

## ORIGINAL ARTICLE

# Anxiety symptoms and alcohol abuse during the COVID-19 pandemic: A cross-sectional study with Brazilian dental undergraduate students

Matheus dos Santos Fernandez BSc<sup>1</sup>  | Igor Soares Vieira PhD<sup>2</sup>  |  
Nathalia Ribeiro Jorge da Silva DDS, MSc<sup>3</sup>  | Taiane de Azevedo Cardoso PhD<sup>2,4</sup>  |  
Camilla Hübner Bielavski BSc<sup>1</sup>  | Coral Rakovski BSc<sup>5</sup>  |  
Alexandre Emidio Ribeiro Silva DDS, PhD<sup>1,3</sup> 

<sup>1</sup> School of Dentistry, Federal University of Pelotas (UFPel), Pelotas, Brazil

<sup>2</sup> Postgraduate Program in Health and Behavior, Catholic University of Pelotas (UCPel), Pelotas, Brazil

<sup>3</sup> Postgraduate Program in Dentistry, Federal University of Pelotas (UFPel), Pelotas, Brazil

<sup>4</sup> Department of Psychiatry & Behavioural Neurosciences, McMaster University, Hamilton, Canada

<sup>5</sup> Neuroscience Graduate Program, McMaster University, Hamilton, Ontario, Canada

## Correspondence

Igor Soares Vieira, Gonçalves Chaves, 373, 402; Zip code: 96015-700, Pelotas, Rio Grande do Sul, Brazil.

Email: [igosv@hotmail.com](mailto:igosv@hotmail.com)

## Abstract

**Aim:** The aim of this study is to assess whether anxiety symptoms are associated with alcohol abuse in Brazilian undergraduate dental students during the COVID-19 pandemic.

**Method:** A cross-sectional study was conducted. A semi-structured questionnaire addressing the variables of interest was hosted on Google Forms and shared with dental undergraduate students from all Brazilian regions between July 8 and 27, 2020. Alcohol abuse was measured using the Cut down, Annoyed, Guilty, Eye opener (CAGE) questionnaire score of  $\geq 2$ . All participants responded to the seven-item Generalized Anxiety Disorder Scale (GAD-7). Hierarchical logistic regression was also conducted.

**Results:** Among the 1050 students evaluated, 18.7% ( $n = 196$ ) had a positive screening for alcohol abuse during the pandemic. The prevalence of mild (GAD-7 = 5–9), moderate (GAD-7 = 10–14), and severe (GAD-7  $\geq 15$ ) anxiety among students were 31.3%, 29.6%, and 24.2%, respectively. The final hierarchical logistic regression model showed that during the COVID-19 pandemic, anxiety levels predict the likelihood of alcohol abuse among students with moderate (OR 10.05 [95% IC: 4.12–24.52]) or severe (OR 15.82 [95% IC: 6.46–38.73]) anxiety, especially for male students (moderate anxiety: OR 17.06 [95% CI: 8.36–34.78]; severe anxiety: OR 28.38 [95% CI: 8.62–38.24]).

**Conclusion:** The prevalence of alcohol abuse and moderate or severe anxiety in Brazilian undergraduate dental students during the COVID-19 pandemic was high. Male students may be more sensitive to the presence of anxiety symptoms in this period, thus contributing to higher levels of alcohol consumption, in comparison to female students. Intervention strategies that promote the adoption of healthier lifestyles can enable the effective management of anxiety symptoms

during the pandemic and thus, hold the potential to reduce exacerbated alcohol intake in this population.

#### KEYWORDS

alcohol, anxiety, COVID-19, dentistry, students

## 1 | INTRODUCTION

Coronavirus disease 2019 (COVID-19) caused by the novel coronavirus, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), began in Wuhan, China in November of 2019. Followed by an exponential increase in the number of cases throughout the world, the disease has rapidly resulted in a public health emergency of international concern, and in March of 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic.<sup>1</sup> Brazil emerged as a new pandemic epicenter, and a year following the onset of the disease, it was the largest nation in Latin America as well as the country with the third highest number of confirmed cases and the second highest number of deaths.<sup>2</sup>

The pandemic context has many implications for people's lives, including increased vulnerability for psychological disorders and alcohol consumption.<sup>3,4</sup> Previous studies showed an increase in alcohol consumption associated with the presence of anxiety symptoms in adults during the COVID-19 pandemic.<sup>5</sup> For university students, this situation is also concerning.<sup>6</sup> Students showed an increase in alcohol consumption during the COVID-19 outbreak, especially among those with more severe anxiety symptoms.<sup>4</sup>

