Stress, cortisol levels and the adaptation of Dental students to the academic environment

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ABSTRACT

The aim of this research was to investigate the presence of stress, anxiety, and depression and to analyze the academic experiences of Dental freshman students. Saliva samples, from 114 students, were collected to dose the cortisol hormone during exams and classes to analyze the physiological stress in both situations. Those who took anti-depression medication or did not sign the Informed Consent Form were excluded from the research. Two valid questionnaires were applied, the QVA-r (Questionnaire of Academic Experiences - reduced version) and DASS 21 (Depression, Anxiety and Stress Scale 21). The correlation coefficient and the Mann-Whitney test were determined with a 5% significance level. Of the total number of participants, the majority were women, with a mean age of 20.06 (+ 2.65) and 18.96 (+ 1.78) years old. The presence of stress was high among the students (45%) and was related to the Personal (-0.518) and Interpersonal (-0.251) domains. The cortisol levels during tests showed a correlation with the highest scores in the Study (0.197), Career (0.347) and Institutional (0.196) domains. From all the students questioned, 81% left the parents' home to study. The presence of stress, anxiety, and depression was related to the students' interaction with their peers and to personal aspects. The highest levels of cortisol were in those more adapted in the Study, Career and Institutional domains.
Descriptors: Dental Students. Cortisol. Stress.

1 INTRODUCTION

To start higher education is challenging. In addition to being a progressive process of adaptation, it is multidimensional and complex, strongly dependent on personal and contextual factors. It concerns several dimensions to the students' development that may be affected by variables of academic, social, personal and vocational/professional nature[1,2].

The college experience cannot be limited to professional training. The way students interact with the higher education context results in taking advantage, or not, of opportunities offered by the university, which can be to their professional training and psychosocial development. Leaving the parents' home, interacting with peers, balancing academic activities with social life, the institutional environment, and other factors are part of this development and influence the students' adaptation process[2-4].

The inherent challenges of attending higher education can increase stress and demand a higher capacity to adapt when facing these circumstances (coping strategies)[5-7], what may contribute to the emergence of psychopathologies, such as stress, anxiety, and depression[8,9]. According to the World Health Organization (WHO), depression is a common disease all over the world, with over 300 million people affected[10]. Review of literature in the academic context, which describes Brazilian and international studies, show that 15% to 29% of college students show some kind of psychiatric disorder during their academic life[6,11]. These phenomena affect the physical and emotional well-being. Those affected by these pathologies, especially depression, feel discouraged to perform several activities, as they start to have a negative perception of themselves, the world and the future; that is, a disturbance of how to observe themselves, of self-worth and self-reinforcement.

Such a phenomenon also influences production and academic performance, as it weakens the capacity to think, to memorize, to be motivated and interested in the teaching-learning process[11-13].

There are also other biological markers besides the scales to measure stress, like dosing cortisol hormone levels, also known as the "stress hormone". This hormone is released through the activation of the hypothalamic-pituitary-adrenal axis (HPA), one of the major neuroendocrine systems activated during stress manifestation. According to Maduka et al.[14], the exaggerated stress hormone excretion during stressful situations may affect the memory process and storage in the brain. It is one of the most studied topics in psychiatry, especially in young adults[15]. Lately, cortisol dosage in the saliva has been a simple, non-invasive and very efficient tool in psychometric researches[16].

The stress the students feel when enrolling higher education has been investigated in several ways; however, its association to academic life and the physiological analysis of stress caused by the academic environment can provide a new perspective of the subject.

Hence, to analyze if this manifestation is more common among students less adapt to the academic environment, through the intensity of the biological stress marker, is the hypothesis.

Therefore, this study's goal was to investigate the perceived stress, anxiety and depression, to verify the stress with biological markers and to analyze the academic experiences of Dental freshman students.

2 MATERIAL AND METHODS

This is a transversal study with the freshman students of the Dental program from a public university in Brazil. Through sample calculation, based on the literature, the prevalence of 50% of stress in Dental students

and the confidence level of 95%, adding 10% to possible losses or refusals, the minimum sample size was calculated, resulting in 94 participants. All the 124 enrolled freshmen were invited to participate of study after a brief explanation of it, those who accepted were from the evening program (34 students) and the full-time program (80 students) were the study's convenience sample, 30% more than n, as there was the possibility of students leaving the research or taking medicine, which could tamper the results. The exclusion criteria were: students who took anti-depression medicine and those who did not sign the Informed Consent Form, with a final sample of 114 students.

