

Female and Worst Academic Performance are Associated with Anxiety and Stress among Dental Students

Mulheres e Pior Desempenho Acadêmico Estão Associados com Ansiedade e Estresse em Estudantes de Odontologia

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Abstract

This study aimed to assess the levels and associated factors of stress and anxiety in dental students during the Covid-19 pandemic. This cross-sectional study involved both undergraduate and graduate dental students regularly enrolled in the first semester of 2020 of one University. An online structured questionnaire was applied, and demographical, behavioral, academic performance, fear and anxiety related to the Covid-19 pandemic were collected. The 21-item Depression Anxiety Stress Scale (DASS-21) was applied, but only the subscales of anxiety and stress were considered. Adjusted analyses were performed using Poisson regression with robust variance. To both anxiety and stress, independent analyses were performed considering the different levels of study (undergraduate and graduate dental students). At least moderate anxiety was detected in 42.9% and 24.7% of undergraduate and graduate students, respectively. Meanwhile, at least moderate stress was observed in 41.7% and 29.9% of undergraduate and graduate students, respectively. In the multivariate analyses, female undergraduate dental students presented significantly more anxiety (prevalence ratio [PR]: 1.57; 95% confidence interval [95%CI]: 1.11 – 2.22) and stress (PR: 1.54; 95%CI: 1.06 – 2.24) when compared to males. Conversely, undergraduate dental students with better academic performance demonstrated lower rates of anxiety (PR: 0.86; 95%CI: 0.75 – 0.98). Females undergraduate dental students demonstrate higher rates of anxiety and stress, and the academic performance may influence the levels of anxiety in these individuals.

Keywords: Coronavirus. Academic Performance. Education in Dentistry. Behavioral Symptoms.

Resumo

O estudo objetivou avaliar os níveis e fatores associados de estresse e ansiedade em estudantes de Odontologia durante a pandemia de Covid-19. Esse estudo transversal envolveu alunos de graduação e pós-graduação em Odontologia regularmente matriculados no primeiro semestre de 2020 de uma Universidade. Um questionário estruturado online foi aplicado, e variáveis demográficas, comportamentais, performance acadêmica, medo e ansiedade relacionados à pandemia de Covid-19 foram coletadas. A "Depression Anxiety Stress Scale" (DASS-21) de 21 itens foi aplicada, mas somente os domínios de ansiedade e estresse foram considerados. Análises ajustadas foram realizadas utilizando regressão de Poisson com variância robusta. Para ambos ansiedade e estresse, análises independentes foram realizadas considerando os diferentes níveis de estudo (estudantes de odontologia de graduação e pós-graduação). Pelo menos ansiedade moderada foi detectada em 42,9% e 24,7% dos alunos de graduação e pós-graduação, respectivamente. Já o estresse pelo menos moderado foi observado em 41,7% e 29,9% dos alunos de graduação e pós-graduação, respectivamente. Nas análises multivariadas, mulheres estudantes de graduação apresentaram significativamente mais ansiedade (razão de prevalência [RP]: 1,57; intervalo de confiança de 95% [IC95%]: 1,11 – 2,22) e maior estresse (RP: 1,54; IC95%: 1,06 – 2,24) quando comparados com homens. Contudo, estudantes de graduação com melhor performance acadêmica demonstraram menores taxas de ansiedade (RP: 0,86; IC95%: 0,75 – 0,98). Estudantes de graduação do sexo feminino demonstraram maiores taxas de ansiedade e estresse, e a performance acadêmica pode influenciar os níveis de ansiedade desses indivíduos.

Palavras-chave: Coronavírus. Desempenho Acadêmico. Educação em Odontologia. Sintomas Comportamentais.

1 Introduction

The mental burden derived from the coronavirus diseases 2019 (Covid-19) pandemic is an important aspect among all individuals. Regarding these aspects, fear, directly related to the rates of transmission and its mortality, depression, anxiety and stress, may be highlighted¹. Among the healthcare workers, dental professionals may experience a higher concern, as it has been established that the primary source for transmission of coronavirus is through droplets and aerosols², increasing the chances of dentists and dental healthcare workers of being infected and disseminating the virus. All these characteristics

may add a higher psychological burden in these professionals³, generating a higher level of anxiety in dentists⁴.

University students are exposed to several stressors, which are directly related to their education⁵. During the Covid-19 pandemic, students are facing several uncertainties towards their academic training⁵, including the social isolation and the online teaching, which increased the level of stress and symptoms of anxiety⁶. In this context, Dentistry has been pointed out as one of the most challenging, demanding and stressful professions⁷. Literature demonstrates that dental students experience significantly higher levels of stress than

students of other health areas, such as medicine⁸.

