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ORIGINAL ARTICLE

Use of alcohol and other drugs among Brazilian college students: effects of gender and age

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Abstract
Objective: To assess the frequency of drug use among Brazilian college students and its relationship to gender and age. *Methods:* A nationwide sample of 12,721 college students completed a questionnaire concerning the use of drugs and other behaviors. The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST-WHO) criteria were used to assess were used to assess hazardous drug use. A multivariate logistic regression model tested the associations of ASSIST-WHO scores with gender and age. The same analyses were carried out to measure drug use in the last 30 days. *Results:* After controlling for other sociodemographic, academic and administrative variables, men were found to be more likely to use and engage in the hazardous use of anabolic androgenic steroids than women across all age ranges. Conversely, women older than 34 years of age were more likely to use and engage in the hazardous use of amphetamines. *Conclusions*: These findings are consistent with results that have been reported for the general Brazilian population. Therefore, these findings should be taken into consideration when developing strategies at the prevention of drug use and the early identification of drug abuse among college students.

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Uso de álcool e outras drogas entre universitários brasileiros: efeitos de gênero e idade

Resumo

Objetivo: Avaliar a prevalência do uso de drogas entre universitários brasileiros, assim como sua relação com gênero e idade. *Métodos*: Uma amostra nacional de 12.721 universitários que preecheram um questionário sobre o uso de drogas e outros comportamentos. Os critérios da escala *Alcohol, Smoking and Substance Involvement Screening Test* (ASSIST-WHO) avaliaram o uso de drogas de risco. Um modelo de regressão logística multivariada testou a associação entre a pontuação do ASSIST-WHO com o gênero, bem como a idade do universitário. O mesmo foi realizado para a medida de uso de drogas nos últimos 30 dias. *Resultados*: Após o controle de outras variáveis sociodemográficas, acadêmicas e administrativas, os homens foram os mais prováveis de usar e se engajar no uso de risco de esteroides anabolizantes androgênicos, mais do que as mulheres, e para todas as faixas etárias. Por outro lado, mulheres > 34 anos foram mais prováveis de usar e se engajar no uso de risco de anfetaminas. *Conclusões*: Estes resultados são consistentes com o que tem sido descrito para a população geral brasileira. Portanto, eles deveriam ser considerados no desenvolvimento de estratégias de prevenção do uso de drogas, bem como para o reconhecimento precoce do abuso de drogas entre universitários.

Introduction

Worldwide, almost two billion people use alcohol, more than one billion people use tobacco[1] and between 149 and 272 million people report having used some type of illicit drug[2]. Among these users, young people (especially college students) deserve particular attention.

There has been a great deal of effort directed toward understanding drug use among college students in the U.S.[3,4] For instance, the *Harvard School of Public Health College Alcohol Study*[4] (CAS) reported that 44% of American college students practice binge drinking *(most recently defined as the consumption of five or more consecutive drinks for men and four or more consecutive drinks for women)*. This risky pattern of alcohol consumption affects approximately 5,200,000 college students in the U.S.[5] More alarming is the finding that one in eight U.S. college students (13%) report having had 10 or more consecutive drinks on their last drinking occasion and that one in twenty (5%) report having had 15 or more consecutive drinks according to the *University of Michigan Monitoring the Future* survey.[3]

The consequences of drug use among college students are of the highest concern to public health authorities. A partial analysis conducted as part of the *National Epidemiologic Survey on Alcohol and Related Conditions* (NESARC) revealed that 45.8% of American college students had some type of psychiatric disorder, and alcohol-related disorders were the most common. According to this large-scale epidemiological study, college students were significantly more likely than their non-college-attending peers to have an alcohol use disorder. This result was also significant for alcohol dependence, but not for abuse.[6] Furthermore, college students are twice as likely to develop alcohol- and drug-related disorders than the rest of the American population.[6-8] In this regard, the prevalence of alcohol abuse and dependence over 12 months was 7.8 and 12.5% among college students, respectively, and the corresponding values for US adults were 4.7 and 3.8%, respectively.[6-8] The 12-month drug abuse and dependence rates among college students were 4.2 and 1.4%, respectively, whereas the corresponding values in U.S. adults were 1.4 and 0.6%, respectively.[6,7]

Although American college students have high rates of substance use, they rarely recognize the need for treatment or seek help.[9] Thus, the mental health treatment rates among students are low for all commonly identified psychiatric disorders. The lowest rates of help seeking have been reported for alcohol and drug use disorders.[6]

The outcomes are worrisome. There has been a 27% increase in the number of deaths from alcohol-related injuries among American college students.[5] In addition, the drinking behavior of others affects thousands of non-drinking students; these consequences are known as the second-hand effects of alcohol.[10] Taken together, these findings indicate a reduction in the life expectancy of the college students who, paradoxically, represent the nation's future.

This state of alcohol use in the U.S. is similar in Brazil. Young people aged 18 to 24 years have the highest rates of drug use and risky behaviors,[11,12] and 40.1% of this population attends college. A total of 5,808,017 students are enrolled in 2,252 higher education institutions HEIs.[13]

Although there have been efforts in Brazil to understand drug use among college students, they have been focused on the southeastern part of the country, particularly São Paulo, which limits the scope of these efforts. Because the onset of drug use disorders (especially drug abuse and drug dependence) typically occurs during late adolescence or early adulthood,[7] college is a particularly vulnerable period and an important target of continuing etiological and preventative research. Thus, the lack of an integrated national study of college students hinders the development of suitable intervention strategies and public control policies devoted to this target population in Brazil.

Due to the importance of this issue, the current study investigated the sociodemographic profiles and the alcohol and drug use of a nationwide sample of college students. The prevalences of the hazardous use of alcohol, other drugs, and both were also estimated. After accounting for the fact that gender and age are sociodemographic variable that are generally associated with drug use,[6-8,14] the present study highlights the specific gender- and age-related effects of drug use among Brazilian college students.

Methods

The data presented in this manuscript are part of the recently launched *1st Nationwide Survey on the Use of Alcohol, Tobacco and Other Drugs Among College Students in the 27 Brazilian State Capitals*.[13] These data were collected between May and December 2009.

