ORIGINAL ARTICLE

Association of Sleep Quality and Stress with Academic Performance among Undergraduate Dental Students of Bhubaneswar, India

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ABSTRACT

Objective: To assess sleep quality and stress level and to analyze their effect on the academic performance of undergraduate dental students. **Material and Methods:** A cross-sectional descriptive survey was conducted among 234 undergraduate dental students at Bhubaneswar. Pittsburgh Sleep Quality Index (PSQI), consisting of 18 items rated on a 4-point Likert scale, assessed sleep quality. Kessler Psychological Distress Scale (K10) evaluated the stress level. Google Forms collected demographic details and marks obtained in their previous examination. Chi-square, Mann-Whitney U, Kruskal-Wallis tests, and Spearman correlation coefficient were used for analysis (p≤0.05). **Results:** Mean PSQI and K10 scores were 4.87±4.5 and 17.60±8.5, respectively. 38% of students had poor sleep quality, and mean actual sleep hours were 8.01±1.7. One-fourth (24.8%) of subjects had moderate to severe stress. Sleep quality significantly differed among the various academic years (p=0.001). A post-hoc test showed a difference between 1st and 2nd-year students and 1st and 4th-year students. A statistically significant difference between genders regarding the components of the K10 scale was observed. A non-significant positive correlation between total marks and K10 score and a negative correlation between marks and global PSQI score was found. **Conclusion:** Sleep quality and stress harm the academic performance of dental students.

Keywords: Sleep Quality; Stress, Psychological; Students, Dental; Academic Performance.

Introduction

Adequate, high-quality sleep of optimum duration facilitates memory processing and learning. It also helps maintain concentration, perform cognitive functions, and integrate sensorimotor systems [1]. Sleep patterns and habits vary among individuals, depending on their age, occupational demands, social engagements, psychiatric and somatic conditions, and individual physiological characteristics [2,3].

Sleep is often the first thing to be hampered when an individual is under stress. Contrary to popular belief, sleep is not a luxury. The popular belief is that if the number of sleep hours is reduced, more time could be spent on qualitative work. However, the fact is that the benefits of limiting sleep hours cannot outweigh the consequences. Insufficient sleep is associated with many adverse health conditions, like diabetes, hypertension, cardiovascular diseases, reduced immune function, the common cold, and obesity [4-8]. These consequences affect an individual's health, causing them to land in financial distress and ultimately decreasing their personal and professional life quality. A study by Colten and Altevogt established that a minimum of 5 hours of sleep [9] is of utmost necessity for maintaining good health. In contrast, in their study, Watson et al. [10] showed that an average young adult needs to sleep 7 hours per day to maintain a healthy and productive lifestyle.

This crisis of sleep and the stress related to it is prevalent not only among adults but also among young adults. This distress has also affected dental students, dentists, and dentistry to a great extent. Dentistry is often associated with a substantial academic curriculum, which demands extensive study hours and clinical practice periods. This specialty also involves deep concentration and raveled dexterity, which also affects the health of an individual in terms of its mental, physical, and psychological aspects [11]. Long working hours also lead to decreased sleep hours. Sleep hours less than this recommended amount might lead to the adverse health conditions discussed above. Sleep disorders tend to set in due to reduced sleep hours, which is most frequently seen in school and college life. A meta-analysis showed that feeling sleepy, reduced sleep length, and sleep quality negatively impact the academic performance of children and adolescents [12]. Hence, it can be rightly said that the mental and psychological well-being of a dental student is highly dependent upon adequate sleep and low distress [13,14]. Studies on medical and dental students have proved that sleep hours decrease and distress increases with their promotion to higher education grades [15].

Dental students and their faculty should realize the adverse effects of sleep deprivation and high academic stress so that adequate measures may be undertaken to improve sleep quality and lower stress levels, resulting in better academic performance. The literature lacks evidence on this issue, so there is a dire need to tackle it. Hence, the current study is conducted to assess the prevalence of sleep quality and stress level and further analyse their effect on academic performance among undergraduate dental students in Bhubaneswar city in India.