To measure the physiological levels of stress, a dosage of the cortisol hormone concentrations in two different moments was made: during an exam of the Anatomy Course and during an ordinary day of classes. Sample collection was in a test Falcon tube. The students were instructed to not eat or brush their teeth for, at least, one hour before saliva sample collection. The moment of the collect the saliva was at 4:00 p.m. in both moments: during test and class with the full-time students, and at 6:30 p.m. with evening students. The storage temperature was of -20º C, to keep the sample stability. After thawing and centrifugation at 1000xg for 2 minutes, the ELISA method with DBC kit (Diagnostics Biochem Canada Inc.) detected the cortisol concentration. One researcher did the sample collation, and another did the tests. The tubes were labeled with a pre-established label, in a way that the researcher who analyzed the samples could not identify in which moment the samples were taken, contributing for a blinding analysis.

Three validated instruments were also applied, the QVA-r (Questionnaire of Academic Experiences - reduced version, Almeida, Ferreira e Soares, 1999)[19], the DASS 21 (Depression, Anxiety and Stress Scale, Lovibond & Lovibond, 1995)[18] and the Brazilian Economic Classification Criteria from ABEP (Brazilian Association of Research Companies).

QVA-r's goal is to cover the opinions and feelings about the academic environment and daily experiences as an undergraduate student. In addition, it can measure the students' adaptation to several demands of the academic life, as it analyzes interpersonal, academic and contextual (institutional) factors[1]. Validation studies of QVA revealed that the instrument has satisfactory psychometric qualities[1,17,19].

DASS 21 is a questionnaire with translation validated for Portuguese, consisting of three Likert subscales of four points each. Each subscale has seven characteristic items of the three studied topics: stress, anxiety, and depression. With this instrument, depression is characterized by a low positive affect, reduced self-esteem, encouragement, and despair, while physiological hyperarousal signs characterize anxiety. Stress is detected through persistent tension, irritability, and low threshold to be disturbed or frustrated. In this questionnaire are mentioned some signs and symptoms of stress, anxiety and depression and by means of a scale of 0 to 3, where 0 means "I did not apply myself" and 3 means "It applied a lot to me, or most of the time", The more or less common signs have been classified for at least one week in your life. According to the more or less common answers and the final categorization of the questionnaire scores, they classified as "normal", "mild", "moderate", "severe" and "extremely severe".

The questionnaire about economic classification used in this study allowed the researchers to, in a very simple way, classify economically the students, based on the purchasing power, the degree of schooling of the father, the mother and the religion that participates frequently.

Because the hypothesis of normality is negative, we opted for non-parametric tests. The Mann-Whitney test, correlation coefficient, and multiple linear regression among the study's variables were used to verify the IBM SPSS Statistics version 21 was used for the analysis.

In this study, all the ethical criteria related to research involving human subjects in an ethics committee in Brazil were fulfilled, in accordance with the provisions of the Declaration of Helsinki. (Ethics Committee Protocol: CAAE 44058915.5.0000.5420).

3 RESULTS

The participants of this study were 114 students, 29.82% (34) enrolled at the evening program, and 70.17% (80) enrolled as full-time students, 73.5% and 72.5% were women, respectively. The average age was of 20.06 (+2.65) and 18.96 (+1.78) for the evening and full-time programs. Regarding social-economic class, 41.2% of the enrolled students at the evening program were from the class C1, as 32.5% of the student's enrolled full-time were classified as B1 (table 1).

A total of 70.2% of the students had chosen the Dental program as their first option, and 72.8% were enrolled at their first choice university. Only 5.3% reported having changed programs. A big part of the students (81%) left their parents' house to go to the university, and only 7% had already some kind of work (a situation only present among the evening program students). Being involved in associative or academic activities was frequent among 33.3% of the students. A total of 97.4% and 95.6% would not change programs or university, respectively.

