Original Research Paper

Physiology

QUALITY OF SLEEP AND ACADEMIC PERFORMANCE IN MEDICAL STUDENTS.

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ABSTRACT Sleep plays a significant role in consolidating learning and memory. Sleep deprivation results in day time sleepiness and impaired neuro-cognitive and psychomotor performance. This main objective of this study was to find out the prevalence of sleep disorder among medical students, and to look for any association between sleep disorder and their academic performance. This is a cross sectional study conducted in 196 medical students. The Pittsburgh sleep quality index (PSQi), a self-rated questionnaire that assesses sleep quality over a time interval of one month, was adopted in the study. Academic performance was graded as: poor: 20%; below average: 21 – 40 %; average: 41- 60%; above average: 60%. Epworth Sleepiness Scale for Daytime Sleep Deprivation Assessment was used to evaluate daytime sleepiness. Among the total 196 respondents, 74(37.76%) students reported poor sleep quality and 32(26.23%) students had daytime sleepiness. The present study did not reveal any correlation between sleep quality and academic performance.

KEYWORDS : Quality of Sleep, academic performance, daytime sleepiness

INTRODUCTION:

Sleep is an essential component for adolescent growth and development. Several studies have revealed that age, sex, socio-economic status, daily life habits, and psychological aspect are contributory factors for sleep disturbances.[1] Additionally, lifestyle, sleeping habits, and course curriculum affects the sleep quality. The quality of sleep affects the leisure activity and academic progress. Poor academic performance, depressed mood, irritation during the day, and daytime sleepiness (DS) are the consequences of insufficient sleep. [2] Sleep is suggested to play a significant role in consolidating learning and memory. Sleep deprivation results in day time sleepiness and impaired neurocognitive and psychomotor performance. [3]

Certain sleep habits were associated with lower academic performance. A late bedtime on weekdays and weekends was associated with lower academic performance. [4] Therefore, sleep deprivation would result in impairment of words, psychological and neurocognitive function [5]. A review by Curcio et al. in 2006 suggested that student learning and academic performance are closely linked to sleep quality and quantity. [5] Most sleep specialists indicate that adult humans require approximately 8 hours of sleep per day. [6] A study on a group of Brazilian medical students showed that excessive daytime sleepiness adversely affected their academic performance. [7] Another Brazilian study showed a correlation between sleep onset, sleep regularity, and sleep length with academic performance of medical students. [8] Many studies have been conducted among medical students supporting the finding that low sleep quality could affect the academic and clinical performance of medical students .[9-10] However, some studies have denied any relation between sleep quality and performance among residents. [11]

Objectives: Based on the significance of sleep quality on academic performance, especially among medical students, this study was initiated to find out the prevalence of sleep disorder among medical students, and to look for any association between sleep disorder and their academic performance.

Methodology:

This is a cross-sectional study conducted in a rural private Medical college in AP among undergraduate medical students. A total of 196 second and third year medical students participated in this study. Students at these academic levels do not have night calls or shift rotations. Among them, 130 were female and 66 were male. *The Pittsburgh sleep quality index (PSQi)* [12], a self-rated questionnaire that assesses sleep quality over a time interval of one month, was adopted in the study. The Pittsburgh sleep quality index (PSQi), a self-rated questionnaire that assesses sleep quality over a time interval of one month, was adopted in the study. Seven properties of sleep were evaluated by this questionnaire:

1. Sleep quality of the individual
2. Time it takes for an individual to sleep
3. Duration of sleep
4. Sleep efficiency
5. Bedtime problems
6. Use of sleeping medication
7. Impairment in daily functioning

The scores for each question range from 0 to 3, with 0 indicating the highest sleep quality and 3 indicating the lowest one. The seven component scores are then added to yield a global PSQi score in the range of 0 to 21; the higher the score is, the worse the sleep quality. A global score greater than 5 indicate poor sleep quality in the past month and a score $\leq$ 5 indicate good sleep quality. All the participants were informed about the targets of the research, the methods of the study, and how to fill the questionnaires. All procedures were performed only with the consent of the participants, and all information was used solely for this research. Those who did not give their consent to participate were excluded. The subjects were followed-up for a month; their previous internal marks were considered for grading the academic performance.