Material and Methods

Study Design and Participants

A descriptive cross-sectional study was carried out from July 2022 to August 2022 on undergraduate dental students from the 1st year of BDS through an internship at the Institute of Dental Sciences, Bhubaneswar. Convenience sampling was used to enrol the participants in the study.

Ethical Considerations

This study has been conducted following the ethical standards of the 1964 Helsinki Declaration and its subsequent amendments. The study protocol was reviewed and approved by the Institutional Ethical Committee.

Utmost care was taken to maintain the confidentiality of the data. Providing consent was mandatory for students to participate in the study.

Questionnaire Administration

A questionnaire designed using two previously standardized and validated questionnaires was distributed through Google Forms among dental students to assess undergraduate students' sleep quality and stress levels. To minimize nonresponse bias, we provided a cover letter explaining the study design, the consent form, and the significance of the study. We also sent a couple of reminders over one week while collecting the responses. The first and second sections of the questionnaire consisted of demographic questions and the marks obtained by the students in their last examination.

Sleep Quality

The third section consisted of questions adapted from the self-rated Pittsburgh Sleep Quality Index (PSQI). It was developed and validated by Buysse et al. [16]. It consists of 18 items, categorized into seven components. Component 1 (Q No. 9) evaluated sleep quality. Component 2 (Q no. 2 and 5) assessed the delay in falling asleep. Component 3 (Q No. 4) evaluated the sleep duration. Component 4 assessed the efficiency and effectiveness of sleep. It was calculated by dividing the total number of hours in bed by the total number of hours of actual sleep and then multiplying it by 100. Component 5 (mean of Q No 5) is related to sleep disorders. Component 6 (Q No. 6) is associated with the usage of hypnotic drugs, and component 7 (total score of Q No. 7 and 8) evaluated their inadequate performance in a day. All the questions were rated on a 4-point scale, with scores from 0 (not at all) to 3 (highest score for each component). Hence, the total score of PSQI ranged from a minimum of 0 to a maximum of 21 for all seven components. Higher scores indicated lower sleep quality and a score of 5 or greater indicated poor sleep quality.

Perceived Stress

The fourth section of our questionnaire assessed the prevalence and levels of stress among the participants using the Kessler Psychological Distress Scale (K10), widely used to measure psychological distress due to non-specific reasons in population-based studies. It consists of 10 items, which evaluated the level of anxiety and symptoms of depression among the participants in the past month. Each item was rated on a 5-point scale, ranging from a score of 10 to a score of 50. Scores ranging from 20 to 24 indicated mild distress, from 25 to 29 indicated moderate, and above 30 indicated severe distress among the participants.

Academic Performance

This was evaluated using the marks obtained (%) in the last examination. We categorized the marks as poor (35-54), moderate (55-74), and high (≥ 75).

Statistical Analysis

Data from the completed forms were transferred to Microsoft Excel and then analysed using SPSS (Statistical Package for Social Sciences) software, version 20.0 (SPSS Inc., Chicago, IL, USA). A normality test (Kolmogorov-Smirnov) was run for all data. Descriptive statistics included means, standard deviation, and percentages. Kruskal Wallis, Mann-Whitney U, and Chi-square tests were applied for statistical analysis. A

correlation test was applied to evaluate the association of marks obtained and the global PSQI score and K10 score. The level of significance was set at p ≤ 0.05.

Results

The questionnaire in the form of Google Forms was sent to 286 students, out of which the response rate was 81.8% (234). The participants were 18 to 27, with a mean age of 21.47±1.61. Demographic characteristic distribution of the study population shows that most of them, 151 (64.5%), were females. Representation per the academic year distribution revealed that the first-year BDS (28.6%) was followed by the second-year BDS (23.1%), students, and others. Most of the participants scored moderately (57.3%) and high (28.6%) in their last examination, with only 14.1% of them scoring low (Table 1).

