Association between academic performance with stress, anxiety and depression among undergraduate dental students: a cross-sectional study

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Abstract This study analyzed the association between academic performance and self-reported anxiety, depression and stress among undergraduate dental students at a Brazilian public university. Students participated via a questionnaire, available on Google Forms, which involved exploratory variables such as age, sex, ethnicity/skin color, use of anxiolytics or antidepressants and remunerated activities. The translated and adapted Depression, Anxiety and Stress Scale-21 (DASS-21) was used to measure participants' symptoms of anxiety, stress and depression. Academic performance was quantified as "poor" for grades <7 points or "good" for ≥7 points, referring to the student's overall average. Logistic regressions were performed to verify the odds ratio (OR) between academic performance and the domains of the DASS-21. Subgroup analyses were also performed to compare the sex of the participants (p<0.05). The final sample evaluated 244 students. It was observed that students with moderate depression were more likely to exhibit poor academic performance when compared to those with normal or mild depression (OR:2.41; 95%CI:1.10–5.29). The subgroup analysis demonstrated that male participants with at least moderate depression had a greater chance of poor academic performance (OR:4.10; 95%CI:1.19–14.19). Poor academic performance was significantly associated with students with at least moderate depression. In addition, male individuals with at least moderate depression had a higher occurrence of poor academic performance.
Descriptors: Learning. Academic Performance. Dental Education. Dental Students. Mental Health.

Asociación del rendimiento académico con el estrés, la ansiedad y la depresión en estudiantes de pregrado en odontología: estudio transversal
Resumen El estudio tuvo como objetivo analizar la asociación entre el rendimiento académico y la prevalencia autorreportada de la ansiedad, la depresión y el estrés en estudiantes de pregrado en odontología de una universidad pública brasileña. Los estudiantes participaron en la investigación a través de un cuestionario disponible en Google Forms, que contemplaba variables exploratorias como la edad, sexo, color de piel, uso de ansiolíticos o antidepresivos y actividades remuneradas. Para medir los síntomas de ansiedad, estrés y depresión se utilizó la escala traducida y adaptada "Depression, Anxiety and Stress Scale-21" (DASS-21). El rendimiento académico se cuantificó como bajo para calificaciones <7 puntos y bueno para ≥7 puntos, considerando el promedio general del estudiante. Se realizaron regresiones logísticas para verificar la razón de posibilidades entre el rendimiento académico y los dominios de la escala DASS-21. También se realizaron análisis de subgrupos comparando el sexo de los estudiantes (p<0,05). La muestra final evaluó a 244 estudiantes. Se observó que los estudiantes con depresión moderada tenían mayor probabilidad de tener bajo rendimiento académico, en comparación con aquellos con depresión normal o leve (OR:2,41; IC95%:1,10-5,29). En el análisis de subgrupos se demostró que, considerando solo el sexo masculino, aquellos con depresión al menos moderada tenían mayor probabilidad de bajo rendimiento académico (OR:4.10; IC95%:1.19-14.19). El bajo rendimiento académico se asoció significativamente con estudiantes con depresión al menos moderada. Además, los individuos del sexo masculino con depresión al menos moderada tuvieron una mayor incidencia de bajo rendimiento académico.

Associação do desempenho acadêmico com estresse, ansiedade e depressão em estudantes de graduação em Odontologia: estudo transversal

Resumo O estudo objetivou analisar a associação entre o desempenho acadêmico e a prevalência autorrelatada de ansiedade, depressão e estresse em alunos de graduação em Odontologia de uma universidade pública brasileira. Os estudantes participaram da pesquisa por meio de um questionário disponibilizado no *Google Forms,* contemplando variáveis exploratórias, como idade, sexo, cor da pele, uso de ansiolíticos ou antidepressivos e atividades remuneradas. A escala traduzida e adaptada "*Depression, Anxiety and Stress Scale-21*" (DASS-21) foi utilizada para aferir os sintomas de ansiedade, estresse e depressão. O desempenho acadêmico foi quantificado como baixo para notas <7 pontos e bom para ≥7 pontos, considerando a média geral do estudante. Regressões logísticas foram realizadas para verificar a razão de chance entre desempenho acadêmico e os domínios da escala DASS-21. Foram feitas, também análises de subgrupo comparando o sexo dos estudantes (p<0,05). A amostra final avaliou 244 estudantes. Foi observado que os estudantes com depressão moderada apresentaram maior chance de terem baixo rendimento acadêmico, quando comparados com aqueles com depressão normal ou leve (RC:2,41; IC95%:1,10-5,29). Na análise de subgrupo foi demonstrado que, somente ao se considerar o sexo masculino, aqueles com depressão pelo menos moderada apresentaram maior chance de baixo rendimento acadêmico (RC:4,10; IC95%:1,19-14,19). O baixo rendimento acadêmico esteve significativamente associado aos estudantes com depressão pelo menos moderada. Além disso, indivíduos do sexo masculino com depressão pelo menos moderada apresentaram maior ocorrência de baixo desempenho acadêmico.

