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The Impact of Sleep Quality on Premenstrual Syndrome Among Females in Three Districts of Agam Regency, West Sumatra

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Abstract: Premenstrual Syndrome (PMS) significantly impacts reproductive-age females, yet the interplay of lifestyle factors in rural contexts remains under-researched. This study aimed to analyze the relationship between sleep quality and PMS severity among females in Agam Regency, West Sumatra. A quantitative survey was conducted with 124 participants selected via purposive sampling. Data were collected using the Pittsburgh Sleep Quality Index (PSQI) and the Premenstrual Symptoms Screening Tool (PSST), then analyzed using Linear Models (LM) in R. Results showed that 84.67% of respondents reported poor sleep quality. LM analysis revealed that poor sleep quality significantly predicted severity across all PMS categories: PMDD ($p = 0.0054$), psychological/somatic symptoms ($p = 0.0013$), and daily dysfunction ($p = 0.0007$). Additionally, higher BMI was linked to increased PMDD symptoms ($p = 0.0290$), while stress significantly influenced daily functional impairment ($p = 0.0234$). In conclusion, poor sleep quality is a primary predictor of severe PMS, exacerbated by high BMI and stress. These findings suggest that sleep hygiene and stress management are critical non-pharmacological interventions for improving menstrual health in rural populations.

Keywords: BMI; Female; Premenstrual Symptoms Screening Tool; sleep quality; stress

Introduction

The developmental phase of a female individual spans from childhood to adulthood. The onset of menstruation (menarche) marks the beginning of adolescence, indicating reproductive maturity (Senolinggi et al., 2015). One biological phenomenon that often accompanies the menstrual cycle is Premenstrual Syndrome (PMS). Approximately 50%–80% of females of reproductive age experience PMS symptoms, which consist of psychological and somatic complaints that occur one to two weeks before menstruation and resolve with its onset (Baker et al., 2007, Dilbas & Aksan, 2021; Hantsoo et al., 2022). These symptoms include physical discomforts—such as breast tenderness, abdominal cramps, fatigue, and headaches—as well as psychological issues like anxiety, mood swings, difficulty concentrating, and sleep disturbances (Shuchy et al., 2025).

PMS is largely caused by hormonal imbalances, especially between estrogen and progesterone (Yunita & Yuneta, 2021). In addition, factors such as sleep quality may influence the severity of PMS symptoms. A study by Baker et al. (2007) and Feinstein et al. (2020) found that Australian women frequently experienced sleep disturbances, such as trouble falling asleep and waking during the night, in the days leading up to menstruation. Sleep quality is defined as one's ability to initiate and maintain uninterrupted sleep (Buysse et al., 1989; Sancho-Domingo et al., 2021; Kohyama, 2021). Good sleep quality is characterized by adequate, uninterrupted rest, whereas poor sleep is marked by short duration and various disturbances such as waking

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in the night, breathing difficulties, frequent urination, pain, or discomfort.

Good sleep quality could reduce PMS symptoms (Cheng et al., 2013; Mighani et al., 2025). This is because sleep quality affects melatonin secretion, a hormone critical in regulating reproductive functions. Poor sleep reduces melatonin production, which may interfere with the secretion of gonadotropin-releasing hormone (GnRH), luteinizing hormone (LH), follicle-stimulating hormone (FSH), estrogen, and progesterone. Low melatonin levels can result in increased estrogen, which thickens the endometrial lining and causes uterine contractions—factors that contribute to PMS somatic symptoms (Siregar et al., 2022).

In Indonesia, several studies have examined the relationship between sleep quality and PMS in students at junior and senior high schools and universities (Fauziah et al., 2023; Lutfiyati et al., 2021). However, research involving the general population across various social groups remains scarce. In rural areas, where evening activities are fewer and physical work is more common, people tend to go to bed earlier and may enjoy better sleep quality. This raises the question of whether such rural lifestyles influence PMS severity.

