Additional wakefulness: A study on self-violation chronic sleep restriction and its effect on medical students

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Introduction

Sleep is a physiological process essential for life. Good quality and adequate amount of sleep is important in order to have better cognitive performance and to avoid health problems and psychiatric disorders. The amount of sleep clocked in is also very important and is positively correlated with alertness and psychomotor vigilance [1]. Its quality is strongly related to psychological and physical health and other measures of well-being [2]. Sleep is also believed to have facilitating role in learning and memory process [3, 4].

Sleep deprivation experiments conducted on humans have shown that sleep deprivation causes impairment of performance, vigilance, attention, concentration and memory [5]. Individuals that report poor sleep quality and other sleep-related disturbances may be at higher risk for depression and other psychiatric disorders throughout their lifetime [6].

Sleep loss due to voluntary bed time curtailment owing to their hectic schedules, medical students are known to have erratic sleep patterns. Sleep itself is in short supply for young physicians in their formative years because they stay up late to cram for examinations in medical college followed by prolonged shifts at the hospital [7].

The present study was designed to determine the prevalence of sleeping difficulties, self-violation chronic sleep restriction and psychological stress among medical students. We also aim to explore correlation of academic stress and academic achievements with sleep quality in medical students.

Materials and Methods

A cross sectional study was carried out on quality of sleep and sleeplessness-related problems on healthy medical students age ranged between 18 to 28 years belonging to both the sexes who volunteered for the study.180 medical students participated in this study, 30 undergraduates from each semesters (2nd, 4th, 6th, and 8th semester), 30 medical interns and 30 postgraduate medical (medical PG) students of Dr. D. Y. Patil Medical College Pimpri, Pune, Maharashtra. This study group (medical students) was compared with 30 Arts students of same age group from Dr. D.Y. Patil University, served as the control group. Ethics approval for the study was received from "Institutional Ethics- Committee".

Assessment of sleep quality, assessment of academic stress, academic achievement and evaluation of perceive stress was carried out for both the groups with the help of approved standardized questionnaires and was compared between control and study groups. Anthropometry measurements [like height, weight, BMI] were also taken for all the participants.

Pittsburgh Sleep Quality Index (PSQI) was used for assessment of quality of sleep. PSQI is a self-reported instrument in which questions are framed in a 4- point Likert-type scale and it analyzes factors such as sleep quality, sleep latency, sleep duration, sleep efficiency, and sleep disturbance, use of sleep medication and day time dysfunction. Individual

score of each component is added to get global PSQI score [8].

Day time sleepiness was measured using the Epworth Sleepiness Scale (ESS). This scale is used to identify excessive sleepiness associated with accumulated sleep debt or clinical sleep disorders. The ESS is used to rank participants' likelihood of falling asleep in different situations. There are 8 items in ESS. This 8-items scale is scored on a 4-point scale. An aggregate of all 8 items produce a total ESS score [8-10].

Academic stress was evaluated by questionnaire containing potential eight academic stressors and evaluation of sleep quality one night before exam. A modified table of potential academic stressors was adopted from similar study by Waqas A et al [11] and Sreerama reddy et al [12]. Severity of academic stress was rated on 6 point likert scale as not at all stressful (0), very little stressful (1), little stressful (2), moderately stressful (3), highly stressful (4) & extremely stressful (5). Sleep quality one night before exam was rated as very bad (0), bad (1), good (2) & very good (3).

Academic achievement was evaluated on a five point likert scale, as poor (0), below average (1), average (2), good (3) and excellent (4). Similar scale was used by Sweileh et al for their study on students of Palestine national university [13].

Perceived Psychological Stress was evaluated for all the participants using 14-item Perceived Stress Scale (PSS-14). It is the most widely used psychological tool for measuring the perception of stress. It comprises 7 positively-stated and 7 negatively-stated items, and is scored by reverse coding the negatively-stated items and then summing the scores for all 14 items. The scores range from 0 to 56 with higher scores indicating higher levels of stress [14].

Information regarding age, sex, Body Mass Index, addictions was collected and questionnaires were distributed among all the participants. All the students were explained about how to fill the questionnaire.

Students with physical/psychological illness, under any kind of medications and individuals with previously diagnosed sleep disorders were not included in the study.

Statistical Analysis

All the test results obtained in the groups were expressed in Mean + SD (standard deviation). The data analysis was carried out using Microsoft Excel 2010. For all the analysis probability values (p value) < 0.05 were considered as statistically significant and p value < 0.01 were considered as statistically highly significant. Correlation was found out by calculating the Pearson's correlation coefficient (r).