Moreover, the perceived stress varies along the different academic phases, as the first year's students perceived significantly lower stress intensity when compared to the last years⁹ and that for each progressive year of training greater difficulties and stressing factors are observed¹⁰. In addition, a recent study showed that higher levels of stress were found in dental students during the clinical phase when compared to those at the preclinical phase, demonstrating that the academic level may impose a different pattern in the sources of stress¹¹. Moreover, female students presented higher prevalence of symptoms of anxiety⁶.

Despite of that, the literature is scarce if undergraduate and graduate dental students experience different levels of stress and anxiety, and little is known about the effect of the Covid-19 pandemic in these students. Furthermore, literature is insufficient of studies, using adjusted analysis, for variables associated with anxiety and stress among these students. The working hypothesis of the present study is that female dental students may face higher burden of stress and anxiety when compared to male ones. Therefore, the aim of this study was to assess the levels of anxiety and stress in undergraduate and graduate dental students during the Covid-19 pandemic. In addition, the associated factors with these conditions (stress and anxiety), including academic performance, were also investigated.

2 Material and Methods

2.1 Study Design and Ethical Aspects

This is a cross-sectional study that involved dental students of one University. The study was approved by the local ethics committee under protocol #3.910.723. All the participants read and electronically signed an informed consent prior to their participation in the study.

2.2 Inclusion Criteria, Sample and Sampling Strategy

Both undergraduate and graduate dental students were invited to participate. To be included, students had to be regularly enrolled in the first semester of 2020. Prior to their inclusion, student enrollment was confirmed with dean of the School of Dentistry. No exclusion criterion was imposed.

In the first semester of 2020, the School of Dentistry had 474 undergraduate and 105 graduate dental students regularly enrolled. All of them were invited to participate by personal and institutional electronic mail, social media and contact through class representative. Due to the current pandemic, the first academic semester happened up to September 2020. Data collection of the present study occurred between June and August 2020. During data collection, the school was performing only remote activities, as face-to-face activities were suspended.

2.3 Data Collection

An electronic questionnaire was applied, which included both structured and semi-structured questions. The questionnaire was composed by 31 questions, which collected demographical, behavioral, occupational, fear and anxiety related to the Covid-19 pandemic variables. All the questions included herein and their response options are available in Table S1. The 21-items Depression Anxiety Stress Scale (DASS-21) was also used in its version validated to Brazil¹². Only the questions related to the subscales of anxiety (items 2, 4, 7, 9, 15, 19 and 20) and stress were considered (items 1, 6, 8, 11, 12, 14 and 18).

All five questions related to fear and anxiety related to the COVID-19 pandemic were adapted and translated by a previous study⁴. No attempt to validate this instrument was performed.

Academic performance was also assessed in both undergraduate and graduate dental students. For undergraduate dental students, the academic performance used grades that ranges from zero to 10. The overall mean of all the completed courses was collected to all undergraduate dental students by access to their academic history. Regarding the graduate dental students, concepts were used, which includes A (excellent), B (good), C (adequate) and D (insufficient). The percent of concepts A to D were collected in their academic history. Only the main researcher of the present study had access to these data.

2.4 Outcome Definition

As previously stated, only the subscales of anxiety and stress were used in the present study. The sum scores were multiplied by 2 to match the original scale score in DASS-42¹². Each subscale score ranged from 0 to 42. Different categories of anxiety and stress were considered using the following cutoff points: Normal (0-7 to anxiety and 0-9 to stress), Mild (8-9 to anxiety and 15-18 to stress), Moderate (10-14 to anxiety and 19-25 to stress), Severe (15-19 to anxiety and 26-33 to stress) and Extremely severe (≥ 20 to anxiety and ≥ 34 to stress)¹². For the present study, the main sample dichotomized as follows: a) Anxiety: Normal or mild anxiety and at least moderate anxiety; b) Stress: Normal or mild stress and at least moderate stress.

2.5 Statistical Analysis

The main outcomes of the present study were at least moderate anxiety and at least moderate stress. Independent analyses to undergraduate and graduate dental students were performed.

Age and monthly family income (in a thousand Brazilian Reais) were used in the continuous fashion. Regarding sex, no participant answer "other". Therefore, only males and females were considered in the present study. For each of the following variables, the sample was dichotomized into "yes"

or “no”: physical activity, Dentistry as first options, current occupation, alcohol exposure, smoking exposure, use of marijuana. The sample was also dichotomized into “yes” for those participants that answered “yes” to all the five questions of fear and anxiety related to the COVID-19 pandemic and “no” to all participants who answered “no” or “do not know” for at least one of those questions .