Descritores: Aprendizagem. Desempenho Acadêmico. Educação em Odontologia. Estudantes de Odontologia. Saúde mental.

INTRODUCTION

Academic performance is the result of a set of student attitudes combined with various interfering variables (of psychiatric, socioeconomic and personal origins) which may define student performance. In this sense, it is a complex and multifactorial phenomenon[1]. The development of mental health problems, such as anxiety, depression and stress, critically affects university students as they are inserted into a competitive environment consisting of demanding assessment activities and an intensified routine[2].

Feelings of anxiety cause symptoms of restlessness and excessive worry; these in turn make it difficult to concentrate and lead to harmful and accelerated thoughts. Depression is a psychiatric illness responsible for causing feelings of persistent sadness, lack of motivation, tiredness and other alterations, both physical and mental, that make it more difficult for the individual to perform any task[3]. Stress keeps the human being in a state of constant vigilance, causing psychological anguish and disturbances that negatively alter thought processes, decrease self-esteem and increase feelings of dissatisfaction[4].

In this way, students' general mental health can be a determining factor in their academic performance[5]. Research has shown that feelings of inferiority, nervousness and discouragement are possible effects of depression, anxiety and stress, all of which decrease learning and compromise the quality of study. These variables can result in poor academic aptitude[6]. In addition, students who must balance their studies with employment further intensify their routines, becoming overloaded and prone to lower academic performance[7]. Thus, lack of time and exhaustion due to the strenuous workload can cause undergraduate students to develop changes in their mental health. This reduces quality of life, which is one of the factors that most strongly influences a student's ability to concentrate and study[8].

Therefore, the aim of this study was to verify the possible association between academic performance and self-reported stress, anxiety and depression among undergraduate dental students enrolled at a public university in southern Brazil.

METHODS

This was an observational cross-sectional study of students at the School of Dentistry of the Federal University of Pelotas, located in the southern region of Brazil. The university's institutional Ethics Committee approved this study under protocol no. 3.910.723 (CAAE: 29343420.2.0000.5318). All participants were informed of the objectives of the study and consented to take part by signing an informed consent form.

Inclusion and exclusion criteria

Students regularly enrolled in the first semester of 2020 at the university's school of dentistry were considered eligible. Confirmation of enrollment was verified with the course coordinator. Only students who allowed access to their academic records during data collection were included. No other exclusion criteria were established.

Data collection

Data were collected using a semi-structured questionnaire created on Google Forms. The questionnaire included data such as age, use of anxiolytics or antidepressants and remunerated activities, and employed the Depression, Anxiety and Stress Scale-21 (DASS-21) instrument to measure symptoms of anxiety, depression and stress. Students were invited to take part via social media. Those who showed interest were contacted and given access to the questionnaire via a link sent to their e-mail address. Data collection took place between June and August 2020. The choice to apply the consultation tool remotely was made because the study took place in the context of the COVID-19 pandemic.

Definition of the outcome and exploratory variables

Academic performance was defined as the study's dependent variable and was dichotomized into "poor" (mean grade <7.0 points) or "good" (mean grade ≥7.0 points) in terms of the student's overall grades up to the time of data collection. At the university, academic performance ranges from 0 (the worst possible grade) to 10 (the best possible grade). The student's overall average is obtained using the arithmetic mean (the sum of all grades obtained divided by the number of subjects completed) regardless of the number of credits in the subjects or the history of failures throughout the course.

The independent variables were age (in years), sex (male or female), ethnicity/skin color (white or non-white [which included those who identified as black, brown, yellow or Indigenous]), remunerated activities (yes [formal employment or some type of teaching, research or extension scholarship] or no), continuous use of anxiolytic or antidepressant medication (yes or no) and symptoms of anxiety, stress and depression (normal to mild or at least moderate) as defined by the DASS-21 scale9.

The DASS-21 scale, translated and validated for Portuguese–BR[9], was used to classify and measure participant symptoms of anxiety, stress and depression. This tool assesses how individuals felt over the last seven days and consists of 21 items in a Likert-type scale which ranges from 0 to 3 depending on symptom intensity. The questionnaire contains three domains (depression, anxiety and stress) with seven questions in each domain. The total number of points ranges from 0 to 63. Symptoms of depression, anxiety and stress are categorized as normal (depression: 0–9 points; anxiety: 0–7 points; stress: 0–14 points), mild (depression: 10–13 points; anxiety: 8–9 points; stress: 15–18 points), moderate (depression: 14–20 points; anxiety: 10–14 points; stress: 19–25 points), severe (depression: 21–27 points; anxiety: 15–19 points; stress: 26–33 points) or extremely severe (depression: ≥28 points; anxiety: ≥20 points; stress: ≥34 points). For the final score, values for each subscale were added and then multiplied by two to match the original scale scores (DASS-42).

