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Risky Alcohol Use Among University Students: Associated Factors and Changes Over a Decade

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Risky alcohol use among university students: associated factors and changes over a decade

Running title: Alcohol and university: changes over a decade

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ABSTRACT

Objective: To assess the prevalence and correlates of risky alcohol use among Brazilian university students and compare findings across a 12-year interval.
Methods: A questionnaire survey conducted in 2018 among a representative sample of students at the State University of Campinas. Alcohol use patterns were assessed using the Alcohol Use Disorders Identification Test, and associations with sociodemographic, academic, and mental health variables were analyzed. A bivariate analysis with a 1% significance level and multiple logistic regression with a 5% significance level were performed.
Results: A total of 6725 university students were evaluated regarding their alcohol consumption, 34.5% of which presenting risky alcohol use. Alcohol consumption was associated with being male, single, from a higher socioeconomic status, and living with peers. Significant associations were found between risky drinking and academic difficulties, risky behaviors, and mental health problems. The comparative analyses (2006/2018) showed an increase,

particularly among women, in risk (20.1% x 34.7%), high-risk drinking (3.6% x 7.6%), and probable alcohol use disorder (1.1% x 2.9%), as well as an increase in the rates of sexual intercourse while intoxicated.

Conclusion: High rates of risky alcohol use, particularly among women, highlight the importance of integrating individual support with population-level education and awareness initiatives.

Keywords: University students, College students; Substance abuse; substance use disorder; Alcohol.

Introduction

The university plays a crucial role in shaping students' development and fostering their critical thinking, primarily through access to knowledge and the richness of interpersonal relationships. During this phase, students undergo a complex and multidimensional transition, rich in subjective experiences and marked by interactions between the youth and the university [1]. Although admission to the university increases access to information, which potentially contributes to changing risk perceptions and adopting healthier behaviors, entering higher education can also represent a vulnerable period with greater exposure to risks, including experimentation and abuse of various psychoactive substances (PAS), particularly alcohol [2].

Third National Survey on Alcohol and Drugs (LENAD III) found that among adolescents aged 14 to 17 years, 27.6% had consumed alcohol at least once in their lifetime, 19.1% reported alcohol use in the past year, and 10.4% in the past month, indicating easy access to alcoholic beverages [3]. While most students enter college with some prior experience with alcohol consumption, certain characteristics of university life may intensify their relationship with this PAS. These include a less structured routine, wide availability of alcohol, reduced parental supervision, and the culture of alcohol use on campuses [4]. Data from the 2024 "Monitoring the Future" survey in the United States showed that college young adults reported higher prevalence than noncollege young adults for alcohol use in the past 12 months (71.5% vs. 63.0%) and past 30 days (52.1% vs. 42.7%) [5]. In line with these findings, the most comprehensive multicentric study among Brazilian university students, conducted in 2009, indicated that 86% of students had already consumed alcohol at least once in

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their lifetime, and 36% consumed five or more alcoholic beverages on a single occasion [6].

For over a decade, the association between alcohol consumption among university students and incidents of intoxication, traffic accidents, acts of violence, unprotected sex, and academic problems has been observed[7]. Studies suggest that, although these harmful consequences remain significant, other contemporary risks have emerged, including those associated with the increasing consumption of alcohol by women and their heightened vulnerability to sexual abuse under the influence of alcohol [7].

Aiming to provide information that can guide the planning of actions to mitigate the harms associated with hazardous alcohol use and to enable each graduate to reach their full potential, the present study has conducted a survey on risky alcohol consumption, associated factors, and changes observed over a decade among Brazilian university students.

Method

Study Type and Sample Delimitation

This report is part of a larger research project in which several aspects of university students from the State University of Campinas (UNICAMP) — one of the most important Brazilian universities — were investigated during the years 2017 and 2018. The research includes only undergraduate students and covered sociodemographic and psychosocial identity aspects, risk and protective behaviors for physical and mental health, and the use of PAS, with alcohol being the focus of this paper. This is a cross-sectional study, funded by the São Paulo Research Foundation (FAPESP) through a research grant (process 2017/01842-6). Quantitative data were collected through an individual questionnaire, filled out anonymously by each participant.

