRANCISCO *et al.*, 2019).

It was observed that the association between the male gender and the co-occurrence of three or four health risk factors was a confounding variable in the adjustment for the other characteristics. However, other studies with university students showed an association between the male gender and the co-occurrence of behavioral risk factors (GHARAIBEH *et al.*, 2012; CREPALDI *et al.*, 2016), as well as an association with biological risk factors, such as the percentage of body fat, bone mass, glucose, cholesterol, triglycerides, low-density lipoprotein (LDL), in addition to the body mass index (BMI) and waist-hip ratio (WHR) (GHARAIBEH *et al.*, 2012;). However, other studies showed that the female gender was associated with the co-occurrence of two or more risk factors (SILVA; PETROSKI, 2012; TASSITANO *et al.*, 2014). In the present study, the association between gender and the co-occurrence of risk factors was not confirmed, due to the greater relevance of knowledge about risk behaviors, which are usually offered in health courses.

An association was found between students belonging to study areas unrelated to Health sciences with the co-occurrence of three or four risk factors. Similar results were observed with university students from Uberlândia, MG, who showed a higher prevalence of co-occurrence of up to 14 risk factors for students in the Human, Social, Applied, Linguistics, Language, and Arts areas, followed by those in the areas of Engineering, Exact, and Earth sciences (CREPALDI *et al.*, 2016). It is evident that health students may be more protected, due to the knowledge acquired on topics during college, in addition to representing professionals who will inform opinions about the need for healthy behaviors, which reinforces the need for expansion of health education in university spaces.

The present study found an association between university students living with a partner and the co-occurrence of two risk factors, though with lower effects of occurrence for this outcome. These results corroborate with a study carried out with university students from Germany, which showed a greater co-occurrence of two or more health risk factors among single students, who live alone and/or who share housing with friends (KELLER *et al.*, 2008).

Being single, with no relationships, can lead to the adoption of negative behaviors, such as unhealthy eating habits, because the lack of a partner can have a negative influence, such as the lack of concern for good nutrition (ALVES; BOOG, 2007), or even the greater exposure to environments that favor or stimulate the consumption of alcohol. Being single

can provide greater opportunities for behaviors that are harmful to health, considering that a large part of university students lives alone or with other young people and most of the time are away from the family, which distances them from possible family control, in addition to greater access to parties and places of leisure, with alcoholic beverages (PELICIOLI *et al.*, 2017).

The limitation of this research was the convenience sampling that may represent a bias, due to the greater adhesion of university students more likely to participate in research. However, to minimize this limitation, the sample was stratified according to each course, in order to avoid sample imbalance between courses. As a strength, the sample size and the research carried out with all undergraduate courses at the institution can be cited, since it provides a broad overview of the university's student's profile.

There was a high prevalence of co-occurring health risk factors among university students, with more than half of the university students presenting two or more simultaneous risk factors. The chance of co-occurrence of 2 risk factors was greater among students who lived with partners, and with higher chances of affecting three or four behavioral risk factors, students belonging to study areas not related to health. The information in this study can be useful for institutional policy strategies in the academic environment, through actions that encourage students to adopt healthy habits, focusing on their main behavioral risk factors, such as inadequate diet and alcohol consumption.

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