

Determinants of Duration and Quality of Sleep among Pregnant Women in Rural South Karnataka: A Hospital-based Cross-sectional Study

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ABSTRACT

Introduction: Sleep is a basic essential, and sleep disturbances are common during pregnancy, which is linked to poor maternal and fetal outcomes.

Materials and methods: A cross-sectional study was conducted among antenatal women attending a rural maternity hospital in Ramnagara District, Karnataka using consecutive sampling. A predesigned, face-validated structured questionnaire and Pittsburgh Sleep Quality Index (PSQI) were administered. Mean PSQI score of ≥ 5 was considered as poor sleep quality.

Results: Of the 200 pregnant women in the study, 54.5% had poor sleep quality and 76.5% had inadequate duration of sleep (<8 hours a day). The factors found to be significantly associated with poor quality sleep in this study were increased maternal age, joint family, lower socioeconomic status, increased parity, increasing gestational age, presence of complications in the current pregnancy, previous bad obstetric history, exposure to passive smoking, not sleeping on a bed and mattress, use of mobile phone and TV at bedtime, lack of physical activity, and lack of afternoon naps. Women who used mobile phones at bedtime had nine times higher risk of inadequate sleep and five times higher risk of poor sleep quality. Women who did not sleep on a bed with mattress had 10 times higher risk and those exposed to passive smoking had four times greater risk of poor sleep quality.

Conclusion: The quality and the duration of sleep among pregnant women were inadequate. There is a need to educate women about the importance of quality sleep during pregnancy and it should be assessed during routine antenatal care.

Keywords: Pregnant women, Pittsburgh Sleep Quality Index, Quality of sleep, Sleep duration.

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INTRODUCTION

Sleep is a complex phenomenon, but a fundamental essential of our health and well-being.¹ The human body follows a circadian rhythm, controlled by the hypothalamus;² however, numerous factors play a role in the sleep process, and the pattern of sleep varies with each individual. Lack of adequate sleep may lead to various cognitive and health issues. Pregnancy, childbirth, and early motherhood physiologically and psychologically affect a woman's sleep.^{3,4} Hormonal alterations during early pregnancy, enlargement of the fetus during late pregnancy, and a newborn with random sleep-wake patterns all contribute to disrupted sleep.⁵ Sleep disturbances in pregnancy are high in the first and last trimesters because of high levels of progesterone in the first trimester and more of physical discomfort and anticipation about having a child in the last trimester.² The American Academy of Sleep Medicine has coined the term "pregnancy-related sleep disorder" which includes both insomnia and excessive daytime sleepiness. Sleep problems during pregnancy include nonrefreshing sleep, insomnia, snoring, periodic leg movement during sleep, and sleep-disordered breathing.⁴ Normal sleep requirement during pregnancy is around 8 hours in the night and 2 hours of afternoon nap/rest. Lack of sleep during pregnancy is associated with an increased chance of gestational diabetes mellitus,³ pregnancy-induced hypertension,⁷ increased length of labor and increased chance of undergoing a cesarean section,⁸ preterm birth, and low birth weight babies. Poor maternal sleep is also linked to depression and anxiety in the mother, while also affecting the fetal neural networks which may lead to various mental health issues such as anxiety and learning disabilities in the later part of the child's life.⁹ Sleep disorders during

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pregnancy are often underdiagnosed or missed completely, in spite of being linked to adverse maternal and fetal outcomes.¹⁰ There is a paucity of literature available on this subject in India, especially among rural women. With the aim of addressing the gaps in our understanding, this study was conducted to assess the duration of sleep and the quality of sleep among antenatal women and its associated factors.