During social confinement due to the pandemic, which has been the main containment measure adopted to prevent the spread of the virus, face-to-face classroom educational activities with university students were suspended or postponed worldwide and replaced—either completely or partially—with remote teaching.<sup>7</sup> Since the beginning of the pandemic, dental schools in Brazil have been developing novel contingency plans for the return of academic activities.<sup>8,9</sup> During this period, approximately 125,585 Brazilian dental undergraduate students have remained there with suspended clinical activities for over a year.<sup>12</sup> In the meantime, remote education has been used to generate ideas for the future practice of clinical, research, and extension activities.<sup>8</sup> The return of clinical activities should occur only after mass vaccination of the population and the correct adoption of biosafety protocols by educational institutions.<sup>10</sup>

Perceptions and feelings related to continuous spread of the disease, prolonged strict isolation measures, delays in returning in-person activities at universities, lack of personal contact with colleagues and teachers, as well as loss of manual dexterity skills and other factors related to the

fear of cross-infection, can all act as stress triggers that influence the mental health of university students.<sup>6,11,12</sup> A recent study showed that a large portion of dental students may experience symptoms of anxiety and stress upon returning to the university clinic.<sup>13</sup> In general, even during periods without public health crises, university students of health courses present a high prevalence of anxiety.<sup>14</sup> Within the current pandemic context, a meta-analysis estimated that the global rate of anxiety is 28% among medical students.<sup>15</sup> For dental students, cross-sectional studies have demonstrated a high prevalence of anxiety symptoms ranging from 31% to 46%.<sup>16,17</sup>

Stress caused by anxiety symptoms can lead to the onset and maintenance of alcohol misuse.<sup>18</sup> Alcohol might be used to manage the anxiety associated with adaptation and the uncertainty about the duration of restrictions.<sup>19</sup> In university students, alcohol abuse is strongly associated with low academic performance, difficulties in social relationships, altered psychological status, and violence.<sup>20,21</sup> Importantly, alcohol abuse is also associated with reduced immunity to viral and bacterial infections,<sup>22</sup> as well as an increased risk of liver disease.<sup>23</sup>

Although home isolation and social detachment undoubtedly have an immediate and important role in controlling the COVID-19 pandemic, the effects of social deprivation on the mental health of undergraduate students are still unclear.<sup>6</sup> In particular, the ways in which psychological disorders can affect alcohol consumption patterns in students are unknown.<sup>24</sup> Therefore, the assessment of psychological symptoms and alcohol consumption in this specific population is especially important. Then, adequate support can be planned and offered through evidence-based measures. Thus, the aim of this study is to determine whether anxiety symptoms are associated with alcohol abuse in Brazilian undergraduate dental students during the COVID-19 pandemic.

## 2 | METHODS

### 2.1 | Study design and ethical considerations

A cross-sectional study was conducted with a target population of Brazilian undergraduate dental students enrolled at public and private universities. This report

followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE). This study received approval from the institutional review board of the School of Medicine of the Federal University of Pelotas, Brazil (#1413950). All volunteers received clarification regarding the objectives of the study and those who agreed to participate had access to the digital consent form.

## 2.2 | Sample size estimation

This study used specific variables from a larger study that investigated the impact of the COVID-19 pandemic on Brazilian dental education. Considering that the previous study evaluated different outcomes, the expected prevalence of the phenomenon equal to 50% was used to obtain the largest sample size. In general, there are approximately 125,585 students at public and private dental schools distributed unequally among the different regions of Brazil.<sup>25</sup> Sample size was calculated considering an alpha of 5% and a 30% dropout rate, thus it was estimated that 500 Brazilian university students were needed for this study, in which 36% should be students from the Southeast region ( $n = 180$ ), 16% from the South ( $n = 80$ ), 10% from the Central West ( $n = 50$ ), 9% from the North ( $n = 45$ ), and 29% from the Northeast ( $n = 145$ ).

For the present study, the statistical power of the sample was subsequently performed and, with an alpha of 5% and the prevalence of alcohol abuse observed in anxious (29%) and nonanxious (6.6%) dental students, a sampling power of 84.87% was found. All calculations were performed using the OpenEPI software program. To be included in the study sample, the individuals needed to be students enrolled in a dentistry course of a public or private higher education institution in Brazil and 18 years of age or older.

