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Psychology of Health

Physical Activity and Substance Use Among University Students

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Abstract: The practice of physical activity is an important component in maintaining health and well-being. This study aimed to verify if there is an association between physical activity practice and substance use among university students. An analytical, descriptive, cross-sectional study involved 1,169 students (50.4% male; 63.3% aged 20–29 years; 92.8% single), from different courses at a public university located in the inland state of Minas Gerais, in southeastern Brazil. Sociodemographic Questionnaire, Alcohol, Smoking and Substance Involvement Screening Test, and Baecke Habitual Physical Activity Questionnaire were applied. The results show a prevalence of binge drinking (47.2%). Marital status, age group, alcohol consumption, tobacco, marijuana, and cocaine have a negative impact on levels of physical activity practice. In conclusion, university students engage in little physical activity, which may contribute to an increase in unhealthy behaviors, including alcohol and/or other substance consumption.

Keywords: students, colleges, physical activity, drug abuse

Prática de Atividade Física e Uso de Substâncias Psicoativas em Estudantes Universitários

Resumo: A prática de atividade física é um importante componente na manutenção da saúde e do bem-estar. Este estudo teve como objetivo verificar se há associação entre prática de atividade física e uso de substâncias em estudantes universitários. Estudo analítico, descritivo, transversal envolvendo 1169 estudantes (50,4% masculinos; 63,3% entre 20 e 29 anos; 92,8% solteiros), de diferentes cursos de uma universidade federal do interior do estado de Minas Gerais, Brasil. Foram aplicados os instrumentos: Questionário Sociodemográfico, Alcohol, Smoking and Substance Involvement Screening Test e Questionário de Avaliação da Atividade Física Habitual. Os resultados mostram prevalência de uso de álcool em *binge* (47,2%). Estado civil, faixa etária, uso de álcool, tabaco, maconha e cocaína têm impacto negativo nos níveis de atividade física. Conclui-se que os estudantes universitários praticam pouca atividade física, o que pode contribuir para o incremento de comportamentos não saudáveis, incluindo o consumo de álcool e/ou outras substâncias.

Palavras-chave: estudantes, universidades, atividade física, droga (abuso)

Práctica de Actividad Física y Consumo de Sustancias Psicoactivas em Estudiantes Universitarios

Resumen: La práctica de actividad física es un componente importante en el mantenimiento de la salud y el bienestar. Este estudio tuvo como objetivo verificar si hay una asociación entre la práctica de actividad física y el uso de sustancias em estudiantes universitarios. Un estudio analítico, descriptivo y transversal reunió a 1169 estudiantes (50,4% hombres; 63,3% con edades de entre 20 y 29 años; 92,8% solteros), de diferentes cursos de una universidad pública del interior del estado de Minas Gerais, Brasil. Se aplicaron el Cuestionario Sociodemográfico, el *Alcohol, Smoking and Substance Involvement Screening Test* y el Cuestionario para Evaluación de la Actividad Física Habitual. Los resultados muestran una prevalencia de consumo de alcohol en exceso (47,2%). El estado civil, edad, consumo de alcohol, tabaco, marihuana y cocaína tienen impacto negativo en los niveles de actividad física. Se concluye que los estudiantes universitarios practican poca actividad física, lo que puede contribuir al aumento de comportamientos poco saludables, incluyendo el consumo de alcohol y/o otras sustancias.

Palabras clave: estudiantes, universidades, actividad física, abuso de drogas

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Young people entering university face a period of psychosocial transition that can have impacts on mental health. University students constitute a group that may be vulnerable to various risk behaviors, including substance use (Pires et al., 2020). From this perspective, investigating the relationship between the practice of physical activity and the consumption of substances among university students is a topic that requires in-depth research, especially in the field of Mental Health, seeking a better understanding to

support health promotion and prevention strategies to adapt to university life.

The use of psychoactive substances among university students is a growing phenomenon, with emphasis on the use of alcohol, which has drawn the attention of educators and public policy managers, as it constitutes risky behavior for the health and well-being of young people (Espíndola et al., 2019; Pires et al., 2020; Rebouças et al., 2021; World Health Organization [WHO], 2022). Studies on the use of alcohol and other substances among young people have highlighted that consumption has occurred increasingly earlier, in early adolescence (Urday-Concha et al., 2019), which raises concerns regarding abuse and its consequences among this population inside and outside university (Zanetti et al., 2019).

