

# A STUDY ON SLEEP QUALITY DURING DIFFERENT PHASES OF MENSTRUAL CYCLE AMONG MEDICAL STUDENTS

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## ABSTRACT

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### BACKGROUND

Sleep is necessary for survival. Sleep quality should be good enough in addition to total time spent in bed. Women are particularly vulnerable between menarche and menopause as within this period, they are under the cyclical influence oestrogen and progesterone during each menstrual cycle.

This is an observational, cross-sectional study to know the sleep quality in women between 18 to 22 years of age by PSQI questionnaire and to suggest means to improve the same.

### MATERIALS AND METHODS

The study was carried out among the female students of first and second semester M.B.B.S. and B.D.S. curriculum of S.C.B. Medical and Dental college (n=75). Study period was from February 2018 to May 2018. The female students were asked to answer the PSQI questionnaire for two calendar months which corresponded roughly to two menstrual cycles of the participants. The sleep quality was assessed by the global scoring system of PSQI after evaluating all its seven components. Scores were calculated for the follicular and luteal phases separately. The observations were recorded carefully. These were analysed statistically using SPSS 20 version.

### RESULTS

This study shows that 60% of women are good sleepers and 40% are bad sleepers in follicular phase. Similarly, 30.67% are good sleepers and 69.33% are bad sleepers in luteal phase. The reasons are different according to the phase of menstrual cycle.

### CONCLUSION

Women don't sleep similar to men nor do they sleep similar on all the days of their menstrual cycle. Awareness of this among the women population, change in life style and seeking medical help whenever necessary is helpful in them.

### KEYWORDS

Menstrual Cycle, PSQI Questionnaire, Sleep.

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### BACKGROUND

Sleep is necessary for survival of all living beings. Various studies imply that sleep is needed to maintain metabolic-caloric balance, thermal equilibrium and immune competence. Sleep is also necessary for learning and memory consolidation.<sup>1,2</sup> Similarly sleep deprivation leads to lifestyle diseases like obesity, hypertension and diabetes mellitus. It is also associated with chronic inflammatory conditions.<sup>2,3</sup> Sleep quality should be good enough in addition to total time spent in sleep. This changes in women during their reproductive age between menarche to menopause as women are under the cyclical influence of the

female sex hormones, namely oestrogen and progesterone. Along with other cyclical changes like heaviness in legs, tenderness in breasts and mood changes; sleep quality also changes during different phases of the menstrual cycle.

### Aims and Objectives

This is an observational cross-sectional study to know the sleep quality in young women of reproductive age group between 18 to 22 years during follicular and luteal phase of their menstrual cycle and to suggest measures about its improvement.

### MATERIALS AND METHODS

The sample size was 75. All the participants were female medical students of 1<sup>st</sup> and 2<sup>nd</sup> semester MBBS and BDS curriculum of SCB Medical College and SCB Dental College. The sleep quality was assessed by PSQI (Pittsburgh Sleep Quality Index) questionnaire. Study period was between Feb. 2018 to May 2018. The participants were asked to answer the PSQI questionnaire for 2 calendar months preceding their current menstrual cycle corresponding to the

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current calendar month. The sleep quality was assessed by the global scoring system suggested by PSQI questionnaire after evaluating its all 7 components. Students with personal or family history of sleep disorder and on drugs that may interfere with sleep were excluded. The participants were on mixed Indian diet. None of the students were married.

**PSQI**

This is a self-report questionnaire that assesses sleep quality over a 1 month time interval. The questionnaire consists of 19 individual items creating 7 components that produce 1 global score. Each of the 7 component scores has points ranging from 0 to 3. In each component score, score 0 indicates no difficulty and score 3 indicates severe difficulty. The global score ranges from 0 to 21, 0 indicating no difficulty and 21 indicating severe difficulty in all areas. It is a standardised sleep questionnaire for clinicians and researchers to use with ease and is used for multiple populations. Global score of  $\leq 5$  is considered as good sleep and score of  $>5$  is considered as bad sleep.

**RESULTS**

Phases of Menstrual Cycle	No. of Women with PSQI Score $<5$	No. of Women with PSQI $>5$
Proliferative Phase	45	30
Secretory Phase	23	52

**Table 1. PSQI Score**

Table 1 shows that among the study population (n=75), 60% women are good sleepers and 40% women are bad sleepers in the follicular phase. Similarly, 30.67% women are good sleepers and 69.33% women are bad sleepers in the luteal phase.