A minimum sample of 20% of students was defined, proportionally distributed among the areas of Arts and Humanities, Basic Sciences, Health Sciences, and Exact and Technological Sciences, covering daytime, evening, and full-time periods.

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Assessment Instrument

The questionnaire used in the study consisted of six sections: sociodemographic information; academic status; physical and mental health, which included the subtopics: sleep, mental health problems (non-suicidal self-injury, suicidal behavior, and seeking mental health care), and questions about sexuality. The following instruments were included: the Alcohol Use Disorders Identification Test (AUDIT) [8] to assess alcohol consumption over the past 12 months, with answers classified into four use patterns: low risk (0 to 7 points); risky use (8 to 15 points); high-risk use (16 to 19 points); and probable alcohol use disorder (20 to 40 points); the Brazilian Market Research Association (ABEP) questionnaire to evaluate socioeconomic status [9]; and the Self-Report Questionnaire (SRQ-20) to assess the presence of Common Mental Disorders (CMDs) when scoring above the cutoff point of 8 [10].

Additionally, associations between risky drinking and driving under the influence of alcohol were analyzed; involvement in traffic accidents, and sexual intercourse with a new, recent, or previously unknown partner while intoxicated, measured via a direct self-report question developed for this survey and previously used in the 2005/2006 assessment, ensuring methodological consistency across study waves.

Procedure

The questionnaire was administered during the most attended classes by pairs of researchers, one of whom was from the mental health field. Before distributing the questionnaires, an explanation of the research and its objectives was provided, and participants were assured of their anonymity and asked to fill out the Informed Consent Form (ICF). The average time to complete the questionnaire was 45 minutes.

Data Analysis

The information from the questionnaires was entered into a database in Excel, and the R/RStudio software was used for statistical analysis. The data were analyzed descriptively, followed by statistical analysis aimed at comparing the dependent variable of interest (risky drinking, defined by AUDIT>=8) and examining its relationship with other independent variables.

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Associations were analyzed using the chi-square test (bivariate analysis). Given the large number of independent variables in the dataset (approximately 160), a more conservative significance level was adopted for bivariate analyses ($p \leq 0.01$) in order to minimize the likelihood of spurious findings due to multiple testing. Subsequently, a multiple logistic regression model was built using a stepwise variable selection criterion, with a significance level of $p \leq 0.05$. This threshold was chosen to allow direct comparability with the 2006 survey conducted at the same university, in which the same criterion was applied. The software used for multivariable analysis was R version 4.2.0.

Additionally, comparative analyses were conducted between the results of the present study and a survey conducted 12 years apart [11] with undergraduate students from the same university, using questions and response options that remained consistent across both studies. This allowed for the comparability of alcohol consumption patterns (AUDIT scores) and risky behaviors associated with PAS use. Analyses were performed using all available valid data.

Ethical Aspects

This project is part of a larger study approved by the Research Ethics Committee (CEP) of UNICAMP, under the No. 1.903.287. The amendment that included this subproject and the researcher was approved under the No. 3.271.098.

Results

A total of 6,906 students were included, representing 34.4% of the 19,869 undergraduate students at UNICAMP in the year of the survey [12], with a refusal rate of 1.2%. There was proportional distribution across the university's areas as follows: Exact and Technological Sciences 33.5% in the study, and 35.6% of the university's students; Health Sciences 23.1% and 18.9%; Arts and Humanities 27.8% and 24.5%; and Basic Sciences 11.1% and 15.4%, respectively.

Among the total sample of university students (6906), there were 180 missing subjects, who did not answer the AUDIT; therefore, for analyzes involving that instrument, the effective sample size of 6725 was considered.

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Prevalence of risky drinking (AUDIT >=8) was 34.5%, meaning one in three students. Tables 1 and 2 present the main sociodemographic, academic, and mental health variables associated with risky drinking among university students.