It is essential to distinguish the terms substance use and abuse. The first concept refers to the use of alcohol or other psychoactive substances. Substance abuse, also called excessive use, deals with the harmful use of a substance (U.S. Department of Agriculture [USDA], 2020).

In this scenario, the pattern of alcohol consumption known as binge drinking (BD) has attracted attention, mainly due to its prevalence among youth (Cardoso et al., 2015). Binge drinking is a pattern of alcohol consumption characterized by the ingestion of five or more drinks for men and four drinks for women within two hours on the same occasion. Such behavior produces a rapid increase in blood alcohol concentration (BAC) of about 0.08 g/dL (USDA, 2020). There are many risks and/or negative impacts associated to BD, such as driving with BAC above those allowed by law – which, according to Brazilian legislation, there is zero tolerance for driving under influence of alcohol (Pires et al., 2020); increased risk of violence and injuries from different causes and engagement in unprotected sexual intercourses (Cardoso et al., 2015), in addition to being responsible for the increase in mortality rates among young people aged 15 to 24 (WHO, 2022).

A population-based cross-sectional study with 601 school adolescents from a municipality in Minas Gerais, Brazil, showed a 23.1% prevalence of binge drinking (Paiva et al., 2023). In the context of higher education, of 518 students from a higher education institution in a municipality in Rondônia State, northern Brazil, just over half presented binge drinking behavior [239 (57%); in terms of frequency, 23.6% of the sample (n = 122) were on BD less than once a month, while 14.9% (n = 77) at least once a month (Terra et al., 2022).

A study conducted with 150 students from a public university in northeastern Brazil showed that, the following risk factors were BD-related: sex (59% were male), early onset of alcohol consumption, entering university, influence of peers, and protective factors (married marital status and religion) (Rebouças et al., 2021). A literature review supported the biopsychosocial impacts of alcohol consumption on affective and friendship relationships, academic life, work, and family life, also influencing the construction of cultural meanings and representations of young adults (Queiroz et al., 2022). An association was also observed between increased body composition and a worse choice of healthy foods among people with lower energy expenditure (Gómez-Infante et al., 2023).

Another review identified 12 studies that associate the use of alcohol and/or other substances with burnout syndrome in university students, suggesting that students of Health programs suffering from academic burnout can resort to the use of negative strategies as a coping resource (Andrade et al., 2021). There is also evidence about the relationship between burnout syndrome and physical activity in university students, indicating that more physically active students had fewer burnout symptoms (Farias et al., 2019). Furthermore, low levels of physical activity were associated with the abusive use of tobacco and/or alcohol, in addition to increasing factors that hinder young university students' life at a biopsychosocial level, not only since the habits acquired at this stage of development tend to linger on in other stages of life (Talarico et al., 2020), as well as due to the greater propensity to adopt risky behaviors (Pires et al., 2020).

When evaluating the relationship between behaviors and lifestyle of 1,405 undergraduates from a public higher education institution in the city of Paranavaí, Paraná, Brazil, with an emphasis on the daily practice of physical activity, the study found that 23.4% were smokers and/or used other drugs and 28.5% consumed alcoholic beverages. Furthermore, 85% did not practice healthy physical activity habits (Fonseca & Prati, 2021). In contrast, an active and non-sedentary life favors a better quality of life and well-being and the adoption of a healthier lifestyle. Adopting a healthier lifestyle, expanding interpersonal relationships and the support network, preserving functional capabilities, and reducing the risk of developing pathologies or worsening pre-existing morbidities are among the benefits of regular physical activity (Fonseca & Prati, 2021). Furthermore, physical activity is considered an essential ally in the treatment of depressive symptoms, as it releases hormones, namely: endorphins, which trigger feelings of pleasure, euphoria, well-being, and pain relief; dopamine, which has a tranquilizing and analgesic effect; oxytocin, which reduces stress levels and enhances social skills, sexual desire, and affectivity. In addition to promoting a relaxing sensation after physical exertion, these benefits help the individual maintain a long-term state of balance (Talarico et al., 2020).