Results

Table 1: Comparison of "Sleep Quality Assessment" in control and study group measured by Pittsburgh Sleep Quality Index (PSQI) score

Statistical analysis:* p < 0.05 is significant; p < 0.01 is highly significant

Table 2: Comparison of "Daytime sleepiness" in control and study group measured by Epworth Sleepiness Scale (ESS) score

Students' Group	C1 Subjective sleep quality (Mean+SD)	C2 Sleep latency (Mean+SD)	C3 Sleep duration (Mean+SD)	C4 Habitual sleep efficiency (Mean+SD)	C5 Sleep disturbances (Mean+SD)	C6 Use of sleep medication (Mean+SD)	C7 Day time dysfunction (Mean+SD)	Global Score (Mean+SD)
Arts (control)	0.3+0.4	0.66+0.60	0.83+0.59	0.3+0.53	0.86+0.46	-	0.36+0.71	3.4+1.56
IMBBS (2semester)	1.2+0.6	1.4+0.91	1.46+1.01	0.75+1.04	1.2+0.60	-	1.28+0.92	8.78+5.88
II MBBS (4semester)	0.9+0.63	0.83+1.01	0.66+0.60	0.56+0.50	1.4+1.56	-	0.56+0.62	5.25+0.90
III MBBS (6semester)	0.7+0.59	1.23+1.00	1.03+1.29	0.4+0.62	1.5+1.73	-	0.96+0.99	6+3.16
Final MBBS (8semester)	1.83+1.09	1.46+1.04	2.2+1.03	0.33+0.66	1.7+1.70	-	1.5+0.72	8.5+1.52
Medical Interns	1.3+0.83	2.16+1.64	1.26+0.90	1.03+1.27	1.3+0.59	-	0.43+0.97	8.3+3.95
Medical PG	1.03+1.71	0.83+0.59	1.6+0.96	1.27+0.86	0.8+60.81	-	1+0.94	8.43+2.52
Statistical analysis (p value)								
IMBBS Vs control	0.0000*	0.0000*	0.03*	0.03*	0.001*	-	0.0000*	0.0000*
IIMBBS Vs control	0.0000*	0.0003*	0.28	0.05*	0.07	-	0.25	0.0000*
IIIMBBS Vs control	0.0000*	0.0000*	0.39	0.50	0.05*	-	0.009*	0.0001*
Final MBBS Vs control	0.0000*	0.0000*	0.0000*	0.83	0.01*	-	0.0000*	0.0000*
Interns Vs control	0.0000*	0.0000*	0.03*	0.005*	0.002*	-	0.0000*	0.0000*
Medical PG Vs control	0.0000*	0.0000*	0.0004*	0.0000*	1.0	-	0.004*	0.0000*

Student Groups	Arts (control)	IMBBS (2semester)	II MBBS (4semester)	III MBBS (6semester)	Final MBBS (8semester)	Medical Interns	Medical PG
ESS score (Mean+SD)	6.73+6.79	10.4+4.98	12.43+5.89	8.83+3.11	9.06+5.18	12.16+4.5	12.5+4.7
p value (control Vs others)	-	0.0006*	0.0000*	0.006*	0.03*	0.0000*	0.0000*

Statistical analysis:*p< 0.05 is significant; p< 0.01 is highly significant

Table 3: **Comparison of "Academic stressors" in control and study group**

(Scale: "0" is no stress & "5" extremely stressful); Statistical analysis: *p< 0.05 is significant; p< 0.01 is highly significant

Table 4: Comparison of "Sleep quality on the night before an exam" in control and study group

Student Groups	Arts (control)	IMBBS (2 semester)	II MBBS (4 semester)	III MBBS (6 semester)	Final MBBS (8 semester)	Medical Interns	Medical PG
Sleep quality on the night before an exam (Mean+SD)	2.26+0.86	1.03+0.76	1.53+0.57	0.93+1.14	0.36+0.71	1.03+0.92	0.4+0.77