Table 1 – Sociodemographic and Academic Life Variables Associated with Risky Drinking (AUDIT >=8)

	AUDIT* -	**AUDIT* +**	*p-value*
Characteristics	n=4,404 (65.5%)	n=2,321 (34.5%)	
Gender			< 0.001
Female	2,279 (52.0)	966 (41.7)	
Male	2,104 (48.0)	1,351 (58.3)	< 0.001
Lives with			
Parents	1,725 (39.3)	600 (25.9)	
Alone	594 (13.5)	309 (13.3)	< 0.001
Friends	2,071 (47.2)	1,407 (60.8)	
Socioeconomic Level**			
A	1,457 (33.2)	979 (42.3)	< 0.001
B	2,282 (51.9)	1,078 (46.5)	
C, D, E	656 (14.9)	260 (11.2)	
Father's Education Level			< 0.001
Incomplete primary education	456 (10.4)	169 (7.3)	
Elementary/high school/technical	3,125 (71.5)	1,649 (71.4)	
Higher education/post-graduation	792 (18.1)	490 (21.2)	< 0.001
Mother's Education Level			< 0.001
Incomplete primary education	391 (8.9)	146 (6.3)	
Elementary/high school/technical	3,172 (72.2)	1,642 (71.1)	
Higher education/post-graduation	830 (18.9)	522 (22.6)	
Attended Elementary School at			< 0.001
Public school	1,761 (40.0)	696 (30.0)	
Private school	2,490 (56.6)	1,552 (67.0)	
Attended High School at			< 0.001
Public school	2,249 (51.1)	957 (41.3)	
Private school	2,137 (48.6)	1,350 (58.3)	
Course Field			< 0.001
Arts and humanities	1,127 (25.6)	737 (31.8)	
Basic sciences	562 (12.8)	177 (7.6)	
Health sciences	1,087 (24.7)	488 (21.0)	
Exact and technological sciences	1,391 (31.6)	857 (36.9)	
Course period			0.001
Full-time	3,123 (71.3)	1,552 (67.3)	
Evening	1,257 (28.7)	754 (32.7)	
Satisfied with the course			< 0.001
No	572 (13.0)	417 (18.1)	
Yes	3,788 (87.0)	1,890 (81.9)	
Lost semester			< 0.001
No	3,914 (89.4)	1,990 (86.2)	
Yes	465 (10.6)	318 (13.8)	

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Academic performance			< 0.001
Above average	1,673 (38.1)	741 (32.0)	
Average	1,799 (41.0)	990 (42.7)	
Below average	682 (15.5)	505 (21.8)	
Don't know	237 (5.4)	81 (3.5)	
Substance use for improved performance			< 0.001
No	2,470 (56.2)	843 (36.4)	
Yes	1,923 (43.8)	1,474 (63.6)	
Positive hazing experience			< 0.001
No	1,541 (36.4)	596 (26.4)	
Yes	2,690 (63.6)	1,660 (73.6)	
Missed classes			< 0.001
Never or almost never	1,880 (42.8)	530 (23.0)	
Few times	1,499 (34.1)	809 (35.0)	
Average compared to peers	694 (15.8)	559 (24.0)	
Frequently or very often	319 (7.3)	421 (18.2)	
Missed classes due to sleep deprivation			< 0.001
No	2,961 (83.7)	1,629 (77.0)	
Yes	577 (16.3)	485 (23.0)	
Missed classes due to laziness			< 0.001
No	2,894 (81.8)	1,487 (70.3)	
Yes	645 (18.2)	627 (29.7)	
Academic initiation or undergraduate research			< 0.001
No	2,809 (64.1)	1,622 (70.0)	
Yes	1,576 (35.9)	692 (30.0)	
Support for university challenges			< 0.001
Haven't needed nor sought	2,483 (56.8)	1,192 (52.0)	
Needed and didn't seek	1,035 (23.7)	618 (27.0)	
Needed and found	662 (15.1)	366 (16.0)	
Needed, sought, didn't find	194 (4.4)	122 (5.3)	
Relationship with faculty			< 0.001
Good	1,844 (41.9)	752 (32.5)	
Average and would like for it to be better	1,787 (40.6)	953 (41.0)	
Average and don't care	350 (8.0)	274 (11.8)	
Bad and would like for it to be better	387 (8.8)	316 (13.6)	
Have someone to rely on at the university			< 0.001
No	1,214 (27.6)	469 (20.2)	
Yes	3,180 (72.4)	1,852 (79.8)	

** AUDIT: Alcohol Use Disorders Identification Test*
*** To evaluate socioeconomic status, the Brazilian Market Research Association (ABEP) questionnaire was used.*

There is an association between risky drinking and being male, living with friends, and variables indicating a better financial situation: socioeconomic levels A and B, having attended private school, and higher parental education.