Energy expenditure-promoting physical activity is crucial for preserving health status, regardless of factors such as age, gender, and race. Regular physical activity minimizes the risk of health problems due to preventable or lifestyle-related causes, such as a sedentary lifestyle (Fonseca & Prati, 2021). Furthermore, some studies consider physical activity as a protective factor against the consumption of alcohol and/or other drugs among adolescents and young people, improving quality of life (Farias et al., 2019), which increases protection against the development of noncommunicable diseases (NCDs). Therefore, practicing weekly physical activity increases the likelihood of maintaining good health.

Physical exercises, that is, organized physical activity with sequenced and repeated movements that aim to promote health and improve the individual's disposition, are also essential (Billerbeck & Borges, 2019).

Physical activity can be considered a healthcare strategy to promote a healthy life, discouraging risky behaviors such as substance use and engaging in violent behaviors, and encouraging the adoption of healthy behaviors involving social interaction (Talarico et al., 2020). Therefore, regular physical activity promotes changes in lifestyle with healthy habits, generating benefits such as a feeling of well-being and the development of psychological, physical, and social skills.

The positive association between a healthy lifestyle and better health outcomes has been documented (Fonseca & Prati, 2021). However, few Brazilian studies investigate the relationship between physical activity and substance use in university students. Examining whether there is an association between physical activity practice and the consumption of substances, such as alcohol, especially in BD, is considered an important issue.

These issues have demanded increasing attention from the university community, requiring new research development. Evidence indicates that this is a relevant research problem because physical activity is considered prominent for promoting physical and mental health and preserving the well-being of young adults (Queiroz et al., 2022). Morbidity and mortality rates related to substance use are part of the indicators the World Health Organization defines for the global monitoring, prevention, and control of NCDs (WHO, 2022). Within the scope of Latin American countries, the Pan American Health Organization (PAHO) set the goal, in the Health Agenda for the Americas for 2018–2030, to stimulate actions to strengthen the prevention and treatment of substance abuse (Organización Panamericana de La Salud [OPAS], 2017).

This study aimed to verify whether there is an association between physical activity and substance use in university students and whether there are differences between sexes and field of knowledge concerning substance use.

Method

This is an analytical, descriptive, and cross-sectional study conducted with students from a public federal university in Southeastern Brazil.

Participants

The non-probabilistic sample by fields of knowledge comprised 1,169 university students of both sexes regularly enrolled in a public university in a large Brazilian municipality in the inland state of Minas Gerais, in Southeastern Brazil.

The students were evenly distributed between sexes (653, 55.9% male), with a mean age of 21.78 years (*SD* = 4.32), ranging from 17 to 44 years old, with the majority single (1,043, 89.2%), who only studied (752, 64.3%) or worked (416, 35.6%). Of the total, 798 (68.3%) belonged to the middle class, and 597 (51.1%) lived with their family. Regarding the distribution by programs, students were enrolled in courses in the following fields of knowledge: 366 (31.4%) Exact Sciences, 318 (27.3%) Human/Social Sciences, 199 (17.1%) Biological Sciences/ Health, and 283 (24.3%) Earth Sciences.

The inclusion criteria were being a student regularly enrolled in undergraduate programs in Human/Social, Health, Exact, Earth, and Biological Sciences, being present on days of data collection, and being 18 years old or over. The exclusion criteria were showing signs of being under the influence of alcohol and/or other substances at the time of collection. According to the inclusion/exclusion criteria, 45 questionnaires were excluded, 23 for being blank and 22 incomplete.

Instruments

Sociodemographic Questionnaire: It comprised questions about age, sex, marital status, undergraduate program, and employment status. The Brazil Economic Classification Criteria from the Brazilian Association of Research Companies (ABEP, 2017) was used to assess socioeconomic status. The issues investigated involve the possession of goods and household comfort items, as well as the level of education of the head of the family. Each item has a score, and the sum of the scores defines the economic class.

Binge drinking: A direct question with a dichotomous answer (Yes/No) was included to assess alcohol consumption characterized by ingesting five or more drinks on the same occasion in the last three months (USDA, 2020).

Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST): This instrument assesses the consumption of alcohol and/or other substances. Developed by WHO researchers in 2002 and translated into and validated for Brazilian Portuguese (Henrique et al., 2004), the questionnaire contains eight items that investigate the use of nine classes of psychoactive substances (tobacco, alcohol, marijuana, cocaine, stimulants, sedatives, inhalants, hallucinogens, and opiates) concerning the frequency of use in life and the last three months, evaluating the level of consumption of respondents, difficulties related to the use or in carrying out expected tasks, concern about use by people in the user's social circle, frustrated attempts to quit or reduce use, bingeing behavior, and injectable use. Each response corresponds to a score ranging from 0 to 4 points, with the total sum varying from 0 to 20. The score range from 0 to 3 was used as an indication of occasional use, from 4 to 15 as an indication of abuse, and >16 as suggestive of dependence. The internal consistency of ASSIST was assessed using Cronbach's alpha coefficient, showing good coefficients: 0.80 for alcohol, 0.80 for tobacco, 0.79 for marijuana, and 0.81 for cocaine (Henrique et al., 2004).

Habitual Physical Activity Assessment Questionnaire (HPA): This instrument investigates the practice of physical activity in the last 12 months. It was adapted and validated for the Brazilian context based on the Baecke Habitual Physical Activity Questionnaire (BHPAQ) originally developed in the Netherlands (Baecke et al., 1982). It consists of 16 items on habitual physical activities (HPA), divided into three domains: (i) occupational physical activities (OPA), with eight items; (ii) physical exercises during leisure time (LPE), with four items; (iii) physical activities during leisure and locomotion (LPA), with four items, excluding physical exercises (Baecke et al., 1982; Florindo et al., 2004). The answers are measured via a 5-point Likert scale (never, rarely, sometimes, often, and always). The instrument presents good psychometric indexes for the Brazilian context, evaluated using Cronbach's alpha coefficient for the domains OPA = 0.76, LPE = 0.77, and LPA = 0.71 (Florindo et al., 2004). To read the total HPA score, the OPA, LPE, and LPA scores are summed according to the score calculation methods recommended by the instrument (Baecke et al., 1982; Florindo et al., 2004). The total score ranges 3–15 and the higher the score, the higher the level of physical activity. This variable was classified into three levels, according to percentiles, with the practice of activity being (1) absent or light, (2) moderate, and (3) vigorous.

Procedure

Data collection. Data collection occurred collectively in the classroom from August to October 2018 for all undergraduate courses. All participants signed an informed consent form.

The Pro-Dean of Undergraduate Studies of the institution granted formal authorization to conduct the study following approval by the Research Ethics Committee. An email request with detailed information about the study was sent to the course coordinators requesting permission to apply the instruments to students in the classroom. Through this authorization and scheduling with the professors responsible for the classes, the students were informed about the objectives and procedures of the study.

Students who agreed to participate in the research signed the consent form and deposited it in an unidentified envelope separate from the questionnaires. They were then invited to fill out the instruments. After completion, the survey form was placed in another envelope. Three data collection visits were conducted in each classroom on alternate days to ensure the participation of students who had missed class on the day of data collection.

Data analysis. The data was entered into an Excel spreadsheet, and the database was validated by double-entry. Data analysis used the Statistical Package for Social Sciences version 21 for Windows, describing the results in percentage and frequency. Pearson's Chi-square test was used to evaluate the existence of an association between two categorical variables in a population. At the same time, the Yates Continuity Correction Test was used (Capp & Nienov, 2020).

First, a comparison was made between alcohol use in the binge drinking behavior (USDA) and the sociodemographic variables (sex, age group, employment status, marital status, housing, social class, and field of knowledge). Subsequently, the practice of habitual physical activity (HPA) was assessed at percentile levels, comparing the types of psychoactive substances (ASSIST) consumed in the last three months, such as tobacco, alcohol, binge drinking, marijuana, cocaine/crack, amphetamines or ecstasy, inhalants, hypnotics/sedatives, and hallucinogens.

Multivariate Linear Regression Analysis was performed using the Backward elimination variable selection criterion (Harrell, 2001), considering the practice of physical activities (HPA) as the dependent variable (continuous outcome variable) with the following predictor variables (categorical): tobacco, alcoholic beverages, marijuana, cocaine or derivatives, and amphetamines or ecstasy (ASSIST), used in the last three months, controlled by sex and age group. In the model used, the variables sex and use of amphetamines or ecstasy were eliminated as they did not present significant values in the collinearity test (Harrell, 2001). The significance level adopted for all tests was $p \leq 0.05$.