Table 1. Distribution of participants according to gender, academic year, and marks obtained in the last examination.

Variables	N (%)
Gender	
Males	83 (35.5)
Females	151 (64.5)
Academic year	
First-Year	67 (28.6)
Second Year	54 (23.1)
Third Year	43 (18.4)
Fourth-Year	49 (20.9)
Interns	21 (9.0)
Percentage of marks obtained in the last examination	
35-54	33 (14.1)
55-74	134 (57.3)
≥ 75	67 (28.6)

Females scored higher than males, though the difference was not statistically significant (p=0.767). The overall percentage of marks obtained was high in the pre-board examination and first-year BDS but declined in the latter years, being the lowest in the final year. These results were statistically significant (p=0.001) (Table 2).

Table 2. Marks obtained during the last examination. Based on academic year and gender.

Variables	Poor N (%)	Moderate N (%)	High N (%)	p-value
Gender				0.767
Males	13 (39.4)	45 (33.6)	25 (37.3)	
Females	20 (60.6)	89 (66.4)	42 (62.7)	
Academic year				0.001*
First Year	7 (21.2)	43 (32.1)	17 (25.4)	
Second Year	0 (0.0)	23 (17.2)	31 (46.3)	
Third Year	8 (24.2)	34 (25.4)	1 (1.5)	
Fourth-Year	11 (33.3)	29 (21.6)	9 (13.4)	
Interns	7 (21.2)	5 (3.7)	9 (13.4)	

*Statistically Significant.

The Global PSQI scores range from 0 to 19. The overall mean Global PSQI score of our study population was 4.87±4.5. Males (4.43±3.97) had better sleep quality than females (5.11±4.72), but the Mann-Whitney U test showed that the difference was not statistically significant (p=0.58). The mean scores for all the seven components of PSQI were lower among males; again, these findings were insignificant (p>0.05).

According to the academic year, the first-year students (3.97±3.57) had good sleep quality, and the others had poor sleep quality (mean PSQI scores>5). These findings were statistically non-significant (p=0.66) per the Kruskal-Wallis test. Among the various components of PSQI, only the fourth component regarding the efficiency and effectiveness of sleeping exhibited a statistically significant relationship (p=0.001). This was further subjected to a Dunn's post-hoc test, which revealed the existence of a statistically significant difference between first- and second-year students (p= 0.006) and also between the first and fourth-year BDS students (p=0.001) (Table 3).

Table 1. Mean scores of the seven components of PSQI based on gender and academic year.

Components of PSQI	Gender			Academic Year (Mean±SD)					
	Males Mean±SD	Females Mean±SD	p-value	First Year Mean±SD	Second Year Mean±SD	Third Year Mean±SD	Fourth Year Mean±SD	Interns Mean±SD	p-value
Subjective Sleep Quality	0.19±0.48	0.33±0.66	0.16	0.24±0.53	0.31±0.69	0.37±0.69	0.24±.0.56	0.24±0.54	0.89
Delays in Falling Asleep	1.02±0.87	1.04±0.94	0.95	0.88±0.86	1.09±0.88	1.05±0.98	1.10±0.92	1.19±1.08	0.57
Sleep Duration	0.35±0.67	0.34±0.72	0.71	0.18±0.52	0.46±0.79	0.33±0.68	0.41±0.76	0.48±0.87	0.22
Efficiency and Effectiveness of Sleeping	0.64±0.77	0.75±1.01	0.81	0.37±0.83	0.89±1.02	0.70±0.83	0.96±0.91	0.81±0.98	0.001*
Sleep Disorders	1.13±0.76	1.21±0.71	0.54	1.12±0.62	1.24±0.76	1.28±0.83	1.10±0.62	1.24±0.94	0.78
Hypnotic Drugs	0.29±0.74	0.42±0.87	0.21	0.30±0.76	0.43±1.86	0.47±0.96	0.39±0.81	0.29±0.72	0.81
Inadequate Performance Throughout the Day	0.81±1.24	1.00±1.38	0.37	0.88±1.20	0.87±1.40	1.16±0.1.51	0.82±1.20	1.05±1.49	0.84
Global PSQI Score	4.43±3.97	5.11±4.72	0.58	3.97±3.57	5.30±4.87	5.35±4.97	5.02±4.15	5.29±5.57	0.66

*Statistically Significant.