Study design

A probabilistic, stratified sample of college students throughout Brazil was selected using unequally sized conglomerates. The five administrative regions of Brazil (i.e., north, northeast, west-central, south and southeast) and the types of administrative organizations of the HEIs (i.e., public or private) were defined as the sampling strata. The Higher Education Institutions (HEIs) and the student classes were considered the conglomerates. A class was defined as the set of students enrolled in a particular subject. Because a single college student could be enrolled in more than one subject, multiplicity sampling was also used. This method enables sample elements to be related to more than one conglomerate.

The sampling was conducted in two stages. The first stage consisted of the random selection of HEIs based on a sampling frame provided by the Anisio Teixeira National Educational Studies and Research Institute, Ministry of Education, Brazil. According to this list, there were 2,252 Brazilian HEIs in 2008. Only HEIs located in state capitals were sampled. Therefore, the sampling frame was organized by the state capital to which the HEIs belonged and then by the administrative organization type. Afterward, a systematic selection was performed based on a random starting point using the PPeS (probability proportional to estimated size), technique to select at least two public and two private HEIs from each Brazilian state capital, based on data from the aforementioned sampling frame and the number of students enrolled.

The next step consisted of selecting student classes. The managers of each HEI that agreed to participate in this study was asked to provide a list of mandatory subjects for all classroom-based, undergraduate-level courses on their HEI state capital campus. This subject list was segregated by academic year, study period and course to enable researchers to randomly select the classes from which to invite students to participate. Therefore, each HEI had its own sampling frame in the second selection stage.

Afterward, classes were systematically selected from the sampling frame. The number of classes selected was proportional to the total number of students at that particular HEI. All of the students in the selected classes were invited to volunteer for the study. Sampling procedures were based on the previous studies of Kish[15] and Cochran.[16]

Main outcome measures

After agreeing to participate, students completed and signed an informed consent statement. The students' participation consisted of individually completing a structured research questionnaire with 98 closed questions. This survey assesses the lifestyle of Brazilian college students. The content of this questionnaire is based on the World Health Organization's (WHO's) research instrument, which was previously adapted by Andrade et al.[17] and Stempliuk et al.[18] for use with Brazilian college students. On average, the questionnaire required 50 minutes to complete. After finishing the questionnaire, the students deposited it along with the consent form in separate urns, thereby making identification of the answers impossible and guaranteeing confidentiality.

The primary outcome of this study was drug use. Drug use was measured in terms of alcohol, tobacco, marijuana, cocaine powder, merla (cocaine paste), crack cocaine, amphetamines, anticholinergics, tranquilizers, opiate analgesics, barbiturates, anabolic androgenic steroids (AAS), inhalants, hallucinogens, and ecstasy. The use of these drugs was measured with respect to three time periods: lifetime, past 12 months, and past 30 days. As in the European School Project on Alcohol and Other Drugs (ESPAD),[19] the fictitious drug Relevin was included in this research instrument to assess the truthfulness of answers. If respondents indicated they had used Relevin, their entire questionnaire were excluded from the data analysis.

The "Alcohol, Smoking and Substance Involvement Screening Test" (ASSIST-WHO, version 3.1) criteria were included in the questionnaire. The 8-item ASSIST-WHO obtains information concerning drug use across the lifetime and over the last 3 months and also obtains information concerning drug-related problems over the last 3 months. Furthermore, the ASSIST-WHO indicates the level of risk associated with a respondent's substance use and whether their use is hazardous and likely to cause harm. The score obtained for each assessed substance is classified into the following risk categories: "low" (occasional or non-problematic use), "moderate" (regular use that warrants a brief intervention) or "high" (frequent and high-risk use that warrants the referral of the user to a specialized alcohol/drug treatment program) . Mid-range scores on the ASSIST-WHO suggest hazardous substance use (i.e., "moderate risk"), and higher scores suggest substance dependence (i.e., "high risk"); however, the ASSIST-WHO is a screening tool that lacks diagnostic criteria.[20] In this study, as the frequencies of high-risk ASSIST-WHO scores were low for all of the drugs investigated, moderate- and high-risk ASSIST-WHO scores were jointly assessed to describe drug use that was hazardous.

Participants

The researchers estimated that a sample of 17,651 Brazilian college students should be invited to take part in this study (as described in detail elsewhere).[13] Thus, given that the classes were each composed of an average of 19 college students (a number that varied among HEIs and Brazilian state capitals), it was estimated that a total of 929 student classes should be sampled nationwide to reach the previously estimated sample size. Additionally, to sample a total of 929 student classes, 114 HEIs needed to be drawn nationwide (at

least two public and two private HEIs from each Brazilian state capital), except for the public HEIs strata in the capitals of Rondônia, Acre, Amapá, Sergipe and Mato Grosso do Sul States (where there was only one public HEI) and in the capital of São Paulo State (where more HEIs were selected for the purpose of gathering a greater variety of responses).

At the end of the data collection period, 100 of 114 HEIs agreed to take part in this study (88% of the estimated size), resulting in a sample of 654 student classes (70.6% of the estimated size)and 12,721 college students throughout Brazil. Although the response rate of participation was 95.6% among the college students who were taking classes at the time of the interview, the final response rate for this study was approximately 72.1% when the estimated size of the college student sample was taken into consideration (12,721/17,651). Finally, of these 12,721 students, 10 were excluded because they claimed to use Relevin; thus, the data from 12,711 college students nationwide were analyzed.

Statistical analyses

Valid questionnaires were entered into a SPSS database. After that, responses were analyzed for consistency. All estimates were adjusted using sampling weights to represent the entire college student population of Brazil. Descriptive and inferential analyses were conducted using the R (version 2.12.0) software package. The gender- and age-related effects of drug use and the ASSIST-WHO scores were assessed using Wald's tests. Null hypotheses were rejected when $p < 0.05$. All results are expressed as the mean and standard error (SE). Afterward, logistic regression models were developed to evaluate whether the effects of gender, age and their interaction explained the use of each drug for which a distribution difference was detected by Wald's test. In each model, the response variables were either drug use in the last 30 days or the ASSIST-WHO score. In addition to gender and age, other sociodemographic, academic and administrative variables were included as covariates. These other variables included Brazilian administrative region, the HEI's administrative organization type, field of study (biological sciences, humanities or physical sciences), marital status, socioeconomic status, ethnicity, and religion affiliation. Variables that did not reach statistical significance (i.e., $p > 0.05$) were excluded from the models using backward stepwise elimination. Confidence intervals were estimated using the Bonferroni correction, and confidence coefficients were set at 95%. The adjusted final models for each drug are described in detail below.