Ethical Considerations

The Research Ethics Committee of the Universidade Federal de Uberlândia approved the project, Opinion No. 1,257,369 and CAAE No. 42585115.9.0000.5152.

Results

Regarding the prevalence of substance use in the last three months (ASSIST), half of the students, 640, had consumed alcoholic beverages (54.7%), 544 (46.5%) had binge drinking behavior, a third, 382, had used marijuana (32.7%) and 187 (16.0%) tobacco. Concerning other substances, 63 (5.4%) used cocaine, 33 (2.8%) hallucinogens, and 24 (2.1%) amphetamines/ecstasy.

Table 1 presents the sociodemographic data of students who had binge drinking. Its prevalence (47.2%) was associated with the following variables: males (52.4%), people aged from 20 to 29 years (49.9%), single (48.9%), who did not work (53.9%), did not live with family (64.0%), and studied in the Human Sciences field (55.3%), with statistically significant differences (Table 1).

Table 2 shows the distribution of habitual physical activity and the use of psychoactive substances in the last three months. Students who used tobacco 79 (42.9%), alcohol 228 (37.9%), and binge drinking 187 (33.7%) were those who moderately practiced habitual physical activities (second percentile) when compared with those classified in the first and third percentiles, with statistically significant values. Those who used substances such as marijuana 162 (43.3%) and cocaine and derivatives 36 (58.1%) were those who performed the least amount of physical activities (first percentile).

Table 1

Sociodemographic characteristics and binge drinking among university students. Uberaba, Minas Gerais, Brazil, 2018 (N = 1,169)

Sociodemographic characteristic		Total	Binge drinking [*N* (%)]		*p*-value
			No	Yes	
Sex	Female	513 (100.0)	293 (57.1)	220 (42.9)	$\chi^2(1) = 6.483$ $p = 0.011$*
	Male	653 (100.0)	324 (49.6)	329 (50.4)	
Age group	17-19	348 (100.0)	198 (56.9)	150 (43.1)	$\chi^2(2) = 6.515$ $p = 0.038$*
	20-29	730 (100.0)	366 (50.1)	364 (49.9)	
	>30	77 (100.0)	47 (61.0)	30 (39.0)	
Employment	Yes	416 (100.0)	272 (65.4)	144 (34.6)	$\chi^2(1) = 40.086$ $p < 0.001$*
	No	749 (100.0)	345 (46.1)	404 (53.9)	
Marital status	Single	1040 (100.0)	531 (51.1)	509 (48.9)	$\chi^2(3) = 15.694$ $p < 0.001$*
	Married	89 (100.0)	57 (64.0)	32 (36.0)	
	Divorced	11 (100.0)	8 (72.7)	3 (27.3)	
	Widowed	28 (100.0)	21 (80.8)	5 (19.2)	
Housing	Different housing away from family	175 (100.0)	63 (36.0)	112 (64.0)	$\chi^2(1) = 14.799$ $p = 0.002$*
	With family	594 (100.0)	302 (50.8)	292 (49.2)	
	Alone	78 (100.0)	32 (41.0)	46 (59.0)	
	Others	60 (100.0)	23 (38.3)	37 (61.7)	
Social class	High	187 (100.0)	102 (54.5)	85 (45.5)	$\chi^2(1) = 4.048$ $p = 0.132$
	Middle	795 (100.0)	369 (46.6)	426 (53.6)	
	Low	60 (100.0)	28 (46.7)	32 (53.3)	
Knowledge area	Human Sciences	318 (100.0)	142 (44.7)	176 (55.3)	$\chi^2(1) = 15.488$ $p = 0.001$*
	Exact Sciences	366 (100.0)	213 (58.2)	153 (41.8)	
	Biological Sciences and Health	199 (100.0)	116 (58.3)	83 (41.7)	
	Earth Sciences	280 (100.0)	143 (51.1)	137 (48.9)	

Note. Chi-squared test (χ^2); (Degree of freedom); *p*-value < 0.05.

