

# Effect of Sleep Deprivation on the Physical, Social and Mental Wellbeing on the Premenstrual Phase in Undergraduate Female Medical Students

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## ABSTRACT

**Introduction:** the aim was to study the relation between sleep deprivation and the physical, mental, social wellbeing in the premenstrual phase of Indian undergraduate female medical students. The objectives were to determine the prevalence of premenstrual syndrome and to study the effect of sleep deprivation with the regularity of the menstrual cycle in these students.

**Material and Methods:** the study included 219 female undergraduate medical students, whose age ranged between 17 and 21 years. The students were categorised into those who are having night sleep less than 6 hours and those who have more than 6 hours. Seven to ten days prior to the beginning of menstruation was considered as the premenstrual phase.

**Results:** in the present study, 85.4% of the students had symptoms of premenstrual syndrome. The comparison was not statistically significant for less than 6 hours of sleep and premenstrual symptoms and the regularity of the menstrual cycles ( $p > 0.05$ ). However, it was observed that the students who had less than 6 hours of night sleep were associated with the depressed mood and fatigue ( $p < 0.05$ ) during the premenstrual phase.

**Conclusion:** the present study observed that, there is no significant association between the sleep deprivation and the regularity of the menstrual cycles, general physical symptoms, social life and relationships in the premenstrual phase in female medical students. However, lack of sleep had significant relationship with the depressed mood and fatigue in the premenstrual phase. The students need to be advised to have more than six hours of night sleep on daily basis.

**Keywords:** Fatigue; Irritable mood; Menstrual cycle; Premenstrual syndrome; Sleep deprivation.

## Introduction

Most of the females of reproductive age suffer from some kind of discomfort during the weeks before the menstruation<sup>1</sup>. This discomfort is known as the premenstrual syndrome (PMS) and its severe form is termed as the premenstrual dysphoric disorder. PMS is characterized by symptoms like abdominal pain, back ache, mood irritation, bloating of abdomen and increased emotional sensitivity. The behavioural symptoms, including tension, tearfulness and depressed mood are the most worrying, but complaints like breast tenderness and bloating of abdomen are also concerning<sup>1</sup>. It was reported that; females tend to have more disturbed sleep than the males<sup>2</sup>. Gupta *et al.*<sup>3</sup> reported that, females suffering from PMS had sleep deprivation than those without PMS. It has been described that women with disturbed and irregular sleep cycles, will have heightened symptoms of PMS. It was suggested that abnormal regulation in the homeostasis of the sleep-wake cycle may lead to altered melatonin secretion in females suffering from PMS<sup>4</sup>. However, the exact reason behind PMS and sleep deprivation is unknown and requires further research.

About seven to nine hours of night sleep is recommended to the young adults by the national sleep foundation<sup>5</sup>. It was reported that the undergraduate student life is more prone to sleep problems and mental health<sup>6</sup>. It was also reported that PMS is prevalent among the university students of health sciences course. It has affected all the domains of the quality of life of students<sup>7</sup>. The premenstrual symptoms can affect the female student's medical studies and the sickness may lead to decreased student performance in the university examinations. This can also cause financial and emotional burden to their parents. It is important to consider treating the PMS issues of the medical students, which have occurred due to the disturbed sleep, before these students become responsible doctors in the society.

There are only very few studies available, which relate the sleeping duration and the symptoms of PMS. Also, there are not much data available about the disability in the premenstrual phase wellbeing due to sleep problems among the university medical students, particularly from Indian literature. In this context, the aim of the present study was to

study the relation between night sleep duration and the premenstrual phase wellbeing in Indian undergraduate female medical students. The objectives were to determine the prevalence of PMS and to study the effect of sleep deprivation on the regularity of menstrual cycle in these students.