The mean K10 score was 17.60±8.5 (range= 10-50) (Table 4). Males presented lower stress (15.77±8.51) than females (18.61±8.31), and the Mann-Whitney U test confirmed that the difference was statistically significant (p=0.001). The mean scores for all the ten components of K10 were lower among males, among them feeling nervous such that nothing could calm them down (p=0.071), experiencing restlessness and guilt (p=0.148), and restless to the extent that they could not sit still (p=0.127) were statistically non-significant. According to the academic year, all the students had an almost equal amount of stress. However, the third-year students scored slightly higher stress (18.12±7.48), and the Kruskal Wallis test revealed that the findings were statistically non-significant (p=0.56). The difference in the mean scores of K10 for all the ten components was statistically not significant (p>0.05) (Table 4).

Table 4. Mean K10 score based on gender and academic year.

K10 Components	Gender			Academic Year					
	Males Mean±SD	Females Mean±SD	p-value	First Year Mean±SD	Second Year Mean±SD	Third Year Mean±SD	Fourth Year Mean±SD	Interns Mean±SD	p-value
During the last 30 days, how often do you feel tired for no reason?	1.75±1.07	2.22±1.19	0.001*	1.90±1.14	2.04±1.13	2.23±1.13	2.16±1.18	1.95±1.07	0.51
During the last 30 days, how often do you feel nervous?	1.61±1.06	1.89±0.99	0.003*	1.78±0.99	1.85±1.12	1.86±0.89	1.80±0.98	1.52±0.98	0.59
During the last 30 days, how often do you feel so nervous that nothing could calm you down?	1.42±0.87	1.56±0.86	0.071	1.40±0.74	1.54±0.97	1.42±0.63	1.69±0.98	1.57±0.21	0.47

During the last 30 days, how often do you feel hopeless?	1.63±1.13	1.90±1.05	0.003*	1.81±1.16	1.76±1.18	1.95±1.06	1.73±0.93	1.71±1.06	0.53
During the last 30 days, how often do you feel restless and guilty?	1.64±1.05	1.75±0.97	0.148	1.64±0.85	1.81±1.25	1.63±0.87	1.76±1.03	1.71±1.01	0.99
During the last 30 days, how often did you feel so restless that you could not sit still?	1.39±0.79	1.51±0.82	0.127	1.48±0.80	1.41±0.77	1.37±0.76	1.59±0.96	1.48±0.68	0.73
During the last 30 days, how often do you feel depressed?	1.67±1.16	1.93±1.17	0.020*	1.96±1.23	1.65±1.07	2.00±1.18	1.80±1.15	1.76±1.22	0.42
During the last 30 days, how often do you feel that everything was an effort?	1.67±1.04	2.04±1.17	0.008*	2.01±1.27	1.74±1.07	1.98±1.14	1.86±1.00	2.00±1.18	0.74
During the last 30 days, how often do you feel that nothing could cheer you up?	1.48±1.03	1.88±1.11	0.001*	1.81±1.23	1.57±1.06	1.86±1.10	1.69±0.85	1.81±1.29	0.41
During the last 30 days, how often do you feel worthless?	1.51±1.03	1.93±1.28	0.003*	1.85±1.38	1.63±1.14	1.79±1.13	1.78±1.05	1.90±1.41	0.66
Total K10 Scores	15.77±8.51	18.61±8.31	0.001*	17.63±8.95	17.00±8.82	18.12±7.48	17.86±8.19	17.43±9.28	0.56

*Statistically Significant.

