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Association between anxiety, self-harm, and substance use in adolescents

Associação entre ansiedade, autolesão e uso de substâncias em adolescentes

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Abstract

Anxiety disorders are the most common psychological disorders in adolescence and are associated with risk behaviors such as substance use and self-harm. This study aimed to investigate associations between anxiety symptoms, gender, alcohol and marijuana consumption, and self-harm behavior in 13-year-old adolescents, using the translated versions of the Health Behavior in School-Aged Children and the Spence Children's Anxiety Scale. The sample consisted of 298 adolescents (M = 13.4 years; SD = 0.3; 61.1% female). Data analysis included chi-square tests, Student's t-test, and binomial logistic regression using the "ENTER" method ($p < 0.05$). Clinical anxiety (60.1%) was associated with self-harm (28.5%), which was more prevalent among girls. Alcohol use in the past month was higher among girls, while marijuana experimentation was more frequent among boys. These findings suggest that the girls in this sample should be considered a more vulnerable group for targeted interventions.

Keywords: Anxiety; Health risk behaviors; Recreational drug use; Self-injurious behavior.

Resumo

Os transtornos de ansiedade figuram entre os mais frequente na adolescência, e relacionam-se a comportamentos de risco, como o uso de substâncias e a autolesão. O objetivo deste estudo foi investigar associações entre sintomas ansiosos, sexo e consumo de álcool, maconha e comportamento autolesivo em adolescentes de 13 anos, com os instrumentos traduzidos Health Behavior in School-Aged Children e a Spence Children's Anxiety Scale. A amostra foi composta por 298 adolescentes (M = 13,4 anos; DP = 0,3) sendo 61,1% do sexo feminino. Para a análise dos dados utilizaram-se os testes qui-quadrado, t de Student e regressão logística binomial, método "ENTER" (p < 0,05). A ansiedade clínica (60,1%) apresentou associação com autolesão (28,5%), a qual foi mais frequente entre as meninas. O uso de álcool no último mês foi maior entre as

meninas e a experimentação de maconha foi mais frequente entre adolescentes do sexo masculino. Os achados indicam que as meninas da amostra configuram um grupo mais vulnerável, demandando atenção prioritária em intervenções preventivas.

***Palavras-chave**: Ansiedade; Comportamentos de risco à saúde; Uso recreativo de drogas; Comportamento autodestrutivo.*

Anxiety disorders are the most prevalent type of psychological disorders in childhood and adolescence (Rapee et al., 2023). The estimated global prevalence of anxiety disorders in children and adolescents is 6.5% (Polanczyk et al., 2015), with rates potentially increasing during adolescence. In a sample of Brazilian adolescents, moderate anxiety levels were observed in 28%, while severe anxiety was reported in 23.6% (Lopes & Rezende, 2013). Furthermore, a review including low- and middle-income countries, such as Brazil, indicated that anxiety prevalence may range from 8% to 27%. Gender differences in these countries may significantly influence mental health and should be considered when designing interventions (Yatham et al., 2018). The literature consistently reports a higher prevalence of anxiety symptoms among females, who are at greater risk of developing anxiety disorders (Essau et al., 2014; Lopes & Rezende, 2013; Rapee et al., 2023).

Anxiety during adolescence is associated with poorer overall adjustment, lower life satisfaction, chronic stress, persistent anxiety, and substance and alcohol use disorders in adulthood (Essau et al., 2014). In this context, substance use – one of the most prevalent risk behaviors among youth, typically emerging during adolescence (Cohen et al., 2018; Instituto Brasileiro de Geografia e Estatística [IBGE], 2021; Inchley et al., 2020) – has also been linked to deteriorating physical and mental health, as well as increased engagement in other short- and long-term risk behaviors.

Alcohol consumption during adolescence is linked to a higher risk of accidents, risky sexual behaviors, polysubstance use, and violent situations (Boden & Fergusson, 2011). It is also associated with increased symptoms of anxiety and depression (Lopes & Rezende, 2013) and suicidal ideation (Sellers et al., 2019). Despite these risks, alcohol use is widely accepted among young people and often associated with positive beliefs about socialization (Yamauchi et al., 2019), making it the most commonly consumed legal substance among adolescents worldwide. In contrast, marijuana remains the most frequently used illicit substance during this developmental stage (Johnston et al., 2019).