Regarding aspects of student life, there is an association between risky drinking and studying in the Exact Sciences or Arts areas, being dissatisfied

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with the course, having a perception of below-average performance compared to peers, having already failed a semester, skipping classes, having used psychoactive substances to enhance performance, being less involved in research activities, and having a poorer relationship with professors. On the other hand, students who engaged in risky drinking more frequently reported having had a positive experience during hazing and believe they have someone within the university they could rely on to help with personal problems.

Table 2 highlights several associations between risky drinking and variables related to mental health problems. Among students with AUDIT>=8, there was a higher demand for mental health care, a higher frequency of family history of mental health problems, a higher rate of students with a positive screening for CMD by the SRQ-20, as well as an association with non-suicidal self-injury and suicidal behavior. Risky alcohol use was significantly associated with all indicators of suicidal behavior. The strongest associations were observed for suicidal planning (OR = 1.28; 95% CI: 1.16–1.41) and suicide attempts (OR = 1.25; 95% CI: 1.10–1.42), while suicidal ideation also showed increased odds (OR = 1.18; 95% CI: 1.10–1.27).

Table 2 - Mental Health Variables Related to Risky Drinking (AUDIT >=8)

Characteristics	**AUDIT* -** n=4,404 (65.5%)	**AUDIT* +** n=2,321 (34.5%)	**Odds ratio** (95% CI)	*p-value*
Has sought mental health services				
No	2,660 (61.2)	1,304 (56.7)	1.13	< 0.001
Yes	1,685 (38.8)	997 (43.3)	(1.06-1.21)	
Family member with mental health issues				
No/don't know	2,416 (56.7)	1,145 (51.0)	1.16	< 0.001
Yes	1,848 (43.3)	1,097 (49.0)	(1.08-1.24)	
SRQ-20 positive				
Negative	2,174 (51.8)	1,018 (46.0)	1.17	< 0.001
Positive	2,026 (48.2)	1,201 (54.0)	(1.09-1.25)	
At least one month with difficulty sleeping				
No	2,352 (53.6)	1,026 (44.3)	1.28	< 0.001
Yes	2,038 (46.4)	1,292 (55.7)	(1.20-1.37)	
Daytime sleepiness				
No	918 (21.5)	381 (16.8)	1.23	< 0.001
Yes	3,349 (78.5)	1,886 (83.2)	(1.12-1.35)	
Non-suicidal self-injury (n=6,562)				
No	3,624 (84.4)	1,777 (78.4)	1.29	< 0.001
Yes	670 (15.6)	491 (21.6)	(1.19-1.39)	
Has thought about suicide (n=6,701)				
No	3,295 (75.0)	1,614 (69.8)	1.18	< 0.001
Yes	1,095 (25.0)	697 (30.2)	(1.10-1.27)	
Has made concrete plans for suicide (n=6,683)				
No	4,039 (92.3)	2,049 (89.0)	1.28	< 0.001

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Yes	339 (7.7)	256 (11.0)	(1.16-1.41)	
Has attempted suicide (n=6,657)				
No	4,165 (95.5)	2,149 (93.6)	1.25 (1.10-1.42)	0.001
Yes	197 (4.5)	146 (6.4)		

**AUDIT: Alcohol Use Disorders Identification Test*

Table 3 presents a comparison of alcohol consumption patterns (risky drinking, high-risk drinking, and probable alcohol use disorder), with AUDIT scores of >=8, >= 16 and >= 20, respectively, among students evaluated at the same university in 2005-2006 and 2017-2018, with differences between genders.

