Original Research Article

Prevalence of Generalized Anxiety Disorder (GAD) and its association with Sleep Quality among dental students of Delhi-NCR: a web-based cross-sectional study

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ABSTRACT

Background: Generalized Anxiety Disorder (GAD), with a lifetime prevalence of 5.1% is a potential global health challenge impacting the physical and psychological well-being of medical students and future healthcare providers. Individuals with anxiety disorders report lower sleep quality impairing the subsequent daytime activities and eventually deteriorating the symptoms. The aim of the study was to know the prevalence of GAD, its determinants, and association with sleep quality among dental students of Delhi-National Capital Region (NCR).
Methodology: The study followed a web-based cross-sectional design to collect data on GAD symptoms and sleep quality components. The assessment was done on 325 dental students across all four academic years of BDS from a total of four dental colleges in Delhi NCR. Validated questionnaires like GAD-7 and PSQI were used to collect data. Data was analyzed using Stata15 software.
Results: The prevalence of moderate to severe GAD among dental students of this multi-university study was 26% while 40% of students reported mild symptoms. Thoughts of abandoning the course midway and dietary frequency were found to be significantly associated with GAD symptoms. GAD-7 score was found positively correlated with PSQI score with Spearman's coefficient of +0.5704 ($p<0.001$). The students with bad sleep quality were five times more likely than students with good sleep quality to be suffering from GAD.
Conclusions: This study demonstrates the prevalent generalized anxiety among dental students and is an indication to have an academic-integrated mental health program to strategically address the issue.
Keywords: Mental health, Dental student, Generalized Anxiety Disorder, Sleep quality, COVID-19

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INTRODUCTION

Mental health, as defined by the World Health Organization (WHO), "a state of well-being in which an individual realizes his or her abilities, can cope with the normal stressors of life, can work productively and can contribute to his or her community". They are manifested in diverse forms such as negative thoughts, abnormal intuition, and emotions, that may affect the individual's behavior and his/her relationships with others. Among all the mental disorders, "the anxiety disorders, including panic disorder with or without agoraphobia (fear of being in situations from which it is hard to escape or receive help), generalized anxiety disorder (GAD), social anxiety disorder (SAD), specific phobias, and separation anxiety disorder, are the most prevalent" [1]. Approximately 264 million people around the globe have anxiety disorders of which 63% are females and 37% are males, as reported by WHO 2017 [2]. In a LMIC like India, the lifetime prevalence of common mental disorders was found out to be 10% (NMHS, 2016) contributing to 1.64% of total DALYs in India [3] giving rise to disease burden and healthcare expenditure.
As per DSM-V, GAD also known as 'internalizing disorder' is defined as "excessive anxiety and worry (apprehensive expectation), occurring on more days than not for a period of at least 6 months, about a number of events or activities". The etiology behind GAD constitutes a multi-factorial range of cognitive, affective, and neurobiological mechanisms [4] with environmental, parenting style, temperament,

interpersonal factors being the prominent risk factors [5]. The Harvard Brown Anxiety Research presented mean age of GAD onset as 21 years with average duration of approximately 20 years. Anxiety disorders are mostly reported higher in women than in men [6]. Complete remission of GAD is not possible however, treatment of GAD is a long-term process particularly focusing upon the symptom resolution with several trials of intervention [7].

Dental education, a specialty branch of medicine is regarded as "a complex, demanding, and often stressful pedagogical exposure involving an acquisition of required academic, clinical and interpersonal skills" [8]. However, 23% of the dental students opt for dentistry because of unavailability of other courses [9]. Dental students encounter a range of academic and non-academic stressors as soon as they enter the dental school. The proportion of dentists committing suicides is ever increasing attributable to growing unemployment and a sense of hopelessness, posing an intense threat to the professional integrity of fresh dental graduates [10]. The pandemic and the uncertainties attached with it further posed a risk to the psychological well-being of the community imputed to the social distancing, quarantine, disruption of studies particularly among medical students [11]. These stressors in a long run can affect the psychological health by manifesting as emotional exhaustion, loss of self-confidence, anxiety, depression and burnout leading to unprofessional conduct [12]. The reported prevalence of GAD among medical students is approximately 35% with a female preponderance [13]. In few India based study on dental students, high rates of mild to moderate anxiety was reported among them [12,14]. Female gender, previous history of anxiety or depression, duration of such episode, previous trauma, family history of mental disorder was identified as factors responsible for newer episode of any mental disorder [15]. Individuals with anxiety disorders report lower sleep quality impairing the subsequent daytime activities and eventually deteriorating the symptoms [16]. As a repercussion of diminished sleep quality, major impact is seen on the academic performance. Short sleep duration significantly affected the future anxiety symptoms [17].