Academic performance was graded as: poor – 20%; below average – 21 – 40 %; average – 41- 60%; above average - 60%.

Students with known chronic medical illnesses or those who were taking drugs that cause sleepiness were excluded from the study. Then, the questionnaires were distributed among the participants. After completion, the questionnaires were collected from the subjects, and the incomplete ones (e.g., an unanswered item or an ambiguous answer) were removed from the study.

Epworth Sleepiness Scale for Daytime Sleep Deprivation Assessment: This scale shall be used to evaluate daytime sleepiness [13]. ESS is a standardized validated questionnaire that assesses the likelihood that the subject will fall asleep during certain activities. It consists of eight items describing different situations and activities of daily living. ESS scores range from 0–24, and based on previous studies, the upper limit of a normal score is estimated to be 10. ESS scores >10 indicate increased daytime sleepiness.

Approval was obtained from the Institutional Ethics Committee. Written informed consent was obtained from the participants after explaining the procedure and ensured that the information pertaining to the subject will not be disclosed to others.

Statistical analysis: The data obtained was analyzed by using Descriptive statistics. Spearman rank correlation was used to correlate the association between the mean scores of PSQi and ESS with Academic performance. Component analysis of individual components of PSQi with ESS and Academic performance was done using linear regression.

RESULTS:
Among the 196 students we observed that 122(62.24%) students had good sleep quality basing on PSQi scores (≤ 5) and 74(37.76 %) students had poor sleep quality (PSQi scores >5). Of these students with good sleep quality (122), we found that 90(73.77%) students had ESS scores ≤10 which indicate no day time sleepiness and 32(26.23%) students had ESS scores greater than 10 which indicate day time sleepiness even though they had good sleep quality.

Among the 74 students with poor sleep, 51(68.92%) students had ESS scores ≤ 10 which indicate no day time sleepiness even though they had poor sleep and 23(31.08%) students had ESS scores >10 indicating day time sleepiness.

When we compare academic performance in good and poor sleep quality students , we observed that 7(5.74 %) students have poor academic performance, 45(36.89%) students have below average academic performance,61(50%) students had average academic performance and 9(7.38%)students had above average academic performance among students with good sleep quality (PSQi ≤ 5).(Table-3)

 4 (5.41%) students had poor academic performance , 31(41.89%) students had below average academic performance, 36(48.65%) students had average academic performance and 3(4.05%) students had above average academic performance among students with poor sleep quality (PSQi>5).(Table-3)

On analysis by spearman rank correlation, we observed that R= -0.08687 and two tailed p is 0.22361when PSQi scores (Sleep Quality) were compared with academic performance which is not statistically significant among the total sample (n=196) indicating no statistically significant relation between sleep quality and academic performance. (Table-1)
When PSQi scores (Sleep quality) were compared with ESS scores (Day time sleepiness) by spearman rank correlation, we observed an R value= 0.07716 and two tailed p value to be 0.2799 which is not significant statistically among total sample (n=196) indicating no statistically significant relation between sleep quality and daytime sleepiness. (Table-1)

When ESS scores which indicate daytime sleepiness were compared with academic performance, we observed an R value = 0.08824 and two tailed p value to be 0.2163 which is not statistically significant among total sample (n=196) indicating no statistically significant relation between

daytime sleepiness and academic performance. (Table-1)

Among students with good sleep (PSQi ≤5) (n=122), we observed no significant relation between daytime sleepiness and academic performance (p=0.6328). Among students with poor sleep quality (PSQi >5) (n=74) we observed no significant relation between daytime sleepiness and academic performance (p=0.14306). (Table-2)