### Material and Methods

The present study was performed on 219 female medical students, who were aged between 17 and 21 years. All these students were Indians, however few of them were foreign students but of Indian origin. The students who have history of alcohol consumption, tobacco smoking and excessive drinking of coffee were not included in this study. The students who are having history of more than one week of menstruation in their menstrual cycle were not included in this study. The students who were taking medications for sleep disorders and other mental health issues were also not included in this research. These students were sexually inactive and were not on oral contraceptive pills. This research has the approval of our institutional ethics committee. Seven to ten days prior to the starting of menstruation was considered as the premenstrual phase. The female students were given a questionnaire and asked to self-rate their sleep duration and symptoms in their premenstrual phase. The questionnaire also included details about the regularity of their menstrual cycle. Only the students, who showed interest and consented in this research were given questionnaire.

The students were categorised into those who are having, night sleep of more than 6 hours and less than 6 hours. They were asked about their physical, mental and social wellbeing during their premenstrual phase. The questionnaire included about their premenstrual irritability (anger), anxiety (tension), depressed mood (hopelessness), increased sensitivity, lack of interest in work, home, social activity, difficulty in concentrating, affected relationship with the social life, family, co-workers and home responsibilities. It also included about the premenstrual nausea, excessive eating (food craving), overwhelming (out of control), fatigue (lack of energy), productivity/work efficiency and other physical symptoms like breast tenderness, headache, myalgia, joints pain, bloating and weight gain. The regularity and irregularity of their menstrual cycles were also asked. Based on the questionnaire, the female students suffering from premenstrual issues and those who are not, were categorized based on the sleep duration. The data analysis was performed by the latest version of SPSS. Both the groups were compared statistically by using the chi square test and the 'p' value less than 0.05 was considered as statistically significant.

### Results

The present study observed that, 166 (76%) female medical students had more than 6 hours of night sleep on daily basis and the remaining 53 (24%) had less than 6 hours of night sleep (Fig. 1). About 80.4% of students in the present study were performing physical activity like doing exercises twice or thrice a week. The 187 students (85.4%) had more than three symptoms and were considered to be suffering from PMS. The remaining 32 students (14.5%) had one or two symptoms of PMS. Table 1 shows the comparison of sleep duration and the premenstrual mental status like irritability (anger), anxiety (tension), increased sensitivity, depressed mood (hopelessness) in these female medical students. It was observed that the comparison was not statistically significant for the less than 6 hours of sleep and premenstrual irritability, anxiety and sensitivity ( $p>0.05$ ). However, it was observed that the students who had less than 6 hours of night sleep were associated with the depressed mood in the premenstrual phase ( $p<0.05$ ). The comparison of duration of night sleep and the interest in social life during the premenstrual phase are represented in table 2. The comparison of less than 6 hours of sleep with the lack of interest in work, home, social activity and difficulty in concentrating during the premenstrual phase were not significant statistically ( $p>0.05$ ).

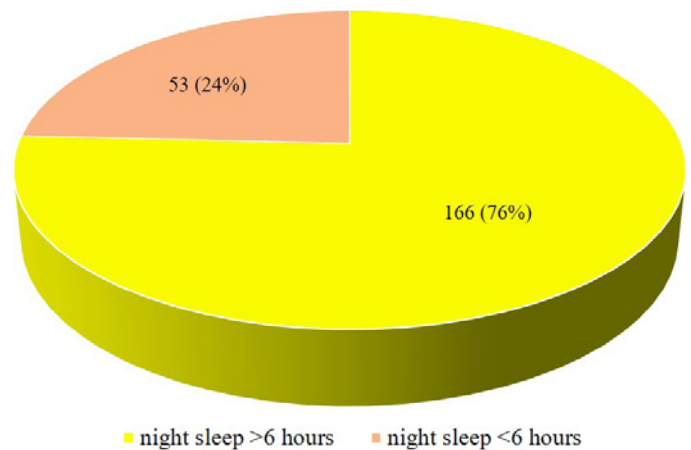


Figure 1. Showing the frequency of daily night sound sleep and sleep deprivation among the participants of this study (n=219).