Since no data represent the psychological status of dental students precisely during COVID 19 pandemic, the present study primarily aims to determine the prevalence of Generalized Anxiety Disorder (GAD) among the dental students of multi-universities of dental education in an urban location i.e. Delhi-NCR. Secondarily, it will explore the determinants of GAD and its relationship with the sleep quality of these students.

METHODOLOGY

The study followed an observational cross-sectional design with online survey method as the quantitative component to collect the data in the month of March 2021. The study settings were Dental colleges in Delhi NCT and NCR (2 Private, 2 Public). The study population included dental students of first, second, third and final professional years of the Bachelor of Dental Surgery (BDS) whereas BDS Interns, students diagnosed with/ on treatment of mental disorders or/and severe/chronic medical illness were excluded. Based on previous literature, reported prevalence of anxiety among dental students in India is 40%. Assigning 95% confidence interval and 5% absolute precision, the calculated sample size of the study was 369. To compensate the non-respondent students on a web platform, an additional 20% of the calculated sample size was added resulting in a target sample of 443.

Among all the dental colleges in Delhi NCR, 2 public and 2 private dental colleges were selected by convenience sampling, since seeking permission and conducting the study in all/randomly selected dental colleges during the COVID19 pandemic was not feasible. The final stage of the study included obtaining roll number wise list of the students from each year and sending the survey form via email to the concerned member of the college administration. Students who completed the form were included in the study.

Ethics approval for the study was obtained from the Institutional Ethics Committee (IEC), Indian Institute of Public Health-Delhi, India by the review of study proposal & tools for the study. Permission was obtained from the respective Dean/ Principal of the colleges included in the study. Written informed consent was taken from the participants on the online platform itself after the detailed explanation of the purpose of the research, process of research & the implications of the research via Participant Information Sheet (PIS) to the participants by the investigator in English language. A conceptual framework was designed for assessment of potential risk factors to mental health and to facilitate the study analysis based on the understanding of previous literature on determinants of mental health among college students.

The responses from the Google forms were transferred and coded on the Excel sheet, and the statistical analysis was conducted using the Stata15 (Stata Corp LLC) software. The sample was described using mean and standard deviation (SD) for continuous variables and frequencies with percentages for nominal and ordinal variables. The primary outcome i.e. prevalence of Generalized Anxiety Disorder was expressed using percentage (95% Confidence Interval). It was further categorized into two categories-presence or absence of GAD using the cut off score of 10 in GAD-7 score [18]. The secondary objective was expressed using spearman's correlation coefficient for GAD-7 and PSQI global scores. To assess the determinants of GAD, bivariate analysis, univariable and multivariable logistic regression were performed. The significant

findings from bivariate analysis were then assessed using univariable logistic regression (crude findings), following which incorporated in a multivariable logistic model and interpreted at p value ≤ 0.05 as the result.

RESULTS

This online questionnaire was filled by 325 dental students (response rate= 79.5%). Figure/Table-1 summarizes the socio-demographic profile, academic and lifestyle information of the study participants.