A habit of going to bed before midnight was reported among 140 (59.8%) students. The mean total number of hours of actual sleep was found to be 8.01±1.7 (range: 5-10). The prevalence of sleep quality assessed by using PSQI scores was poor among 89 (38%) of the participants, which was higher among females 59 (39.1%) than males 30 (36.1%) (Table 5). The Chi-square test revealed that the difference in findings between the genders was statistically insignificant (p=0.68). First years 48 (71.6%) and Interns 13 (61.9%) reported having good quality sleep in comparison with other students, but the results were not significant (p=0.407). Concerning the stress scores evaluated using K10 scores, one-fourth, 58 (24.8%) of the students reported a certain amount of stress, with 21 (9%) having severe distress. Stress scores were higher in females (30.5%) than males (14.5%), which was statistically significant (p=0.019). The distribution of stress scores according to the academic years was insignificant (p=0.810).

Table 5. Prevalence of sleep quality and stress among the study population according to gender and academic years.

	Global PSQI Score			K10 Score				
Variables	Good Sleep Quality (PSQI < 5)	Poor Sleep Quality (PSQI ≥ 5)	**p-value**	No Distress (K10 < 20)	Mild Distress (K10 20-24)	Moderate Distress (K10 25-29)	Severe Distress (K10 ≥ 30)	**p-value**
Gender								
Males	53 (63.9)	30 (36.1)	0.68	71 (85.5)	2 (2.4)	3 (3.6)	7 (8.4)	0.019
Females	92 (60.9)	59 (39.1)		105 (69.5)	19 (12.6)	13 (8.6)	14 (9.3)	
Academic Year								
First-Year	48 (71.6)	19 (28.4)	0.407	50 (74.6)	3 (4.5)	7 (10.4)	7 (10.4)	0.810
Second Year	31 (57.4)	23 (42.6)		43 (79.6)	3 (5.6)	3 (5.6)	5 (9.3)	
Third Year	24 (55.8)	19 (44.2)		31 (72.1)	6 (14.0)	2 (4.7)	4 (9.3)	
Fourth-Year	29 (59.2)	20 (40.8)		36 (73.5)	7 (14.3)	3 (6.1)	3 (6.1)	
Interns	13 (61.9)	8 (38.1)		16 (76.2)	2 (9.5)	1 (9.0)	2 (9.5)	
Total	145 (62.0)	89 (38.0)		176 (75.2)	21 (9.0)	16 (6.8)	21 (9.0)	

The correlation analysis was used to test the association between the student's academic performance and Global PSQI score and K10 scores (Table 6). A statistically insignificant weak relationship was observed between the scores with PSQI (r=0.029, p=0.663). Stress scores were inversely correlated with academic performance (r=-0.015, p=0.823), which was not significant. A moderate relationship (r=0.523) was found between the PSQI and the K10 scores among the study subjects, which was statistically significant (p=0.001).

Table 6. Spearman's correlation analysis between the study variables.

Spearman's rho		Marks Obtained in the Last Examination	Global PSQI Score	K10 Score
Marks Obtained in the Last Examination	Correlation Coefficient	1.000	0.029	-.015
	p-value		0.663	0.823
Global PSQI Score	Correlation Coefficient	0.029	1.000	0.523
	p-value	0.663		0.001
K10 Score	Correlation Coefficient	-0.015	0.523	1.000
	p-value	0.823	0.001	

Discussion

The dental sciences course exerts a lot of mental and physical stress on dental students, which might be because of the vast syllabus and curriculum and long working hours involving both academics and clinical practice. This leads to reduced sleep hours, increased distress, and escalated work burdens. So, the current study was conducted to assess the quality of sleep and the level of distress among dental students and to analyse their association with their academic performance.