Regarding the level of education training, undergraduate dental students were divided into 1st, 2nd, 3rd, 4th and 5th Years of educational training, and graduate dental students were dichotomized into master’s degree student and Ph.D. student. Mean grades was used to express the academic performance of undergraduate dental students. In graduate dental students, the percent of concepts A was used.

Missing data were detected only in two independent variables, monthly family income and academic performance. No attempt to data input was performed in these variables.

The mean scores of the anxiety and stress subscales were compared between undergraduate and graduate dental students. In addition, these scores were compared between the sexes and between the different levels of education training. For these comparisons, separate analyses were performed to undergraduate and graduate dental students. As non-normal distributions were detected to both subscales, non-parametric tests were used for these comparisons (Mann-Whitney and Kruskal-Wallis tests).

The different categories of anxiety and stress were also compared between undergraduate and graduate dental students. For these comparisons, Chi-square test was used. Additionally, bi- and multivariate analyses were performed using Poisson regression with robust variance to detect associated factors with at least moderate anxiety and at least moderate stress. For these analyses, independent models were constructed to undergraduate and graduate dental students. Therefore, four independent multivariate models were performed in the present study. In order to be included in the initial multivariate model, the independent variable had to be a p-value <0.25 in the bivariate analysis.

However, regardless of the p-value detected in the bivariate analysis, sex, level of educational training and academic performance were included and maintained in the final multivariate model. Sex was used, as the literature shows a higher patterns of stress among female students¹³. Similarly, different patterns of depression, and possibly of anxiety and stress, are expected among the different years of educational training¹⁴. Additionally, academic performance was defined as the main confounder of the present study. As the study was conducted during the pandemic of COVID-19, higher burden of anxiety and stress was hypothesized among these individuals. Therefore, the variable related to fear and anxiety of this pandemic was also included in the final multivariate model.

To all analyses a p<0.05 was established to statistical significance. Regarding multivariate models, analyses of model modification were also considered. All the analyses were performed on SPSS software (version 21.0) for Windows.

3 Results and Discussion

In total, 331 and 77, respectively, undergraduate and graduate dental students were included in the present study. For the 474 undergraduates initially available, nine of them were excluded, as they were not regularly enrolled in the first semester of 2020. No exclusion was performed among graduate dental students. Thus, the response rate was 71.78% (for undergraduate students) and 74.29% (for graduate students). No statistically significant difference was detected between dental students included and those that did not answer the questionnaire, regarding sex ($P=0.448$ for undergraduate students and $P=0.550$ for graduate students).

The comparison of the levels of anxiety and stress subscales between undergraduate and graduate dental students are reported in Table 1. It was detected significantly higher mean scores of anxiety and stress in undergraduate dental students. Conversely, when the different categories of anxiety and stress were considered, no statistically significant difference between the groups were reported.

Table 1 – Descriptive results of the anxiety and stress subscales from DASS tool, comparing undergraduate and graduate dental students

Variables		Undergraduate (n=331; 81.1%)	Graduate (n=77; 18.9%)	Total (n=408)	P-value
Anxiety subscale	Mean±SD	10.39±10.71	6.26±7.94	9.61±10.37	0.001#
Anxiety subscale	Normal	169 (51.1)	53 (68.8)	222 (54.4)	0.051*
	Mild	20 (6.0)	5 (6.5)	25 (6.1)	
	Moderate	43 (13.0)	7 (9.1)	50 (12.3)	
	Severe	35 (10.6)	3 (3.9)	38 (9.3)	
	Extremely severe	64 (19.3)	9 (11.7)	73 (17.9)	
Stress subscale	Mean±SD	17.29±11.02	13.56±10.60	16.59±11.02	0.007#
Stress subscale	Normal	150 (45.3)	45 (58.4)	195 (47.8)	0.062*
	Mild	43 (13.0)	9 (11.7)	52 (12.7)	
	Moderate	56 (16.9)	7 (9.1)	63 (15.4)	
	Severe	44 (13.3)	13 (16.9)	57 (14.0)	
	Extremely severe	38 (11.5)	3 (3.9)	41 (10.0)	

Legend: *Chi-square test; #Mann-Whitney test; SD: standard deviation.

Source: Resource data.