Table 1: Descriptive Characteristics of the Study Participants (n=325)

Variable	N (%) or Mean (SD)
Socio-demographic information	
Age (years): (reported as mean ± SD)	20.6 ± 1.7 years
Gender:	
Female	239 (73.5)
Male	86 (26.5)
Place of origin:	
Urban	291 (90)
Rural	34 (10)
Relationship status:	
Single	300 (92.3)
In a relationship	25 (7.7)
Living with:	
Family	216 (66)
Paying guest (PG)- Sharing	94 (29)
Paying guest (PG)- Single	15 (05)
Family type:	
Extended	107 (33)
Nuclear	208 (64)
Single parent	10 (03)
Whether parents are doctor:	
No	299 (92)
Yes, only one of them	16 (05)
Yes, both	10 (03)
Medium of study in school:	
English	319 (98)
Hindi	6 (02)
Academic Information	
Academic year:	
First	115 (35)
Second	107 (33)
Third	69 (21)
Final/fourth	34 (11)
University type:	
Public	122 (38)
Private	203 (62)
No. of years dropped before joining BDS	
0	91 (28)
1	128 (39)
2	74 (23)
>2	32 (10)
Whether satisfied with pursuing BDS:	
Yes	198 (61)
Neutral	112 (34)
No	15 (05)

Thoughts of abandoning the course (BDS):	
Yes	38 (12)
Neutral	108 (33)
No	179 (55)
Academic performance (in percentage): (reported as mean ± SD)	
For all years except first year	64.5 ± 9.2
Missing values (first year)	115
Lifestyle and Recreational Activities Information	
Time spent on social media daily - hrs	
Less than 1 hour	97 (30)
1 - 3 hours	170 (52)
More than 3 hours	58 (18)
Extracurricular activities:	
Active	115 (35)
Moderately active	104 (32)
Sedentary	106 (33)
Physical activities:	
Active	201 (62)
Moderately active	66 (20)
Sedentary	58 (18)
Dietary frequency:	
More than 2 meals a day	211 (65)
1-2 meals a day	114 (35)
Dietary habits:	
Nutrients rich diet	153 (47)
Combination diet	142 (44)
Nutrients deficient diet	30 (09)
Daily caffeine intake:	
Occasional/ never	147 (45)
Once daily	109 (34)
More than once daily	69 (21)
Smoking habits:	
Never	303 (93)
Occasional	12 (04)
Frequent	10 (03)
Alcohol consumption:	
Never	265 (82)
Occasional	43 (13)
Frequent	17 (05)
Awareness about anxiety:	
Aware	164 (50)
Moderately aware	126 (39)
Not aware	35 (11)
Average time spent on COVID-19 news updates daily (in hours):	
Less than 1 hour	267 (82)
1 - 3 hours	48 (15)
More than 3 hours	10 (03)
Emotions about COVID19 outbreak:	
Fearful	26 (08)
Worried	175 (54)
Indifferent	124 (38)

112 (34%) of the participants did not report symptoms of generalized anxiety disorder, 129 (40%) had mild symptoms, 41 (13%) had moderate symptoms while 43 (13%) had severe symptoms. The reported prevalence of GAD among dental students is 26% (95% CI: 21%-31%). Worrying too much about different things (34%), not being able to stop worrying (28%), being easily irritable or annoyed (28%), feeling afraid as if something

awful might happen (28%), feeling anxious/on the edge/ nervous (27%) were the most common symptoms reported daily. 58% (95% CI: 53%-64%) of the participants were found to have bad sleep quality.

Table 2: Distribution and Prevalence of GAD and Sleep Quality (n=325)

Domain	Mean score ± SD		N (%)	Overall Prevalence (%) (95% CI)
Generalized Anxiety Disorder (GAD)	7.2 ± 5.3*	Mild	129 (40)	
		Moderate	41 (13)	
		Severe	43 (13)	26 (21%-31%)**
Sleep Quality	5.9 ± 4.0***	Good sleepers	135 (42)	
		Bad sleepers	190 (58)	58 (53%-64%)****

*Mean GAD-7 score ranging from 0-21

**Following GAD score more than or equal to 10 (considered as the cut-off score for GAD with specificity= 82%, sensitivity= 89%)

***Mean PSQI score ranging from 0-21

****Prevalence of poor quality of sleep indicating difficulties in majority of the PSQI components

Table-3 illustrates the findings of bivariate analysis with GAD as outcome variable. GAD is seen to be significantly (p-value <0.05) associated with course satisfaction, thoughts of abandoning the course, time spent on social media, physical activity and daily dietary frequency. No socio-demographic variable is found to be associated with GAD in this study. The overall sleep quality and its other components including subjective sleep, sleep duration, sleep disturbances and daytime dysfunction were found out to be statistically significant with GAD.