Research ethics committee approval

The Research Ethics Committee of the Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo (CAPPesq HC-FMUSP; Protocol n# 0378/08) approved this study.

Results

Sociodemographic data

The greatest proportions of the sample were female (55%), aged 18 to 24 years (67.5%), single (80.6%), Caucasian (55.5%), from high-income families (72.2%; socioeconomic status A and B), Catholic (53.0%) and studied exact sciences (47.2%) in the evening (36.8%). Additional details concerning these socio-demographic data are described elsewhere.[13]

Drug use

Table 1 shows the prevalence of drug use both in general and by gender. According to this table, alcohol was the most widely used drug across all measures (lifetime = 86.2%; use in the last 12 months = 72%; use in the last 30 days = 60.5%). Nearly half of the students (48.7%) reported that they had tried at least one illicit drug in their lifetime, slightly over one-third (36.9%) reported using a drug in the last 12 months and approximately one quarter (25.9%) reported using a drug in the last 30 days. Marijuana was by far the most commonly used illicit drug, followed by amphetamines, tranquilizers, inhalants and hallucinogens.

Regarding gender-related differences in drug use, men tried illicit drugs more often than women *(lifetime use;* $p < 0.05$); they also tried and recently used (in the last 12 months) alcohol, tobacco, marijuana, inhalants, cocaine powder, ecstasy and AASs at higher rates than ($p < 0.05$). In addition, men had used alcohol, marijuana and AASs more frequently than women in the last 30 days ($p < 0.01$). In contrast, women used amphetamines, tranquilizers and opiate analgesics more often than men across all measures ($p < 0.05$).

Table 2 shows the prevalence of drug use by age. College students over 34 years of age were more likely to have tried at least one illicit drug more than students in other other age ranges ($p < 0.001$). This finding was especially true for cocaine powder, tranquilizers, opiates and amphetamines ($p < 0.05$). The use of tranquilizers, opiate analgesics and amphetamines was more prevalent among this age group in the last 12 months and in the last 30 days. In contrast, the use of marijuana, inhalants and hallucinogens in the last 12 months was more frequent among students aged 18 to 24 years ($p < 0.05$). This finding was also true for marijuana, inhalants and alcohol in the last 30 days ($p < 0.01$).

ASSIST-WHO score

Table 3 shows the prevalence of college students whose ASSIST-WHO scores suggest hazardous drug use for each investigated drug, both in general and by gender. As observed in 3, 21.8% of college students engaged in hazardous alcohol use. Specifically, it may be suggested that while 19.2% of these students abused alcohol, 2.6% of students may be alcohol-dependent. In addition, 8.4, 3.8 and 3.4% of college students engaged in the hazardous use of marijuana, amphetamines and tranquilizers, respectively. Men met the criteria for hazardous alcohol use more often than women ($p < 0.001$); this result was also observed for marijuana ($p < 0.001$) and AASs ($p < 0.05$). Conversely, women met the criteria for hazardous amphetamine ($p < 0.01$) and opiate analgesic use ($p < 0.05$) more often than men.

Table 4 shows the prevalence of college students whose ASSIST-WHO scores suggest hazardous drug use for each investigated drug by age. Student age was associated with the development of the hazardous use of alcohol ($p < 0.05$), marijuana ($p < 0.001$), inhalants ($p < 0.01$), hallucinogens ($p < 0.05$), ecstasy ($p < 0.01$), AAS ($p = 0.053$), tranquilizers

Table 1 The prevalences of drug use (lifetime use, use in the last 12 months and use in the last 30 days) in general and by gender among Brazilian college students