Mean scores of both subscales were also compared for the different sexes and difference study levels to both undergraduate and graduate dental students (Table 2). Significantly higher levels of anxiety and stress were detected

in female undergraduate dentals students when compared to males. Conversely, no statistically significant differences were detected for the comparison of sex among graduate dental students and the different levels of educational training (Table 2).

Table 2 - Descriptive results of the DASS tool, comparing sexes and level of education training in both undergraduate and graduate dental students. Values are reported in mean±standard deviation

	Variables	Undergraduate	P-value	Variables	Graduate	P-value
Anxiety subscale	Male Female	6.95±9.15 12.03±11.03	<0.001*	Male Female	3.81±6.98 7.18±8.14	0.180*
Anxiety subscale	1 st Year 2 nd Year 3 rd Year 4 th Year 5 th Year	10.76±11.23 11.64±11.55 9.37±9.28 11.10±10.94 9.12±10.43	0.600#	Master's degree Ph.D.	5.94±7.39 6.49±8.39	0.588*
Stress subscale	Male Female	13.20±10.43 19.25±10.77	<0.001*	Male Female	10.86±10.42 14.57±10.58	0.390*
Stress subscale	1 st Year 2 nd Year 3 rd Year 4 th Year 5 th Year	17.85±11.27 18.00±11.13 16.63±10.77 18.63±11.98 15.58±10.04	0.527#	Master's degree Ph.D.	12.69±9.47 14.18±11.40	0.651*

Legend: *Mann-Whitney test; #Kruskal-Wallis test.

Source: Resource data.

Tables 3 and 4 show, respectively, the bivariate analysis for the comparison among the independent variables and at least moderate levels of anxiety and at least moderate levels of stress. The prevalence of at least moderate anxiety

was 42.9% and 24.7% among undergraduate and graduate students, respectively. In addition, 41.7% and 29.9% of the undergraduate and graduate dental students, respectively, presented at least moderate stress.

Table 3 - Bivariate analysis for the presence of at least moderate anxiety in dental students . Independent analyses were performed for undergraduate and graduate dental students

No (n=189; 57.1%)		Undergraduate			Graduate		
		Yes (n=142; 42.9%)	PR (95%CI)	No (n=58; 75.3%)	Yes (n=19; 24.7%)	PR (95%CI)	
Age (year)	Mean±SD	22.81±3.54	22.61±3.45	0.99 (0.95 – 1.03) P=0.628	30.97±7.38	28.21±5.14	0.94 (0.87 – 1.02) P=0.144
Sex	Male Female	75 (39.7) 114 (60.3)	32 (22.5) 110 (77.5)	1 1.64 (1.19 – 2.26) P=0.002	17 (29.3) 41 (70.7)	4 (21.1) 15 (78.9)	1 1.41 (0.53 – 3.76) P=0.496
Monthly family income (in thousand Reais)	Missing data	9.94±40.85 18	6.37±5.17 8	1.00 (0.99 – 1.00) P=0.107	9.09±6.74 1	6.75±3.42 0	0.94 (0.87 – 1.01) P=0.077
Do you regularly do physical activities?	Yes No	92 (48.7) 97 (51.3)	67 (47.2) 75 (52.8)	1 1.04 (0.81 – 1.33) P=0.788	35 (60.3) 23 (39.7)	9 (47.4) 10 (52.6)	1 1.48 (0.68 – 3.23) P=0.323
Sexual orientation	Heterosexual Other	174 (91.2) 15 (7.9)	117 (82.4) 25 (17.6)	1 1.55 (1.18 – 2.05) P=0.002	56 (96.6) 2 (3.4)	17 (89.5) 2 (10.5)	1 2.15 (0.74 – 6.23) P=0.160
Was Dentistry your first option?	Yes No	133 (70.4) 56 (29.6)	92 (64.8) 50 (35.2)	1 1.15 (0.89 – 1.49) P=0.273	43 (74.1) 15 (25.9)	14 (73.7) 5 (26.3)	1 1.02 (0.42 – 2.47) P=0.969
Years of education (undergraduate only)	1 st Year 2 nd Year 3 rd Year 4 th Year 5 th Year	34 (18.0) 39 (20.6) 35 (18.5) 34 (18.0) 47 (24.9)	21 (14.8) 33 (23.2) 25 (17.6) 33 (23.2) 30 (21.1)	1 1.20 (0.79–1.83) 1.09 (0.70–1.71) 1.29 (0.85–1.95) 1.02 (0.66–.58) P=0.394, 0.704, 0.229, 0.928, respectively	-	-	-