Table 3: Association of Moderate to Severe GAD with various Socio-Demographic/Academic/ Lifestyle Profile (n=325)

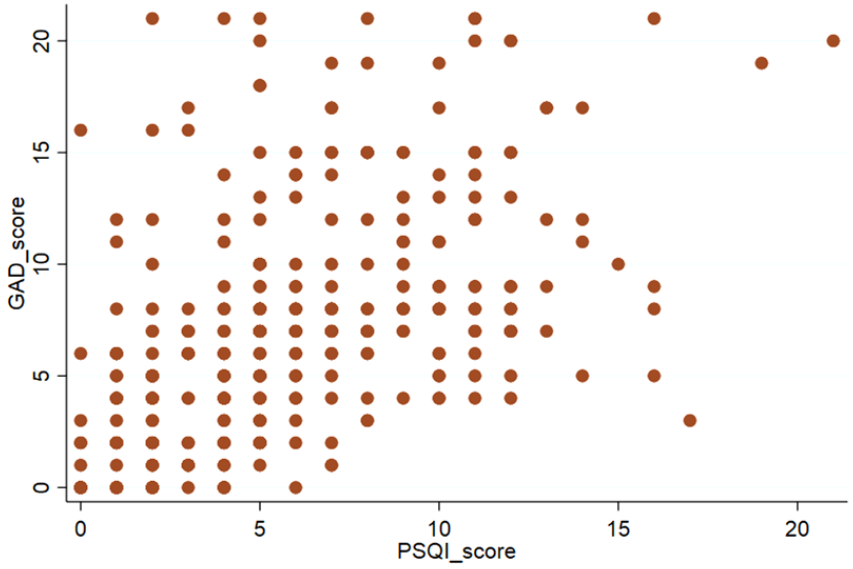
Variables	GAD Absent (n=241)	GAD Present (n=84)	p-value*
Whether satisfied with pursuing BDS (Course satisfaction):			
Yes	155 (64)	43 (51)	<0.001*
Neutral	82 (34)	30 (36)	
No	04 (02)	11 (13)	
Thoughts of abandoning the course (i.e BDS):			
Yes	21 (09)	17 (20)	<0.001*
Neutral	71 (29)	37 (44)	
No	149 (62)	30 (36)	
Time spent on social media daily (hours):			
Less than 1 hour	76 (32)	21 (25)	0.03*
1 - 3 hours	130 (54)	40 (48)	
More than 3 hours	35 (14)	23 (27)	
Physical activities:			
Active	159 (66)	42 (50)	0.03*
Moderately active	43 (18)	23 (27)	
Sedentary	39 (16)	19 (23)	
Dietary frequency:			
More than 2 meals a day	166 (69)	45 (54)	0.01*
1-2 meals a day	75 (31)	39 (46)	

Sleep Quality Components			
Overall sleep quality:			
Good	122 (51)	13 (15)	<0.001*
Bad	119 (49)	71 (85)	
Subjective sleep:			
Good	211 (88)	52 (62)	<0.001*
Bad	30 (12)	32 (38)	
Sleep duration:			
>7 hours	64 (26)	12 (14)	0.005*
6-7 hours	50 (21)	13 (16)	
5-6 hours	110 (46)	44 (52)	
<5 hours	17 (07)	15 (18)	
Sleep disturbances:**			
No difficulty	39 (16)	01 (01)	<0.001*
With difficulty	202(84)	83 (99)	
Daytime dysfunction:**			
No difficulty	89 (37)	11 (13)	<0.001*
With difficulty	152 (63)	73 (87)	

*Chi square/fisher exact test; p value significant <0.05
**For additional details on the scoring of the PSQI components, see (Buysse et al., 1989); sleep disturbances, subjective sleep and daytime dysfunction components are further categorized for the ease of understanding.

It is evident that overall sleep quality is strongly associated with GAD. However, this finding is again supported in Figure/Table-2 where GAD-7 score is positively correlated with PSQI score with Spearman's coefficient of +0.5704 (p value <0.001). It statistically shows that when the value of GAD scores increases, the PSQI scores also increase significantly (positively correlated) (Figure/Table-4). Although this correlation is moderate in magnitude (r=0.57).