Psychoactive Substance	Lifetime use							Use in the last 12 months							Use in the last 30 days						
	Total		Male students		Female students			Total		Male students		Female students			Total		Male students		Female students		
	%	SE	%	SE	%	SE	p-value	%	SE	%	SE	%	SE	p-value	%	SE	%	SE	%	SE	p-value
Alcohol	86.2	1.7	90.3	1.7	83.1	2.2	<0.01*	72.0	2.3	77.3	2.6	68.0	2.6	<0.001*	60.5	2.3	66.6	2.7	55.8	2.4	<0.001*
Tobacco	46.7	2.00	51.7	2.6	42.9	2.5	<0.01*	27.8	1.6	31.8	2.1	24.8	2.2	<0.05*	21.6	1.6	23.5	1.7	20.1	2.1	0.11
Marijuana/hashish/skank	26.1	2.1	34.5	2.8	19.9	1.9	<0.001*	13.8	1.4	19.8	1.9	9.2	1.6	<0.001*	9.1	1.1	13.0	1.7	6.1	1.4	<0.01*
Inhalants	20.4	1.8	25.5	2.3	16.6	2.0	<0.001*	6.5	0.8	9.1	1.5	4.7	1.0	<0.05*	2.9	0.5	3.6	0.9	2.4	0.8	0.30
Cocaine (powder)	7.7	1.0	11.3	1.8	5.0	0.9	<0.01*	3.0	0.4	4.8	0.9	1.6	0.5	<0.01*	1.8	0.4	2.4	0.7	1.4	0.5	0.23
Merla	0.8	0.2	1.3	0.5	0.3	0.2	0.055	0.1	0.1	0.2	0.1	0.1	0.1	0.16	0.1	0.1	0.1	0.1	0.1	0.1	0.25
Crack cocaine	1.2	0.4	2.1	0.6	0.5	0.3	<0.01*	0.2	0.1	0.3	0.1	0.1	0.0	0.14	0.2	0.1	0.3	0.1	0.1	0.1	0.15
Hallucinogens	7.6	0.9	11.0	1.3	4.9	1.0	<0.001*	4.5	0.6	6.0	1.0	3.4	0.9	0.07	2.8	0.6	3.4	0.9	2.4	0.9	0.45
Cetamina®	0.8	0.4	0.6	0.3	0.9	0.6	0.74	0.6	0.4	0.4	0.3	0.8	0.7	0.66	0.6	0.5	0.4	0.3	0.8	0.8	0.61
Ayahuasca Tea	1.4	0.4	1.9	0.8	1.0	0.4	0.38	0.9	0.3	0.9	0.4	0.8	0.4	0.83	0.2	0.1	0.2	0.1	0.1	0.1	0.92
Ecstasy	7.5	0.9	11.0	1.3	4.9	1.0	<0.001*	3.1	0.6	4.7	1.0	1.9	0.8	<0.05*	1.9	0.5	2.8	0.9	1.3	0.8	0.21
Anabolic Androgenic Steroids	3.8	0.7	8.1	1.4	0.4	0.2	<0.001*	0.9	0.2	2.0	0.6	0.2	0.1	<0.01*	0.5	0.2	1.1	0.4	0.0	--	<0.01*
Tranquilizers	12.4	1.1	9.3	1.2	14.7	1.7	<0.001*	8.4	1.2	5.6	0.9	10.3	1.9	<0.05*	5.8	0.8	3.5	0.8	7.4	1.3	<0.05*
Sedatives	1.7	0.4	1.4	0.4	1.9	0.7	0.52	1.1	0.5	0.4	0.2	1.6	0.8	0.15	0.9	0.4	0.2	0.1	1.4	0.8	0.15
Opiate Analgesics	5.5	0.7	4.4	0.6	6.3	0.9	<0.05*	3.8	0.6	2.2	0.6	4.8	0.8	<0.05*	2.0	0.4	1.0	0.3	2.7	0.6	<0.05*
Codeine-based syrups	2.7	0.6	2.3	0.7	2.9	1.0	0.64	1.0	0.4	0.8	0.4	1.2	0.7	0.61	0.7	0.4	0.2	0.1	1.1	0.8	0.29
Anticholinergics	1.2	0.3	1.1	0.4	1.2	0.4	0.91	0.6	0.2	0.6	0.3	0.6	0.2	0.97	0.4	0.2	0.2	0.2	0.5	0.2	0.11
Heroin	0.2	0.1	0.5	0.3	0.0	--	0.10	0.1	0.0	0.1	0.1	0.0	--	0.20	0.0	--	0.1	0.1	0.0	--	0.0
Amphetamines	13.8	1.4	8.1	1.8	18.1	2.0	<0.001*	10.5	1.4	5.5	1.8	14.1	2.1	<0.05*	8.7	1.3	4.4	1.5	11.7	1.9	<0.01*
Synthetic Drugs	2.2	0.5	2.7	0.7	1.8	0.7	0.39	1.1	0.4	1.0	0.4	1.1	0.7	0.88	0.8	0.5	0.5	0.3	1.0	0.8	0.59
At least one illicit drug	48.7	2.0	52.8	2.7	45.6	2.6	<0.05*	36.9	2.8	35.0	2.9	33.5	2.7	0.67	25.9	1.7	25.4	2.7	26.3	2.9	0.84

[a]Averages are expressed in percentages (%); [b]SE: standard error; [c] the prevalence was zero, (statistical tests could not be performed, and SEs could not be calculated. *The level of significance adopted was α = 0.05.

(p < 0.01) and amphetamines (p < 0.05). This pattern of results was also observed for the use of drugs in the 30 days prior to the interview.

Logistic regression models

Table 5 shows the results of the logistic regression model examining drug use in the last 30 days according to gender, age and their interaction. Gender predicted alcohol and marijuana use over the last 30 days after controlling for other sociodemographic, academic and administrative variables. Thus, men were more likely than women to use alcohol (OR = 1.545; p < 0.01) and marijuana (OR = 2.511; p < 0.01). An age effect was also identified. College students aged 18-24 years were more likely to use alcohol (OR = 2.038; p < 0.05) than their in from other age ranges. Interaction between age and gender were observed regarding the use of AASs, tranquilizers and amphetamines; women aged 34 or older were more likely to use amphetamines than men in the same age range. In addition, women younger than 18 years were more likely to use amphetamines and tranquilizers than men. Finally, for all investigated age ranges, men were more likely to use AASs than women.

Table 6 shows the results of a logistic regression model examining the college students whose ASSIST-WHO scores suggested hazardous drug use by gender, age and their interaction. Gender predicted ASSIST-WHO alcohol and marijuana scores after controlling for other sociodemographic, academic and administrative variables. Men were more likely than women to engage in the hazardous use of alcohol (OR = 2.033; p < 0.001) and marijuana (OR = 2.015; p < 0.01). Interaction between age and gender were observed regarding the use of AASs, amphetamines and opiate analgesics. Whereas men were more likely to engage in the hazardous use of AASs than women in the same age range, women older than 34 years were more likely to engage in the hazardous use of amphetamines than men.

Discussion

The most frequently observed demographics in this college student sample were female gender, aged between 18 and 24 years, unmarried, and Caucasian from a high income family; these distributions resemble those of the general population.[21] However, college students may come from higher income families compared with their peers of the same age in the population at large.[22]

Alcohol was the most widely consumed drug, closely followed by tobacco, for all measures. Nearly half of the college students reported having tried at least one illicit drug in their lifetime, slightly over one-third reported using

Table 2 The prevalences of drug use (lifetime use, in the last 12 months and in the last 30 days*)* by age among Brazilian college students