The statistical significance was not observed between the lack of sleep and affected relationship (table 3) with the social life, family, co-workers and home responsibilities during the premenstrual phase ( $p>0.05$ ). The present study also compared the duration of sleep with the premenstrual nausea, excessive eating (food craving), overwhelming (out of control), productivity (work efficiency) and other physical symptoms (table 4), it was observed that the comparison of these parameters were statistically not significant ( $p>0.05$ ). However, it was statistically

**Table 1.** showing the effect of sleep duration on the premenstrual mental wellbeing in female medical students (n=219).

<b>Irritability/anger</b>	<b>Sleep Less Than 6 Hours (n=98)</b>	<b>Sleep More Than 6 Hours (n=121)</b>	<b>p value</b>
No/mild irritability	49 (50%)	66 (54.5%)	0.44
Moderate/severe irritability	49 (50%)	55 (45.5%)	
<b>Anxiety (tension)</b>			
No/mild anxiety	65 (66.3%)	82 (67.8%)	0.82
Moderate/severe anxiety	33 (33.7%)	39 (32.2%)	
<b>Increased sensitivity/tearful</b>			
No/mild increased sensitivity	43 (43.9%)	68 (56.2%)	0.07
Moderate/severe increased sensitivity	55 (56.1%)	53 (43.8%)	
<b>Depressed mood (hopelessness)</b>			
No/mild depressed mood*	47 (47.9%)	80 (66.1%)	0.007*
Moderate/severe depressed mood*	51 (52.1%)	41 (33.9%)	

The chi-square statistical test; significance\* if 'p' value > 0.05

**Table 2.** Showing the effect of sleep duration on the interest in social life during the premenstrual phase in female medical students (n=219).

<b>Lack of interest in work</b>	<b>Sleep less than 6 hours (n=98)</b>	<b>Sleep more than 6 hours (n=121)</b>	<b>p value</b>
No/mild	55 (56.1%)	78 (64.5%)	0.21
Moderate/severe	43 (43.9%)	43 (35.5%)	
<b>Lack of interest in home</b>			
No/mild	69 (70.4%)	89 (73.6%)	0.61
Moderate/severe	29 (29.6%)	32 (26.4%)	
<b>Lack of interest in social activity</b>			
No/mild	68 (69.4%)	81 (67%)	0.69
Moderate/severe	30 (30.6%)	40 (33%)	
<b>Difficulty in concentrating</b>			
No/mild	70 (71.4%)	92 (76%)	0.44
Moderate/severe	28 (28.6%)	29 (24%)	

The chi-square statistical test; statistical significance\* if 'p' value > 0.05

**Table 3.** showing the effect of sleep duration on the social relationships during the premenstrual phase in female medical students (n=219).

<b>Affected relationship with co-workers</b>	<b>Sleep less than 6 hours (n=98)</b>	<b>Sleep more than 6 hours (n=121)</b>	<b>p value</b>
No/mild	75 (76.5%)	92 (76%)	0.93
Moderate/severe	23 (23.5%)	29 (24%)	
<b>Affected relationship with family</b>			
No/mild	69 (70.4%)	98 (81%)	0.07
Moderate/severe	29 (29.6%)	23 (19%)	
<b>Affected social life</b>			
No/mild	72 (73.5%)	92 (76%)	0.66
Moderate/severe	26 (26.5%)	29 (24%)	
<b>Affected home responsibilities</b>			
No/mild	82 (83.7%)	98 (81%)	0.61
Moderate/severe	16 (16.3%)	23 (19%)	

The chi-square statistical test; significance if 'p' value > 0.05

Table 4. showing the effect of sleep duration on the premenstrual physical symptoms in female medical students (n=219).