No (n=189; 57.1%)		Undergraduate			Graduate		
		Yes (n=142; 42.9%)	PR (95%CI)	No (n=58; 75.3%)	Yes (n=19; 24.7%)	PR (95%CI)	
Graduate level	Master's degree Ph.D.	-	-	-	26 (44.8) 32 (55.2)	6 (31.6) 13 (68.4)	1 1.54 (0.66 – 3.62) P=0.322
Academic performance	Mean±SD	7.77±1.11	7.53±0.89	0.89 (0.78 – 1.01) P=0.077	88.90±8.76	90.76±9.88	1.02 (0.97 – 1.07) P=0.520
Do you receive any scholarship or are you currently employed?	Yes No	41 (21.7) 148 (78.3)	33 (23.4) 108 (76.6)	1 0.95 (0.71 – 1.27) P=0.709	55 (94.8) 3 (5.2)	19 (100.0) 0 (0.0)	No estimate due to lower number
Did you consume alcohol in the last 30 days?	No Yes	67 (35.4) 122 (64.6)	35 (24.6) 107 (75.4)	1 1.36 (1.01 – 1.84) P=0.045	18 (31.0) 40 (69.0)	5 (26.3) 14 (73.7)	1 1.19 (0.49 – 2.92) P=0.700
Did you smoke in the last 30 days?	Yes No	16 (8.5) 173 (91.5)	12 (8.5) 130 (91.5)	1 1.00 (0.64 – 1.57) P=0.996	3 (5.2) 55 (94.8)	2 (10.5) 17 (89.5)	1 0.59 (0.19 – 1.87) P=0.369
Did you use marijuana in the last 30 days?	Yes No	19 (10.1) 170 (89.9)	15 (10.6) 127 (89.4)	1 0.97 (0.65 – 1.45) P=0.879	4 (6.9) 54 (93.1)	1 (5.3) 18 (94.7)	1 1.25 (0.21 – 7.55) P=0.808
Answered "yes" to all the COVID-19 questions	No Yes	155 (82.0) 34 (18.0)	100 (70.4) 42 (29.6)	1 1.41 (1.09 – 1.82) P=0.008	39 (67.2) 19 (32.8)	9 (47.4) 10 (52.6)	1 1.84 (0.85 – 3.99) P=0.123

Legend: RP: prevalence ratio; 95%CI: 95% confidence interval.

Source: Resource data.

Table 4 - Bivariate analysis for the presence of at least moderate stress in dental student. Independent analyses were performed for undergraduate and graduate dental students

No (n=193; 58.3%)		Undergraduate			Graduate		
		Yes (n=138; 41.7%)	PR (95%IC)	No (n=54; 70.1%)	Yes (n=23; 29.9%)	PR (95%IC)	
Age (year)		22.90±3.46	22.47±3.55	0.98 (0.94 – 1.02) P=0.334	30.93±7.38	28.78±5.75	0.96 (0.90 – 1.02) P=0.219
Sex	Male Female	79 (40.9) 114 (59.1)	28 (20.3) 110 (79.7)	1 1.88 (1.33 – 2.65) P<0.001	16 (29.6) 38 (70.4)	5 (21.7) 18 (78.3)	1 1.35 (0.57 – 3.17) P=0.491
Monthly family income (in thousand Reais)	Missing data	7.16±15.53 19	9.98±43.49 7	1.01 (0.99 – 1.01) P=0.071	8.79±6.88 1	7.83±4.02 0	0.98 (0.93 – 1.03) P=0.438
Do you regularly do physical activities?	Yes No	102 (52.8) 91 (47.2)	57 (41.3) 81 (58.7)	1 1.31 (1.01 – 1.71) P=0.041	34 (63.0) 20 (37.0)	10 (43.5) 13 (56.5)	1 1.73 (0.87 – 3.46) P=0.118
Sexual orientation	Heterosexual Other	174 (90.2) 19 (9.8)	117 (84.8) 21 (15.2)	1 1.31 (0.94 – 1.81) P=0.109	52 (96.3) 2 (3.7)	21 (91.3) 2 (8.7)	1 1.74 (0.61 – 4.94) P=0.300
Was Dentistry your first option?	Yes No	139 (72.0) 54 (28.0)	86 (62.3) 52 (37.7)	1 1.28 (0.99 – 1.66) P=0.055	40 (74.1) 14 (25.9)	17 (73.9) 6 (26.1)	1 1.01 (0.46 – 2.19) P=0.988
Years of education (undergraduate only)	1 st Year 2 nd Year 3 rd Year 4 th Year 5 th Year	28 (14.5) 40 (20.7) 40 (20.7) 34 (17.6) 51 (26.4)	27 (19.6) 32 (23.2) 20 (14.5) 33 (23.9) 26 (18.8)	1 0.91 (0.63 – 1.32) 0.68 (0.43 – 1.06) 1.00 (0.70 – 1.44) 0.69 (0.46 – 1.04) P=0.601, 0.090, 0.986, 0.076, respectively	-	-	-