Among students with good sleep quality (PSQi n=122) (Table-4) on analysis by individual component of PSQi, C1 which represents *subjective sleep quality*, we observed that 78 students (63.94%) had very good subjective sleep quality, 44 students (36.065%) had fairly good subjective sleep quality. On Analysis of component C2 which represents *Sleep Latency*, 42 students (34.45%) had ≤15 min sleep latency,61 students (50%) had 16-30 min of sleep latency,12 students (9.84%) had 31-60 min of sleep latency and 7 students (5.74%) had >60 min of sleep latency. On analysis of component C3 which represents *Sleep duration*, 85 students (69.67%) had sleep duration greater than 7 hours , 27 (22.13%) students had sleep duration 6-7 hrs, 8 (6.56%) students had sleep duration 5-6 hrs and 2 (1.64%) students had sleep duration < 5 hrs. On analysis of component C4 which represents *Sleep Efficiency*, 95 (77.87%) students had sleep efficiency > 85%; 24 (19.67%) had sleep efficiency between75-84%; 2 (1.64%) had sleep efficiency between 65-74% and 1 student had sleep efficiency <65%. On analysis of C5 which represents *Sleep disturbance*, 25 students (20.49%) had no sleep disturbance in the past month; 96 (78.69%) had sleep disturbance less than once a week even though they had good sleep quality;1 (0.82%) had sleep disturbance once/twice a week in the past month . On analysis of C6 which represents *Use of sleep medication*, 115 (94.26%) had no use of sleep medication during the past month, 7(5.74%) students had sleep medication less than once a week. On analysis of C7 which represents *Daytime dysfunction*, 69 (56.56%) students had no daytime dysfunction during past one month, 49(40.165) students had daytime dysfunction less than once a week in the past month, 3 (2.46%) students had daytime dysfunction once/twice a week in the past month and 1 student had daytime dysfunction three or more times a week in the past month even though they had good sleep quality.

Among students with poor sleep quality (PSQi n=74) (Table-5) on analysis by individual component of PSQI, C1 which represents *subjective sleep quality*, we observed that 8 students (10.81%) had very good subjective sleep quality, 49 students (66.21%) had fairly good subjective sleep quality, 14 students (18.92%) had fairly bad subjective sleep quality and 3 students (4.05%) had very bad subjective sleep quality. On Analysis of component C2 which represents *Sleep Latency*, 3 students (4.05%) had ≤15 min sleep latency,25 students (33.78%) had 16-30 min of sleep latency,36 students (48.65%) had 31-60 min of sleep latency and 10 students (13.51%) had >60 min of sleep latency. On analysis of component C3 which represents *Sleep duration*, 12 students (16.22%) had sleep duration greater than 7 hours , 24 (32.43%) students had sleep duration 6-7 hrs, 28 (37.84%) students had sleep duration 5-6 hrs and 10 (13.51%) students had sleep duration < 5 hrs. On analysis of component C4 which represents *Sleep Efficiency*, 27 (36.49%) students had sleep efficiency > 85%; 29 (39.18%) had sleep efficiency between75-84%; 12 (16.22%) had sleep efficiency between 65-74% and 6 students (8.11%) had sleep efficiency <65%. On analysis of C5 which represents *Sleep disturbance*, 1 student (1.35%) had no sleep disturbance in the past month; 48 (64.86%) had sleep disturbance less than once a week; 16 (21.62%) had sleep disturbance once/twice a week in the past month. On analysis of C6 which represents *Use of sleep medication*, 52 (70.27%) had no use of sleep medication during the past month,17(22.97%) students had sleep

medication less than once a week, 5 students (6.76%) had once or twice a week. On analysis of C7 which represents *Daytime dysfunction*, 10 (13.51%) students had no daytime dysfunction during past one month, 48(64.86%) students had daytime dysfunction less than once a week in the past month, 16 (21.62%) students had daytime dysfunction once/twice a week in the past month and none had daytime dysfunction three or more times a week in the past month.

Tables:

Table-1 Comparison of Mean values of PSQi, ESS and Academic performance among the total respondents

n=196	PSQi	ESS	P Value
Mean	5	8.5606	0.2799
± SD	± 2.806	± 3.166	R= 0.07716
n=196	PSQi	Academic Performance	P Value
Mean	5	42.9318	0.22361
± SD	± 2.806	± 12.801	R= -0.08687
n=196	ESS	Academic Performance	P Value
Mean	8.5606	42.9318	0.2163
± SD	± 3.166	± 12.801	R= 0.08824

Table-2 Comparison of Daytime sleepiness and Academic performance among Good and poor sleep quality respondents

	Good Sleep (n=122)	Poor Sleep (n=74)	P Value
ESS (Mean ± SD)	8.393 ± 3.129	8.756 ±3.055	0.6328
Academic Performance (Mean ± SD)	43.557 ±13.326	41.668 ±11.932	0.14306