MATERIALS AND METHODS

A cross-sectional study was conducted over a period of 2 months (April–May) in 2019, among pregnant women who were attending the antenatal clinic at a rural maternity hospital in

Ramnagara district, Karnataka. Based on a previous study done in the Pudukcherry district, where the prevalence of poor sleep quality among pregnant women was found to be 11%,¹¹ the sample size was calculated to be 195, with 95% confidence limits and 80% power. Consecutive sampling was followed. The data were collected using a face-validated, structured questionnaire with details on sociodemography, medical history, obstetric history, and factors affecting sleep. It also included the Pittsburg Sleep Quality Index (PSQI) for assessing sleep quality, Patient Health Questionnaire-2 (PHQ-2) to screen depression, and General Anxiety Depression (GAD-2) to screen for anxiety. The PSQI scale is composed of seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction. Each component is scored from 0 to 3. Women with a PSQI score of >5 were considered to have poor sleep quality.¹² PHQ-2 and GAD-2 contain two questions each, with each having a total score ranging from 0 to 6. A score of 3 or more for PHQ-2 and GAD-2 indicates possible depression and possible anxiety disorder, respectively, and they were referred within the same hospital for further assessment.^{13,14}

Ethical approval was obtained from the college Institutional Ethics Committee, and written informed consent was taken. The data collected were entered in MS Excel and analyzed using statistical software SPSS v 16. The data were described by calculating proportions and means. Association between duration of sleep and quality of sleep with various sociodemographic, health and lifestyle factors was measured using Chi-square test, Fisher's exact test, independent t-test, and Mann-Whitney U test as applicable. A p-value of less than 0.05 was considered to be statistically significant.

RESULTS

Sociodemographic Details

The total antenatal women included in the study were 200, with a mean age of 23.94 ± 3.6 years. Most of the participants were educated up to secondary school and were homemakers. Majority were living in rural area and mostly from the middle and upper-middle class, according to modified BG Prasad socioeconomic classification.

Younger participants, those from nuclear families and with higher economic status, were significantly more likely to have both adequate sleep and good quality sleep. Women residing in an urban area and women of Islamic faith had significantly longer duration of sleep, while women who were more educated had a better quality of sleep (Table 1).

Medical and Obstetric History

Majority of the study subjects were primigravidae (49%), with a mean gestation age of 25.0 ± 9.2 weeks.

Of the study population, 91 (45.5%) had no complications in the current pregnancy. Among those with complications, 66 (33%) had anemia, 20 (10%) were of short stature, 14 (7%) had gestational diabetes mellitus, and 11 (5.5%) had pregnancy-induced hypertension. Among the study population, 6 (3%) had a previous seizure disorder and 5 (2.5%) had a psychiatric disorder and were on treatment.

It was found that women with poor sleep quality were of significantly higher gestational age.

The presence of any complication in the current pregnancy was associated with inadequate sleep duration and poor sleep quality, while those with previous bad obstetric history had significantly

Table 1: Association of duration and quality of sleep with various sociodemographic factors (Source: Original)