	Sleep Less Than 6 Hours (n=98)	Sleep More Than 6 Hours (n=121)	p value
<b>Nausea</b>			
No/mild	93 (94.9%)	111 (91.7%)	0.36
Moderate/severe	5 (5.1%)	10 (8.3%)	
<b>Fatigue/lack of energy</b>			
No/mild*	39 (39.8%)	69 (57%)	0.01*
Moderate/severe*	59 (60.2%)	52 (43%)	
<b>Excessive eating/food craving</b>			
No/mild	55 (56.1%)	72 (59.5%)	0.61
Moderate/severe	43 (43.9%)	49 (40.5%)	
<b>Insomnia</b>			
No/mild	88 (89.8%)	113 (93.4%)	0.33
Moderate/severe	10 (10.2%)	8 (6.6%)	
<b>Hypersomnia</b>			
No/mild	66 (67.3%)	90 (74.4%)	0.25
Moderate/severe	32 (32.7%)	31 (25.6%)	
<b>Overwhelming/out of control</b>			
No/mild	67 (68.4%)	82 (67.8%)	0.92
Moderate/severe	31 (31.6%)	39 (32.2%)	
<b>Physical symptoms like breast tenderness/headache/myalgia/joints pain/bloating/weight gain</b>			
No/mild	55 (56.1%)	74 (61.2%)	0.36
Moderate/severe	43 (43.9%)	47 (38.8%)	
<b>Work efficiency/productivity</b>			
No/mildly affected	74 (75.5%)	88 (72.7%)	0.64
Moderately/severely affected	24 (24.5%)	33 (27.3%)	

The chi-square statistical test; significance if 'p' value > 0.05

observed that the students with history of less than 6 hours of sleep were complained of fatigue (lack of energy) ( $p < 0.05$ ) in their premenstrual phase (table 4).

The present study also observed that, there was no statistically significant association ( $p > 0.05$ , chi-square test) between the duration of sleep and the regularity of the menstrual cycle (Fig. 2). The students (36.1%), who had less than 6 hours of sleep in the night time on daily basis also maintained the regular menstrual cycle. About 12.3% of students had more than 6 hours of night sleep on daily basis and gave history of irregular menstrual cycles.

### Discussion

Insomnia and menstrual problems are the health issues, which have limited success in their management<sup>8</sup>. The PMS is a recurrent condition characterised by a set of symptoms like increased irritation (anger), nausea, increased emotional

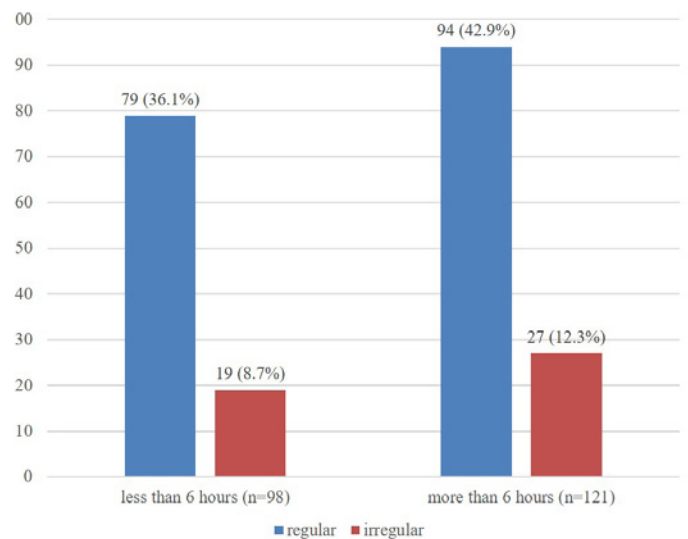


Figure 2. The effect of duration of sleep on the regularity of menstrual cycle in female medical students (n=219); the comparison was statistically not significant ( $p > 0.05$ , chi-square test).