Psychoactive Substance	Lifetime use									Use in the last 12 months									Use in the last 30 days								
	<17		18-24		25-34		>35			<17		18-24		25-34		>35			<17		18-24		25-34		>35		
	%	SE	%	SE	%	SE	%	SE	p	%	SE	%	SE	%	SE	%	SE	p	%	SE	%	SE	%	SE	%	SE	p
Alcohol	79.2	6.2	89.3	1.3	82.4	3.3	83.3	4.3	0.10	72.0	6.4	75.7	1.8	67.3	3.9	66.2	5.0	0.11	50.5	5.8	64.1	2.1	56.8	3.9	53.4	5.1	<0.05*
Tobacco	26.7	5.8	45.5	2.4	47.4	3.0	54.6	5.2	<0.05*	24.0	6.2	27.3	2.2	28.3	3.0	29.8	5.8	0.93	21.0	6.3	19.1	1.9	23.4	3.1	30.0	6.2	0.42
Marijuana/hashish/skank	5.9	1.9	26.9	2.4	29.0	3.1	21.1	5.0	<0.001*	5.6	2.1	16.9	1.7	12.5	2.3	4.2	1.9	<0.001*	4.6	2.0	10.7	1.2	8.6	2.2	3.5	1.4	<0.001*
Inhalants	5.6	2.6	21.6	1.7	20.5	2.9	17.5	4.0	<0.001*	4.5	3.0	9.7	1.2	3.0	1.0	0.2	0.1	<0.001*	1.6	1.3	4.2	0.9	1.3	0.8	0.2	0.2	<0.01*
Cocaine (powder)	0.7	0.6	5.3	0.6	10.5	1.9	13.9	4.7	<0.001*	0.8	0.7	3.5	0.6	3.5	1.0	0.3	0.2	<0.001*	0.8	0.7	2.0	0.5	2.4	0.9	0.3	0.2	<0.05*
Merla	0.0	--	0.4	0.2	1.8	0.8	0.5	0.3	--	0.0	--	0.1	0.1	0.2	0.2	0.0	--	--	0.0	--	0.1	0.1	0.2	0.2	0.0	--	--
Crack cocaine	0.0	--	0.3	0.1	2.9	1.3	2.4	1.3	--	0.0	--	0.1	0.0	0.4	0.2	0.0	--	--	0.0	--	0.1	0.0	0.4	0.2	0.0	--	--
Hallucinogens	2.7	1.6	7.9	1.0	9.6	2.2	3.6	1.5	<0.05*	3.1	1.9	6.2	1.0	3.1	0.9	0.0	--	<0.001*	2.5	1.9	4.2	1.0	1.1	0.6	0.0	--	--
Cetamina®	0.6	0.6	1.0	0.6	0.5	0.2	0.4	0.3	0.90	0.0	--	1.0	0.8	0.0	--	0.0	--	--	0.0	--	1.0	0.8	0.0	--	0.1	0.0	--
Ayahuasca Tea	0.1	0.0	0.9	0.3	2.7	1.0	1.5	0.9	<0.001*	0.0	--	0.8	0.3	1.5	0.8	0.1	0.0	0.07	0.0	--	0.2	0.1	0.1	0.1	0.0	--	0.21
Ecstasy	0.9	0.6	7.5	1.0	11.2	2.9	1.8	1.2	<0.001*	0.7	0.7	4.3	0.9	2.2	0.9	0.0	--	<0.001*	0.7	0.7	2.5	0.8	1.7	0.8	0.0	--	<0.05*
Anabolic Androgenic Steroids	5.3	3.8	1.9	0.4	7.2	1.6	5.4	3.4	<0.05*	1.4	1.4	0.8	0.2	1.5	0.8	0.1	0.0	<0.05*	1.4	1.3	0.4	0.2	0.7	0.5	0.0	--	<0.05*
Tranquilizers	4.5	1.3	8.9	0.7	14.9	2.0	23.9	4.4	<0.01*	2.8	1.3	6.5	0.7	8.3	1.9	16.7	4.9	<0.05*	0.1	0.1	4.5	0.6	5.8	1.8	11.9	2.7	<0.001*
Sedatives	0.5	0.3	1.1	0.2	1.1	0.5	5.5	2.7	0.24	0.3	0.3	0.7	0.3	0.2	0.1	4.8	3.1	0.38	0.0	--	0.7	0.3	0.1	0.1	3.4	3.3	--
Opiate Analgesics	1.2	0.5	4.6	0.9	6.4	1.0	8.5	2.3	<0.01*	1.3	0.6	3.7	0.9	2.6	0.8	6.8	2.0	<0.05*	1.0	0.5	1.9	0.5	1.4	0.5	3.7	2.1	0.48
Codeine-based syrups	1.3	1.0	2.3	0.7	3.9	1.6	2.6	1.0	0.55	0.2	0.2	1.3	0.8	0.9	0.6	0.1	0.0	0.30	0.2	0.2	1.1	0.8	0.2	0.1	0.1	0.0	0.44
Anticholinergics	0.1	0.1	0.8	0.3	1.6	0.7	2.2	1.0	<0.05*	0.0	--	0.4	0.1	0.7	0.6	1.2	0.7	0.08	0.0	--	0.2	0.1	0.4	0.3	1.3	0.8	0.28
Heroin	1.3	1.1	0.1	0.0	0.5	0.4	0.0	--	0.42	1.5	1.4	0.0	--	0.0	--	0.0	--	0.78	1.4	1.4	0.0	--	0.0	--	0.0	--	--
Amphetamines	5.9	3.5	10.0	1.1	17.9	3.0	23.6	4.4	<0.05*	6.6	4.0	7.3	1.1	13.7	3.1	18.6	3.5	0.12	2.7	1.8	5.7	1.1	11.6	2.8	16.5	3.9	<0.05*
Synthetic Drugs	0.0	--	2.1	0.7	3.3	0.9	0.9	0.9	--	0.0	--	1.6	0.8	0.7	0.4	0.0	--	--	0.0	--	1.3	0.8	0.2	0.2	0.0	--	--
At least one illicit drug	22.7	4.7	45.7	2.1	51.9	2.9	59.8	4.3	<0.001*	18.0	5.2	35.5	3.1	36.3	2.8	39.2	4.7	0.06	8.6	2.8	24.8	1.9	27.0	3.0	31.4	4.2	<0.01*

[a]Averages are expressed as percentages (%); [b]SE: standard error; [c] the prevalence was zero, (statistical tests could not be performed, and SEs could not be calculated. *The level of significance adopted was α = 0.05.

an illicit drug in the last 12 months and approximately one-quarter reported using an illicit drug in the 30 days prior to the interview.