| Variable | Category | Total (N%) | Adequate sleep (≥8 hrs) 47 (23.5) | Inadequate sleep (<8 hrs) 153 (76.5) | p value | Good sleep quality 109 (54.5) | Poor sleep quality 91 (45.5) | p value |
|---------------------|------------------|------------|---|--|---------------------|-------------------------------------|------------------------------------|---------------------|
| Age in years | Mean (±SD) | 200 (100) | 22.89 ± 2.92 | 24.26 ± 3.81 | 0.02 | 23.30 ± 2.97 | 24.70 ± 4.2 | 0.007 ^c |
| | Nuclear | 100 (50) | 25 (25) | 75 (75) | | 64 (64.0) | 36 (36.0) | |
| Type of family | Joint | 76 (38) | 6 (7.9) | 70 (92.1) | <0.001 ^a | 28 (36.8) | 48 (63.2) | <0.001 ^a |
| | Three generation | 24 (12) | 16 (66.7) | 8 (33.3) | | 17 (70.8) | 7 (29.2) | |
| Residence | Rural | 167 (83.5) | 44 (26.3) | 123 (73.7) | 0.03 ^c | 89 (33.3) | 78 (46.7) | 0.38 ^a |
| | Urban | 33 (16.5) | 3 (9.1) | 30 (90.9) | | 20 (60.6) | 13 (39.4) | |
| | Illiterate | 8 (4) | 2 (25) | 6 (75) | | 2 (25.0) | 6 (75.0) | |
| Education | Primary | 15 (7.5) | 1 (6.7) | 14 (93.3) | 0.65 ^c | 5 (33.3) | 10 (66.7) | 0.014 ^c |
| | Middle | 23 (11.5) | 5 (21.7) | 18 (78.3) | | 9 (39.1) | 14 (60.9) | |
| | Secondary | 66 (33) | 17 (25.8) | 49 (74.2) | | 34 (51.5) | 32 (48.5) | |
| | Pre University | 58 (29) | 16 (27.6) | 42 (72.4) | | 37 (63.8) | 21 (36.2) | |
| Religion | Graduate | 30 (15) | 6 (20) | 24 (80) | | 22 (73.3) | 8 (26.7) | |
| | Hindu | 163 (81.5) | 35 (21.5) | 128 (78.5) | 0.016 ^c | 89 (54.6) | 74 (45.4) | 0.38 ^b |
| | Christian | 28 (14) | 12 (42.9) | 16 (57.1) | | 17 (60.3) | 11 (39.3) | |
| Muslim | 9 (4.5) | 0 | 9 (100) | 3 (33.3) | | 6 (66.7) | | |
| Socioeconomic class | Upper | 32 (16) | 8 (25) | 24 (75) | 0.000 ^c | 22 (68.8) | 10 (31.2) | 0.02 ^a |
| | Upper-middle | 56 (28) | 23 (41.1) | 33 (58.9) | | 37 (66.1) | 19 (33.9) | |
| | Middle | 48 (24) | 11 (22.9) | 37 (77.1) | | 21 (43.8) | 27 (56.2) | |
| | Lower middle | 31 (15.5) | 4 (12.9) | 27 (87.1) | | 16 (51.6) | 15 (48.4) | |
| | Lower | 33 (16.5) | 2 (3.1) | 31 (96.9) | | 13 (39.3) | 20 (62.5) | |

^aChi-square test; ^bFisher's exact test; ^cindependent t-test; numbers in parentheses indicate row percentages

poorer quality of sleep. Obstetric factors, such as number of living children, number of previous pregnancies, parity, and age of the youngest living child, did not have an effect on the sleep quality or duration (Table 2).

Housing and Lifestyle Factors

Women who slept on a bed with mattress had significantly better sleep quality and longer sleep duration. The use of mobile phones within an hour before sleeping was associated with both inadequate sleep and poor quality of sleep. Watching TV or consumption of tea or coffee within an hour before sleep was associated with inadequate duration of sleep, as was physical inactivity. Sleeping in a separate bedroom, sleeping position at the time of falling asleep, and time of last meal were not found to be associated with duration and quality of sleep.

Among the study population, 8 (4%) subjects were consuming chewable tobacco and 6 (3%) consumed alcohol. This was not found to have any association with duration or quality of sleep. Women

exposed to passive smoking had a significantly poorer quality of sleep (Table 3).

Sleep Duration and Sleep Quality

Based on the Global PSQI score, 109 (54.5%) had poor sleep quality. The mean duration of sleep among our study population was 6.61 ± 1.1 hours. Majority of the subjects had a sleep duration of more than 7 hours, a sleep latency period of 16–30 minutes, and sleep efficiency of 75–84% (Table 4). Most of the women reported having sleep disturbance and daytime dysfunction (feeling sleepy during routine activities, while watching TV, etc.) less than once a week. 30 (15%) women were taking sleep medication (Table 3).

Women were also screened for depression and anxiety using PHQ-2 and GAD-2. It was found that 16 (8%) were screened positive for depression and 10 (5%) were screened positive for anxiety. However, there was no association between depression or anxiety and the duration or quality of sleep.

