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COMPARATIVE STUDY ASSESSING STRESS, DEPRESSION AND ANXIETY SCALES IN STUDENTS BELONGING TO DIFFERENT FIELDS OF EDUCATION AND THEIR ASSOCIATION WITH SALIVARY CORTISOL LEVELS.

Oral Medicine

Dr. Santan Reddy Muthyam Professor And Head, Department Of Oral Medicine & Radiology, Sri Balaji Dental College, Hyderabad, India.

Dr. Jeevika Jonnak Post Graduate Student, Department Of Public Health Dentistry, Government Dental College, Hyderabad, India.

Dr. Komanduri Sowmya Assistant Professor, Department Of Oral Medicine & Radiology, Sri Balaji Dental College, Hyderabad, India.

Dr. Alka Kumari Muthyam Assistant Professor, Department Of Public Health Dentistry, Paneeniya Mahavidyalaya Institute Of Dental Sciences And Research Sciences, Hyderabad, India.

ABSTRACT

Objectives: To identify the prevalence of stress, anxiety and depression in undergraduate students using DASS-21 questionnaire and salivary cortisol as a physiological biomarker. **Material And Methods:** A total of 460 undergraduate students excluding interns were part of the study. The students were divided into four equal groups, 115 students each from medical, dental, engineering and art courses. Depression, anxiety and stress were evaluated using DASS-21 scale. Salivary cortisol levels were assessed using ELISA kit. The data was analyzed using chi-square test. **Results:** A significant difference in the levels of depression, anxiety, stress based on the streams was observed (p = <0.001). No significant association of these levels was seen with cortisol levels, wherein higher percentage of medical students had abnormal levels of cortisol in comparison to other streams. Comparison of depression, anxiety, stress according to year of study did not reveal any significant difference (p = 0.137,0.462,0.066 respectively.) with regards to cortisol levels, higher percentage of second year subjects had abnormal levels, but a significant difference was not observed in comparison with other academic years (p=0.599). **Conclusion:** In the present study significantly abnormal levels of cortisol levels were seen in the majority of subjects who had extreme and extremely severe levels of depression, anxiety, stress levels. Mental health is an important aspect of overall health and therefore addressing these conditions at this stage will have a positive impact in their career. Salivary cortisol levels can be used as adjuncts to questionnaires for routine screening to identify severe forms of this disease and provide selective care.

KEYWORDS

Depression, Stress, Anxiety, Cortisol, Saliva

INTRODUCTION

In recent years, stress, anxiety and depression among students, especially in India, has been a major concern. Depression, anxiety and stress (DAS) have invariably affected students of every field of education. Anxiety and depression have been established as some of the major etiological factors leading to cardiovascular diseases [1,2] temporomandibular disorders [3] and sleep disorders [4] etc., thereby negatively affecting the quality of life. In addition, these disorders adversely affect the interpersonal, social and occupational spheres of life. Such disturbances can hamper the learning ability and academic performance of the affected students [5]. In extreme cases, it can also lead to the tendency of self-harm, substance abuse and in some cases suicide [6,7]. As debilitating as they are, identification and management of these conditions becomes extremely important.

Stress is defined as a state in which homeostasis is disturbed by various external and internal factors. Anxiety is a generalized unpleasant sensation of fear and concern with an unknown origin, which one can feel. It consists of feelings of uncertainty, helplessness which sometimes manifests physiologically [8]. Depression encompasses a wide array of emotional lows, from the mere perception of sadness to suicidal state [9].

Students of every field of education invariably undergo stress due to varying reasons. It is expected of dental students to work hard to learn a variety of subjects and develop the necessary abilities. Research to date indicates that a significant number of dentistry students experience stress, anxiety, and depression [10]. Engineering students face different problems, due to high competition levels as the number of students pursuing this course is very high. In India art courses are less preferred creating a negative mindset and a feeling of inadequacy in the students.

With its simplicity of collection and potential broad applicability, salivary cortisol levels present a fresh technique in the study of stress indicators. It closely reflects the concentration of free, biologically active cortisol in plasma and is independent of the rate of saliva secretion [11].

The existing literature concerning the stress, anxiety and depression levels in undergraduate students is mostly questionnaire-based, and studies involving physiological biomarkers are very few. Moreover, comparative studies are generally lesser and for the most part concentrated on medical, dental and engineering students. This study takes a multi-field comparative approach to understand the prevalence of psychological disorders, and understand the relevance of salivary cortisol as biomarker in the chosen demography.

Materials And Methodology

This institutional cross-sectional study was conducted in the Department of Oral Medicine and Radiology from September 2021 to October 2021. Ethical clearance was obtained from the institutional ethical committee (IEC/SBDC/SS/ICMR/001-2021). Permission from all the colleges were obtained before commencing the research. A total of 460 undergraduates students excluding interns were a part of the study. The students were divided into four equal groups, 115 students from medical, 115 from dental, 115 students from engineering, and 115 students from art courses.