Stress, anxiety, and depression were frequent among students enrolled full-time. Overall, the most common manifestation among them was Stress, with levels ranging from "low"

to "extremely severe" in 45% of the students (table 1). A Spearman correlation analysis was made between the QVA-r domains with these variables, and it was observed negative coefficients in all crosses, showing that, when the QVA-r score increases, the DASS score decreases. In other words, higher the student's adaptation to higher education, lower the stress, anxiety and depression levels. The QVA-r domains that had a significant coefficient in the presence of these three manifestations (stress, anxiety and depression) were "Personal" and "Interpersonal", being the highest coefficients in the "Personal" domain, meaning that this domain has the highest association to stress, anxiety and depression (table 2).

The comparison of the cortisol levels found at the two moments (during tests and during an ordinary day) showed that, during tests (stressful study situation), high stress hormone levels were found and they were higher among students from the evening program. This situation inverts during classes, shown in table 3 and 4 with the Spearman coefficient, where the high level of cortisol and the association between cortisol levels and QVA-r domains was verified. A significant positive correlation was found between the cortisol levels during tests and Personal, Career, Study and Institutional domains. That is, as the coefficient was positive, higher the student's cortisol levels during tests, higher the domains' score, showing that the students that were more stressed were those who were better adapted to the mentioned domains. The highest scores were in the Career (0.347), as shown in table 3.

The variables Study (p=0.036) and Career (p=0.040) showed scores significantly higher among full-time students (table 5) when compared to evening program students; therefore, they were better adapted to these domains. Regarding gender, men had a better

adaptation in the Personal (p=0.009) and Institutional (p=0.041) domains than women.

Table 1. Undergraduates distribution according to studied variables and program (evening or full-time)

Variables		Evening		Full-time		Total	
		N	%	N	%	N	%
Reasons to be enrolled at the Dental program							
To be prepared for a profession		33	97.1	77	96.3	110	96.5
To become a well-educated person with more information		8	23.5	15	18.8	23	20.2
My parents were expecting this		4	11.8	12	15.0	16	14.0
To have more social opportunities		7	20.6	14	17.5	21	18.4
My friends are also at the Higher education		1	2.9	2	2.5	3	2.6
To know myself better		2	5.9	7	8.8	9	7.9
Social-economic Class							
A1		-	-	4	5.0	4	3.5
A2		1	2.9	13	16.3	14	12.3
B1		3	8.8	26	32.5	29	25.4
B2		10	29.4	21	26.3	31	27.2
C1		14	41.2	11	13.8	25	21.9
C2		5	14.7	4	5.0	9	7.9
D		1	2.9	1	1.3	2	1.8
DASS 21							
	Extremely severe	1	2.9	6	7.5	7	6.1
	Severe	2	5.9	8	10.0	10	8.8
Stress	Moderate	6	17.6	11	13.8	17	14.9
	Mild	5	14.7	13	16.3	18	15.8
	Normal	20	58.8	42	52.5	62	54.4
	Extremely severe	1	2.9	11	13.8	12	10.5
	Severe	1	2.9	4	5.0	5	4.4
Anxiety	Moderate	4	11.8	4	5.0	8	7.0
	Mild	4	11.8	8	10.0	12	10.5
	Normal	24	70.6	53	66.3	77	67.5
	Extremely severe	-	-	4	5.0	4	3.5
	Severe	3	8.8	3	3.8	6	5.3
Depression	moderate	2	5.9	8	10.0	10	8.8
	Mild	5	14.7	11	13.8	16	14.0
	Normal	24	70.6	54	67.5	78	68.4
Total		34	100.0	80	100.0	114	100.0

Table 2. Correlation coefficients between QVA-r and DASS21

QVA-r	DASS 21		
	Stress	**Anxiety**	**Depression**
Personal	-0.518*	-0.491*	-0.637*
Interpersonal	-0.251*	-0.399*	-0.497*
Career	-0.125	-0.256*	-0.361*
Study	-0.054	-0.202*	-0.272*
Institutional	-0.174	-0.204*	-0.412*

* Statistically significant correlation coefficient. The results show negative numbers that means that this correlation is negative: when the QVA-r is high, the DASS is low

Table 3. Saliva cortisol levels (nmol/L of Dental undergraduates during tests and classes, according to program