The lifetime use of alcohol and other drugs is more common among college students compared with the general population,[11] peers of the same age (i.e., 18- to 24-year-olds)[23] and elementary and high school students in Brazil.[24] Many of these differences are specific to the use of hallucinogens and amphetamines as described elsewhere.[23] When compared with peers of the same age in the general Brazilian population, college students report having tried alcohol, marijuana, inhalants, hallucinogens, tranquilizers, opioid analgesics and amphetamines more often. With regard to amphetamines, this difference is up to five times greater.[23]

To put this pattern in an international context, the prevalences of alcohol, tobacco and illicit drug use in Brazilian and U.S. college students are similar across all measures according to the *University of Michigan Monitoring the Future* survey.[3] The differences in drug use between genders were also similar. However, some drug-use patterns should be noted. Specifically, although the lifetime use of marijuana is higher in U.S. college students, the use of inhalants among more common in Brazilians across all measures. However, compared with college students from other Latino countries (e.g., Bolivia, Colombia, Ecuador and Peru),[25] Brazilians report using illicit drugs more often (although similar frequencies of alcohol and tobacco use are observed). Again, inhalants are used more often among Brazilian college students according to all drug-use measures. Thus, this type of use appears to be typical of Brazilian students.

Regarding the ASSIST-WHO scores, approximately 22% of Brazilian college students engaged in the hazardous use of alcohol. Specifically, 19.2% of these students may be abusing alcohol, and 2.6% of students may be alcohol-dependent. This situation differs from the general Brazilian population. According to the "1st National Survey on Patterns of Alcohol Consumption in the Brazilian Population",[12] 3.0% of the general Brazilian population abuses alcohol, and 9.0% of this population is alcohol-dependent. This report also found that alcohol abuse and dependence are more prevalent in young adults aged between 18 and 24 years, i.e., the age range that corresponds to college life. Regarding prevalence of the hazardous use of other drugs, the "2nd Household Survey on the Use of Psychotropic Drugs in Brazil: a study involving the 108 largest cities in the country"[11] reported data regarding drug dependence but not abuse because the frequencies of abuse were too low; however, this comparison is limited.

Table 3 The prevalences of Brazilian college students whose ASSIST-WHO scores suggest hazardous drug use for each investigated drug, both in general and by gender

Psychoactive substance	ASSIST Score						
	Total		Male students		Female students		
	%	SE	%	SE	%	SE	p-value
Alcohol	21.8	1.7	29.2	2.3	16.2	1.6	<0.001*
Tobacco	21.5	1.8	22.5	1.9	20.9	2.4	0.48
Marijuana/hashish/Skank	8.4	1.1	11.6	1.5	5.9	1.2	<0.001*
Inhalants	1.2	0.3	1.5	0.4	1.0	0.4	0.44
Cocaine (powder)	1.8	0.4	2.4	0.7	1.3	0.4	0.18
Merla	0.1	0.0	0.0	0.0	0.2	0.1	0.17
Crack cocaine	0.1	0.0	0.1	0.0	0.1	0.0	0.85
Hallucinogens	1.3	0.4	1.3	0.4	1.3	0.8	0.99
Cetamina®	0.2	0.1	0.3	0.3	0.1	0.0	0.32
Ayahuasca Tea	0.2	0.1	0.2	0.1	0.2	0.1	0.68
Ecstasy	1.6	0.5	2.2	0.6	1.2	0.8	0.32
Anabolic Androgenic Steroids	0.5	0.2	1.1	0.4	0.1	0.0	<0.05*
Tranquilizers	3.4	0.6	2.2	0.7	4.3	0.8	0.07
Sedatives	0.4	0.1	0.2	0.1	0.5	0.2	0.16
Opiate Analgesics	0.9	0.2	0.4	0.2	1.3	0.3	<0.05*
Codeine-based syrups	0.4	0.2	0.4	0.3	0.3	0.2	0.76
Anticholinergics	0.2	0.1	0.1	0.1	0.3	0.2	0.57
Heroin	0.1	0.0	0.1	0.0	0.1	0.0	0.90
Amphetamines	3.8	0.9	1.1	0.5	5.9	1.6	<0.01*
Synthetic Drugs	1.0	0.5	0.7	0.3	1.2	0.8	0.53

[a]Averages are expressed as percentages (%); [b]SE: standard error; [c] the prevalence was zero, (statistical tests could not be performed, and SEs could not be calculated. *The level of significance adopted was α = 0.05.

According to NESARC,[6] 7.8% of American college students can be classified according to the DSM-IV criteria as alcohol abusers, whereas 12.5% of these students can be classified as alcohol-dependent. According to the "Alcohol Use Disorders Identification Test" (AUDIT) criteria, one out of three (33%) college students who reported using alcohol in the previous 12 months fulfilled the criteria for hazardous use in Bolivia, Colombia and Ecuador. On the other hand, is has been suggested that 10.5, 12 and 16% of students in Bolivia, Colombia and Ecuador, respectively, are alcohol-dependent.[25]

Regarding hazardous marijuana use, 35.6% of college students in Ecuador can be classified according to the DSM-IV as marijuana abusers. Similar findings have been observed in college students in Bolivia (32.6%), Colombia (25.5%) and Peru (17.3%).[25] These frequencies are higher than those observed in Brazil (8.4%).

Although interesting, all of these comparisons are merely speculative and should be considered with caution because the aforementioned studies used different instruments to estimate the prevalence of hazardous alcohol/other drug use in college students.

The influences of age and gender on drug use among college students are also important to consider. As revealed by a recent cohort study conducted in high school , gender is predictive of drug use; specifically, the male gender is associated with the initiation of substance use.[26]

The 2010 *National Survey on Drug Use and Health* revealed that men aged 12 or older use alcohol, tobacco and illicit drugs more often than women in the general U.S. population.[27] Similar findings have been observed in the analogous Brazil population.[11]

In addition, gender is predictive of which drugs have been tried and which are regularly consumed. Specifically, men are more likely than women to be current users of several different illicit drugs including marijuana, cocaine, and hallucinogens.[27] Conversely, women are more likely to use prescribed medications than men.[28]

One cross-sectional survey in individuals over 12 years of age from the general Brazilian population revealed that the 12-month prevalence of alcohol and marijuana use was higher among men than women and higher among young than elderly individuals.[29,30] In addition, Lobo et al.[31] found that the majority of AAS users were young men. Conversely, an analysis of the prescriptions obtained from Brazilian compounding pharmacies and drug stores indicated that women (especially middle-aged women) receive the majority of prescriptions for amphetamine-type anorectics and benzodiazepines.[32] In addition to drug use, alcohol abuse and dependence are found more frequently in men.[30] This outcome also extends to other drugs.[11] Taken together, these findings suggest not only that there is a gender effect on drug use and abuse but also that there is an important interaction of gender and age in the general population.