Marijuana use during adolescence has been linked to an increased risk of depression and suicidal behaviors but does not appear to be directly associated with anxiety (Gobbi et al., 2019). However, a longitudinal study by Duperrouzel et al. (2018) suggests that early marijuana use may predict future anxiety levels, particularly in adolescents who engage in occasional substance use. More frequent marijuana consumption was associated with a higher likelihood of persistent anxiety over time.

According to the transnational Health Behaviour in School-Aged Children (HBSC) survey (Inchley et al., 2020), over one-third of adolescents have consumed at least one alcoholic drink by age 13, with this figure nearly doubling by age 15. At that age, 13% have experimented with marijuana. Reported substance use in the 30 days preceding the study was 37% for alcohol and 7% for marijuana. Gender differences in substance use are more pronounced before age 15, with boys consuming more, though usage patterns tend to converge in later adolescence.

In Brazil, data from the *Pesquisa Nacional de Saúde do Escolar* (PeNSe, National Adolescent School-Based Health Survey) indicate that 55.9% of students aged 13 to 15 had consumed alcohol at some point in their lives (IBGE, 2021). Alcohol use in the 30 days prior to the survey was reported by

22.1% of participants, while marijuana use was reported by 3.4%. In this sample, alcohol consumption was higher among girls, whereas marijuana use was more frequent among boys.

Non-suicidal self-harm is a prevalent risk behavior during adolescence, linked to heightened anxiety and depressive symptoms, increased substance use, experiences of abuse, bullying, and other adverse factors (McEvoy et al., 2023). In a study using the Brazilian version of the HBSC (Oliveira et al., 2020), 23% of adolescents reported engaging in self-harm, and these individuals also showed a greater tendency toward anxiety and depressive symptoms. However, no significant gender differences were found.

This overview emphasizes the prevalence of anxiety in adolescence and its connection to risk behaviors, which may further aggravate existing socioemotional difficulties. The association between anxiety symptoms and risk behaviors highlights the need for further research to strengthen health prevention efforts, particularly for high-risk groups. This study aimed to examine the associations between anxiety symptoms and gender, as well as between anxiety symptoms and risk behaviors – specifically alcohol use, marijuana use, and self-harm behavior – in a sample of adolescents from São Paulo, Brazil.

Method

Participants

The sampling process followed a series of steps. First, the sample was stratified according to the city's regions, and the number of 7th – and 8th – grade students enrolled in the 44 state schools in the city of Ribeirão Preto (SP, Brazil) was determined. This information was obtained through telephone contact with each school, where a designated representative provided the number of eligible students per grade. Since stratification was based on student distribution across regions, the exact number of participating schools was not recorded.

The estimated student population was 6,523, of whom 1,750 were invited to participate. Among them, 900 agreed, but only 360 returned consent forms signed by their guardians. During data collection, 32 students either declined to participate or were absent, resulting in an initial sample of 328 students aged 12 to 14 years.

Of these, 30 were excluded based on the study's selection criteria (age between 12 and 14 years and parental authorization) and exclusion criteria (observed reading comprehension difficulties during data collection, incomplete responses on more than 25% of the assessment instruments, or failure to complete at least one of the applied instruments).

The final sample consisted of 298 adolescents, 61.1% (n = 182) of whom were female, with a mean age of 13.4 years (SD = 0.3). Based on a subscale of the HBSC Protocol, 37.6% (n = 112) of participants were classified as having a low economic level, while 12.4% (n = 37) were classified as having a high economic level.

Instruments

To assess these variables, the Brazilian version of the HBSC Protocol (Maltoni et al., 2019), adapted from the Portuguese protocol (Matos et al., 2015), was used. The original research protocol was developed in collaboration with the World Health Organization and currently includes adolescent health surveys in more than 40 countries (HBSC/WHO – http://www.hbsc.org). The

instrument is self-administered and designed for use with adolescents aged 13 to 15 years, covering 16 thematic domains through approximately 80 closed-ended questions. These questions assess sociodemographic factors, nutrition, oral hygiene, body mass index, diet, substance use, school environment, life satisfaction and quality of life, physical and psychological well-being, physical activity, sedentary behavior, sexual behavior, bullying, injuries, family relationships, peer relationships, leisure time, and electronic media communication. The Brazilian protocol included additional questions on self-declared ethnicity, parental supervision, and self-harm. The variables used in this study focused on substance use and self-harm.