Sl. No.	Components of PSQI	0	1	2	3
1.	Subjective Sleep Quality	10	80	10	0
2.	Sleep Latency	60	30	5	5
3.	Sleep Duration	53.6	33.3	13.1	0
4.	Habitual Sleep Efficiency	61.7	21.6	16.7	0
5.	Sleep Disturbances	0	8	80	12
6.	Sleep Medication	100	0	0	0
7.	Day Time Dysfunction	71.4	27	1.6	0

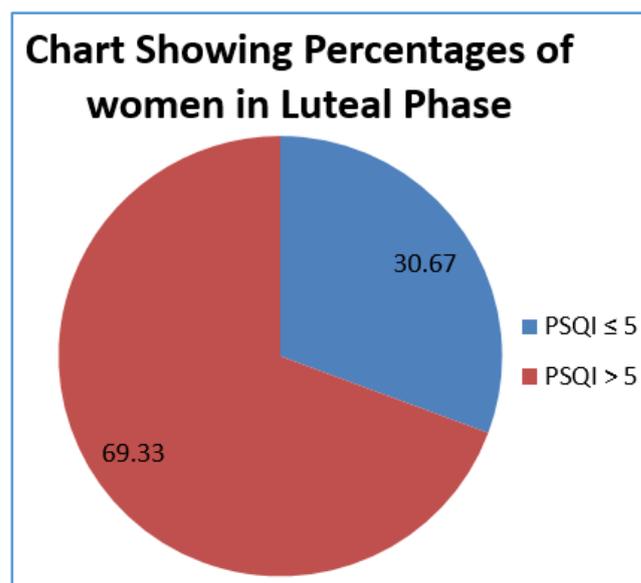
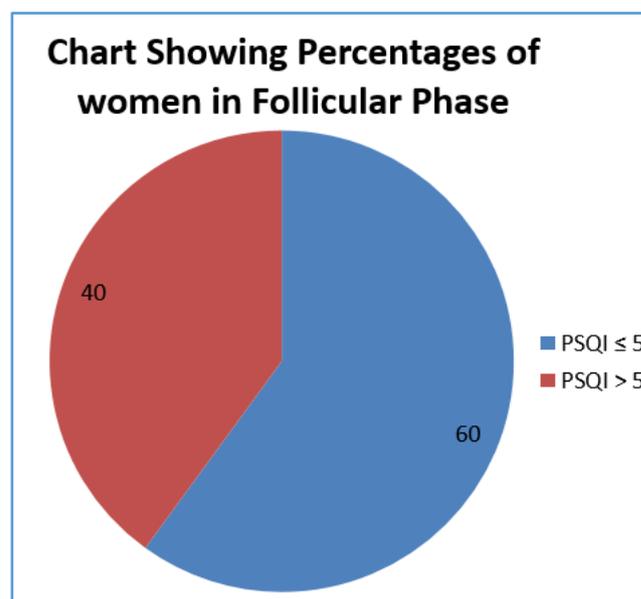
**Table 2. Cases in Percentage in Proliferative Phase in Each Score**

Table 2 shows high score in component-5 (sleep disturbance) in follicular phase that is statistically significant (p value  $<0.05$ ).

Sl. No.	Components of PSQI	0	1	2	3
1.	Subjective Sleep Quality	0	26.9	70	3.1
2.	Sleep Latency	0	10	30	60
3.	Sleep Duration	20	48.8	31.2	0
4.	Habitual Sleep Efficiency	0	6	10.7	83.3
5.	Sleep Disturbances	0	0	86	14
6.	Sleep Medication	98	2	0	0
7.	Day Time Dysfunction	2	72	26	0

**Table 3. Cases in Percentage in Secretory Phase in Each Score**

Table 3 shows high score in components 2(sleep latency) and 4(habitual sleep efficiency) in luteal phase that are statistically significant (p value  $< 0.05$ ).