Table 2

Substance use in the last three months and physical activity among university students. Uberaba, Minas Gerais, Brazil, 2018 (N = 1,169)

ASSIST		Practice of habitual physical activity (HPA) [*N* (%)]			Chi-squared test *p*-value
		First tertile	Second tertile	Third tertile	
Tobacco	Yes	42 (19.1)	79 (42.9)	70 (38.0)	$\chi^2(1) = 19.165$ $p < 0.001$*
	No	315 (35.3)	285 (32.0)	292 (32.7)	
Alcohol	Yes	148 (24.6)	228 (37.9)	226 (37.5)	$\chi^2(1) = 30.981$ $p < 0.001$*
	No	194 (40.4)	145 (30.2)	141 (29.4)	
Binge drinking	Yes	166 (30.6)	187 (33.7)	204 (33.3)	$\chi^2(1) = 10.094$ $p = 0.006$*
	No	240 (39.2)	169 (27.2)	204 (36.2)	
Marijuana	Yes	162 (43.3)	131 (35.0)	81 (21.7)	$\chi^2(1) = 44.447$ $p < 0.001$*
	No	193 (26.7)	244 (33.8)	285 (39.5)	
Cocaine/crack	Yes	36 (58.1)	14 (22.6)	12 (19.4)	$\chi^2(1) = 21.113$ $p < 0.001$*
	No	302 (30.1)	348 (34.7)	352 (35.1)	
Amphetamines and ecstasy	Yes	6 (25.0)	10 (41.7)	8 (33.3)	$\chi^2(1) = 0.765$ $p = 0.682$
	No	328 (31.7)	350 (33.8)	356 (34.4)	
Inhalants	Yes	9 (30.0)	12 (40.0)	9 (30.0)	$\chi^2(1) = 0.489$ $p = 0.783$
	No	317 (32.3)	333 (33.9	332 (33.8)	
Hypnotics/sedatives	Yes	7 (41.2)	2 (11.8)	8 (41.1)	$\chi^2(1) = 3.889$ $p = 0.143$
	No	318 (31.9	344 (34.5)	334 (33.5)	
Hallucinogens	Yes	12 (35.3	11 (32.4)	11 (32.4)	$\chi^2(1) = 0.172$ $p = 0.918$
	No	313 (31.9)	337 (34.4)	330 (33.7)	

Note. χ^2: Chi-squared test (degree of freedom); **p*-value < 0.001.

Table 3 presents the results related to the multivariate linear regression analysis. The variables age group (β = 0.104; $p < 0.001$), marital status (β = -0.099; $p < 0.001$), use of alcoholic beverages (β = 0.075, $p = 0.018$), tobacco (β = 0.074, $p = 0.018$), marijuana (β = -0.090; $p = 0.004$), and cocaine (derivatives) (β = 0.099, $p = 0.001$) presented lower scores when practicing habitual physical activity.

Table 3

Multiple Linear Logistic Regression Analysis between the variables practice of habitual physical activity (HPA), alcohol and drug use (ASSIST) in the last three months among university students. Uberaba, Minas Gerais, Brazil, 2018 (N = 1169)

Coefficient					
Model	Non-Standardized		Standardized	*t*-value	*p*-value
	B	Standard Error	βeta		
Intercept	4.569	0.092		49.439	<0.001*
Age group	0.222	0.063	0.104	3.523	<0.001*
Marital status	-0.179	0.054	-0.099	-3.318	<0.001*
Tobacco (3 months)	0.242	0.102	0.074	2.363	0.018*
Alcoholic beverages (3 months)	0.181	0.076	0.075	2.369	0.018*
Marijuana (3 months)	-0.229	0.079	-0.090	-2.892	0.004*
Cocaine or derivatives (3 months)	-0.526	0.163	-0.099	-3.236	0.001*
Model Summary					
Model	R		R^2	Adjusted R^2	
	0.229[c]		0.053	0.048	

c. Predictors: (Intercept), Age Group, Marital status, Tobacco, Alcoholic beverages, Marijuana, Cocaine, or derivatives in the last three months

Note. = **p*-value > 0.05; Variables in the model controlled by sex, age, and marital status; Correlation coefficient = R; Coefficient of determination = R^2; Correlation value = B.