To assess anxiety classification, the Spence Children's Anxiety Scale (Spence, 1998), adapted by DeSousa et al. (2014), was utilized. This self-report instrument includes 44 items designed to assess anxiety symptoms in children and adolescents, with an alpha coefficient (α) of 0.92. Scoring followed the criteria established by Muris et al. (2000), where clinical anxiety was defined as scores of ≥ 25 for boys and ≥ 36 for girls.

Procedures

Data collection was conducted through a survey, with the city's regions serving as the stratified sampling units. After stratification, state schools in the city were randomly invited to participate in the study, followed by an invitation to 13-year-old students from the 7th and 8th grades. The data collection took place in groups at the schools, in a designated private space for participants, using printed instruments, and was coordinated by the study's researchers.

This study was conducted in the city of Ribeirão Preto, in the state of São Paulo, Brazil. Participation required adolescents to return a signed informed consent form from their parents or guardians and provide their own assent via the assent form. Authorization for data storage through the Database Formation Term was optional. Guardians of participants with clinical-level anxiety scores were informed and provided with guidance on accessing free psychological care services.

Descriptive analyses were performed for the variables (percentage, mean, and standard deviation), and chi-square tests and Student's t-tests were used to examine the relationship between anxiety classification and independent variables. To analyze the influence of independent variables on adolescent anxiety classification, binary logistic regression using the ENTER method was employed. The significance level was set at $p < 0.05$. Statistical analyses were conducted using the IBM®SPSS® software, version 24.

This study was approved by the Research Ethics Committee of the Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto (Faculty of Philosophy, Sciences, and Letters of Ribeirão Preto – Certificate of Ethical Appreciation Presentation No. 45947415.5.1001.5407). Only adolescents whose parents signed the informed consent form and who provided their own assent at the time of data collection participated in the study.

Results

Only adolescents who were 13 years old at the time of data collection were included in this study. The analyses focused on socioeconomic variables (gender and school grade), anxiety classification, and self-reported self-harm. Substance use variables included lifetime alcohol consumption, recent alcohol use, and marijuana use (Table 1).

Table 1
Description of the variables involved in the stud

Variables	Measure		
Gender	1= Boy	2= Girl	
School grade	1 = 7th grade (MS); 2 = 8th grade (MS);	3 = 9th grade (MS);	4 = 10th grade (HS)
Alcohol consumption (lifetime)*	1 = Never (...)	7 = 30 days (or more)	
Alcohol consumption (last 30 days)*	1 = Never (...)	7 = 30 days (or more)	
Marijuana use (lifetime)*	1 = Never (...)	7 = 30 days (or more)	
Self-harm	1 = Yes;	2 = No	
Anxiety classification*	Spence Children's Anxiety Scale (SCAS); α = 0.92. Responses range from never, sometimes, often, always, with a maximum score of 114. Clinical anxiety was considered for boys with a score of ≥ 25 and for girls ≥ 36.		

Note: *This variable was recoded. HS: High School; MS: Middle School.

Table 2 presents the sociodemographic characteristics of the participants. Half of the sample (50.3%) reported having tried alcohol at least once (beyond just a sip), while 22.7% (*n* = 66) reported alcohol consumption in the past 30 days. Although girls reported higher rates of lifetime alcohol use (52.7%, *n* = 96) and clinical anxiety symptoms (61.5%, *n* = 112), these differences were not statistically significant. However, monthly alcohol use was significantly higher among girls (26.7%, *n* = 47). Self-harm behaviors were also significantly more prevalent among girls (36.8%, *n* = 67). In contrast, boys reported significantly higher rates of marijuana experimentation (10.3%, *n* = 12). Overall, clinical anxiety was observed in 60.1% of the sample, and 28.5% of adolescents reported engaging in self-harm.

Table 3 presents the results of the bivariate analyses. Clinical anxiety was associated with self-harm in both genders, while alcohol consumption was also linked to clinical anxiety among girls.