## DISCUSSION

In a typical night of sleep, a young adult first enters NREM sleep or slow-wave sleep. NREM is divided into four stages. A person enters stage 1 first when falling asleep. The stages change from 1 to 4 consequently. Deep sleep is characterized by rhythmic slow waves indicating synchronization which occurs during stage 4. The subject spends 70-100 minutes in stages 3 and 4. Sleep then lightens after which REM period follows. During REM sleep, otherwise known as paradoxical sleep the EEG activity is rapid. This cycle repeats itself throughout the night every 90 minutes. NREM sleep occurs more in children that decreases in adulthood.<sup>1</sup>

Menstrual cycle is divided into follicular phase and luteal phase according to the events occurring in the ovarian cycle.<sup>1</sup> Follicular phase starts with day one of menstrual cycle which starts with bleeding and ends with ovulation. This phase is relatively variable in comparison with the luteal phase. In the initial part of follicular phase, the level of oestrogen is low and progesterone is practically nil. Later on around the 12 to 14<sup>th</sup> day oestrogen level peaks to high value. FSH level gradually rises from low to high during this phase. The level of LH rises sharply one day prior to ovulation called LH surge that brings about ovulation.<sup>1</sup>

Luteal phase starts from ovulation and ends in menstruation. This phase is relatively fixed in its duration of 14 days. In the luteal phase both FSH and LH decline. Progesterone peaks around 20 to 22 days then declines. Oestrogen also peaks around the same time after that it also declines. So during late luteal phase there is low level of both oestrogen and progesterone.<sup>1</sup>

Menstrual cycle is marked by fluctuations in oestrogen, progesterone, FSH and LH. Oestrogen is secreted from the granulosa cells of the ovarian follicle, the corpus luteum and the placenta. It is responsible for the overall wellbeing of the female.<sup>1</sup> Oestrogen causes widespread increases in postsynaptic type 2A serotonin receptor availability.<sup>4</sup> It also increases the sensitivity of the type 1A serotonin autoreceptor presynaptically.<sup>4</sup> More availability of serotonin is reflected as more availability of melatonin. High level of oestrogen thus helps to maintain sleep throughout night.

Progesterone is secreted from the corpus luteum and the placenta. It aids in maintaining early pregnancy. Progesterone exerts a sleep inducing or hypnotic effect. Progesterone affects reproduction, sleep quality, respiration, mood, appetite, learning memory and sexual activity.<sup>5</sup>

In our study we found out difficulty in sleeping as evident by high PSQI score of >5, in component-5 (sleep disturbances) in follicular phase. High PSQI score (more than 5) was seen particularly in component-2 (sleep latency) and component-4 (habitual sleep efficiency) in late luteal phase. Some subjects reported having high component-5 score (sleep disturbances) both during early follicular phase that coincides with menstrual phase and late luteal phase (premenstrual phase).

The reasons here vary according to the phase of menstrual cycle. In early follicular phase (menstrual bleeding), subjects reported having to get up to use the bath

room repeatedly, having pain due to dysmenorrhoea, feeling compelled to sleep in one position in bed due to fear of staining.

In late luteal phase, the reasons are different like headache, painful and tender breasts, bloating, cramps and pain in the legs.

The difference seen in sleep by PSQI questionnaire during the follicular phase and the luteal phase of menstrual cycle is supported by several previous works.

Chaturvedi et al. Studied 112 numbers of Indian college students aged 17-22 years in a retrospective study. >50% of the subjects recalled (2.6 + 3.5 out of 10) negative sleep change in premenstrual / secretory phase of menstrual cycle.<sup>6</sup>

Brown et al studied 89 healthy students and concluded that sleep quality is poorer in premenstrual phase.<sup>7</sup>

Driver et al studied 514 subjects in USA. 70% of the subjects retrospectively stated that their sleep was disturbed by premenstrual and menstrual physical symptoms.<sup>8</sup>

Manber and Bootzin studied 32 number of subjects in Arizona USA and stated that there is decrease sleep efficiency and quality and increase sleep onset latency in the luteal phase. They concluded that sleep is worse in premenstrual phase.<sup>9</sup>

Sarah Romans et al studied 76 women aged 18-42 years for subjective sleep quality. Premenstrual sleep quality was poorer than the rest of the cycle.<sup>10</sup>

Prior to puberty, there is no difference in sleep in boys and girls. Children of both sexes sleep similarly. However, after menarche girls / women are under the cyclical influence of female sex hormones that bring about the change in sleep in women. Clinical evidence indicates that men and women sleep differently.<sup>11</sup>