## 2.3 | Questionnaire

A self-report questionnaire was developed for the present study. The questionnaire was organized in three different thematic blocks: (a) sociodemographic factors; (b) characteristics related to educational profile; and (c) diagnosis for COVID-19, anxiety symptoms, and alcohol abuse and consumption.

The questionnaire was pretested by a group of postgraduate dental students (master's and doctoral levels) at two public universities in Brazil during a pilot study to verify the feasibility of the instrument. Based on the methods in the previous study, the participants were asked to assess the clarity, writing, and organization of the items.<sup>26</sup> The assessors answered the questionnaire, recorded the time required to complete it, and scored the clarity of each item

on a scale of 1 (unclear) to 5 (very clear). The researchers discussed all items attributed a score of  $\leq 3$  to reach a consensus on how to modify the items based on the assessors' feedback. The average time required to complete the questionnaire was 10 min. The mean clarity score for all items on the questionnaire was 4.8. The present study did not aim to validate the questionnaire used in this study.

The survey instrument containing the variables for this study is included in Appendix SA1. For all variables in sections 1 and 2, the response option "Prefer not to say" was available. During data analysis, these responses were considered to be missing data. Regarding section 3, missing data were not detected, as all variables were answered adequately. For variables with missing data, we did not perform data imputation, and the participants were not included in the analysis.

## 2.4 | Sample recruitment

In general, this study did not adopt any sampling strategy. Students were recruited through social media advertisements. The researchers advertised the study by sharing the link to the questionnaire on the official page of the project on Instagram (@ensino.odonto\_covid19). Emails containing descriptive information about the study, banners, and digital posters for dissemination, and the link to access the questionnaire were sent electronically to 250 coordination departments of Brazilian dental schools (public and private) in the five regions of country, encouraging institutions to share the study information with their students. The response rate to the emails was 48.4% ( $n = 121$ ). Participating researchers shared the official research dissemination post on their personal Instagram, Twitter, and Facebook profiles (feed and stories), as well as asking other dentists to help spread the word about the campaign. Brazilian professors and professionals of dentistry with professional profiles on Instagram were selected by active search on the social media and subsequently invited to share the research invitation post on their individual pages. A total of 248 accounts were contacted through the project profile, and more than half of these contributed to the dissemination of the research (response rate: 75.4%;  $n = 187$ ). We reached professionals categorized as micro (<10,000 followers) and meso (10,000–1 million) on the followers' scale.<sup>27</sup> By the end of the data collection, the project's profile on Instagram had a maximum number of 1,389 followers.

## 2.5 | Outcome

Alcohol abuse was assessed using the Brazilian version of the CAGE questionnaire.<sup>28</sup> The CAGE questionnaire is

a validated screening test for alcohol abuse, consisting of four questions represented by the respective keywords for each letter: C: Cut Down (decrease intake); A: Annoyed (angry); G: Guilty (guilty); and E: Eye-Opener (hangover identification). Students receive 1 point for each “yes” on CAGE and “0” points if all questions are answered “no.”<sup>28</sup> A score of 2 or more (CAGE  $\geq 2$ ) was considered a positive screening for alcohol abuse.<sup>29</sup>

## 2.6 | Independent variables

The following sociodemographic variables were considered: gender (female or male), self-reported skin color according to the Brazilian Institute of Geography and Statistics (Caucasian or non-Caucasian: Black, Brown, Yellow, or Indigenous), age (in years), region (North, Northeast, Central West, Southeast, or South), place of residence (urban or rural), and number of residents at home during the COVID-19 pandemic. Characteristics related to the profile of each student were also assessed: type of teaching institution (public or private), and stage of undergraduate course (initial stage: first to fourth semester; intermediate stage: fifth to seventh semester; final stage: eighth to 10th semester).

The diagnosis of COVID-19 was investigated through a self-report question. The students were classified as not having a diagnosis of COVID-19 (no, only suspected or suspected but tested negative) or having a diagnosis of COVID-19 (tested positive).