Table 2: Association of sleep duration and the quality of sleep with various obstetric factors (Source: Original)

| Variable | Category | Total N (%) | Adequate sleep (≥8 hrs) N = 47 (23.5) | Inadequate sleep (<8 hrs) N = 153 (76.5) | p value | Good sleep quality N = 109 | Poor sleep quality N = 91 | p value |
|------------------------------------|------------|----------------|---|--|-------------------|----------------------------------|---------------------------------|--------------------|
| Current gestational age in weeks | Mean (±SD) | 200 (100) | 23.83 ± 8.56 | 25.37 ± 9.4 | 0.31 | 23.88 ± 9.65 | 26.36 ± 8.5 | 0.05 ^b |
| Complications in current pregnancy | Yes | 109 (54.5) | 14 (12.8) | 95 (87.2) | <0.001 | 50 (45.9) | 59 (54.1) | 0.007 ^a |
| | No | 91 (45.5) | 33 (36.3) | 58 (66.7) | | 59 (64.8) | 32 (35.2) | |
| Previous BOH (n = 113) | Yes | 33 (29.2) | 5 (17.8) | 28 (82.2) | 0.07 ^a | 14 (42.4) | 19 (57.6) | |
| | No | 80 (70.8) | 25 (45.4) | 55 (54.6) | | 36 (51.4) | 34 (48.6) | |

^aChi-square test; ^bindependent t-test; numbers in parentheses indicate row percentages

Table 3: Association of sleep duration and the quality of sleep with various housing and lifestyle factors (Source: Original)

| Variable | Category | Total N (%) | Adequate sleep (≥8 hrs) N = 47 (23.5) | Inadequate sleep (<8 hrs) N = 153 (76.5) | p value | Good sleep quality N = 109 | Poor sleep quality N = 91 | p value |
|---|------------|----------------|---|--|--------------------|----------------------------------|---------------------------------|---------------------|
| Passive smoking | Yes | 48 (24) | 8 (16.6) | 40 (83.4) | 0.20 ^a | 15 (31.2) | 33 (68.8) | 0.0002 ^a |
| | No | 152 (76) | 39 (27.4) | 113 (79.6) | | 94 (61.8) | 58 (38.2) | |
| Sleeping on a bed with mattress | Yes | 135 (67.5) | 38 (28.1) | 97 (71.9) | 0.02 ^a | 81 (60.0) | 54 (40.0) | 0.02 ^a |
| | No | 65 (32.5) | 9 (13.8) | 56 (86.2) | | 28 (43.1) | 37 (56.9) | |
| Use of mobile phone within an hour before sleep | Yes | 135 (67.5) | 22 (16.3) | 113 (83.7) | 0.001 ^a | 59 (43.7) | 76 (56.3) | <0.001 ^a |
| | No | 65 (32.5) | 25 (38.5) | 40 (61.6) | | 50 (76.9) | 15 (23.1) | |
| Watching TV within an hour before sleep | Yes | 172 (86) | 42 (24.4) | 130 (75.6) | 0.44 ^a | 89 (51.7) | 83 (48.3) | 0.04 ^a |
| | No | 28 (14) | 5 (17.9) | 23 (82.1) | | 20 (71.4) | 8 (28.6) | |
| Consumption of coffee/tea with an hour before sleep | Yes | 29 (14.5) | 2 (6.9) | 27 (93.1) | 0.01 ^a | 15 (51.7) | 14 (48.3) | 0.74 ^a |
| | No | 171 (85.5) | 45 (26.3) | 126 (73.7) | | 94 (55.0) | 77 (45.0) | |
| Physical activity on most days of the week | Yes | 89 (44.5) | 13 (14.6) | 76 (85.4) | 0.007 ^a | 46 (51.6) | 43 (48.4) | 0.47 ^a |
| | No | 111 (55.5) | 34 (30.6) | 77 (69.4) | | 63 (56.8) | 48 (43.2) | |
| Duration of afternoon rest/nap (in min) | Mean (±SD) | 200 (100) | 75.94 ± 27.64 | 55.91 ± 25.29 | 0.005 ^b | 62.74 ± 27.255 | 55.18 ± 25.44 | 0.13 ^b |
| Duration of sleep latency (in min) | Mean (±SD) | 200 (100) | 18.60 ± 5.31 | 17.64 ± 5.88 | 0.32 ^b | 18.53 ± 7.58 | 25.29 ± 13.072 | <0.001 ^b |
| Duration of sleep (in hrs) | Mean (±SD) | 200 (100) | — | — | | 7.13 ± 1.1 | 5.99 ± 0.9 | <0.001 ^b |

^aChi-square test; ^bMann–Whitney U test; numbers in parentheses indicate row percentages