Table 2
Participant characteristics

Variables	Total	Boys	Girls	*p*
	% (n)	% (n)	% (n)	
School grade				0.200
7th grade (Middle School)	59.7 (178)	44.8 (52)	62.6 (114)	
8th grade (Middle School)	40.3 (120)	55.2 (64)	37.4 (68)	
Alcohol consumption (lifetime)				0.297
Yes	50.3 (150)	46.6 (54)	52.7 (96)	
No	49.7 (148)	53.4 (62)	47.3 (85)	
Alcohol consumption (last 30 days)				**0.043***
Yes	22.7 (66)	16.5 (19)	26.7 (47)	
No	77.3 (225)	83.5 (96)	73.3 (129)	
Marijuana use (lifetime)*				0.076
Yes	7 (21)	10.3 (12)	4.9 (9)	
No	93 (277)	89.7 (104)	95.1 (173)	
Self-harm				**< 0.001**
Yes	28.5 (85)	15.5 (18)	36.8 (67)	
No	71.5 (213)	84.5 (98)	63.2 (115)	
Anxiety classification				0.516
Clinical	60.1 (179)	57.8 (67)	61.5 (112)	
Non-clinical	39.9 (119)	42.2 (49)	38.5 (70)	
Total	100 (298)	100 (116)	100 (182)	

Note: *This variable was recoded. $p < 0.05$. Values shown in bold correspond to comparisons with statistical significance ($p < 0.05$).

Table 3
Bivariate analyses of anxiety, substance use, and risk behaviors in adolescents, by gender

Variables	Anxiety Classification					
	Non-clinical	Clinical	*p*	Non-clinical	Clinical	*p*
	Boys			Girls		
	% (n)			% (n)		
School grade[1]			0.458			0.561
7th grade (MS)	40.8 (20)	47.8 (32)		40 (28)	35.7 (40)	
8th grade (MS)	59.2 (29)	52.2 (35)		60 (42)	64.3 (72)	
Alcohol consumption (lifetime)[1]			0.070			0.133
Yes	36.7 (18)	53.7 (36)		45.7 (32)	57.1 (64)	
No	63.3 (31)	46.3 (31)		54.3 (38)	42.9 (48)	
Alcohol consumption (last 30 days)[1]			0.116			**0.031**
Yes	10.2 (5)	21.2 (14)		17.6 (12)	32.4 (35)	
No	89.8 (44)	78.8 (52)		82.4 (56)	67.6 (73)	
Marijuana use (lifetime)[1]			0.303			0.736
Yes	2 (1)	6 (4)		1.4 (1)	0.9 (1)	
No	98 (48)	94 (63)		98.6 (69)	99.1 (111)	
Self-harm[1]			**0.017**			**0.032**
Yes	6.1 (3)	22.4 (15)		27.1 (19)	42.9 (48)	
No	93.9 (46)	77.6 (52)		72.9 (51)	57.1 (64)	

Note: [1] Chi-square test. $p < 0.05$. MS: Middle School. Values shown in bold correspond to comparisons with statistical significance ($p < 0.05$).

Table 4 presents the results of the binary logistic regression analyzing the association between anxiety classification and adolescents' risk behaviors. Anxiety classification was positively associated with self-harm. The model was statistically significant at 7% (χ^2 (6) = 15.885, $p = 0.014$) in explaining variations in adolescent anxiety classification.

Table 4
Association between anxiety classification, substance use, and risk behaviors in adolescents – Binomial logistic regression model

Variables	Anxiety Classification	
	OR (95% CI)	*p*
	Model $\chi^2 = 15.885$	**0.014**
Alcohol consumption (lifetime)	1.14 (0.64-2.04)	0.642
Alcohol consumption (last 30 days)	1.87 (0.89-3.91)	0.097
Marijuana use (lifetime)	0.92 (1.62-5.28)	0.931
Self-harm	2.16 (1.18-3.95)	**0.013**

Note: Analyses were adjusted for age and gender $p < 0.05$. CI: Confidence Interval; OR: Odds Ratio. Values shown in bold correspond to comparisons with statistical significance ($p < 0.05$).