All participants responded to the Brazilian version of the seven-item Generalized Anxiety Disorder Scale (GAD-7).<sup>30</sup> The GAD-7 includes seven items based on seven core symptoms and inquires the frequency with which respondents suffered from these symptoms within the last 2 weeks. Respondents report their symptoms using a four-item Likert rating scale ranging from 0 (not at all) to 3 (almost every day), such that the total score ranges from 0 to 21. The following cut-offs correlate with the level of anxiety severity: normal anxiety (score 0–4), mild anxiety (score 5–9), moderate anxiety (score 10–14), and severe anxiety (score  $\geq 15$ ).<sup>6</sup>

## 2.7 | Data analysis

Descriptive analyses were determined by the absolute and relative frequency of the variables. Bivariate analyses testing the factors associated with alcohol use disorder were run using the chi-square test. Only those variables with a  $p$ -value  $\leq 0.20$  were also entered in the regression model through backward selection. The hierarchical logistic regression (crude and adjusted analysis) evaluated

the contribution of each variable (e.g., sociodemographic, educational, diagnosis of COVID-19, and anxiety) to alcohol use disorder; and we tested for interactions ( $\times$ ) among anxiety levels  $\times$  gender. In the hierarchical model, the first step included sociodemographic variables. The second step included variables related to educational institution and course. The third and fourth steps referred to the diagnosis of COVID-19 and generalized anxiety disorder levels, respectively. In the fifth step, the interaction between anxiety levels according to gender was performed with control for all other variables. Regression results are presented in odds ratio (OR), 95% confidence interval (95% CI), beta coefficient ( $\beta$ ), and standard error (SE). Tests for multicollinearity in all variables were run. Variables were required not to exceed a variance inflation factor (VIF) of 10. Outliers were also explored by applying the case-wise diagnosis (more than 3 standard deviations below or above the mean). All statistical analyses were conducted using IBM SPSS Statistics version 26.0. Statistical significance was set at  $p \leq 0.05$ .

## 3 | RESULTS

The sample included 1050 Brazilian undergraduate dental students. All participants were included in the sample as they met the inclusion criteria for this study. Table 1 presents the general characterization of the sample. The alcohol abuse rate was 18.7% ( $n = 196$ ). Male gender ( $p < 0.001$ ), black skin color ( $p < 0.001$ ), being older than 25 years ( $p < 0.001$ ), living in a rural area ( $p = 0.006$ ), living with more than three people at home ( $p < 0.001$ ), and living in the Central West region of Brazil ( $p < 0.001$ ) were associated with a higher prevalence of alcohol abuse. Regarding educational characteristics, studying at a public university ( $p < 0.001$ ) and being in the intermediate semesters of the course ( $p < 0.001$ ) were associated with a higher prevalence of alcohol use. In addition, a positive diagnosis of COVID-19 was also associated with a higher prevalence of alcohol abuse ( $p < 0.001$ ) (Table 1).

The prevalence of mild, moderate, and severe anxiety among students were 31.2% ( $n = 329$ ), 29.6% ( $n = 311$ ), and 24.2% ( $n = 254$ ), respectively. Less than a third of the participants in the sample (15%;  $n = 154$ ) were not diagnosed with anxiety symptoms. A higher frequency of alcohol abuse was associated with the degree of severity of anxiety symptoms according to the student's gender (Figure 1). Alcohol abuse was greater among male academics with moderate or severe anxiety symptoms, when compared to female students ( $p < 0.001$ ).

The multivariate models of factors predicting alcohol abuse in Brazilian dental students during the COVID-19 pandemic are shown in Table 2. All variables were