Table 3 - Comparisons between Students in 2005-06 and 2017-18 by Gender

Variables	**2005/2006** (n=1,654)* n (%)	**2017/2018** (n=6,730)* n (%)	p-value
Average AUDIT** score among university students (n= 8,183)	4.7	6.1	<0.001
Average AUDIT score among women (n= 3,841)	4.3	6.1	<0.001
Average AUDIT score among men (n=3,940)	5.3	6.2	<0.001
Risky drinking (AUDIT >=8) among university students (n=8,016)			
AUDIT 0-7	985 (76.6)	4,407 (65.5)	<0.001
AUDIT >=8	301 (23.4)	2,323 (34.5)	
High-risk drinking (AUDIT >= 16) university students (n=8,016)			
AUDIT 0-15 university students	1,231 (95.7)	6,205 (92.2)	<0.001
AUDIT >=16 university students	55 (4.3)	525 (7.8)	
Probable alcohol use disorder (AUDIT>= 20) university students (n=7,966)			
AUDIT 0-19 university students	1,217 (98.5)	6,529 (97)	0.002
AUDIT >=20 university students	19 (1.5)	201 (3)	
Risky drinking (AUDIT>= 8) women (n=3,940)			
AUDIT 0-7 women	570 (79.9)	2,106 (65.3)	<0.001
AUDIT >=8 women	143 (20.1)	1,121 (34.7)	
High-risk drinking (AUDIT >= 16) women (n=3,940)			
AUDIT 0-15 women	687 (96.4)	2,983 (92.4)	<0.001
AUDIT >=16 women	26 (3.6)	244 (7.6)	
Probable alcohol use disorder (AUDIT>= 20) women (n=3,940)			
AUDIT 0-19 women	705 (98.9)	3,132 (97.1)	0.006
AUDIT >=20 women	8 (1.1)	95 (2.9)	
Risky drinking (AUDIT >=8) men (n=4,041)			
AUDIT 0-7 men	414 (72.6)	2,278 (65.6)	0.001
AUDIT >=8 men	156 (27.4)	1,193 (34.4)	
High-risk drinking (AUDIT >= 16) men (n= 4,042)			
AUDIT 0-15 men	541 (94.9)	3,193 (92)	0.015
AUDIT >=16 men	29 (5.1)	279 (8.0)	
Probable alcohol use disorder (AUDIT>= 20) men (n=4,041)			
AUDIT 0-19 men	559 (98.1)	3,365 (96.9)	0.138
AUDIT >=20 men	11 (1.9)	106 (3.1)	
Driving under the influence of PAS*** (n=7,285)			

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No	1,005 (79.7)	4,736 (78.6)	0.394
Yes	256 (20.3)	1,288 (21.4)	
Driving under the influence of PAS women (n= 3,596)			
No	626 (88.9)	2,456 (84.9)	0.007
Yes	78 (11.1)	436 (15.1)	
Driving under the influence of PAS men (n=3,668)			
No	379 (68.0)	2,261 (72.7)	0.025
Yes	178 (32.0)	850 (27.3)	
Sexual intercourse with a new or previously unknown partner under the influence of PAS (n=6,563)			
No	993 (86.7)	3,282 (60.6)	<0.001
Yes	152 (13.3)	2,136 (39.4)	
Sexual intercourse with a new or previously unknown partner under the influence of PAS women (n=3,196)			
No	573 (93.0)	1,617 (62.7)	<0.001
Yes	43 (7.0)	963 (37.3)	
Sexual intercourse with a new or previously unknown partner under the influence of PAS men (n=3,347)			
No	420 (79.4)	1,647 (58.4)	<0.001
Yes	109 (20.6)	1,171 (41.6)	

**Variable analysis conducted based on valid data.*
***AUDIT: Alcohol Use Disorders Identification Test*
****PAS: psychoactive substances*

When comparing alcohol consumption patterns of students from the same university across two time periods approximately twelve years apart, a significant increase in alcohol consumption is observed. Regarding AUDIT scores, it is noted that, although the average score remains below the cutoff point, it has increased, particularly among women. The same trend is observed across all consumption patterns: risky drinking, high-risk drinking, and probable alcohol use disorder.

With respect to changes in risky behaviors during the comparison periods, the frequency of engaging in sexual intercourse under the influence of alcohol tripled (13.3% x 39.4%) among students, and when considering gender, this rate doubled among male students and quintupled (7% x 37.3%) among female students.