Discussion

This study analyzed the association between physical activity and substance consumption in undergraduates, identifying positive associations between these variables. Substance consumption, alcohol use, and BD among higher education students is a growing phenomenon, considered a serious but preventable public health issue. The implications are diverse and intensify following the upward trend of consumption. Exposure to risky behaviors is significant, negatively influencing the personal safety and well-being of these young people due to various social consequences (violence and traffic accidents, non-use of helmets and seat belts) and harm to health (comorbidities and mental disorders, suicide, gastric and cardiovascular diseases, sexually transmitted infections, unprotected sex, injuries, and death), which can prematurely compromise the lives of future professionals (Espíndola et al., 2019).

An interesting finding in our sample is that binge drinking was higher among males. According to the Centers for Disease Control and Prevention (2018), one in six American adults binge drink, especially young men (4 out of 5; aged 18–34 years), low-income, and lower education levels. Binge drinking has been more frequent in the male population due to the influence of several combined biological and psychosocial factors. This consumption pattern has become very common among the university students. The discrepancy between sexes may be related to sociocultural and psychosocial influences, such as ideals of masculinity, age and education differences between men and women, and the learning of gender roles. Men are taught to be fearless and to test their limits to "prove" their masculinity, which can encourage exposure to risky behaviors, such as early onset of alcohol use and BD.

Our data support other studies involving Brazilian undergraduates (Cardoso et al., 2015; Rebouças et al., 2021), which show varying prevalences of binge drinking ranging from 15.3% (Cardoso et al., 2015) to 59% among students (Rebouças et al., 2021). Furthermore, these authors consider that, in addition to being male, other risk factors influence the practice of binge drinking among university students, such as early onset of alcohol use, entry into university, and peer influence (Rebouças et al., 2021).

Binge drinking in young people has been associated with serious negative consequences, with high social and economic costs, combined with high morbidity and mortality rates. The damage to health is significant, resulting in lower performance in executive functions (WHO, 2022), increased prevalence of risk behaviors, such as driving under influence of alcohol (Pires et al., 2020), less use of condoms during sexual intercourses, and greater risk of injuries (Cardoso et al., 2015). These conditions are further aggravated according to age, with greater vulnerability to binge drinking among those aged 20 to 29 years (66.8%) and 18 to 29 years (60.5%) (Terra et al., 2022).

The absence of parental monitoring can lead to greater consumption (Pires et al., 2020), so the lack or the relaxation of parental supervision may be one of the factors

that contribute to the ingestion of more significant amounts of alcohol by university students. However, it must be considered that, in our sample, 49.2% of students still lived with their families. Notably, more than half of participants were only studying, and 46.1% did not carry out work activities concomitantly with their studies. Evidence shows that the main risk factors for drinking alcohol in large quantities are the influence of peers and groups of friends, lack of religion, and deprivation of family life (Terra et al., 2022), added to the search for sensations and the permissive university context. It is essential to mention that, strictly speaking, risk factors must precede the outcome, which is only possible to establish in longitudinal studies. Other elements that help to understand this phenomenon are related to the availability of more free time, greater autonomy concerning parental supervision, and enjoying a good family income (Pires et al., 2020). These factors can interact in multiple ways, influencing consumption.

In our sample, just over half of the students in Human Sciences courses (55.3%) consumed alcoholic beverages as binge drinking. Another result that deserves to be highlighted is the fact that smoking students who consumed alcohol and had binge drinking behavior were classified among the first two percentiles (absence, light, and moderate) in the practice of physical activities (42.9%, 37.9% and 33.7%, respectively) (Table 2). The use of these substances, together with an inadequate diet and a sedentary lifestyle, can further compromise the general health status (Pillon et al., 2017; Pires et al., 2020). It is essential to highlight that these are highly preventable behaviors and are among the main risk factors for NCDs in the last decade (WHO, 2022), comprising the objectives to be addressed in the 2023 Agenda (OPAS, 2017).

Furthermore, students who smoke, drink alcohol, and BD showed impaired practice of physical activities (Table 2). The low percentages of physical activities among adolescents and young people may be related to the increase in time spent studying (full-time and long hours in the classroom) and studying and working (half of the sample was working), which may favor the sedentary lifestyle and lack of habit of engaging in regular physical activity. The reduction of leisure options should also be considered more actively, as justified by the growth of urban violence (Gomes et al., 2020).