No (n=193; 58.3%)		Undergraduate			Graduate		
		Yes (n=138; 41.7%)	PR (95%CI)	No (n=54; 70.1%)	Yes (n=23; 29.9%)	PR (95%CI)	
Graduate level	Master degree Ph.D.	-	-	-	23 (42.6) 31 (57.4)	9 (39.1) 14 (60.9)	1 1.11 (0.55 – 2.24) P=0.779
Academic performance	Mean±SD	7.71±1.12	7.60±0.86	0.94 (0.83 – 1.08) P=0.381	89.14±6.88	90.11±9.07	1.01 (0.96 – 1.06) P=0.711
Do you receive any scholarship or are you currently employed?	Yes No	41 (21.2) 152 (78.8)	33 (24.1) 104 (75.9)	1 0.91 (0.68 – 1.22) P=0.534	52 (96.3) 2 (3.7)	22 (95.7) 1 (4.3)	- No estimate due to lower number
Did you consume alcohol in the last 30 days?	No Yes	68 (35.2) 125 (64.8)	34 (24.6) 104 (75.4)	1 1.36 (1.00 – 1.86) P=0.050	16 (29.6) 38 (70.4)	7 (30.4) 16 (69.6)	1 0.97 (0.46 – 2.05) P=0.944
Did you smoke in the last 30 days?	Yes No	15 (7.8) 178 (92.2)	13 (9.4) 125 (90.6)	1 0.89 (0.58 – 1.35) P=0.581	3 (5.6) 51 (94.4)	2 (8.7) 21 (91.3)	1 0.73 (0.24 – 2.26) P=0.585
Did you use marijuana in the last 30 days?	Yes No	18 (9.3) 175 (90.7)	16 (11.6) 122 (88.4)	1 0.87 (0.60 – 1.28) P=0.485	4 (7.4) 50 (92.6)	1 (4.3) 22 (95.7)	- No estimate due to lower number
Answered “yes” to all the COVID-19 questions	No Yes	161 (83.4) 32 (16.6)	94 (68.1) 44 (31.9)	1 1.57 (1.22 – 2.02) P<0.001	35 (64.8) 19 (35.2)	13 (56.5) 10 (43.5)	1 1.27 (0.64 – 2.52) P=0.489

Legend: RP: prevalence ratio; 95%CI: 95% confidence interval.

Source: Resource data.

Regarding the final multivariate analyses, no independent variable was significantly associated with anxiety or stress subscales among graduate dental students (Table 5). Conversely, to both anxiety and stress subscales, female undergraduate dental students presented significantly higher symptoms than

undergraduate male students. Moreover, those who answered “yes” to all the questions related to fear and anxiety towards the COVID-19 were associated with significantly higher anxiety (PR: 1.39; 95%CI: 1.07–1.82) and stress (PR: 1.57; 95%CI: 1.20–2.05) among undergraduate dental students.

Table 5 - Multivariate analysis for the presence of at least moderate anxiety and stress in dental students. Independent analyses were performed for undergraduate and graduate dental students.

Anxiety PR (95%CI) P-value		Undergraduate		Graduate	
		Stress PR (95%CI) P-value	Anxiety PR (95%CI) P-value	Stress PR (95%CI) P-value	
Sex	Male Female	1 1.57 (1.11 – 2.22) P=0.011	1 1.54 (1.06 – 2.24) P=0.023	1 0.90 (0.31 – 2.63) P=0.846	1 1.16 (0.42 – 3.16) P=0.778
Monthly family income		-	1.01 (1.00 – 1.01) P<0.001	0.94 (0.87 – 1.02) P=0.131	-
Sexual orientation	Heterosexual Other	1 1.52 (1.14 – 2.02) P=0.004	-	-	-
Years of education (undergraduate only)	1 st Year	1 0.82 (0.49 – 1.35) P=0.429	1 0.79 (0.48 – 1.30) P=0.352		
	2 nd Year	0.84 (0.50 – 1.42) P=0.510	0.62 (0.36 – 1.06) P=0.078		
	3 rd Year	1.00 (0.62 – 1.62) P=0.992	0.90 (0.56 – 1.43) P=0.473	-	-
	4 th Year	0.68 (0.40 – 1.16) P=0.160	0.48 (0.27 – 0.84) P=0.010		
	5 th Year				
Graduate level	Master’s degree Ph.D.	-	-	1 1.93 (0.67 – 5.58) P=0.226	1 0.97 (0.36 – 2.65) P=0.953
Academic performance		0.86 (0.75 – 0.98) P=0.023	0.89 (0.77 – 1.03) P=0.106	1.00 (0.95 – 1.06) P=0.960	1.01 (0.95 – 1.07) P=0.757