**TABLE 1** Sample characteristics and their association with alcohol abuse

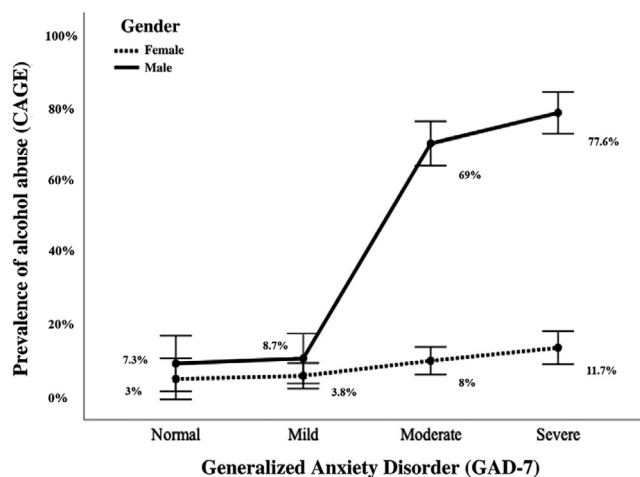
Variables	Total sample (n = 1050)	Alcohol abuse (n = 196; 18.7%)	p-Value
<i>Sociodemographic factors</i>			
<i>Gender,<sup>c</sup> n (%)</i>			
Female	739 (70.6)	49 (6.6)	<0.001 <sup>a</sup>
Male	308 (29.4)	146 (47.4)	
<i>Skin color,<sup>c</sup> n (%)</i>			
Caucasian	682 (65.2)	88 (12.9)	<0.001 <sup>a</sup>
Non-Caucasian	364 (34.8)	107 (29.3)	
Age - mean (SD)	23.27 (4.74)	25.05 (4.35)	<0.001 <sup>a</sup>
<i>Area of residence,<sup>c</sup> n (%)</i>			
Urban	994 (95.5)	179 (18.0)	0.006 <sup>a</sup>
Rural	47 (4.5)	16 (34.0)	
Number of residents sharing home, <sup>c</sup> mean (SD)	2.42 (1.04)	2.70 (0.83)	<0.001
<i>Region,<sup>c</sup> n (%)</i>			
North	51 (4.9)	13 (25.4)	<0.001 <sup>a</sup>
Northeast	247 (23.6)	67 (27.1)	
Central West	68 (6.5)	28 (41.1)	
Southeast	222 (21.2)	45 (20.2)	
South	460 (43.9)	41 (8.9)	
<i>Educational profile</i>			
<i>Type of university institution, n (%)</i>			
Private	514 (51.0)	73 (13.8)	<0.001 <sup>a</sup>
Public	536 (49.0)	122 (22.7)	
<i>Stage of course, n (%)</i>			
Initial (1st–4th semesters)	333 (31.7)	35 (10.5)	<0.001 <sup>a</sup>
Intermediate (5th–7th semesters)	436 (41.5)	127 (29.1)	
Final (8th–10th semesters)	281 (26.8)	33 (11.7)	
<i>COVID-19 diagnosis</i>			
<i>COVID-19, n (%)</i>			
No	992 (94.5)	154 (15.5)	<0.001 <sup>a</sup>
Positive	58 (5.5)	41 (70.6)	

Abbreviation: SD, standard deviation.

<sup>a</sup>Chi-square test.

<sup>b</sup>t-Test unequal.

<sup>c</sup>Variable with missing data.



**FIGURE 1** Prevalence of alcohol abuse according to the anxiety levels between the genders ( $p < 0.001$ )

associated with the outcome in the crude regression analysis, while after adjusting for the potential confounders in the adjusted analysis, only the variable related to the area of residence of the students did not remain significantly associated with alcohol abuse. Thus, these results demonstrated that the best fitting model for the variables associated with alcohol abuse outcome involved a combination of gender, ethnicity, age, type of educational university, stage of course, diagnosis of COVID-19, and anxiety. Regarding the tests for multicollinearity, none of the VIF values exceeded 10. The model, including all the previously mentioned variables, accounted for up to 53.1% of the variance observed in the data ( $\chi^2 = 415.61$ ;  $p < 0.001$ ,  $R^2_{\text{Nagelkerke}} = 0.531$ ). Furthermore, in the last step, an interaction between gender and anxiety was tested and it was statistically significant. When gender interacts with moderate (OR 10.05 [95% IC: 4.12–24.52]) or severe (OR 15.82 [95% IC: 6.46–38.73]) anxiety disorder, the risk for alcohol abuse is increased ( $p < 0.001$ ). Thus, the interaction between anxiety levels  $\times$  gender predicts the likelihood of alcohol abuse for male students with moderate (OR 17.06 [95% CI: 8.36–34.78]) and severe (OR 28.38 [95% CI: 8.62–38.24]) anxiety ( $p < 0.001$ ).

#### 4 | DISCUSSION

Our findings demonstrate that during the COVID-19 pandemic, Brazilian dental undergraduate students diagnosed with moderate or severe anxiety symptoms are more likely to abuse alcohol, especially male academics. In fact, pandemics such as COVID-19 can trigger many medical, psychological, and social problems.<sup>1,6</sup> This in turn can cause changes to health and behavioral habits, including increased anxiety symptoms and alcohol consumption.<sup>4</sup>

TABLE 2 Multivariate models of factors predicting alcohol abuse in Brazilian dental students during the COVID-19 pandemic