Student Groups	Exam frequency (Mean+SD)	Academic performance (Mean+SD)	Academic curriculum (Mean+SD)	Dissatisfaction with class lectures (Mean+SD)	Unavailability of learning materials (Mean+SD)	Lack of leisure time (Mean+SD)	Competition with peers (Mean+SD)	Performance in practical (Mean+SD)
Arts (control)	1.1+1.24	1.1+1.06	1.16+ 1.04	0.26+ 0.69	0+0	0.4+0.9	0.53+ 1.0	0.13+0.5
IMBBS (2semester)	3.31+0.82	3.09+0.85	3.37+1.15	2.78+1.38	2.75+1.77	3+0.95	3.35+0.98	3+1.48
II MBBS (4semester)	3.77+1.5	3.67+1.21	3.67+1.21	3.47+1.3	3.27+1.61	3.4+1.73	3.60+1.86	3.67+1.70
III MBBS (6semester)	3.83+1.08	3.1+1.39	3.06+0.98	2.0+1.09	2.63+1.92	3.2+1.39	3.34+1.56	3.36+1.24
Final MBBS (8semester)	3.46+0.73	4.86+0.73	3.46+0.81	3.53+1.45	3.2+1.74	3.63+0.99	3.4+1.4	3.66+1.70
Interns	3.53+1.40	2.83+1.01	2.7+1.39	2.46+1.69	1.66+1.56	2.73+1.70	2.66+1.39	3.03+0.85
Medical PG	3.1+1.34	2.8+1.58	3.73+1.2	2.9+1.68	1.32+1.63	2.76+1.44	3.5+1.61	3.06+1.20
Statistical analysis (p value)								
IMBBS Vs control	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
IIMBBS Vs control	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
IIIMBBS Vs control	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
Final MBBS Vs control	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
Interns Vs control	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
Medical PG Vs control	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*

p value (control Vs others)	-	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*

(Scale: "0" is very bad, "1" is bad, "2" is good & "3" is very good)
Statistical analysis *p<0.01 is highly significant (control Vs others)

Table 5: Comparison of "Academic achievement" in control and study group

Student Groups	Arts (control)	IMBBS (2semester)	II MBBS (4semester)	III MBBS (6semester)	Final MBBS (8semester)	Medical Interns	Medical PG
Academic achievement (Mean+SD)	2.96 +0.71	2.4+0.93	2.30 +0.83	1.73+1.22	1.96+1.27	2.33+0.80	0.4+0.89
p value (control Vs others)	-	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*

(Scale: "0" are poor, "1" is below average, "2" is average, "3" is good, "4" is excellent)
Statistical analysis:*p<0.01 is highly significant (control Vs others)

Table6: Correlation of "Academic achievement" with "PSQI score"

Students Groups	r value
Medical interns	-0.4
Medical PG	-0.5

Table 7: Comparison of "Perceived Psychological Stress (PSS 14 Score)" in control and study group

Student Groups	Arts (control)	IMBBS (2 semester)	IIMBBS (4 semester)	IIIMBBS (6 semester)	Final MBBS (8 semester)	Medical Interns	Medical PG
PSS Score (mean+SD)	25.5+4.15	27.6+4.81	26.9+3.44	30+5.33	28.4+3.4	27.4+4.81	29.7+5.73
p-value	-	0.09	0.142	0.0004*	0.004*	0.1	0.001*

Statistical analysis:*p<0.01 is highly significant (control Vs others)

Discussion

In the last few years, there has been a growing attention to sleep and sleeplessness related problems. This interest is mainly due to the recognition that sleeplessness and fatigue are becoming endemic in the population [15].

A cross sectional study was carried out on quality of sleep and sleeplessness related problems on 180 medical students , 30 undergraduate from each semesters (2nd ,4th ,6thand 8th semester), 30 medical interns and 30 postgraduate medical students of Dr. D .Y. Patil Medical College Pimpri, Pune, Maharashtra. This study group (medical students) was compared with 30 Arts students (age and BMI

matched) of Dr. D .Y. Patil University, participating as control group.

Assessment of sleep quality, assessment of academic stress, academic achievement and evaluation of perceive psychological stress was carried out for both the groups with the help of approved standardized questionnaires and was compared between control and study groups. Anthropometry measurements [like height, weight, BMI] were also taken for all the participants. None of our participants were obese. All under graduate medical students were hostel lite. None of them had any adjustment problems in hostel &stress related to family.

Table 1 shows the comparison of various components of Pittsburgh Sleep Quality Index (PSQI) between medical students (study group) and Arts students (control group). None of our participants were taking any medication for sleep. The global PSQI score of Arts students were found to be 3.4+1.56 which was less than all medical students of different semesters. These results were statistically highly significant (p<0.01). Further, it was also noted that the global score in medical students were more than five. A global score greater than 5 is regarded as indicative of a poor-quality sleep, whereas a score of 5 or less is regarded as indicative of a good-quality sleep [10]. The observations of PSQI score also shows that "sleep latency" and "sleep disturbance" is statistically significantly high in medical students than the control group. Habitual sleep efficiency was also found significantly poor in medical students (first years, second years, interns and post graduates).These results are indicative of sleeping difficulties in medical students.