sensitivity and symptoms like bloating and breast tenderness. These symptoms begin to occur a few days before the menstrual phase and cease a few days after the onset of bleeding of menstrual cycle in the reproductive phase<sup>9</sup>. The primary cause for PMS is believed to be variations in the ovarian steroidal hormones<sup>10</sup>. The serotonin receptors are present in the cerebral cortex, particularly in the prefrontal region, which are known to be increased by the ovarian hormones. Serotonin is a hormone which influences multiple functions of the body like regulation of mood, sexual function, appetite, aggression, wakefulness and sleep<sup>11</sup>. Thus, the changes in sleeping habits can reflect a change in the levels of serotonin, or the number of serotonin receptors which are in turn influenced by the ovarian hormones. PMS is affected by a wide range of things. However, its relation with the sleeping habits like duration, interruptions, have not been defined. Theoretically, changes in the sleeping habits will change the circadian rhythm, which in turn influence the severity of PMS. A wholesome sleep would reflect a stable circulation of hormones like serotonin, melatonin and prostaglandins<sup>12</sup>. Nocturnal melatonin secretion is markedly reduced in women with premenstrual dysphoric disorder and experimentally their symptoms were alleviated by the light therapy<sup>13</sup>. There are few studies which have been done to illustrate the effects of PMS on the sleeping quality<sup>14-15</sup>, however there is hardly any literature which talks about the effects of sleeping habits on the symptoms of PMS. Certain studies suggest that, poor sleep is perceived by those suffering from PMS during their premenstrual period, but evidence was not being provided for it<sup>16</sup>.

There are no clear cut diagnostic criteria for the PMS, because of the subjectivity of its symptoms. The addition of psychological factors and lack of specific tests will hinder its confirmed diagnosis<sup>7</sup>. However, it was reported that about 50 to 80% of females of child bearing age have few symptoms of PMS. In the present study from Indian medical students, the PMS was observed in 85.4% of students, which is slightly higher prevalence in comparison to the studies conducted in university students of Turkey (36.3%)<sup>17</sup>, Taiwan (39.8%)<sup>18</sup>, Brazilian (72.6%)<sup>19</sup>, Polish (76.4%)<sup>20</sup> and Jordanian females (80.2%). But the prevalence of PMS in Indian students in our study (85.4%) is lesser in comparison to the Iranian medical students (94.6%)<sup>21</sup>. It is believed that the difference in the prevalence of PMS is due to the variability in the diagnostic criteria of PMS and difference in the geographical, social and life of the populations studied. In our study group, about 80.4% of the students were performing physical activity on weekly basis and they still suffered from PMS (85.4%). This supports the findings of Turkish study by Sahin *et al.*<sup>17</sup> that, the physical activity is not beneficial in the management of PMS. Another Polish study by Drosdzol *et al.*<sup>20</sup> also suggests that there

is no relationship between the physical activity and symptoms of PMS.

It was described that; the sleep problems are associated with the decreased outcome of the mental wellbeing<sup>22</sup>. The sleep and mental health go hand to hand and it was reported that the mental health problems are often associated with sleep disorders<sup>23</sup>. The shorter night sleep was related to the anxiety and mood disorders in the young individuals<sup>24</sup>. The sleeping difficulty and mental health issues have impact on the individuals and society<sup>25</sup>. It was reported that the interventions intended to improve the sleep performance can improve the mental well-being<sup>23</sup>. Ho *et al.*<sup>26</sup> described that, cognitive behavioural therapy has helped in decreasing the symptoms of insomnia. The relaxation training, psychoeducational sleep programs and mindfulness are also tried as the treatment modality for the sleep disorders<sup>6</sup>. However, it is difficult to say if the sleep deprivation causes mental issues or mental health problems lead to insomnia. It may be bidirectional in nature<sup>23</sup>. The sleep problems have caused mental ill health from the childhood days to the adulthood, which included anxiety, aggression, behavioural issues and depression<sup>6</sup>.