Figure 1: Correlation of GAD Score and PSQI Score



The final multivariate model showed that the students with bad sleep quality are 4.91 (OR: 4.91, CI: 2.52-9.56, p <0.001) times more likely than students with good sleep quality to be suffering with GAD. The students with bad subjective sleep quality are 2.58 (OR: 2.58, CI: 1.32-5.05, p: 0.006) times more likely than their counterpart to have GAD. The students with moderate to severe difficulties in daytime functioning are 2.20 (OR: 2.20, CI: 1.06-4.56, p: 0.03) times more likely than students without any daytime dysfunction to be anxious or having GAD. The students with sleep disturbances (moderate to severe) are 8.52 (OR: 8.52,

CI: 1.11-65.15, p: 0.04) times more likely than with no sleep disturbances to have GAD. Apart from sleep related variables, diet frequency (OR: 1.75, CI: 1.00-3.06, p: 0.05) was also found to have significant association with GAD. The students with thoughts of abandoning the course midway are 3.51 (OR: 3.51, CI: 1.56-7.92, p: 0.007) times and students with neutral thoughts on course abandoning are 2.38 (OR: 2.38, CI: 1.30-4.34, p: 0.007) times more likely than students without such thoughts to have GAD.

Table 4: Multivariate Logistic Regression of the Factors associated with GAD.

Variables		**Crude/ Unadjusted Estimate**		**Adjusted Estimate**
	OR (95% CI)	p- value*	OR (95% CI)	p- value**
Diet frequency:				
More than 2 meals a day	1	0.01	1	0.05
1-2 meals a day	1.92 (1.15-3.19)		1.75 (1.00-3.06)	
Thoughts of abandoning the course				
No	1	<0.001	1	0.007
Neutral	2.59 (1.48-4.52)		2.38 (1.30-4.34)	
Yes	4.02 (1.90-8.51)		3.51 (1.56-7.92)	
Overall sleep:				
Good	1	<0.001	1	<0.001
Bad	5.60 (2.94-10.65)		4.91 (2.52-9.56)	
Subjective sleep:				
Good	1	<0.001	1	0.006
Bad	4.33 (2.42-7.76)		2.58 (1.32-5.05)	
Daytime dysfunction:				
No difficulty	1	<0.001	1	0.03
With difficulty	3.89 (1.96-7.71)		2.20 (1.06-4.56)	
Sleep Disturbances:				
No difficulty	1	0.007	1	0.04
With difficulty	16.02 (2.17-18.56)		8.52 (1.11-65.15)	

Goodness of fit (gof) p-value= 0.71 (data fits well in the model) when adjusted for all the sleep quality components and 0.16 when adjusted for academic/ lifestyle characteristics
*using bivariate logistic regression **using multivariate logistic regression

DISCUSSION

A web-based cross-sectional study was conducted among the dental students of colleges operating in Delhi NCT and NCR, with the objective to know their anxiety status and sleep quality during the COVID19 pandemic. Interestingly, this study reports high proportion of students with milder anxiety symptoms (40%) when compared to Indian studies which reported prevalent moderate symptoms of anxiety among dental students (DAS anxiety score 12.8 ± 4.0) [14]. 21 years is claimed to be the mean onset age for GAD [15]. The mean age of our study i.e., 20.6 ± 1.7 years indicates that most of our study participants would be in the initial stage of developing the disorder and hence, high prevalence of milder GAD symptoms.