Table 4: Components of quality of sleep (Source: Original)

| Component | Category | N (%) N = 200 |
|--|----------------------------|------------------|
| Subjective sleep quality | Very good | 46 (23) |
| | Fairly good | 134 (67) |
| | Fairly bad | 17 (8.5) |
| | Very Bad | 3 (1.5) |
| Sleep latency | <15 min | 68 (34) |
| | 16–30 min | 112 (56) |
| | 31–60 min | 18 (9) |
| | >60 min | 2 (1) |
| Sleep duration | >7 hrs | 97 (48.5) |
| | 6–7 hrs | 81 (40.5) |
| | 5–6 hrs | 16 (8) |
| | <5 hrs | 6 (3) |
| Sleep efficiency (total hours of sleep/total hours in bed × 100) | >85% | 34 (17) |
| | 75–84% | 124 (62) |
| | 65–74% | 35 (17.5) |
| | <65% | 7 (3.5) |
| Sleep disturbance | Not during the past month | 85 (42.5) |
| | Less than once a week | 107 (53.5) |
| | Once or twice a week | 8 (4) |
| | Three or more times a week | 0 |
| Usage of sleep medications | Not during the past month | 170 (85) |
| | Less than once a week | 23 (11.5) |
| | Once or twice a week | 6 (3) |
| | Three or more times a week | 1 (0.5) |
| Daytime dysfunction | Not during the past month | 90 (45) |
| | Less than once a week | 99 (49.5) |
| | Once or twice a week | 10 (5) |
| | Three or more times a week | 1 (0.5) |

Table 5: Multiple logistic regression of factors associated with quality of sleep (Source: Original)

| Variable | Category | Odds ratio | Confidence interval | p value |
|---|----------|------------|---------------------|---------|
| Sleeping on a bed with mattress | Yes | 1 | | |
| | No | 10.66 | 1.603–70.965 | 0.014 |
| Use of mobile phone within an hour before sleep | No | 1 | | |
| | Yes | 5.03 | 2.413–10.485 | <0.001 |
| Passive smoking | No | 1 | | |
| | Yes | 3.86 | 1.769–8.427 | 0.001 |
| Afternoon rest/nap | Yes | 1 | | |
| | No | 6.83 | 1.299–37.96 | 0.028 |
| | <6 hrs | 12.22 | 4.34–28.0 | |
| Duration of sleep | 6–8 hrs | 2.2 | 0.798–6.28 | <0.001 |
| | >8 hrs | 1 | | |

On conducting multivariate logistic regression analysis, women who did not sleep on a bed with mattress had over 10 times higher risk, women who used mobile phone before bedtime had five times higher risk, those exposed to passive smoking had nearly four times greater risk, and women who did not have afternoon nap were nearly seven times more likely to have poor sleep quality

Table 6: Multiple logistic regression of factors associated with duration of sleep (Source: Original)

| Factor | Categories | Odds ratio | Confidence interval | CI | p value |
|-----------------------------------|------------|------------|---------------------|-------|---------|
| Residence | Urban | 1 | | | |
| | Rural | 3.58 | 1.04 | 12.31 | 0.04 |
| Mobile phone usage before bedtime | No | 1 | | | |
| | Yes | 9.3 | 2.5 | 34.1 | 0.001 |

(Table 5). Women residing in rural areas had three times higher risk and women who used mobile phone before bedtime had nine times higher risk of poor duration of sleep (Table 6).

DISCUSSION

Duration of sleep and the quality of sleep are altered, and sleep problems are often under-reported in pregnancy.⁹

The mean age of our study population was 23.94 ± 3.6 years, which were similar to other studies done in Puducherry and Bangalore.^{11,16} Our study showed that increased maternal age was associated with poor quality and less duration of sleep, similar to a study in China.¹⁸ These findings can be attributed to household responsibilities of older women and the presence of other living children.¹⁷

The mean duration of sleep among our study population was 6.61 ± 1.1 hours and only 47 (23.5%) had adequate sleep of 8 hours as recommended for pregnant women. The mean duration of sleep was 8.2 hours. in the study conducted in Puducherry.¹¹ The inadequate duration of sleep in our duration can be due to higher maternal age, parity index, place of residence, and type of family.¹¹ It was also noted that as the gestational age increased the quality and the duration of the sleep decreased and this can be attributed to various factors, such as hormonal changes and physical discomfort.⁶ In our study, women who slept for less than 6 hours were having 12 times higher risk of developing poor sleep quality.