Regular physical activity has also been considered a protective factor to prevent the development or worsening of several chronic health conditions (Farias et al., 2019) and, therefore, can minimize the impact of damage caused by substance use behavior. This outcome is likely influenced by the release of neurotransmitters associated with physical activity and stress reduction (Talarico et al., 2020).

The practice of physical activity contributes to physical and mental well-being, reducing the desire to ingest substances, in addition to favoring the more assertive expression of behavioral manifestations resulting from increased tension and anxiety, promoting social engagement and better adaptation to the environmental context (Farias et al., 2019; Fonseca & Prati, 2021), which may be one of the motivators for reducing consumption. Sedentary lifestyle rates are increasing in contemporary society, which is an issue *per se* that must be considered for several reasons. When evaluating the association between physical activity and alcohol use in a sample of 1,179 adolescents from public schools in Petrolina, Pernambuco, Brazil, only 16.4% were physically active (Gomes et al., 2020). Furthermore, the odds ratios among students who performed little physical activity were associated with current alcohol consumption (OR = 1.67 [1.11 – 2.52]) and drunkenness episodes (OR = 1.88 [1.03 – 3.33]) (Gomes et al., 2020).

A study conducted with students from a university center in the interior of São Paulo, Brazil, showed that the prevalence of alcohol use (abstinent or low risk 91.7%) and physical activity (64.21%) were relatively high among students (n = 224). However, 24.5% of the sample indicated greater substance consumption after entering university. Regarding smoking, 42.85% had a high level of nicotine dependence, and 32% increased their use of tobacco after entering university (Talarico et al., 2020).

A review study showed that regular physical activity was an essential strategy for controlling smoking and related pathologies among individuals aged 20 and 49 (Billerbeck & Borges, 2019). This relationship was observed in physical education students at an institution in São Paulo, Brazil, since non-smokers practiced an average of 332.1% more moderate physical activity than smoking students (Flôr et al., 2020).

The multivariate linear regression analysis applied to the results of this study identified that the variables associated with the practice of physical activity were age group, marital status, alcoholic beverages, tobacco, marijuana, and cocaine. These data are congruent with those obtained in a study carried out with 129 university students from health courses at an institution located in the countryside of Pernambuco, Brazil, aged between 18 and 49 years old and with a predominance of the age group between 18 and 21 years old (48.8% of the sample). Although half of the sample (53.4%) was abstinent, 46.5% occasionally consumed alcoholic beverages, and 63.6% stated that they did not practice physical activity (Costa et al., 2021). In contrast to these results, another study showed a low frequency of physical activity among university students but with low percentages of alcohol and tobacco use (Ramos et al., 2019). The relevance of implementing health promotion and prevention programs at the university level is noted, with strategies and activities that can promote well-being and quality of life, considering the specificities of this public.

The results obtained in this study with a robust sample confirm that university students practice little physical activity, which can contribute to the increase in several unhealthy behaviors, including the consumption of alcohol and/or other substances. This study is innovative in that it establishes associations between binge drinking and/or consumption of other substances and the practice of physical activity in Brazilian university students.

University authorities should pay greater attention to the issues highlighted in this study, encouraging the discussion of shared risk factors, such as psychological vulnerabilities, the search for new sensations and experiences, or the influence of the social environment in the university. Still, concerning the practical implications of the results obtained, the findings are considered usable to promote concrete actions in the university environment by implementing projects and intervention proposals that aim to provide a healthier lifestyle for students.

A suggestion is to invest in students' health education and training and increase the awareness of educators and employees. Awareness campaigns about conscious consumption, health promotion actions, and educational support and harm reduction programs aimed at this target audience can also reduce vulnerabilities and mitigate the potential impacts of problematic substance use and low physical activity levels. Promoting a healthy university environment, which can mitigate exposure to risks and optimize quality of life and well-being, favors adequate coping with problems associated with substance abuse, especially in the context of university celebrations and parties.

As a limitation of the study, it stands out that, due to its cross-sectional design, the results obtained are correlational. i.e., the low level of physical activity cannot be established as leading to the consumption of substances or the opposite, or the bidirectionality of the relationship, or even if other variables could explain the magnitudes of the two variables.

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