Excluding Criteria – Students with systemic conditions and those on medications/drugs.

Informed consent form was prepared according to the template given by World Health Organization Research Ethics Review Committee [WHO – ERC] and was obtained from the participants.

Questionnaire

The students who provided their consent were then instructed to fill-in the questionnaire. The questionnaire can be divided into two parts: Demographic data, Depression, Anxiety and Stress scale -21 (DASS-21).

DASS-21 Depression, Anxiety and Stress scale -21 designed to measure the emotional states of depression, anxiety and stress. Each of the three DASS-21 scales contains 7 items, divided into subscales with similar content. Subjects were asked to use 4-point severity/frequency scales to rate the extent to which they have experienced each state over the past week. Scores for Depression, Anxiety and Stress were calculated by summing the scores for the appropriate items. To get the final levels, multiply the scores by two.

The scoring is as follows [Table 1]

Salivary Sample Collection
Saliva samples were self-collected by students in their home between 8 and 8:15am before meal using spitting method in sterile plastic containers. The saliva samples were asked to be placed in dry ice containers until arrival to the college. Samples were collected from participants and taken to laboratory and stored at -20° C until further processing. The samples collected, were then thawed and centrifuged at 2000 to 3000 rpm for 20minutes and the supernatant was removed. The samples were then processed using Krishgen Biosystems Cortisol Elisa kit.

Data Analysis
Statistical analysis was done using software SPSS24. Pearson's chi-square test was used to analyze the data at a significant level of $p < 0.05$. Descriptive statistics (frequency, percentages) were calculated for demographics.

RESULTS
A total of 460 subjects participated in the present study, comprising 212 males (46.1%) and 248 females (53.9%). Comparably 1/3rd of the subjects were in the final year (30.2), 27.4% in the first year, 22.2% in the second year, and 20.2% in the third year. An equal number of 115 students each from dental (25%), Arts and Commerce (25%), Medical (25%), and Engineering colleges (25%) participated in the study. [Table 2]

According to the level of depression, nearly half of the subjects were normal (48.3%). Comparably, a high percentage of subjects had moderate levels of depression (22.8%), 14.3% had mild, 10% had severe depression, and only 4.6% had extremely severe depression.

In regards to anxiety levels, a higher percentage of subjects were normal. Among the subjects who had anxiety, nearly 1/3rd of them had moderate levels of anxiety, 14.1% had mild, 10.4% had extremely severe, and only 2.8% had extreme anxiety.

Based on the levels of stress, 12% had moderate, 11.7% had mild, 9.3% had extreme, and 3.3% had extremely severe stress. The majority of the subjects had no stress (63.7%). [Graph]

On a positive note, nearly 90% of the subjects had normal cortisol levels (89.1%), and only 10.9% had abnormal levels. [Pie diagram]

A comparison of DAS levels based on gender revealed that the majority of the females had no depression, anxiety, and stress levels, if present, most of them had mild levels in comparison to males. Whereas moderate and severe levels of DAS were seen in the majority of males than females. Nonetheless, the comparison was not statistically significant (p=0.065). While, a comparable percentage of both males and females had abnormal cortisol levels (11.3% and 10.5% respectively), with no significant difference (p=0.774). Comparison of DAS according to the year of the study did not reveal any significant difference (p=0.137, 0.462, 0.066 respectively).

With regards to cortisol levels, a comparably higher percentage of 2nd-year subjects had abnormal levels, but no significant difference was observed in comparison with other academic years (p=0.599). Significantly abnormal levels of cortisol levels were seen in the majority of the subjects who had extreme and extremely severe levels of depression, anxiety, and stress levels. [Table 3]

A significant difference in the level of DAS based on the streams was observed (p=<0.001). A comparably higher percentage of dental subjects had no depression (61.7%), anxiety (53.9%), and stress (70.4%). Mild levels of depression in seen in a higher percentage of Medical subjects, while moderate, severe, and extremely severe levels are among Arts and Commerce subjects. Whereas, mild to severe levels of anxiety were most commonly seen among Arts and Commerce subjects. Likewise, mild and extreme levels of stress are seen in the majority of Medical (16.5%), whereas moderate levels in Arts and Commerce subjects. No significant association was seen with cortisol levels, wherein higher percentage of medical students had abnormal levels in comparison to other streams. [Table 4]

DISCUSSION
In the current comparative study, it was found that students of all fields of education show high prevalence of psychological disorders which was consistent with existing literature. Out of four professional courses arts and commerce students had a greater prevalence of depression, anxiety and stress which is consistent with results of Mandar et.al [12] and contradicts the results of Mohammad Amin Wani et.al [13]. Arts students generally may feel stressed due to lack of privilege compared to other fields. Contrary to the findings of current study, Sumaiya Nezam et.al [9] study revealed higher prevalence of depression in engineering students. In the current study higher percentage of dental students had no depression (61.7%), anxiety (53.9%), stress (70.4%) which were contrary to the results of [10, 14,15,16].