Women spend more time in bed and sleep longer, but report as poorer sleep quality than men across a wide age range.<sup>9</sup> Women have less wakefulness after sleep onset, less light stage-1 sleep, more slow wave sleep (NREM) and more slow wave activity during sleep as compared to men.<sup>11</sup> Sleep disruptions are more common in women with insomnia 1.5-2 times more frequent than man.<sup>12</sup>

Sleep complaints commonly occur during the post ovulatory luteal phase in healthy women according to Manber and Bootzin.<sup>9</sup>

Women subjectively complain of disturbed sleep during the late luteal phase and premenstrual days.<sup>13,14,15,16</sup>

Both oestrogen and progesterone act directly on the sleep centre of the brain. Progesterone promotes sleep as it makes a metabolite allopregnanolone which interacts with GABA receptors and is very soothing.<sup>17</sup>

EEG also shows sleep - enhancing effect of progesterone. After ovulation when progesterone is high, EEG waves show more sleep spindles as seen in stage 3 and 4 of NREM sleep.

Oestrogen excess causes irritability, tension and trouble falling asleep. Oestrogen deficiency causes difficulty in staying asleep. Many women report waking up post-midnight.

Healthy sleep requires a stable hypothalamic - pituitary - adrenal axis and decrease in night time cortisol, stress reduction measures like yoga, massage and simple carbohydrate diet in order to avoid fluctuations in blood sugar during sleep.<sup>16</sup>

Low progesterone is associated with sleeping difficulties. Progesterone has overall calming and destressing effect on the mind. Chronic stress can decrease progesterone level. Stress causes more cortisol release from the adrenal glands. As pregnenolone is the precursor of cortisol, in chronic stress the extra amount is met by compromising formation of other hormones like progesterone from the hormone cascade diverting pregnenolone towards formation of extra cortisol. This is known as pregnenolone steal. Hence stopping pregnenolone steal due to chronic stress may help improve hormone function and improve sleep. Taking destressing measures, maintaining a proper gut health and controlling chronic inflammation may help in this regard.<sup>18</sup>

Low oestrogen also leads to sleep problems. Low oestrogen may lead to low serotonin activity by decreasing type 2A serotonin receptor availability in the cerebral cortex and contribute to sleep problems, depression and anxiety. Females are particularly dependent on oestrogen for overall wellbeing and normal functioning of body and mind. Simple carbohydrate diet, avoiding alcohol and smoking and maintaining a proper immune balance can maintain optimum hormone balance and improve sleep.<sup>18</sup>

Women with ovulatory cycles report reduced subjective sleep quality premenstrually and at menstruation, while sleep homeostatic mechanism as reflected by slow wave sleep are unaltered. The mid luteal phase is associated with more stage-2 sleep, higher spindle frequency activity, reduced REM sleep when compared to mid follicular phase.<sup>15</sup>

Studies in premenopausal women have documented more subjective sleep disruption during the week preceding menstruation and during menstruation coinciding with low levels of progesterone and oestrogen. Sleep complaints occur more during mid-through late luteal phase compared with mid-follicular phase and there is lower subjective sleep quality during the late luteal phase and menstruation compared with other phases.<sup>9</sup>

Women report greater subjective sleep disturbances and lowered sleep quality during the late-luteal phase when both oestrogen and progesterone are declining and menstruation when both hormones are low.<sup>9</sup>

## CONCLUSION

In summary, women cannot sleep similar to men as they are under cyclical influence of female sex hormones namely oestrogen and progesterone throughout their reproductive life from menarche to menopause. Within days of the menstrual cycle, women do not sleep equally either qualitatively or quantitatively on all the days as these two hormone levels fluctuate. Women should be made aware of these facts that would avoid unnecessary anxiety and depression in them. Research shows that the quality of sleep and the time spent in sleep is directly linked to the phase of

menstrual cycle. In spite of all this, it is important for a human being to get the recommended 7-8 hours of sleep every night. So, this study is an attempt to find out the factors that are responsible for difficulty in sleeping during different phases of the menstrual cycle. Awareness among the female population regarding this is necessary to alleviate unnecessary anxiety and depression. Change in lifestyle like simple carbohydrate diet, effective stress management measures like yoga and massage are helpful. Subjects who do not benefit from these might be suffering from PMS or PMDD. Seeking medical consultation and taking treatment wherever necessary is recommended for them.

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