Program	Cortisol nmol/L	N	Lowest Value	Highest Value	Median	Average	Standard Deviation
Evening	Sampling 1 - Test	34	9.75	61.86	39.56	37.88	12.77
	Sampling 2 - Class	34	10.12	49.31	22.71	24.36	9.47
Full-time	Sampling 1 - Test	79	4.86	158.11	29.39	31.97	20.06
	Sampling 2 - Class	79	8.90	87.86	35.44	37.13	16.41
Total	Sampling 1 - Test	113	4.86	158.11	31.53	33.75	18.32
	Sampling 2 - Class	113	8.90	87.86	30.15	33.29	15.77

* For this analysis were excluded from the sample students who were taking anti-depression medication, because it alters cortisol levels

Table 4. Correlation coefficients between QVA-r and cortisol

QVA-r	Cortisol	
	Sampling 1 Test	**Sampling 2 Class**
Personal	0.187*	-0.036
Interpersonal	0.076	0.134
Career	0.347*	0.021
Study	0.197*	0.067
Institutional	0.196*	-0.108

* Statistically significant correlation coefficient

Table 5. QVA-r variables and program comparison

QVA-r	Program	Median	Average	Standard Deviation	Results Average Position	Mann-Whitney p-value*
Personal	Evening	3.58	3.57	0.44	56.87	0.894
	Full-time	3.62	3.55	0.79	57.77	
Interpersonal	Evening	4.04	3.92	0.55	59.85	0.620
	Full-time	3.85	3.83	0.59	56.50	
Career	Evening	3.88	3.74	0.64	47.54	0.036*
	Full-time	4.15	3.98	0.68	61.73	
Study	Evening	3.08	3.13	0.74	47.76	0.040*
	Full-time	3.46	3.42	0.72	61.64	
Institutional	Evening	4.38	4.17	0.60	50.79	0.156
	Full-time	4.50	4.34	0.51	60.35	

*Statistically significant

There was no statistical significance between QVA-r variables and leaving the parents' home and academic or associative performance (p> 0.05).

The choice of program and university were also related to the QVA-r variables. The students which classified the program as their first choice had significantly higher scores in the Career domain (p=0.000). The university choice also showed a similar significance between the Career (p=0.024) and Institutional (p=0.002) domains; that is, the students that classified the university choice as their first, were more decided about their career and more adapted to the university's environment.

To start higher education had as main reason "to be prepared for a profession" (96.5%) (table 1). The association between the reasons to have higher education and the QVA-r domains was only possible with the following options: "to become a well-educated person with more information", "my parents were expecting this" and "to have more social opportunities". However, there was no statistical significance among them (p>0.05). The other reasons had very few quotes, which unabled statistical test.

4 DISCUSSION

In this research about stress, anxiety and depression and the academic experiences of Dental undergraduates in both study programmes, it was confirmed the presence of these elements in the life of these young college students. Stress, anxiety, and depression among freshman students were reported in several studies, the percentage of stress around 40% is considered high according to the literature[19,21,22]. Many are the causes of stress during this transitional period; however, the Personal and Interpersonal domains were more influenced in the presence of these elements; that is, students that were less adapted to the personal and interpersonal levels had a tendency to have symptoms. Recent studies show how important these factors are to the student's adaptation[2,22]. Santos et al.[23] tried to know the college students' opinion about the characteristics of establishing relationships with their peers and the influence of

academic adaptation. They observed that students believe classmates contribute to better academic performance by providing instrumental and affective support, helping the learning process and the familiarity with the university.

Former studies, as Dyson and Renk[5], Saeed et al.[24] e Goel et al.[25], observed the gender role, the depressive symptomatology and that the stress levels showed by the students can be important during the transition into higher education. This study, as most studies already published, uses psychometric scales for its analyses. However, besides these scales, this research used biological markers that may identify the intensity of physiological stress via saliva cortisol. This methodology has been widely applied in recent studies[14,22,26]. The correlation between cortisol levels and QVA-r domains reveals the influence of the students' adaptation with their levels of stress. High cortisol levels during test, related to higher Career scores, show that there is a higher response during stress moments among those that had a vocation for the profession, justified by the responsibility of getting good grades. Although stress can be defined as an effort to perform a task beyond its adaptive capacity or tolerance, it can be considered a stimulus factor and, therefore, it can be the answer in the search for good academic performance [27-29].