The female gender and younger age predominance reported in majority literature [13, 6,19] has not been evident in the present study. As reported in few studies [20], this study as well did not find any significant association between socio-demographic profile and GAD/anxiety disorders. Students from second academic year of BDS showed the higher prevalence of GAD, followed by the first year, third year and final year students respectively. Incongruent with our significant findings, association of successive year of study with increasing GAD was reported in few studies among medical students [21, 6, 13]. This study population has significantly shown thoughts of abandoning the course (OR: 3.51, CI: 1.56-7.92, p: 0.007) before its completion as a contributing factor of GAD. But congruent with the literature, the dental students in our study reported satisfaction with the course [22]. The issues behind such unsettled intentions need to be thoroughly explored in future studies. Furthermore, providing counselling support to students who are considering abandoning their course could also be important in managing anxiety levels. Academic support could be provided through comprehensive counselling services, stress management workshops, and programs that help students cope with academic pressures. Mental health interventions may include providing access to psychological services, implementing peer support systems, and creating an environment that reduces the stigma associated with seeking mental health care. Interestingly, the dietary implications on GAD in terms of dietary frequency (OR: 1.75, CI: 1.00-3.06, p: 0.05) seen in this study has been in alignment with the literature [23]. It is safe to say that nutritional counselling could also play a role in supporting students' mental health. Dietary interventions might promote better eating habits that can support mental health. Unlike other studies, alcohol consumption and smoking were not significantly associated with GAD in the present population during the pandemic [24]. In alignment with literature, this study establishes that students with GAD are more likely to be physically inactive than students without GAD [6, 24].

Our study also explored the buffering hypotheses about bidirectionality between GAD and sleep quality. The numbers of poor sleepers in this study are considerably higher than other countries like Saudi Arabia [25]. Surprisingly, our results show among those having GAD, 85% students are poor sleepers, 38% have poor subjective sleep, 86% reported daily sleep duration of <7 hours, 87% have daytime dysfunction and 99% reported sleep disturbances. The average sleep duration (in hours) and PSQI score here is 6.43±1.85 and 5.9 ± 4.0; incongruent with other studies 5.85±1.85 and 7.6±3.4 [26], 7.17±1.34 and 2.63±2.08 [27] respectively. The figures reported are anyway less than the WHO recommended mean sleep duration of 8 hours. A strong association of GAD with overall sleep quality of the dental students (OR: 4.91, CI: 2.52-9.56, p-value:<0.001) is established here like findings of a Saudi Arabia based study [25]. The wide 95% confidence intervals reported in our study are attributable to the limited sample size achieved to establish the findings effectively. We can also notice that 69.2% students in our study had reported daytime dysfunction; more than the figures reported in literature (59.3%) [27]. The strong link between sleep disturbances and GAD underscores the need for sleep hygiene education and possibly screening for sleep disorders as part of wellness programs for medical/ dental students that emphasize the importance of good sleep quality.

There are several strengths of the present study including the use of an online platform for collecting the data; stringently following the WHO recommended 'social distancing' during COVID19 pandemic. This study precisely reports the Generalized Anxiety Disorder (GAD) among dental students using globally validated e-questionnaires unlike other studies published reporting anxiety disorders. To witness the multi-factorial causes of GAD, the data was collected on three broad domains including socio-demographic, academic and lifestyle related information making up a total of 25 exposure variables excluding the sleep components. The study is one of a kind exploring the association of GAD with sleep quality along with determining the risk factors behind it in a multi university setting, giving a base for future research in this area. However, there are few limitations that should be taken care of while interpreting the results. Firstly, the study design does not allow someone to assess the change in figures across time and hence does not establish a causal pathway. Secondly, short assessment period of two months while the on-going pandemic and existing reporting bias (web-based mode of data collection) can also be counted as the study limitations. Thirdly, the calculated sample size of 369 could not be achieved as the second wave of COVID19 hit the region during the data collection, however the sample size used (325) explicitly contributes to analyze the situation.

CONCLUSIONS

In conclusion, this study demonstrates the prevalent generalized anxiety among dental students, often affected by varying academic and lifestyle related stressors. This approach recognizes the complex interplay between various factors that contribute to anxiety and aims to create a supportive environment that promotes both mental and physical well-being. It is high time that the students start paying extra attention to their mental health and sleep hygiene. The study suggests that a comprehensive approach that addresses multiple aspects of a student's life is necessary to effectively manage GAD in dental students. Overall, a multifaceted

approach to addressing GAD in dental students with a focus on sleep, diet, academic support, and mental health interventions is required. There is an anticipation that the Dental Council and Government of India will align their actions to better preserve the integrity of the budding dentists.

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