Table-3 Academic performance among total respondents n=196

Academic Performance (%)	Good Sleep (n=122)	Poor Sleep (n=74)
Poor 0 - < 20%	7 (5.74%)	4 (5.41%)
Below average 21-40%	45 (36.89%)	31 (41.89%)
Average 41-60 %	61 (50%)	35 (48.65%)
Above average > 60%	9 (7.38%)	3 (4.05%)

Table 4 - Component Analysis Among Respondents with Good Sleep (n=122)

C1 Subjective Sleep Quality	Very Good	Fairy Good	Fairy Bad	Very Bad
	78(63.93%)	44(36.06%)	0	0
C2 Sleep Latency	≤ 15 min)	16-30 min	31-60 min	> 60min
	42 (34.45%	61 (50%)	12 (9.84)	7 (5.74%)
C3 Sleep Duration	> 7 hours	6-7 hours	5-6 hours	< 5 hours
	85(69.67%)	27(22.13%)	8(6.55%)	2(1.64%)
C4 Sleep Efficiency	> 85%	75-84%	65-74%	65%
	95 (77.87%)	24(19.67%)	2(1.64%)	1 (0.82%)
C5 Sleep Disturbance	No Disturbance Past 1 month	< Once a Week	Once/Twice a week	Three or More times
	25 (20.41%)	96 (76.69%)	1 (0.82%)	0
C6 Sleep Medication	No	< Once a Week	Once/Twice a week	Three or More times
	115(94.26%)	7(5.73%)	0	
C7 Day Time Dysfunction	No	< Once a Week	Once/Twice a week	>3 per week
	69(56.55%)	49(40.16%)	3(2.45%)	1(0.81%)

Table 5 - Analysis Among Respondents with Bad Sleep (n=74)

C1 Subjective Sleep quality	Very Good	Fairy Good	Fairy Bad	Very Bad
	8(10.81%)	49(66.22%)	14(18.91%)	3(4.05%)
C2 Sleep Latency	≤ 15 min)	16-30 min	31-60 min	> 60min
	3 (4.05%)	25 (33.78%)	36 (48.65%)	10 (13.51%)
C3 Sleep Duration	> 7 hours	6-7 hours	5-6 hours	< 5 hours
	12(16.21%)	24(32.43%)	28(37.83%)	10(13.51%)
C4 Sleep Efficiency	> 85%	75-84%	65-74%	65%
	27 (36.49%)	29 (39.18%)	12 (16.22%)	6 (8.11%)
C5 Sleep Disturbance	No Disturbance Past 1 month	< Once a Week	Once/Twice a week	Three or More times
	1 (1.35%)	48 (64.86%)	16 (21.62%)	0
C6 Sleep Medication	No	< Once a Week	Once/Twice a week	Three or More times
	52 (70.27%)	17 (22.97%)	5 (6.76%)	0
C7 Day Time Dysfunction	No	< Once a Week	Once/Twice a week	>3 per week
	10(13.51%)	48(64.86%)	16(21.62%)	0

DISCUSSION:

The prevalence of sleep disorders in the general population has been estimated to be 15% - 35% [14], and in medical students it was evaluated at about 30% [15]. Recent studies have demonstrated that the sleep-wake cycle of medical students is characterized by insufficient sleep duration, delayed sleep onset, and occurrence of napping episodes during the day [16,17], which has been found to affect cognitive function in medical students [18]. Moreover, multiple studies have indicated a high correlation between sleep duration and performance in some activities and in subjective alertness [19, 20]. Medical students require cognition and alertness abilities that are impeded by sleep disorders [21]. Many studies have demonstrated a high level of psychological distress, anxiety, and depression in medical students in different countries [22]. Many studies have been conducted among medical students supporting the finding that low sleep quality could affect the academic and clinical performance of medical students [9, 10].