Anxiety PR (95%CI) P-value		Undergraduate		Graduate	
		Stress PR (95%CI) P-value	Anxiety PR (95%CI) P-value	Stress PR (95%CI) P-value	
Did you consume alcohol in the last 30 days?	No Yes	-	1 1.84 (1.23 – 2.75) P=0.03	-	-
Answered “yes” to all the COVID-19 questions	No Yes	1 1.39 (1.07 – 1.82) P=0.015	1 1.57 (1.20 – 2.05) P=0.001	1 1.41 (0.53 – 3.78) P=0.489	1 0.85 (0.35 – 2.04) P=0.711

Legend: RP: prevalence ratio; 95%CI: 95% confidence interval.

Source: Resource data.

Regarding the anxiety outcome, undergraduate students that reported other sexual orientation (homosexual, bisexual, or others) presented 52% higher prevalence ratio (PR) of having at least moderate anxiety in comparison to those that reported being heterosexual. Academic performance was significantly associated only with anxiety among undergraduate dental students (PR: 0.86; 95%CI: 0.75 – 0.98).

When the outcome at least moderate stress was considered, the undergraduate dental students with higher family income presented higher prevalence ratios. In contrast, undergraduate dental students of the 5th year demonstrated 52% lower PR of having at least moderate stress in comparison to those in the 1st year (PR: 0.48; 95%CI: 0.27 – 0.84). Moderate stress was also significantly higher in those that reported exposure to alcohol in the last 30 days (PR: 1.84; 95%CI: 1.23 – 2.75).

The present study aimed to evaluate the levels of stress and anxiety in both undergraduate and graduate dental students during the COVID-19 pandemic. In addition, it was investigated which factors are associated with these conditions. It was demonstrated that female undergraduate dental students presented the highest scores of anxiety and stress. Furthermore, a better academic performance was associated with lower PR for anxiety among undergraduate students.

The university students are in greater risk for mental health issues when compared to the general population¹⁵. Therefore, a recently published systematic review demonstrated that the overall prevalence of self-reported at least mild depression was 29% among dental students¹⁴. Previous data have also showed that these students are in greater stress during their training¹³. Despite this important knowledge, there is a lack of studies assessing the associated factors with these conditions using adjusted data.

Higher prevalence of anxiety and stress were detected in the present study. It may be hypothesized that undergraduate dental student deal with additional stressors sources, including adaptation to higher workload, changes in the lifestyle in comparison to their period in high school, development of manual skill, clinical care and responsibility with their patients^{13,16}. This can partially explain why none of the tested independent variables were significantly associated with anxiety or stress among graduate dental students.

A higher mental health burden in female dental students

is demonstrated in the literature¹⁴, which agrees with the results demonstrated in the present study. This was also demonstrated in another study performed in other populations during the COVID-19 pandemic¹⁷. It is possible that the social construction of masculinity may influence the better report among male individuals, as they are less likely to report stress¹⁸. In addition, the female physiology may be considered when interpreting these results, as the cyclical hormonal fluctuations favor stress, giving women the higher susceptible to anxiety and depression¹⁹.

Mental health can be shaped by social and economic conditions in which people live²⁰. In this sense, a lower income may be a risk factor for depression²¹, while individuals with higher income may decrease these levels, as they may afford an integrate treatment for mental health²². However, in the present study, an opposite result was detected, as undergraduate dental students with higher income demonstrated higher levels of stress. The interpretation of these results is challenging, but it may be explained by the higher socioeconomic levels of the included students, which were higher than the general population²³. In addition, the literature also shows that the majority of dental students from Brazil attended private schools during their high school²⁴, demonstrating better educational opportunities for these individuals.