The students' concept about the chosen program and institution are crucial to their transition process into higher education[2]. This was observed with the association of the program as their first choice and being adapted to the Career and Institution domains, indicating that the more decided the students are about the program and university they want to be enrolled at, better adapted they will be. In addition, the explanation for the program choice as "to be prepared for a profession" corroborates what is found in the literature. The student chooses the program by vocation and wants to work at their own office and

have a specialization. According to Silva et al[30], the Brazilian Dental student profile has had this characteristic. Another important fact is that the lowest age for college enrollment was 20, showing that students are even younger, questioning if these students were mature enough to choose a profession, or if they were lead by others, what could certainly influence academic and professional activities. The also called "academic period", from 18 to 24 years of age, can be classified as emerging adulthood and represents a phase of the search for family independence; however, they do not usually have the financial, physiological and emotional maturity to support themselves, an aspect that could be noticed during this study. As most of the students left their parents' home, very few works, showing a financial dependence from a big number of the students[2].

It can be observed that less than half of the students had academic and associative activities. According to Fadel et al.[31], extensionists activities bring benefits to personal, professional and citizenship fields. In this qualitative study, there were reports showing feelings like satisfaction, personal fulfillment, recognition and of being a critic and active citizen. Associative and academic activities are related to the students' involvement level with the educational institution, which has an important role in the students' adaptation. The institution has the responsibility to encourage and give these students the chance to become more active inside and outside the academic environment, by means of culture and its organizational climate, according to Kuh et al.[32] and Garbin et al.[33]. Identifying and understanding the factors that stress trigger among students can enable better management of stressful situations, contributing to improved academic performance and, consequently, improved quality of life among students[34].

The study of factors that influence the students' adaptation to the higher education is

recent. The students' behavior, style, and quality of life are still not so discussed topics. However, with the knowledge produced so far, the Higher Education Institution has a great responsibility to the students' adaptation process and, as a consequence, in decreasing failure and dropout rates.

The external validity of this study is also one of its limitations, as the results of researches on this subject can vary according to the university's characteristics and/or the students' profile. Therefore, this study's results may only be compared to researches from in similar environments. Studies from different universities, with students from other programs, may contribute to the subject, especially about the psychometric aspects of the undergraduate and their influence in the academic life. Comparing freshman and seniors would help to observe which factors are really present during the beginning of academic life and which changes occur until the end of college.

5 CONCLUSION

The presence of stress, anxiety, and depression was high, and it was related to the student's interaction with their peers and personal aspects. Cortisol levels were higher among students who were more adapted to the Career domain. The program of choice and their first-choice university were decisive for their adaptation, as well as the interpersonal relations. Future researches will be necessary to describe these characteristics in the same groups of students in different universities.

RESUMO
Estresse, níveis de cortisol e a adaptação de estudantes de odontologia no ambiente acadêmico.
O objetivo desta pesquisa foi investigar a presença de estresse, ansiedade e depressão e analisar as experiências acadêmicas de estudantes de ingressantes no curso de Odontologia. Amostras de saliva de 114 estudantes foram coletadas para dosagem de cortisol durante exames e aulas para análise do estresse fisiológico em ambas as situações. Aqueles que tomaram antidepressivos ou não assinaram o Termo de Consentimento Livre e Esclarecido foram excluídos da pesquisa. Dois questionários validados foram aplicados, o QVA-r (Questionário de Experiências Acadêmicas - versão reduzida) e o DASS 21 (Depressão, Ansiedade e Escala de Estresse 21). O coeficiente de correlação e o teste de Mann-Whitney foram determinados com nível de significância de 5%. Do total de participantes, a maioria era do sexo feminino, com média de idade de 20,06 (+ 2,65) e 18,96 (+ 1,78) anos. A presença de estresse foi alta entre os estudantes (45%) e esteve relacionada aos domínios Pessoal (-0,518) e Interpessoal (-0,251). Os níveis de cortisol durante os testes mostraram correlação com as pontuações mais altas nos domínios Estudo (0,197), Carreira (0,347) e Institucional (0,196). De todos os alunos questionados, 81% deixaram a casa dos pais para estudar. A presença de estresse, ansiedade e depressão estava relacionada à interação dos alunos com seus pares e aos aspectos pessoais. Os maiores níveis de cortisol foram naqueles mais adaptados nos domínios Estudo, Carreira e Institucional.
Descritores: Estudantes de Odontologia. Cortisol. Estresse.

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