In the present study, decreased sleep quality and daytime sleepiness was found to be common among medical students. Among the total 196 respondents, 74(37.76%) students reported poor sleep quality and 32(26.23%) students had daytime sleepiness. Among the respondents with good sleep quality majority of them had no daytime sleepiness (73.77%) and 32(26.23%) respondents had daytime sleepiness even though they had good sleep quality. The overall prevalence of

daytime sleepiness among the respondents was 28.06%.The reported prevalence in this study is less when compared with studies done in Pakistan (39.5%) and Malaysia (35.5%) [23, 24], but well below the medical students in Brazil (63%) [25].Individual components of PSQi when analyzed among respondents with good sleep, we observed that majority of them had good subjective sleep quality, sleep latency of 16-30 minutes ,sleep duration greater than 7 hrs, sleep efficiency greater than 85%,no use of sleep medication ,no daytime dysfunction even though they experienced sleep disturbance less than once a week. Individual components of PSQi when analyzed among respondents with poor sleep, we observed that majority of them had fairly good subjective sleep quality, sleep latency of 31-60 minutes, sleep duration between 5-6 hrs, sleep efficiency between 75-84%, daytime dysfunction less than once a week but still they managed with no use of sleep medication .Sleep duration, sleep latency, sleep efficiency and daytime dysfunction were altered when respondents with poor sleep quality were compared with respondents with good sleep quality.

The current study did not reveal any correlation between sleep quality and the academic performance similar to a study done in Palestinian students [17]. In a study by Iqbal et al also, there was no significant association between sleep quality and academic performance [10] .However, some studies have denied any relation between sleep quality and performance among residents [11].Our study did not correlate with the Iranian study which concluded that poor sleep quality was reported in all medical sciences schools in a university of medical science in the northwest of Iran and was associated with academic achievement [26].

Poor sleep quality has been associated with reduced academic achievement and sleep quality has also been reported to be related to negative effects on health, emotional feelings and well-being in college students [27]. Bahammam [4] concluded that decreased nocturnal sleep time is negatively associated with academic performance in medical students. Recent studies in molecular genetics, neurophysiology ,cognitive and behavioural neurosciences reported that, sleep may play an important role in memory consolidation and learning processes [28,29].

Poor quality of sleep, including short sleep duration, irregular sleep schedules, sleep deprivation, and daytime sleepiness, have all been indicated to negatively affect university students' academics [30-33]. Fallone and Wolfson [34-36] reported that a poor sleep habit with an increased sleep fragmentation, late bedtimes and early awakenings, usually tend to associate with a decreased academic performance and a reduced neurobehavioral functioning in general.

Our study didn't find any correlation between sleep quality and student's academic performance which doesn't go in line with Curcio et al [5], Bahammam et al [4].This inconsistency can be explained by limitations of study design and self-report data, which are subjected to several sources of error including recall and social desirability leading to either over or under-reporting.

In Asia, epidemiological data of sleep problems among medical students are available from China, Hong Kong, Malaysia, India, and Iran. In a Chinese study, 19% of the medical students were found to have poor sleep quality as assessed by the Pittsburgh Sleep Quality Index (PSQi), with differences seen between years of study but not between genders [37]. Another study in Chinese medical students reported that more than 90% of the undergraduates had experienced excessive sleepiness in class, with more males than females affected [38]. About 70% of Hong Kong medical students self-reported sleep deprivation, confirmed by objective actiwatch recordings, with no significant gender and age differences [39].

A large survey study of Malaysian medical students revealed that daytime sleepiness occurred in 35.5% (as assessed by Epworth Sleepiness Score [ESS] > 11), and poor sleep quality was reported by 16% [40]. In Europe, one Lithuanian study revealed poor sleep quality in 40% of medical students as measured by the PSQI [41]. Al Adel AM, Al Olayan LI [42] concluded that the effect of sleep quality and general mental well-being on academic achievement is inconclusive, the findings which were consistent with our study. Sepehr Rasekhi et al [43] studied about the effects of sleep quality on the academic performance of undergraduate medical students and they observed that a significant relationship between PSQi scores and marital status, habitat, smoking, physical activity, and academic performance.

Summary:
The exact prevalence of poor sleep in medical students varies between studies based on the measurement tools used but also related to the significant differences in baseline demographics including age, gender. Apart from these issues, cultural differences would be an important aspect that will contribute towards the variability of sleep problems across countries, but this theme has not been mentioned clearly in available studies. But if we consider the broad cultural grouping (e.g., Western and non-western countries), they all showed more or less similar patterns in the studies. In general, the current data consistently showed that medical students around the world frequently report symptoms of either insomnia or sleepiness. In several studies, it appears that the prevalence of sleep complaints exceeds that of the general population.

Conflicts of Interest: Nil

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