Discussion

The objective of this study was to investigate potential associations between anxiety symptoms, gender, and risk behaviors (alcohol consumption, marijuana use, and self-harm) in a sample of Brazilian adolescents. Over half of the adolescents (60.1%, $n = 179$) exhibited clinical anxiety symptoms, with no gender-based differences observed. The prevalence of anxiety in this sample was higher than reported in the literature (Lopes & Rezende, 2013; Yamauchi et al., 2019; Yatham et al., 2018), although no clinical assessments were performed with the adolescents. Self-harm behaviors were reported by 28.5% ($n = 85$) of participants, with a significant association to the female gender.

Girls, therefore, had more concerning results regarding self-harm behaviors. However, self-harm was associated with anxiety classification in both genders, suggesting it may reflect a dysfunctional emotion regulation strategy. The link between self-harm, the female gender, and heightened anxiety symptoms aligns with the findings of McEvoy et al. (2023), though it contrasts with Oliveira et al. (2020) study, which found no gender differences in a Brazilian sample.

Consistent with the literature on substance use during adolescence (IBGE, 2021; Inchley et al., 2020), half of the adolescents in the sample had experimented with alcohol by age 13, and 22.7% (n = 66) had consumed it in the 30 days prior to the study. The association between monthly alcohol consumption and the female gender aligns with national findings (IBGE, 2021), while the lack of gender differences in alcohol experimentation contrasts with international studies (Inchley et al., 2020), which typically report higher consumption among boys at this stage. Based on the analyzed data, it is concluded that alcohol consumption among girls is linked to clinical anxiety classification, supporting studies that demonstrate the relationship between anxiety and alcohol use (Boden & Fergusson, 2011; Lopes & Rezende, 2013). Marijuana experimentation was reported by 7% (n = 21) of participants, showing a lower prevalence compared to both national and international findings, but remaining consistent with the association with the male gender (IBGE, 2021; Inchley et al., 2020).

It is concluded that the girls in the studied sample exhibit greater psychological vulnerability and should be considered a risk group for the development of clinical anxiety symptoms and engagement in risk behaviors. The causes of gender differences in mental health are complex and multifactorial, and a complete understanding of this phenomenon is still lacking (van Droogenbroeck et al., 2018). Some possible explanations for poorer mental health outcomes among girls include heightened exposure to social stressors, hormonal differences, variations in social roles, coping strategies, and cognitive patterns (Hantsoo & Epperson, 2017). Investigating the role of gender in mental health is critical for developing effective public policies and interventions in this area (Yatham et al., 2018).

Despite the observed differences, boys also had high levels of clinical anxiety and greater use of illicit substances, supporting findings on the psychological vulnerability of adolescence. Prevention and health promotion are crucial during this developmental phase, as both symptoms and the frequency of risk behaviors tend to escalate between early and late adolescence (Inchley et al., 2020). Since risk behaviors may stem not only from the desire for social inclusion but also from dysfunctional emotional regulation, mental health interventions for this population should prioritize the development of life skills and socio-emotional competencies. In addition to the roles of family and school, social support emerges as a key factor in coping with adversities at this stage, as higher perceived support is linked to lower symptoms of anxiety, depression, and psychological stress in adolescents (van Droogenbroeck et al., 2018). This highlights the need for interventions that also emphasize the importance of the social and peer context.

It is important to acknowledge several limitations of this study, including the reliance on self-report instruments and the absence of clinical interviews to validate the observed symptoms and behaviors. Furthermore, the study focused on a specific population from the interior of São Paulo. However, the sampling methodology employed allows the sample to be considered representative of the population under investigation.

Conclusion

The authors conclude that the studied sample exhibits psychological vulnerability concerning anxiety and the assessed risk behaviors. Girls displayed the poorest health indicators,

highlighting the need for targeted interventions for this group. The variables investigated in this study interact in complex ways, and causal claims cannot be made. Future research should focus on understanding how these behaviors relate to anxiety, particularly in terms of their potential role as coping strategies for emotional regulation and their impact on symptom exacerbation. Moreover, it is crucial to track the trajectories of at-risk individuals, accounting for contextual and gender-related differences. Most studies, including this one, do not address the underlying causes of gender differences in anxiety and engagement in risk behaviors. Therefore, further research into these factors is essential for enhancing our understanding of the phenomenon. Public policies and intervention strategies should foster collaboration within the family-school-peer triad, while also empowering adolescents by expanding their awareness regarding mental health and risk behaviors.

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