In the current study anxiety was the most prominent psychological disorder seen in undergraduate students of all fields. This could be attributed to the pandemic, increase in anxiety levels after pandemic as was seen in some studies. Depression was prevalent in more than half undergraduates. Males students were generally more affected in our chosen demography which contradicts the general norm. However, female students showed higher prevalence of severe forms of these conditions.

The majority of subjects were found to have normal levels of depression, anxiety and stress, which is encouraging. Around 4.6% subjects had extremely severe depression, 2.8% had extremely severe anxiety, 3.3% had extremely severe stress.

The current study also aimed to understand the relevance of salivary cortisol as a biomarker of chronic stress in the chosen demography. No significant association was seen with cortisol levels, wherein higher percentage of medical students had abnormal levels in comparison to other streams. Abnormal levels of salivary cortisol levels were found to be positively associated with severe forms of the conditions. However, they were not found to be present in mild and moderate forms of conditions. This may be due to the fact that mild and moderate forms of these conditions are not at a threshold to cause physiological changes or the sensitivity of ELISA needs to be much high to record minute variations in salivary cortisol. However, these subjects still have a higher risk of falling into extreme categories of the conditions and hence cannot be overloaded. Abnormal levels of salivary cortisol levels were found to be associated with students who are not suffering from these mental disorders. However, they were insignificant. Diurnal variations and other factors may be associated with this discrepancy.

Limitations: The study relied on self-reported data provided by students. As a result, there is the possibility of some reporting bias. Salivary cortisol was only associated with severe forms DAS this could be because of the less sensitivity of the ELISA based evaluation. The sample size of the individual streams was less which might lead to the contrary results when compared to other studies.

CONCLUSION
The high prevalence of stress, anxiety and depression in undergraduate students is a grave concern. Salivary cortisol levels can be used as physiological biomarkers to identify the student at risk. Salivary cortisol estimation is the one of the cheapest methods and it can be used as a screening tool to identify severe forms of this conditions. However, for an apt and proper diagnosis, diurnal samples can be collected. Salivary cortisol concentrations are a good adjunct to questionnaires. The students need to be diagnosed clinically by a psychologist and appropriate treatment need to be provided. Mild and moderate levels of these disorders cannot be over-looked and they should be provided counselling after identifying them as high-risk groups. Mental health is very important for physical health and cannot be over-looked.

Figure Legends
Graph: Distribution of study subjects based on their level of depression, anxiety, and stress.
Pie Diagram: Distribution of study subjects based on cortisol concentration levels.

Tables
1. DAS scoring based on severity

	Stress scores	Anxiety scores	Depression score
Normal	0-14	0-7	0-9

Mild	15-18	8-9	10-13
Moderate	19-25	10-14	14-20
Severe	26-33	15-19	21-27
Extremely severe	34+	20+	28+

2. Demographic Details

Variables		n	%
Gender	Males	212	46.1
	Females	248	53.9
Year of Study	1st year	126	27.4
	2nd year	93	20.2
	3rd year	102	22.2
	4th year	139	30.2
Field of Education	Dental	115	25.0
	Arts and commerce	115	25.0
	Medical	115	25.0
	Engineering	115	25.0
Overall sample	460	100	

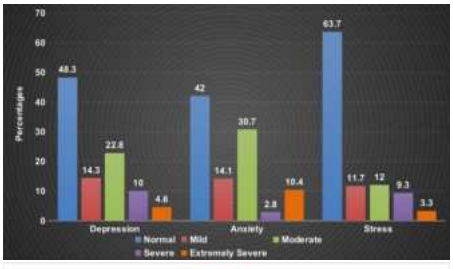
3. Comparison of DAS based on the variables (all samples)4: Comparison of Depression, Anxiety, Stress, and cortisol levels according to field of education