Table 4 The prevalences of Brazilian college students whose ASSIST-WHO scores suggest hazardous drug use for each investigated drug by age

Psychoactive Substance	ASSIST score								
	<17		18-24		25-34		>35		
	%	SE	%	SE	%	SE	%	SE	p-value
Alcohol	16.8	4.4	24.3	1.6	19.6	3.5	16.0	3.5	<0.05*
Tobacco	10.0	4.1	19.6	2.1	23.7	3.8	28.6	6.2	0.12
Marijuana/hashish/skank	4.5	2.1	9.9	1.2	8.4	2.3	2.5	1.3	<0.001*
Inhalants	0.3	0.2	1.7	0.4	0.6	0.5	0.0	0.0	<0.01*
Cocaine (powder)	0.1	0.1	1.9	0.4	2.5	1.1	0.2	0.1	<0.01*
Merla	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.20
Crack cocaine	0.1	0.1	0.2	0.0	0.1	0.0	0.0		-----
Hallucinogens	0.1	0.1	2.0	0.8	0.6	0.5	0.0	0.0	<0.05*
Cetamina®	0.1	0.1	0.3	0.2	0.0	0.0	0.0	0.0	0.44
Ayahuasca Tea	0.1	0.1	0.3	0.1	0.1	0.1	0.0	0.0	0.11
Ecstasy	0.1	0.1	2.4	0.8	0.9	0.6	0.0	0.0	<0.01*
Anabolic Androgenic Steroids	0.1	0.1	0.6	0.2	0.6	0.5	0.1	0.0	>0.05
Tranquilizers	0.6	0.3	2.7	0.5	3.7	1.1	6.4	3.0	<0.01*
Sedatives	0.1	0.1	0.4	0.1	0.1	0.0	0.7	0.7	0.08
Opiate Analgesics	0.3	0.2	0.8	0.2	0.6	0.2	0.9	0.6	0.32
Codeine-based syrups	0.3	0.2	0.1	0.0	0.7	0.6	0.7	0.6	0.61
Anticholinergics	1.5	1.3	0.3	0.2	0.0	0.0	0.0	0.0	0.42
Heroin	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.07
Amphetamines	0.1	0.1	3.1	0.8	5.5	1.7	4.7	1.8	<0.05*
Synthetic Drugs	0.1	0.1	1.4	0.8	0.7	0.5	0.0	0.01	0.21

[a]Averages are expressed as percentages (%); [b]SE: standard error; [c] the prevalence was zero, (statistical tests could not be performed, and SEs could not be calculated). *The level of significance adopted was α = 0.05.

Gender effects on drug use have already been reported among college students in Brazil.[18,33-35] Thus, the current study extended these findings to a national sample of Brazilian college students. For instance, the surveys regarding drug use among college students at the Universidade de São Paulo (conducted in 1996 and 2001) suggested that the prevalence of the use of at least one illicit drug was higher among male college students than their female peers.[18,33] Although men tend to try alcohol, marijuana, inhalants, cocaine and AASs, women often experiment with prescription drug, as previously mentioned for the general population.[33-35] However, the interaction between gender and age has not been previously described in a national sample of college students.

We believe that these results may reflect gender differences in students' personal reasons for using drugs and the influence of social factors on their decision to do so. However, these reasons are not detailed here because they are beyond the scope of this study.[36-37]

Finally, studies of drug use among college students in the U.S. indicates an increase in alcohol- and drug-related harms. Among these detrimental effects, increases in the rate of drinking and driving reduce life expectancy.[5] In addition, hospitalizations related to alcohol overdoses, drug overdoses or both among people aged 18-24 years cost more than $1.2 billion annually in the U.S.[38] Additionally, the finding that the hazardous alcohol-use rate is higher among college students compared with the general U.S. population over 12 years of age[6-8] has warranted the attention of authorities.

Sociodemographic and health indicators indicate that males aged between 20-25 years old die earlier in Brazil; this result modifies the life expectancy and differential mortality between genders and influences the epidemiological profile of the general population.[39] In addition, this result may affect the Brazilian economy.

External causes significantly affect the life expectancy between genders and age ranges; drug use may be one such external cause. For instance, the "Brazilian Report on Drugs" indicated that young males are most likely group to have alcohol-related work absences, drug-related requests for early retirement and, drug-related deaths and hospitals admissions for drug problems.[40]

Thus, the findings of this study motivate differences in the need for a better understanding of these issues in college students. Moreover, the of this study may encourage Brazilian authorities to enact drug-control policies for college students, especially for those in public HEIs. In this regard, the development of awareness campaigns that alert young people to the potential health risks associated with drug use, and help them recognize the need for treatment is important.

This information must also reach private HEI administrators so that they are able to identify alcohol and drug use among students at their institutions. Furthermore, these

Table 5 The results of the logistic regression model developed using drug use (e.g., marijuana, AASs, amphetamines, tranquilizers and opiate analgesics) in the last 30 days as the response variable