We also found that women who had a previous history of any abortions/intrauterine death etc. were found to inadequate duration of sleep but the quality of sleep was not significantly different. This was similar to the study done in Turkey.¹⁵

Our study also showed that women who did not take afternoon rests/naps were almost seven times at higher risk of having poor sleep quality. A study done in Taiwan showed that women who took daytime naps were having poor sleep quality which was in contrary to our study findings.¹⁹

The mean PSQI scores in our study were found to be 5.80 ± 2.72 which was similar to a meta-analysis study done by Sedov et al.²⁰ Our study showed that 109 (54.5%) had poor sleep quality based on the PSQI global sleep quality scoring.¹¹ The present study found that living in rural areas and in joint families were associated with poor sleep quality and duration and this could explain the higher proportion of women with poor sleep in our study, in contrast to the Puducherry and Singapore studies where poor quality of sleep was seen among 24.4 and 43.1% of pregnant women, respectively.^{3,16}

In our study, 16 (8%) were screened positive for depression and 10 (5%) were for anxiety. Unlike other studies which found that depression and anxiety were linked to poor sleep, we were unable to elicit such an association. This could be explained by the fact that in our study, several housing and lifestyle factors were found to be

associated with sleep, the strength of which was amply exhibited through multilogistic regression.

Our study showed that women who did physical activity had better duration of sleep although quality was not affected, but a study done in USA among pregnant women to find out the relationship between physical activity and sleep during pregnancy showed that physical activity increased the duration of sleep which was similar to our study findings.²¹ This was contrary to the findings of another study done in the same setting in the USA, which found out that physical activity during pregnancy was negatively affecting the sleep quality and sleep onset latency.²²

In our study, women who did not sleep on a bed with mattress were associated with 10 times higher risk of having poor sleep quality. The extensive literature review has not been able to find studies done among pregnant women regarding the effect of bed with mattress on sleep duration and quality. The authors, therefore, presume that this factor has remained unstudied thus far.

We found that women who were exposed to passive smoking were almost four times at higher risk of poor quality of sleep. A study done in Japan by Ohida et al. similarly showed a relationship between passive smoking exposure and negative health outcomes in pregnant women.²³ This has public health implications since cessation of exposure to passive smoking could result in improved sleep quality and thereby improve maternal and newborn health outcomes.²⁴

Use of mobile phone and TV significantly affected the duration of sleep and sleep quality adversely. Women who used mobile phone within an hour before sleep were five times at higher risk of poor sleep quality and nine times at higher risk for inadequate duration of sleep. Various studies have been done on the effect of mobile phone and the quality of sleep among various age-group populations which showed that long term use of mobile phone and TV will have an adverse effect on the duration of sleep and the sleep quality;²⁵⁻²⁷ however, this phenomenon has yet to be studied among pregnant women, and therefore, this finding provides a further direction of research into mobile phone usage and maternal health outcomes.

CONCLUSION

There is poor quality and inadequate duration of sleep among pregnant women. The various factors found to be associated with poor quality sleep in this study were increased maternal age, joint family, lower socioeconomic status, increased parity, increasing gestational age, presence of complications in the current pregnancy, previous bad obstetric history, exposure to passive smoking, not sleeping on a bed and mattress, use of mobile phone and TV at bedtime, lack of physical activity, and lack of afternoon naps.

RECOMMENDATIONS

Healthcare professionals must be trained to diagnose poor quality and lack of sleep among pregnant women. Regular screening of all antenatal women should be done as a part of the routine antenatal checkup.

Health education should be given on:

- Importance of adequate sleep and afternoon nap during pregnancy
- Avoid use of mobile phones and TV before sleeping

- Avoid passive smoking
- Encourage physical activity during pregnancy
- Encourage sleeping on a comfortable mattress and bed.

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