Table 4 - Comparative Multiple Logistic Regression for Risky Drinking between Periods

Variables	**2005/2006**			**2017/2018**		
	n=1,654*			n=6,730*		
	AUDIT+* (259) X AUDIT- (792)			AUDIT+(2,321) X AUDIT- (4,404)		
	P-value	Odds ratio	95% CI	P-value	Odds ratio	95% CI
Gender						
Male X Female	<0.0001	2.59	1.81-3.72	0.244	1.14	0.92-1.41

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Housing						
Friends X Family	0.0237	1.57	1.06-2.33	0.001	1.31	1.12-1.52
Marital Status						
Single X Not Single	0.0203	5.90	1.32-26.40	0.002	1.72	1.23-2.44
Elementary School						
Private X Public	0.0001	1.77	1.34-2.34	0.001	1.27	1.10-1.47
Cigarette use in a year						
Yes X No	0.0166	1.70	1.10-2.64	<0.001	2.74	2.27-3.31

**AUDIT: Alcohol Use Disorders Identification Test*
** Variable analysis conducted based on valid data.*

In the comparison between the two periods evaluated, it is noteworthy that some variables remained significant as factors associated with risky drinking among university students: living with friends, being single, having attended private school, and having smoked tobacco cigarettes in the past 12 months. Although still more prevalent, the male gender lost its significance in the multivariate analysis in the second period, corroborating the increase in risky drinking among women.

Discussion

This paper is the first, to our knowledge, to examine different patterns of alcohol use, factors associated with risky drinking, and changes over a 12-year interval in a large sample of Brazilian university students.

The prevalence of risky drinking was 34.5%, meaning one in three students, a rate higher than that observed in a Finnish study (29%) [13], but lower than those found among university students in England (61%) [14] and Norway (43.7%) [15]. This rate is also higher than that observed in a comprehensive national survey[6], which included 12,711 university students and found that 19.2% of them engaged in moderate risky drinking and 2.6% were high-risk drinkers, according to the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) scale.

As pointed out both nationally and internationally, in the bivariate analysis the results associate risky drinking among university students with living with friends, resulting in less parental supervision and greater peer influence, and with having a higher economic status. People with higher socioeconomic status may consume similar or greater amounts of alcohol, although lower

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socioeconomic status groups suffer the consequences of alcohol use disproportionately [16].

In the academic context, an association was found between risky drinking and various variables indicative of academic difficulties, such as dissatisfaction with the course, less involvement in research activities, more frequent absences and loss of a semester. Additionally, more students in this group reported using psychoactive substances in an attempt to improve performance. These findings are consistent with Finnish [13] and British [17] studies, which pointed to an association between better academic performance and less involvement in alcohol use among university students, suggesting a possible protective role of good academic performance against risky drinking and probable alcohol use disorder.

It is important to emphasize that the cross-sectional design does not permit causal inferences. Therefore, the observed association may reflect a bidirectional relationship, in which higher alcohol consumption is related to poorer academic performance, while academic difficulties may also be associated with increased alcohol use. Longitudinal studies are needed to clarify the directionality of these relationships. Despite this, it is important for higher education institutions to have preventive programs and facilitate access to treatment for risky alcohol use, as well as academic support measures for students facing difficulties [18].

The results also show an association between risky drinking and mental health problems, as evidenced by the statistically significant frequencies of positive screening for CMD by the SRQ-20, sleep complaints, family history of mental health problems, and a higher rate of seeking mental health care, as highlighted in international studies [19,20]. Supporting this finding, the “Healthy Minds Network” study investigated the mental health of undergraduate students in the United States from 2007 to 2013, demonstrating that students with major depressive symptoms reported more frequent episodes of binge drinking, besides having higher blood alcohol concentrations when compared to students without depressive symptoms [20].

Another indicator of mental distress among university students who engage in risky alcohol use was the association with non-suicidal self-injurious behavior, present in 21% of students with a positive AUDIT score and

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associated with higher odds of self-injury (OR= 1.29; 95% CI: 1.19-1.39). This association was discussed in a Belgian study involving 4,565 university students, which found a relationship between NSSI and alcohol dependence (OR= 5.7; 95% CI: 2.3 - 14.1) [21]. Recent studies have focused on this relationship, such as the one conducted by Hooley & Franklin (2018), which postulates the interface between self-mutilation and alcohol use as difficulties in emotion regulation or as a strategy to reduce negative affect [22].