In the present study, higher PR of anxiety was detected among those dental students who reported other sexual orientations rather than heterosexual. This finding is also reported in several studies which have shown that gender- and sex-related minorities (lesbian, gay, bisexuals and transgenders [LGBT+]) have a significant higher risk for psychiatric disorders, such as depression, suicidal ideation and anxiety, in comparison to heterosexuals^{25,26}. One systematic review demonstrated that lesbians, gays and bisexuals had 1.5 times higher risk of having anxiety and depression when compared to heterosexuals²⁵. The reasons for these results may be explained by the theory of “stress of minorities”, defined as a unique stressor experienced by these individuals living in a social environmental characterized by prejudice and anti-LGBT+ stigma. These disparities imply in distal (prejudice and discrimination) and proximal (expectations of rejection and hypervigilance) stressors that LGBT+ individuals have to live throughout their lives²⁷.

Although literature have demonstrated higher stress

among dental students in the last years of education²⁸, other studies did not detect differences among the years^{29,30}, as similar pressure and stress load may be detected in all dental students. In the present study, undergraduate dental students from the 5th year presented a significantly lower level of stress in comparison to those in the 1st year. Similar results were also detected in the literature when dental students in the preclinical phase self-reported higher levels of stress³¹.

The present study also showed 84% higher PR of stress among undergraduate students that consumed alcohol in the last 30 days prior the study. Alcohol and stress have a complex bidirectional relationship. In addition, literature shows that the vulnerability to stress is a risk factor to disorders and abuse of alcohol³². Conversely, alcohol may present properties that reduce anxiety, which may reduce or alleviate stress³³. Literature also demonstrates that students are more exposed to harmful health habits, including alcohol consumption³⁴. However, it is important to highlight that the present study only assessed the alcohol consumption within the last 30 days, and number of doses were not assessed. This must be considered when interpreting the current results.

A better academic performance was associated with lower PR for anxiety in undergraduate dental students. The academic performance is one of the main factors that impairs the psychological health in dental students²⁹. Studies have reported that higher levels of stress are observed in students with lower grades^{35,36}, and the fear of failing a course is one of the main source of stress for them³⁷. As long-term stress may develop other mental disorders, such as anxiety²⁹, these findings may explain the results of the study.

As the present study was conducted during the COVID-19 pandemic, which may have affected dental students' mental health, five questions related to fear and anxiety of this conditions were included in the present study. A systematic review evaluated the psychological status in the general population during the pandemic and showed a high prevalence of psychiatric problems in all the income strata³⁸. These mental health issues may be related to depression, anxiety disorders, panic attack, sleeping and emotional disorders, and suicidal behavior³⁹. University students also suffered major challenges during this period, higher uncertainties due to academic concern may arise, which compromise their quality of life and mental health⁴⁰. In addition, when interpreting the results of the present study, it is important to consider that data collection was performed during the suspension of face-to-face activities caused by the pandemic.

Furthermore, dental students have greater challenges when they returned to their clinical practices, as biosafety protocols are more difficult, but essential to proceed their clinical educational⁴¹. All those reasons may trigger significant higher levels of anxiety and stress in dental students, especially undergraduate ones, as it was observed in those that answered "yes" to all the questions related to fear and anxiety related to the COVID-19 pandemic.

The higher response rate (over 70%) is one of the main strengths of the present study, indicating a representativeness of the whole population of the Dentistry institution students. The use of adjusted data and the inclusion of COVID-19-related questions in the analysis are other important factors that must be highlighted. However, other aspects must be included as limitations. The validated DASS-21 tool also assess the depression domain, but this outcome was verified in another study from this sample. This is a cross-sectional study, which does not allow causality. Only students from one institution were included, and a lower external validity may be expected, especially in dental students with different socioeconomical background. However, the inclusion of only one institution may allow a better assessment of academic performance due to a better standardization.

It is also important to emphasize the fear towards the COVID-19 was assessed by a non-validated tool⁴. As the data collection was performed in the first months of the pandemic, no other validated tool was available at that moment. Readers must understand that when interpreting the current findings.

Consumption of alcohol, tobacco, and marijuana was assessed dichotomously, and their quantity or other exposure history was not assessed. Moreover, all dental students regularly enrolled were invited to participate, and no exclusion were made based on the history of previous psychiatric disorders or use of medications to anxiety or depression. As few longitudinal studies are available in the literature, further studies must address these issues, especially in interventional studies aiming to reduce the burden of anxiety and stress in dental students.

4 Conclusion

In conclusion, it was demonstrated that female undergraduate dental students had higher rates of anxiety and stress, and that academic performance may influence the levels of anxiety in these individuals. Conversely, none of the collected independent variables were significantly associated with anxiety or stress among graduate dental students.

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