Use in the last 30 days	Effect										
	Gender			Age				Gender+Age			
	OR	IC	P		OR	IC	p		OR	IC	p
Alcohol	–	–	–	<18	1.00	–	–	–	–	–	0.24
				18-24	2.04	1.02-4.05	<0.05*				
Female	1.00	–	–	25-34	1.66	0.74-3.71	0.22	–	–	–	–
Male	1.54	1.18-2.02	<0.01*	>35	2.14	0.90-5.09	0.09	–	–	–	–
Marijuana	–	–	–	>35	1.00	–	–	–	–	–	0.11
				<18	1.31	0.19-9.00	0.78				
Female	1.00	–	–	18-24	2.00	0.60-6.68	0.26	–	–	–	–
Male	2.51	1.33-4.73	<0.01*	25-34	1.88	0.55-6.45	0.32	–	–	–	–
AAS	–	–	–	–	–	–	–	<18	>1,000a	>1,000->1,000	<0.001*
	–	–	–	–	–	–	–	18-24	279.15a	42.62->1,000	<0.001*
	–	–	–	–	–	–	–	25-34	121.61a	8.91->1,000	<0.001*
	–	–	–	–	–	–	–	>35	>1,000a	>1,000->1,000	<0.001*
Amphetamines	–	–	–	–	–	–	–	<18	>1,000b	<1,000->1,000	<0.001*
	–	–	–	–	–	–	–	18-24	1.27b	0.34-4.67	0.73
	–	–	–	–	–	–	–	25-34	1.61b	0.43-6.01	0.48
	–	–	–	–	–	–	–	>35	698.4b	127.56->1,000	<0.001*
Tranquilizers	–	–	–	–	–	–	–	<18	<1,000b	>1,000->1,000	<0.001*
	–	–	–	–	–	–	–	18-24	0.66b	0.22-1.96	0.46
	–	–	–	–	–	–	–	25-34	0.37b	0.06-1.98	0.21
	–	–	–	–	–	–	–	>35	0.51b	0.13-1.92	0.32
Opiates analgesics	–	–	–	<18	1.00	–	–	–	–	–	–
				18-24	1.62	0.46-5.75	0.46				
Male	1.00	–	–	25-34	1.10	0.19-6.29	0.91	–	–	–	–
Female	2.16	0.93-5.01	0.072	>35	1.76	0.24-3.01	0.58	–	–	–	–

College student gender, age and their interaction (gender+age) were the explanatory variables. Data are presented as odds ratios (ORs) and confidence intervals (CIs), where (a) women are the reference category and (b) men are the reference category.

data may help public health authorities develop educational interventions aimed at preventing such behaviors and treatment tools for students who already abuse drugs. Such efforts should come together to change the current situation and prevent drug use that may shorten lives or cause problems for users as well as third parties.

Conclusions

The most frequently observed demographic characteristics in the current sample were unmarried status, Caucasian race female gender, 18 to 24 years of age, coming from a high-income family. Alcohol was the most widely used drug in this sample. Nearly half of the students interviewed reported that they had tried at least one illicit drug during their lifetime. Marijuana was by far the most commonly used illicit drug. After controlling for other sociodemographic, academic and administrative variables, male college students were found to use alcohol and marijuana more frequently and were more likely to engage in the hazardous use of these drugs than their female peers. In addition, male students were more likely to use and engage in the hazardous use of AASs. Conversely, female students older than 34 years were more likely to use and engage in the hazardous use of amphetamines. Taken together, these findings extend the gender- and age-related effects on drug use that have been previously described in the general Brazilian population to college students. These findings may help public health authorities, researchers, health practitioners, and HEI administrators and staff to understand the roles that gender and age play in drug use. Furthermore, these findings should be considered when developing drug-use prevention strategies. The early recognition of college students who abuse drugs may help to prevent the continuation and progression of their disease and its related harmful effects.

Clinical implications and limitations

Despite the large sample size of this study, the study results are not generalizable to the entire population of Brazilian college students because only the HEIs located in state capitals, and not those located in the countryside, were considered. Moreover, it

Table 6 The results of the logistic regression model developed using the ASSIST-WHO score as the response variable in Brazilian college students whose scores were suggestive of hazardous drug use (e.g., marijuana, AASs, amphetamines, tranquilizers and opiate analgesics)

ASSIST Score	Effect										
	Gender			Age				Gender+Age			
	OR	IC	P		OR	IC	p		**OR**	**IC**	**p**
Alcohol		–	–	<18	1.00	–	–	–	–	–	0.35
Female	1.00			18-24	1.60	0.65-4.00	0.31				
Male	2.03	1.46-2.84	<0.001*	25-34	1.27	0.43-3.73	0.66	–	–	–	–
	–	–	–	>35	1.09	0.36-3.28	0.88	–	–	–	–
Marijuana	–	–	–	<18	1.22	0.11-14.10	0.87	–	–	–	–
Female	1.00	–	–	18-24	1.83	0.35-9.58	0.48	–	–	–	–
Male	2.01	1.18-3.43	<0.01*	25-34	2.11	0.42-10.49	0.36	–	–	–	–
AASs	–	–	–	–	–	–	–	<18	>1,000a	>1,000->1,000	<0.001*
	–	–	–	–	–	–	–	18-24	44.41a	8.92-221.32	<0.05*
	–	–	–	–	–	–	–	25-34	35.47a	5.36-234.81	<0.05*
	–	–	–	–	–	–	–	>35	0.27a	0.01-5.96	0.40
Amphetamines	–	–	–	–	–	–	–	<18	0.39b	0.02-7.93	0.54
	–	–	–	–	–	–	–	18-24	4.86b	1.24-19.07	<0.05*
	–	–	–	–	–	–	–	25-34	2.93b	0.73-11.76	0.13
	–	–	–	–	–	–	–	>35	>1,000b	<1,000->1,000	<0.001*
Tranquilizers	–	–	–	<18	1.00	–	–	–	–	–	0.59
				18-24	4.67	1.10-19.72	<0.05*				
Male	1.00	–	–	25-34	9.24	1.78-47.86	<0.01*	–	–	–	–
Female	1.76	0.68-4.57	0.24	>35	16.32	1.97-135.02	<0.01*	–	–	–	–
Opiates analgesics		–	–	–	–	–	–	<18	<1,000b	<1,000->1,000	<0.001*
	–	–	–	–	–	–	–	18-24	1.015b	0.218-4.729	0.98
	–	–	–	–	–	–	–	25-34	0.562b	0.09-3.548	0.54
	–	–	–	–	–	–	–	>35	0.159b	0.015-1.740	0.13

Gender, age and their interaction (gender+age) were the explanatory variables. Data are presented as odds ratios (ORs) and confidence intervals (CIs), where (a) women are the reference category and (b) men are the reference category.

should be taken into consideration that these outcomes were based only on college students who were in class at the time of the interview at the HEIs that agreed to take part in the survey.

The use of the ASSIST-WHO to estimate the rate of college students students' engagement in the hazardous use of alcohol and other drugs was important, but it is merely a screening test without diagnostic criteria. Thus, the findings reported here regarding the hazardous use of alcohol and other drugs should be considered with caution.

Considering the different methodologies used in previous studies, it should be noted that the comparisons of Brazilian college students with American and other Latino college students and the general populations of Brazil and the U.S. are merely exploratory.

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