Even more concerning are the high rates of suicidal ideation, planning, and attempts found, reported by 30%, 11%, and 6.4% of university students with risky drinking, respectively, each showing higher odds in this group (suicidal ideation: OR = 1.18, 95% CI: 1.10–1.27; planning: OR = 1.28, 95% CI: 1.16–1.41; attempts: OR = 1.25, 95% CI: 1.10–1.42)—frequencies higher than those observed in the general Brazilian population [23]. Although the magnitude of these associations is modest, their clinical and public health relevance should not be underestimated, given the severity of suicidal behaviors and the high prevalence of risky alcohol use among university students. This association was corroborated by an American study [24] that investigated 40,335 students across four universities between 2015 and 2018. Of these, 2,296 met criteria for an increased risk of suicidal behavior, with alcohol consumption as a significant predictor of future attempts. Overall, the consistent association between risky alcohol use and multiple indicators of suicidal behavior underscores the importance of integrating mental health and substance use screening and prevention strategies on university campuses.

The findings demonstrate consistent associations between risky alcohol use and multiple indicators of mental distress, including common mental disorders, non-suicidal self-injury, and suicidal behavior. However, due to the cross-sectional design, these associations should not be interpreted as causal. The relationship may be bidirectional, and longitudinal studies are needed to clarify the temporal sequence of these factors.

When comparing alcohol consumption patterns among university students in both time periods (2005/06 and 2017/18), a significant increase was observed in all patterns of alcohol use (risky drinking, high-risk drinking, and probable alcohol use disorder), as well as a significant increase in risky behaviors such as having sexual intercourse with a new or previously unknown

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partner while intoxicated, and driving under the influence of alcohol, the latter observed only among women. It is worth noting that the increase in alcohol use patterns during this period was particularly driven by the rise in consumption among female university students.

In this regard, although problematic alcohol use patterns are more frequent among men, there has been a significant and disproportionate increase among female university students when comparing data from the same university collected twelve years ago, consistent with the trend toward gender parity that has been observed particularly among younger generations [25]. Binge drinking among female university students in the United States has increased 40% in the last decades[26]. Regarding the national scenario, population surveys converge on the increase in alcohol consumption among the female population. Comparative data between Brazil National Alcohol and Drugs Survey (LENAD) I and II show an increase in binge drinking in the past 12 months, rising from 36% to 49% in the female population, as well as in frequent drinking, which saw a more significant increase among women, rising from 27%, in 2006, to 38% in 2012 [27,28].

It is noteworthy that there is a scarcity of studies, particularly national ones, with this comparative focus. One exception is a study conducted at one of the largest universities in Latin America, which analyzed trends in drug use among university students between 1996, 2001, and 2009 [29–31]. The first survey (1996) identified alcohol as the most consumed substance, with a 12-month prevalence of 82.5%, and the 2001 survey revealed an increase in the rate of alcohol experimentation among men. Thirteen years after the first survey (2009), there was a slight decrease in alcohol use in the previous 12 months (82.5% vs. 80%) and in consumption over the previous 30 days (72.9% vs. 62.1%; $p<0.005$) [30,31].

The importance of the increase in alcohol consumption among female university students was corroborated by the multivariate analysis, in which the male gender was identified as an associated factor in the 2005-06 study, but no longer in 2017-18. Our study has confirmed a convergence theory of drinking behavior between genders, a finding consistent with other research[32] suggesting that women are currently more likely to experience more serious alcohol problems in university than men, including alcohol use disorder and

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substance-related harm[25]. Evidence from the literature indicates that heavy episodic drinking and related risk behaviors are more frequently observed among younger, single women with higher educational attainment, with variations across cities and co-occurrence with other risk factors[33,34]. These changes align with international patterns reported in the literature, suggesting that evolving gender norms and targeted marketing strategies have played a role in the rising levels of alcohol consumption among women[35].