Variables	OR <sub>CRUDE</sub>	95% CI		$\beta$	SE	p-Value	OR <sub>ADJUSTED</sub>	95% CI		$\beta$	SE	p-Value
		Lower	Upper					Lower	Upper			
<i>Step (1)</i>												
Male gender <sup>c</sup> (ref. female)	11.29	7.68	16.58	2.42	0.19	<0.001	10.80	6.92	16.84	2.38	0.22	<0.001 <sup>a</sup>
Non-Caucasian <sup>c</sup> (ref. Caucasian)	1.55	1.24	1.95	0.44	0.11	<0.001	1.40	1.07	1.84	0.34	0.13	0.013 <sup>a</sup>
Age (in years)	1.06	1.03	1.10	0.06	0.23	<0.001	1.05	1.01	1.10	0.05	0.02	0.012 <sup>a</sup>
Area rural <sup>c</sup> (ref. urban)	2.34	1.25	4.37	0.85	0.31	0.008	0.62	0.23	1.63	-0.46	0.49	0.626 <sup>a</sup>
Number of residents sharing home <sup>c</sup>	1.52	1.26	1.84	0.42	0.09	<0.001	1.30	1.05	1.62	0.26	0.11	0.016 <sup>a</sup>
<i>Step (2) (n = 1050)</i>												
Public institutions (ref. private)	1.84	1.32	2.56	0.22	0.16	<0.001	1.73	1.12	2.67	0.55	0.22	0.004 <sup>a</sup>
Intermediate stage course (ref. initial stage)	0.95	0.57	1.58	-0.49	0.25	0.849	1.00	0.53	1.87	0.00	0.31	0.992 <sup>a</sup>
Final stage course (ref. initial stage)	3.34	2.19	5.09	1.20	0.22	<0.001	1.78	1.04	3.06	0.58	0.27	0.034 <sup>a</sup>
<i>Step (3) (n = 1050) (ref. No)</i>												
Positive COVID-19 diagnosis	14.28	7.83	26.05	2.65	0.30	<0.001	5.81	2.55	13.24	1.76	0.42	<0.001 <sup>a</sup>
<i>Step (4) (n = 1050) (ref. normal anxiety)</i>												
Mild anxiety	1.08	0.43	2.71	0.84	0.46	0.856	1.95	0.73	5.21	0.67	0.50	0.179 <sup>a</sup>
Moderate anxiety	7.12	3.20	15.86	1.96	0.40	<0.001	10.05	4.12	24.52	2.30	0.45	<0.001 <sup>a</sup>
Severe anxiety	12.71	5.71	28.28	2.54	0.41	<0.001	15.82	6.46	38.73	2.76	0.95	<0.001 <sup>a</sup>
<i>Step (5) (n = 1050) (ref. normal anxiety-female gender)</i>												
Mild anxiety-gender (male)	1.33	0.55	3.21	0.28	0.45	0.525	2.19	0.74	6.41	0.78	0.54	0.152 <sup>b</sup>
Moderate anxiety-gender (male)	31.06	18.23	52.93	3.43	0.27	<0.001	17.06	8.36	34.78	2.83	0.36	<0.001 <sup>b</sup>
Severe anxiety-gender (male)	48.29	27.85	83.73	3.87	0.28	<0.001	28.38	8.62	38.24	2.89	0.38	<0.001 <sup>b</sup>

Note: Step 1: sociodemographic factors; Step 2: educational profile; Step 3: COVID-19 diagnosis; Step 4: anxiety levels; Step 5: interaction between anxiety levels according to gender.

Abbreviations: CI, confidence interval; OR, odds ratio; SE, standard error;  $\beta$ , beta coefficient.

<sup>a</sup>Adjustment for all variables included in steps (1) (2), (3), and (4).

<sup>b</sup>Adjustment for all variables included in steps (1), except gender, (2), and (3).

<sup>c</sup>Variable with missing data.

Previous research has shown that the presence of psychological disorders and problematic alcohol consumption often co-occur.<sup>4,18</sup> A meta-analysis study highlighted the high risk of comorbidity between alcohol use and anxiety disorder among adults.<sup>31</sup> The relationship between anxiety symptoms and alcohol intake seems to be bidirectional in nature; that is, higher anxiety symptoms predict greater likelihood of developing alcohol-related disorders, and alcohol problems predict anxiety symptoms.<sup>32</sup>

Literature shows that the presence of negative biopsychosocial stimuli can drive the relationship between anxiety and harmful alcohol consumption, particularly among those with symptoms of psychological distress who resort to drinking to treat or buffer their symptoms (reduce stress-anxiety).<sup>33</sup> In the pandemic period, the stress and social isolation experienced by individuals can act as a significant trigger to increase anxiety symptoms,<sup>6,13</sup> resulting in subsequent alcohol abuse.<sup>5,19</sup>