In the university students, night time sleep disturbances were the etiological factors for the mental illness like obsessive-compulsive disorder, psychological distress and somatization<sup>27</sup>. Baglioni *et al.*<sup>28</sup> did a meta-analysis, which studied the association between the insomnia and depression. They opined that, the people suffering from insomnia have two times higher risk of developing depression, than the people who have sound sleep on daily basis. It was suggested that, the objective and subjective components like sleep duration, quality, latency of sleep and interest in the daily activity are important<sup>29</sup>. Zivin *et al.*<sup>30</sup> reported that, about 25% of the university students, who had no mental issue initially were reported with mental health problem after a period of 2 years. It was also reported that, about 60% of students had at least one mental health issue over the period of time. Zivin *et al.*<sup>30</sup> also reported that, 50% of the students who had mental health issues did not consult for the mental health treatment. In the paediatric age group, it was observed that the decreased sleep acted as an etiological factor for the attention deficit hyperactivity disorder, aggressive disorder with anxiety and emotional disorders<sup>31</sup>. The children with interrupted sleep suffered from thought and behavioural problems like social withdrawal, somatic complaints and lack of work<sup>32</sup>. This suggested that sleep deprivation has led to the affected child functioning. It was reported that, about 67% of the adolescents who were suffering from insomnia and early morning awakening ended up in the diagnosis of anxiety disorder or depression<sup>33</sup>.

The relation of sleep and mental health among medical students is an important research, because it was reported that the sleep habits of children get

worsen over the period of time<sup>34</sup>. Even a shorter duration of sleep disorders may have a significant impact for the mental issue<sup>22</sup>. Milojevich and Lukowski<sup>16</sup> reported that, decreased night sleep affects several aspects of mental health of undergraduate students. It is known that, the medical syllabus is heavy and the students have to really work hard to accomplish their basic medical degree. The medical students often tend to have irregular sleep habits and also will have lesser sleep than the recommended. In female students, this may aggravate the symptoms of PMS. The mental health of the student is not only a concern for their parents, but also to institutional counsellors and student health promoters.

Sleep deprivation could lead to the hormonal imbalance, which can affect the menstrual cycle. It is also true that, menstrual symptoms can prevent the sound sleep<sup>35</sup>. According to Arafa *et al.*<sup>8</sup>, insomnia has significant relationship with the premenstrual symptoms and dysmenorrhea. But there was no association between the duration of night sleep and the PMS. The present study agrees with Arafa *et al.*<sup>8</sup> that there is no association between the sleep deprivation and most of the premenstrual symptoms. However, the present study observed that sleep deprivation was associated with the depressed mood and fatigue, which was statistically significant ( $p < 0.05$ ). Xing *et al.*<sup>36</sup> also observed the premenstrual depressed mood due to less than six hours of sleep in their study from Chinese university female students.

We believe that the present study will help the gynaecologists and psychiatrists in understanding the effects of sleep duration on the PMS. This may also assist the successful diagnosis and management of PMS among the university female students. However, the present study has few limitations, as it is a cross sectional study in female students based on the

retrospective recall of the symptoms during their premenstrual phase. There could be associated recall bias, due to the busy schedule of the medical students. Future implication of this study include studying the symptoms prospectively by considering at least next 2 or 3 cycles. The other limitation of this study is that the other differential diagnoses like hypothyroidism and psychological issues were not taken into consideration. This might have given higher number of symptoms in the premenstrual phase. The present study was conducted at our single medical institution, without involving the other institutions of our university. So the findings of this study can't be generalized to our university. Since the findings of this study are from the health sciences institution students, they cannot be generalized to public females of this geographical location.

## Conclusion

The present study observed that, there is no significant association between the sleep deprivation and the general physical, social and, mental wellbeing in the premenstrual phase in female medical students. Also there is no relation between lack of sleep and regularity of the menstrual cycle. However, it was observed that lack of sleep had significant relationship with the depressed mood and fatigue in the premenstrual phase. The higher prevalence of symptoms of fatigue and depressed mood due to sleep deprivation among our institutional medical students suggests that they need to be informed about their symptoms. They should be aware of the symptoms of sleep deprivation, compromised quality of life and they may seek medical help, particularly they should be advised to have more than six hours of night sleep per day.

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