Most dental students rated their sleep to be either fairly or very good and reported that they underwent no or mild distress. The same was reflected in the PSQI and K10 scores, which were used to assess the sleep quality and the level of stress, respectively, among the students, which revealed that a majority of the students had good sleep quality (PSQI ≤ 5; 62%) and experienced no distress (K10 < 20; 75.2%). Similar results were found in the study conducted by Asiri et al. [17]. But, these findings were contradictory to the conclusions of the studies undertaken by Elagra et al. [14], Valic et al. [11], and Serra-Negra et al. [18]. Globally, the sleep of medical students has been estimated to be 19% in China, 40% in Lithuania [19], 50.9% in the USA [20], and 55.8% in Ethiopia [2]. It was also found in the present study that third-year BDS students were highly dependent on hypnotic drugs to fall asleep. In contrast, the most minor dependency was found among the interns, although the difference was not significantly different.

It has been firmly established that sleep quality and stress influence learning. A systematic review by Schotac et al. [21] showed that inadequate sleep is associated with adverse outcomes in several areas of health and functioning, including somatic and psychosocial health, school performance, and risk-taking behavior. The current study showed statistical significance among all the academic years regarding the marks obtained in the last examination. Still, no such relevance was observed in terms of their sleep quality and their level of stress. However, a study by Jacob et al. showed that first-year BDS students experienced the poorest sleep quality and, hence, the highest stress compared to senior students [22].

The current study showed that the sleep quality score (PSQI) and the level of stress (K10) were significantly positively associated with each other. Even the total number of sleepless hours in bed was significantly positively associated with each other. A similar association has been seen in the studies conducted by Valic et al. [11] and Elagra et al. [14].

The present study showed that the association between gender and the level of stress (K10 score) was significant. Females stated that they felt more tired for no reason, more nervous, hopeless, and depressed, and that nothing could cheer them up as compared to males. Stress is more prevalent in females than in males, which was also shown by the study conducted by Alotaibi et al. [23] and Jowkar et al. [13,15]. A study by Lin et al. [24] found no significant difference between the two genders in terms of their level of stress. Further, a study by Murphy et al. [25] showed that dental students underwent more stress than their medical counterparts.

Although the first class in the morning starts at 8:00 A.M, many students stated that they go to bed at or beyond midnight, thus reducing their bedtime or total sleep hours and increasing their stress level due to poor sleep quality. Another point to note in the study was that the first-year BDS students had the most prolonged sleep hours, and the second-year students had the shortest. This might be related to the sudden change in the study pattern experienced by first-year BDS students. The study also showed that the male students had higher sleep duration than the female students. However, a survey by Sladek et al. showed contradicting results [26].

The association of the PSQI scores and the K10 scores, although positively correlated to the dental students' academic performance, was not statistically significant. Similar results have been found in a few previous studies [13,15] and a systematic review conducted by Duarte et al. [27] But, Elagra et al. [14] showed that poor sleep quality in dental students was associated with lower academic performance, especially for the students in the clinical years. This discrepancy in the results of the various studies could be attributed to the fact that the existence of many factors and variables, namely, social relationships and activities, family income and priorities, different kinds of mental states among the students, the importance of social media in their respective lives, and dependency on medications, which are neither under the control of the participants nor the researchers [28].

This cross-sectional study has a few limitations. The sample of undergraduate dental students belonged to one dental college; hence, caution must be exercised to generalize the findings. We could not assess the cause-effect relationship between the PSQI and K10 scores and academic performance among students. Longitudinal, multicentre studies should be conducted to identify the effect of poor sleep quality and distress levels among dental students and its likely implications on their academic performance. Moreover, our results and analysis depended upon the students' self-reported responses to the questionnaire, which can have a reporter bias.

Conclusion

Participants in this study were found to have good sleep quality and no distress. The analysis showed no significant relationship between PSQI and K10 scores and dental students' academic performance. However, a significant positive correlation was found between PSQI and K10 scores.

Authors' Contributions

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All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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