Alcohol consumption by university students is related to an increased risk of physical injury, high-risk sexual behavior, low academic performance, and psychosocial consequences.<sup>20,21</sup> In general, alcohol abuse among Brazilian university students is a well-documented finding in the literature. Cross-sectional studies conducted during non-pandemic periods show that most Brazilian undergraduate dental students regularly consume alcoholic beverages,<sup>34</sup> especially with high alcohol intake pattern.<sup>34,35</sup>

Undergraduate students enrolled in health courses (e.g., medicine and dentistry) have higher anxiety rates, when compared to estimates of the general population and their colleagues of courses in other areas of knowledge.<sup>36,37</sup> The high prevalence of symptoms related to anxiety disorder among students of this study represents reference values higher than those found in the literature, regardless of the period (pandemic and nonpandemic).<sup>6,15,36</sup> This meets the trend of anxious behavior rates in the general population that may increase up to four times during the context of a pandemic.<sup>38</sup> Thus, we believe that the high prevalence of anxiety in the sample reflects the fact that the students experienced great disturbance in their life and education situation during the COVID-19 pandemic.

Nevertheless, the dental students may be concerned about the impact of disruption of teaching activities caused by pandemic containment measures on their curriculum progress, fearful of losing manual dexterity skills, and insecure to return to in-person service (due to cross-contamination in clinical practice and risk perception of becoming a vector of transmission of the virus among family members).<sup>11,12,16</sup> Therefore, such factors can influence the worsening of symptoms related to generalized anxiety disorder, which consequently can lead to alcohol abuse among students. Although no studies were found that verified the relationship between anxiety and alcohol abuse

in samples composed exclusively of dental students, other authors have already identified a correlation between the highest level of anxiety and high alcohol consumption among general university students during periods without public health emergencies.<sup>39</sup>

In comparison to the results of previous periods, the only study that used the CAGE test in evaluations with dental students showed that Colombian undergraduate dental students have a higher prevalence of alcohol abuse than that found in this study.<sup>40</sup> The high frequency of alcohol abuse among Colombian students was already expected, as estimates show that a significant portion of the country's adult population consumes and abuses alcohol,<sup>41</sup> with even more alarming data among undergraduate students.<sup>42</sup> In contrast, the prevalence of alcohol abuse among dental students was similar to that found in Brazilian undergraduate medical students in 2006,<sup>43</sup> and higher than that found in other more recent studies with representative university samples from Brazil and the United Kingdom.<sup>20,29</sup> In addition, no studies were identified that evaluated the prevalence of alcohol abuse in university samples during the SARS-CoV-2 outbreak using the CAGE questionnaire. Given this, an accurate comparison of our findings is limited. From a broader perspective, we found cross-sectional studies that used this screening instrument in different adult populations during the COVID-19 pandemic, and we can highlight that university students in this study had a higher prevalence of alcohol abuse than that found among Brazilian, Portuguese, and Italian adults during this period.<sup>44,45</sup>

Our results demonstrate that male dental students may be more sensitive to the presence of moderate or severe anxiety symptoms, thus contributing to higher levels of alcohol abuse, in comparison to female dental students. Both women and men with anxiety disorders show different patterns of co-occurring mental disorders and lifestyle habits.<sup>46</sup> While women with generalized anxiety disorder symptoms suffer more frequently with other comorbid mental disorders, men are more frequently diagnosed with substance abuse or antisocial behavior.<sup>46</sup> Therefore, these results are consistent with past findings, which found that in comparison to women, when faced with anxiety symptoms, men are more prone to alcohol consumption and abuse as a way to deal with stress. This serves as a contributing factor that may justify the greater vulnerability of this group to disorders resulting from alcohol consumption.<sup>47,48</sup>

Interestingly, we found that the prevalence of alcohol abuse was higher among dental students who had already been infected by COVID-19. This data are supported by a recent retrospective cohort study including a large sample of COVID-19 survivors ( $n = 236,379$ ), which showed that approximately 24% of these individuals developed

psychiatric manifestations including mood, anxiety, or psychotic disorders.<sup>49</sup> It is known that the occurrence of anxiety symptoms may predispose to a higher alcohol consumption,<sup>6</sup> what might be a potential explanation for our findings.