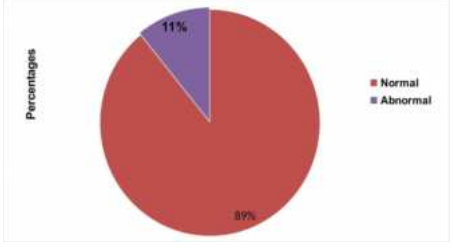
Subscale	Categories	Sex N (%)		Educational year N (%)				Concentration of Cortisol (ng)	
		Male	Female	1st year	2nd year	3rd year	4th year	Normal	Abnormal
Depression	Normal	96 (45.3)	126 (50.8)	59 (46.8)	39 (41.9)	58 (56.9)	66 (47.5)	219 (53.4)	3 (6)
	Mild	27 (12.7)	39 (15.7)	19 (15.1)	14 (15.1)	11 (10.8)	22 (15.8)	65 (15.9)	1 (2)
	Moderate	58 (27.4)	47 (19)	29 (23)	21 (22.6)	18 (17.6)	37 (26.6)	96 (23.4)	9 (18)
	Severe	25 (11.8)	21 (8.5)	16 (12.7)	15 (16.1)	7 (6.9)	8 (5.8)	26 (6.3)	20 (40)
	Extremely Severe	6 (2.8)	15 (6)	3 (2.4)	4 (4.3)	8 (7.8)	6 (4.3)	4 (1)	17 (34)
	P value	0.065		0.137				**<0.001***	
Anxiety	Normal	81 (38.2)	112 (45.2)	47 (37.3)	33 (35.5)	44 (43.1)	69 (49.6)	188 (45.9)	5 (10)
	Mild	27 (12.7)	38 (15.3)	19 (15.1)	15 (16.1)	17 (16.7)	14 (10.1)	64 (15.6)	1 (2)
	Moderate	74 (34.9)	67 (27)	42 (33.3)	30 (32.3)	27 (26.5)	42 (30.2)	136 (33.2)	5 (10)
	Severe	8 (3.8)	5 (2)	4 (3.2)	3 (3.2)	1 (1)	5 (3.6)	4 (1)	9 (18)
	Extremely Severe	22 (10.4)	26 (10.5)	14 (11.1)	12 (12.9)	13 (12.7)	9 (6.5)	18 (4.4)	30 (60)
	P value	0.246		0.462				**<0.001***	
Stress	Normal	129 (60.8)	164 (66.1)	75 (59.5)	52 (55.9)	73 (71.6)	93 (66.9)	288 (70.2)	5 (10)
	Mild	26 (12.3)	28 (11.3)	15 (11.9)	16 (17.2)	6 (5.9)	17 (12.2)	54 (13.2)	0 (0)
	Moderate	29 (13.7)	26 (10.5)	19 (15.1)	13 (14)	7 (6.9)	16 (11.5)	52 (12.7)	3 (6)
	Severe	22 (10.4)	21 (8.5)	10 (7.9)	8 (8.6)	15 (14.7)	10 (7.2)	16 (3.9)	27 (54)
	Extremely Severe	6 (2.8)	9 (3.6)	7 (5.6)	4 (4.3)	1 (1)	3 (2.2)	0 (0)	15 (30)
	P value	0.692		0.066				**<0.001***	
Concentration of Cortisol (ng)	Normal	188 (88.7)	222 (89.5)	111 (88.1)	81 (87.1)	90 (88.2)	128 (92.1)	410 (100)	0 (0)
	Abnormal	24 (11.3)	26 (10.5)	15 (11.9)	12 (12.9)	12 (11.8)	11 (7.9)	0 (0)	50 (100)
	P value	0.774		0.599				-	

Chi-Square test; *p≤0.05 considered statistically significant

4: Comparison of Depression, Anxiety, Stress, and cortisol levels according to field of education

Subscale	Categories	Field of education n(%)			
		Dental	Arts & commerce	Medical	Engineering
Depression	Normal	71(61.7)	36(31.3)	58(50.4)	57(49.6)
	Mild	14(12.2)	16(13.9)	20(17.4)	16(13.9)
	Moderate	17(14.8)	38(33)	18(15.7)	32(27.8)
	Severe	6(5.2)	20(17.4)	11(9.6)	9(7.8)
	Extremely Severe	7(6.1)	5(4.3)	8(7)	1(0.9)
	P value	**<0.001***			
Anxiety	Normal	62(53.9)	30(26.1)	49(42.6)	52(45.2)
	Mild	14(12.2)	22(19.1)	14(12.2)	15(13)
	Moderate	29(25.2)	49(42.6)	28(24.3)	35(30.4)
	Severe	3(2.6)	3(2.6)	2(1.7)	5(4.3)
	Extremely Severe	7(6.1)	11(9.6)	22(19.1)	8(7)
	P value	**<0.001***			
Stress	Normal	81(70.4)	60(52.2)	69(60)	83(72.2)
	Mild	12(10.4)	12(10.4)	19(16.5)	11(9.6)
	Moderate	10(8.7)	20(17.4)	10(8.7)	15(13)
	Severe	7(6.1)	14(12.2)	16(13.9)	6(5.2)
	Extremely Severe	5(4.3)	9(7.8)	1(0.9)	0(0)
	P value	**0.001***			
Concentration of Cortisol (ng)	Normal	104(90.4)	98(85.2)	103(89.6)	105(91.3)
	Abnormal	11(9.6)	17(14.8)	12(10.4)	10(8.7)
	P value	0.457			





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