Table 2 shows comparison of "Daytime sleepiness" in control and study group measured by Epworth Sleepiness Scale (ESS) score. An aggregate of all 8 items ESS score of Arts students were found to be 6.73+6.79 which was less than all medical students of different semesters. These results were statistically highly significant (p<0.01). Further it was also observed that aggregate scores were greater than 9 in IMBBS, IIMBBS, Medical Interns and Medical PG students indicating significant levels of daytime sleepiness in these students. The ESS is used to rank participants' likelihood of falling asleep in different situations. An aggregate of all 8 items of ESS produce a score between 0 - 24, with scores greater than 9 regarded as significant levels of daytime sleepiness. This scale is used to identify excessive sleepiness associated with accumulated sleep debt or clinical sleep disorders [9,10].

The comparison of "Academic stressors" is shown in Table 3 between control and study group. Potential eight academic stressors were compared between the groups. In our study medical students reported significantly high level of academic stress than their counterparts.

Our university offers a 5and 1/2-year-long MBBS degree divided into four and half years of academics followed by one year of internship. Teaching methods consist of long lectures, tutorials, practical tasks and attending clinics. Students are also frequently assessed with written, oral or practical examinations throughout the year, and each year ends with a final exam held by the university. Results of our study suggest that medical curriculum is very stressful for students. Similar results were also found by Waqas A et al in their study on medical students [11].

Table 4 shows quality of sleep one night before exam in control and study group. Results indicate significantly poor sleep quality in medical students (statistically highly p<0.0000). This also indicates very high academic stress in medical students.

Due to high academic stress and lack of leisure time medical students compromise their sleep duration to meet academic demands. Duration of sleep was found to be statistically significantly poor in medical students (first year, final year, interns and post graduate) than the control group as shown in table 1. This restrictive sleep or additional wakefulness in these student leads to lack of good quality sleep which has adverse effects on cognitive function. In addition to air, water, and food, the only other biological necessity our bodies require is sleep [16]. Sleep is critical for memory consolidation, learning, decision making, and critical thinking [17-20]. Sleep is thus necessary for the optimal operation of key cognitive functions related to academics [21]. Sleep itself is in short supply for young physicians in their formative years because they stay up late to cram for examinations

in medical college followed by prolonged shifts at the hospital [7].

All students were also asked to rate their own academic achievement on a five point scale, as poor (0), below average (1), average (2), good (3) and excellent (4). As shown in table 5, self-rated academic achievement was found to be significantly low in medical students as compared to Arts students. Further, academic achievement was found to be negatively correlated with global PSQI score in medical interns and post graduate medical students (r = -0.4, r = -0.5 respectively) as shown in table 6. Similar self-reported academic achievement scale was used by Sweileh et al. They found a significant correlation between academic achievement and nightmares. The students with higher nightmare frequency have low academic achievement [13].

Table 7 shows comparison of "perceived psychological stress" between control and study group. In our study, medical students (third years, final years and post graduates) were reported significantly high level of psychological stress than control group. According to Shah et al, medical students who reported academic stressors were 3.45 times more likely to be suffering from psychological stress than their counterparts [22].

It is essential for students and health professionals to understand the importance of sleep deprivation and other sleep disorders and their consequences. Loayza and colleagues (2001) showed an association between sleep disturbance and suspicion of psychiatric disorders in medical students [23]. The effect of sleep loss on cognitive performance of resident physicians is well documented by Jacques and coworkers (1990) in a study that demonstrated a decline in composite test score with decreasing sleep on the night before the examination [24].

Conclusion
Medical students carry a large academic load which could potentially contribute to poor sleep quality and psychological stress. There is ample evidence for high incidents of the sleeping problem in medical students. There is a need of stress-management programs for medical trainees and these programs should take sleep habits into account. Stress, associated with insufficient sleep

and excessive daytime sleepiness should be reduced to prevent psychological morbidity and its effect on academic performance in these students.

The results of our study are indicative of sleeping difficulties in medical students. I MBBS, II MBBS, Medical Interns and Medical PG students indicating significant levels of daytime sleepiness. Further, medical students were also reported significantly high level of academic stress and psychological stress than their counterparts.

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