Within this context, cost-effective therapeutic approaches, such as cognitive-behavioral therapy (CBT) and mindfulness-based stress reduction (MBSR), are viable treatment modalities for reducing anxiety symptoms in adults.<sup>50,51</sup> CBT is typically conceptualized as a skill-centered treatment aimed at altering adaptive emotional responses by changing the patient's thoughts, behaviors, or both.<sup>52</sup> Mindfulness is related to meditation, but the terms are not synonymous. In general, MBSR consists of formal meditation exercises (e.g., paying attention to your body, lying down on the floor, or walking slowly with a sense of awareness of your environment) as well as informal exercises (e.g., paying full attention to what you are doing or experiencing at a given moment), and use of techniques centered on the present moment and not judgment.<sup>53</sup> Randomized controlled trials and meta-analyses studies in adult populations with anxiety disorders have demonstrated that both techniques can be effectively delivered via the internet or digital devices.<sup>54,55</sup> Thus, we recommend students to pursue these therapeutic approaches to managing anxious symptoms during a pandemic,<sup>56</sup> thereby reducing binge drinking as an escape mechanism for coping with stress.

The results of this study should be interpreted in consideration of some limitations. The first involves the representativeness of the sample. Most of the sample was not from the region of the country in which the largest number of dental courses is found. Furthermore, the cross-sectional design of this study does not allow the assessment of the temporality of the relationship between alcohol abuse and exploratory variables. Thus, the generalization of the results should be performed with caution. The second limitation is related to the instrument used to evaluate alcohol abuse in the sample. While the CAGE questionnaire has demonstrated a high efficacy in detecting alcohol-related problems, it has limitations in people with less severe alcohol problems. Apparently, this screening test is not able to distinguish between current and past drinking problems.<sup>57</sup> Finally, the use of a nonvalidated research instrument can be listed as a limitation of this study, although it is able to provide important knowledge about the population at this time of pandemic crisis. However, the questionnaire was previously tested by a group of dental students to increase its applicability. Moreover, all associations between the variables of the present study are considered valid and robust. Thus, we encourage new research with a longitudinal design to evaluate the consumption of alcohol in university student samples through

tests to identify alcohol use disorders capable of verifying the drinking frequency and intensity, together with the prevalence of alcohol-related problems and dependence.

The adoption of an innovative method of online data collection and dissemination through social media, which is an especially useful research tool and a promising method in times of social isolation, is one of the main strengths of this study and deserves to be highlighted.<sup>26</sup> Furthermore, this study provides important information about mental and behavioral disorders among Brazilian dental students, and our findings are useful for the development of several intervention and prevention programs aimed at university students. These may include precautionary measures, such as providing adequate and culturally responsive information on how to deal adequately with the stress associated with pandemic without resorting to alcohol as a coping mechanism. For this, university counseling centers can play a key role in this difficult situation and have great potential to provide professional assistance in improving mental health and reducing alcohol use among undergraduate students.

## 5 | CONCLUSION

The present findings reveal that during the COVID-19 pandemic, the worsening of generalized anxiety disorder influences alcohol abuse among Brazilian undergraduate dental students, especially among males. Intervention strategies that promote the adoption of healthier lifestyles can enable the effective management of anxiety symptoms and thus, hold the potential to reduce excessive alcohol consumption in this population.

## ACKNOWLEDGMENTS


The authors gratefully acknowledge all Brazilian undergraduate dental students who participated in this study, as well as professors and other collaborators who helped disseminate the research on their social networks and institutions. Matheus dos Santos Fernandez holds a scientific initiation FAPERGS (Research Support Foundation of the State of Rio Grande do Sul - *Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul*) scholarship for undergraduate students (Project 2019/2020-10133). Dr. De Azevedo Cardoso acknowledges her postdoctoral fellowship from the Canadian Institutes of Health Research (CIHR).

## CONFLICT OF INTEREST

The authors declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.




## ORCID


Matheus dos Santos Fernandez BSc  <https://orcid.org/0000-0001-7781-3083>

Igor Soares Vieira PhD  <https://orcid.org/0000-0002-3263-8397>

Nathalia Ribeiro Jorge da Silva DDS, MSc  <https://orcid.org/0000-0002-2691-3970>

Taiane de Azevedo Cardoso PhD  <https://orcid.org/0000-0003-1925-8709>

Camilla Hübner Bielavski BSc  <https://orcid.org/0000-0002-2928-0582>

Coral Rakovski BSc  <https://orcid.org/0000-0002-5321-4833>

Alexandre Emidio Ribeiro Silva DDS, PhD  <https://orcid.org/0000-0001-6402-0789>

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**How to cite this article:** Fernandez MS, Vieira IS, da Silva NRJ, et al. Anxiety symptoms and alcohol abuse during the COVID-19 pandemic: A cross-sectional study with Brazilian dental undergraduate students. *J Dent Educ.* 2021;85:1739–1748. <https://doi.org/10.1002/jdd.12742>