Statistical analysis

Descriptive data analysis was performed using the mean and standard deviation for continuous variables and the frequency distribution for categorical variables. Multivariate analyses were performed using logistic regression to verify the association between academic performance and each domain of the DASS-21. Independent analyses were carried out for each domain (depression, anxiety and stress). All analyses were adjusted for sex, age, skin color, use of anxiolytic or antidepressant medication and remunerated activities. In addition, a subgroup analysis was performed to analyze this association only for the sex variable. In all analyses, statistical significance was set at p<0.05.

RESULTS

Of the 465 eligible students, 331 answered the questionnaire (response rate: 71.18%). From these, 87 students were excluded, 60 of whom did not allow access to their academic records and 27 of whom were not enrolled in the course during the first semester of 2020. Thus, the final sample totaled 244 students.

Figures 1 and 2 show the distribution of the occurrence of anxiety, stress and depression associated with good or poor academic performance in male and female participants. A higher prevalence of symptoms of anxiety, stress and at least moderate depression was observed in students with poor academic performance when compared to those with good academic performance.
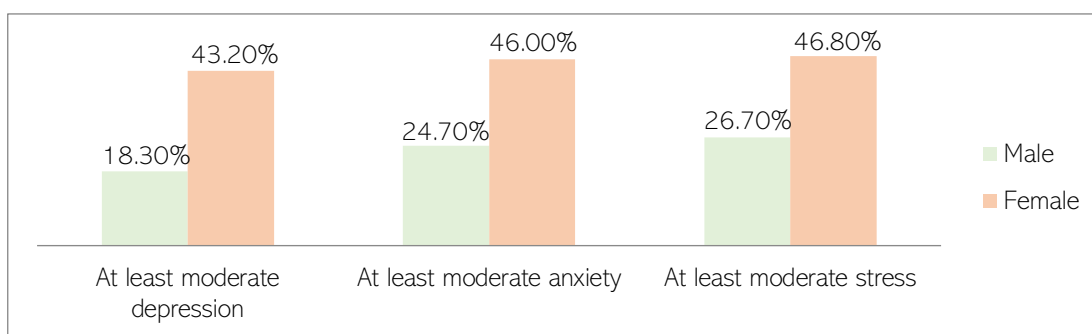
Figure 1. Distribution of the occurrence of anxiety, stress and depression associated with good academic performance. in men and women.
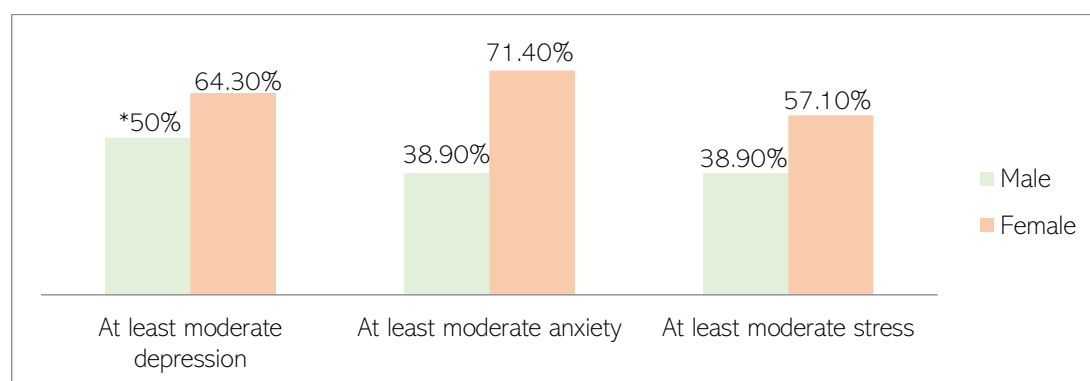
Figure 2. Distribution of the occurrence of anxiety, stress and depression associated with low academic performance in men and women.

When considering the total sample, at least moderate stress was not significantly associated with poor academic performance (Odds Ratio [OR]:1.27; 95% Confidence Interval [95%CI]:0.58–2.75) (Table 1). Similarly, no significant association was observed between at least moderate anxiety and poor academic performance. However, in the final

adjusted analysis, it was observed that students with at least moderate depression were 2.41 times (95%CI:1.10–5.29) more likely to exhibit poor academic performance when compared to those with normal or mild depression.

Subgroup analysis according to sex showed that, when only male students were considered, those with at least moderate depression were more likely to have poor academic performance (OR:4.101; 95%CI:1.186–14.187) (Table 2). No significant association was found between depression and academic performance when only female students were considered. Furthermore, no significant association was found between either stress or anxiety and academic performance (Table 2).