The multivariate analysis pointed to the persistence, in both time periods, of the association between risky drinking and living with friends, being single, having a better socioeconomic status (indicated by having attended a private school), and smoking tobacco cigarettes. This finding aligns with the literature that highlights the simultaneous use of alcohol and cigarettes by university students, as noted by Weitzman & Chen, who found that over 98% of university students who smoke also drink alcohol, and 44 to 59% of university students who drink also smoke [36].

Approaches addressing risky alcohol use during university should consider the role of peer pressure, where normative social influences contribute to the development of positive perceptions of alcohol consumption, creating an environment where the drinking behavior is socially accepted and encouraged [37]. Other aspects are the motivations behind the use of this substance, which may occur as a socialization activity or as a coping mechanism for negative emotions [18].

Therefore, it is important to understand the target population when implementing intervention projects and to comprehend the underlying reasons associated with alcohol consumption among university students, guiding the necessary preventive actions. Brief Motivational Interventions, such as the Brief Alcohol Screening and Intervention for College Students (BASICS), are among the most effective preventive strategies for addressing alcohol use among university students[38]. A systematic review has shown significant reductions in alcohol consumption and alcohol-related consequences. This effectiveness is likely attributable to the preventive, harm-reduction focus of these interventions, which do not require abstinence and are well suited to the developmental and contextual characteristics of young adults[38].

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Successful intervention strategies should involve peer counseling, campaigns aimed at questioning the social normalization of alcohol, information on responsible consumption and the use of ride-hailing apps, as well as facilitated access to mental health support [18,39].

Another risky behavior that deserves attention due to its worsening between the two survey periods is having sexual intercourse with a new or previously unknown partner while intoxicated, a behavior that tripled (13.3% vs. 39.4%) among the total university student population and quintupled (7.0% vs. 37.3%) among female university students. Although there is a scarcity of national studies on this topic, an American study conducted with 966 university students highlights that being young and female significantly increases the chances of victimization by sexual violence among university students. Particularly relevant in this study is the finding that 5.2% of men and 11.2% of women had unwanted sexual intercourse while intoxicated, in addition to 4.3% of men and 14.4% of women who experienced an attempted forced sexual encounter while intoxicated or under the influence of other PAS [40].

Given the above, the importance of informational approaches regarding the prevention of alcohol-related sexual victimization is evident. Information should be provided on how high levels of alcohol consumption affect cognitive functions, which can reduce the ability to detect signals and threats of danger, and the ability to effectively resist unwanted advances that may arise in social situations; as well as discussing harm reduction strategies [41]. Additionally, since most victims are women, another point of focus should be on sensitizing men to the fact that an intoxicated person cannot legally consent to sexual contact and that engaging in sexual activity with an intoxicated or incapacitated person due to the use of other PAS is unacceptable [41].

Universities, in light of their students' mental health demands and, particularly, the risks associated with excessive alcohol consumption, need to implement a combination of multiple interventions, combining individual student support for those with risk factors with education and awareness programs for the university population as a whole, as well as gender-targeted strategies [39]. The results presented suggest the importance of implementing educational programs and interventions aimed at increasing awareness of the negative consequences of risky behaviors and promoting healthier decision-making

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within this population. Providing information about the effects associated with alcohol consumption can influence students' motivation to engage in more adaptive behaviors, the benefits of which may extend to everyone in the university environment [39].

Limitations

Despite the findings, the cross-sectional design precludes causal inferences regarding the observed associations. In addition, potential selection bias should be considered, as heavy drinkers may have been underrepresented due to lower class attendance, reducing their likelihood of participating in surveys administered in academic settings. Although conducted at a large public university, caution is warranted when generalizing these findings to institutions with different socioeconomic and academic profiles, which may limit external validity. Nevertheless, the protocol may serve as a model for replication in other Brazilian universities.

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Disclosures statement

The authors report there are no competing interests to declare.

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Author Contributions

Paulo Dalgalarrondo and Amilton dos Santos Júnior supervised the research project that led to this work. Marjourie Dragoni Biscaro Pastore, Renata Cruz Soares de Azevedo, Paulo Dalgalarrondo, and Amilton dos Santos Júnior were involved in all phases of the study: design, data collection, database organization, analysis, manuscript writing, and critical review for publication.

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