Table 1. Prevalence of depression, anxiety and stress in the entire sample using multivariate analysis.

	Odds ratio (95%CI)	p-value
Depression		0.029*
Normal or mild	1	
At least moderate	2.41 (1.10 – 5.29)	
Anxiety		0.080
Normal or mild	1	
At least moderate	2.09 (0.92 – 4.75)	
Stress		0.550
Normal or mild	1	
At least moderate	1.27 (0.58 – 2.75)	

Independent models for each domain of the DASS-21. Analyses were adjusted for sex, age, skin color and use of anxiolytic or antidepressant medication. * Statistically significant (p<0.05).

Table 2. Prevalence of depression, anxiety and stress according to sex using multivariate analysis.

	Male Odds ratio (95%CI)	Female Odds ratio (95%CI)
Depression		
Normal or mild	1	1
At least moderate	4.10 (1.19 – 14.19) p=0.026*	1.38 (0.46 – 4.12) p=0.560
Anxiety		
Normal or mild	1	1
At least moderate	1.01 (0.25 – 4.08) p=0.990	2.84 (0.88 – 9.24) p=0.082
Stress		
Normal or mild	1	1
At least moderate	1.20 (0.33 – 4.34) p=0.786	0.92 (0.32 – 2.67) p=0.873

Independent models for each domain of the DASS-21. Analyses were adjusted for sex, age, skin color and use of anxiolytic or antidepressant medication. * Statistically significant (p<0.05).

DISCUSSION

This study aimed to associate self-reported depression, anxiety and stress with academic performance in dental students. It was observed that only symptoms of depression were associated with poor academic performance, and that this association was especially prominent among male students. Academic performance is the result of various causal factors that determine a university student's aptitude[1]. Thus, good academic performance can be measured by the student's competence as well as by their quality of life, emotional stability and several other factors.

Students in healthcare fields, where most courses are full-time and require many hours of dedication to study, are under pressures which can affect their academic performance[10] as well as their mental health[11]. In addition, dental students have particularly high rates for the development of depression, anxiety and stress[12]. The presence of these disorders

can lead to negative impacts such as reduced concentration, negative thoughts and feelings of guilt, and these factors may help explain such an association.

Depression and stress can have a major influence on students' university performance, as these disorders reduce the capacity for memorization, reasoning, motivation and interest[13]. Therefore, the presence of these disorders can potentially alter academic performance, since the symptoms of these disorders have effects that directly reduce the student's quality of life[14]. However, the chronic course of depressive characteristics, especially when compared to stress, may help explain the findings detected.

This study considered the symptoms of anxiety, stress and depression in the context of alterations in mental health, with at least moderate depression being of greater interest in students with poor academic performance. Prior literature has shown that self-reported depression affects not only the mental health of university students, but also other aspects of their general health such as insomnia and poor nutritional habits[15].

Women generally have a higher risk of suffering episodes of depression and anxiety throughout their lives in comparison to men[16]. As can be seen from the results of this study, at least moderate levels of depression, anxiety and stress are significantly higher in women compared to men; significantly, this holds true for students who exhibit either poor or good academic performance.

It is important to note that data collection for this study took place during the COVID-19 pandemic. At this time, students experienced rapid and radical changes such as social isolation, switching from face-to-face to remote activities and adapting to new teaching approaches, resulting in consequences such as increased anxiety, nervousness, depression, sadness, confusion, sleep disturbances, sensitivity, aggressiveness and frustration[17]. These factors can lead to a decrease in academic development, a higher rate of online absences, a feeling of mental wandering, lack of attention, delays in delivering activities, attachment to technology and plagiarism in online activities[17].

Universities are responsible not only for the intellectual growth and development of students, but also for their mental health[18], especially for those students who depend on some affirmative action from the university to remain involved in higher education. Students and universities alike can benefit from the implementation of mental health care spaces where students can find support for academic performance as well as awareness and training for self-detection and proper management of the signs and symptoms of mental health concerns[19].

The goal of this study is that these findings will serve as incentive and foundation to build improvements that help reduce the factors that cause mental health problems in students, which could lead to improvements in their academic performance. We suggest the creation of student support networks and access to therapies to manage these situations, with the aim of improving the quality of university students' performance.

This is a cross-sectional study, which limits the causality of the findings. Furthermore, data were gathered from students of only one higher education institution, limiting result applicability. However, greater internal validity is expected with these findings, especially given the high response rate, and the use of a validated and translated instrument was an additional strength of this study.

CONCLUSION

Poor academic performance was associated with at least moderate depression among dental students. In addition, male students with at least moderate depression had a higher incidence of poor academic performance. Stress and anxiety were not associated with academic performance.

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