Agam Regency, a rural region in West Sumatra with a population of 540,905 (BPS, 2022), presents an ideal context for this research. The area features a wide demographic spectrum in terms of age, occupation, and socio-economic background, offering insights applicable to diverse groups. Therefore, this study aims to analyze the relationship between sleep quality and the severity of Premenstrual Syndrome (PMS) among females in Agam Regency. The expected outcome is a deeper understanding of how sleep disturbances correlate with PMS symptoms and the identification of sleep quality as a potential target for non-pharmacological PMS intervention.

Method

Research Design

This study employed a quantitative descriptive design to explore the relationship between menstrual symptoms and sleep quality among adult females.

Study Setting and Period

The research was conducted over a three-month period, from January to March 2024, in three sub-districts of Agam Regency, West Sumatra—Lubuk Basung, Tanjung Raya, and Tanjung Mutiara. These locations were selected based on population data from the Central Statistics Agency (BPS, 2022), with Lubuk Basung having the largest population (83,285 people), followed by Tanjung Raya (38,310 people) and Tanjung Mutiara (33,764 people). Data collection involved a door-to-door approach, where participants were given a thorough explanation of the study's objectives and procedures before signing informed consent. Once consent was obtained, respondents' anthropometric data (weight and height) were measured using standardized digital instruments, followed by the administration of structured questionnaires to assess demographic characteristics, menstrual patterns, and sleep quality. Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), while menstrual symptoms were assessed using the Premenstrual Symptoms Screening Tool (PSST).

Ethical Consideration

The research obtained ethical clearance from the Ethics Committee of the Faculty of Medicine, University of Lampung (No: 1321/UN26.18/PP.05.02.00/2024), and adhered to ethical standards throughout the research process.

Population and Samples

The population of this study consisted of adult females residing in three selected sub-districts of Agam Regency—Lubuk Basung, Tanjung Raya, and Tanjung Mutiara—who had experienced menstruation. A total of 124 respondents participated in the study, selected using purposive sampling. Inclusion criteria included adult females aged 18 years and above, who had regular or irregular menstrual cycles, and who were willing to provide informed consent. Exclusion criteria were applied to individuals with known hormonal disorders, pregnancy, or diagnosed sleep disorders, in order to avoid confounding factors that could influence menstrual symptoms or sleep quality. The final sample was determined based on voluntary participation during field visits, and all eligible individuals were invited to complete the required instruments following anthropometric measurements and a brief explanation of the study objectives.

Instrument

Prior to data collection permission was requested from local health authorities and community leaders. The research team conducted an initial socialization to introduce the study's purpose and procedures to potential participants. After obtaining informed consent, anthropometric measurements (body weight and height) were taken using calibrated digital scales and stadiometers to calculate Body Mass Index (BMI).

Participants were then asked to complete three sets of instruments: the personal data form, the Premenstrual Symptoms Screening Tool (PSST), and the Pittsburgh Sleep Quality Index (PSQI). Data collection took place at designated community health posts and village halls to ensure convenience and privacy for respondents.

The research team consisted of trained enumerators and a field coordinator who ensured that all instructions were clearly communicated and all forms were properly filled out. Respondents were assisted if they had difficulty understanding any items, particularly in rural areas where literacy levels varied. Completed forms were checked on-site for completeness and validity before being collected for analysis.

Procedure

Pittsburgh Sleep Quality Index (PSQI) Assessment

The sleep quality of participants was assessed using the Pittsburgh Sleep Quality Index (PSQI) questionnaire, which consists of 9 items. The PSQI measures seven components of sleep:

- Sleep duration
- Sleep latency (time taken to fall asleep)
- Daytime dysfunction (e.g., sleepiness and difficulty concentrating)
- Sleep efficiency (the ratio of total sleep time to time spent in bed)
- Subjective sleep quality
- Use of sleep medication
- Sleep disturbances (e.g., waking during the night, bathroom needs, breathing difficulties, nightmares, and pain)

The total PSQI score ranges from 0 to 21, with lower scores indicating better sleep quality. A global score of 0–5 is categorized as good sleep quality, while a score of 6 or above indicates poor sleep quality. A higher score reflects greater sleep disturbances (Buysse et al., 1989; Sancho-Domingo et al. 2021; Carpi, 2025).

Premenstrual Symptoms Screening Tool (PSST) Assessment

The Premenstrual Symptoms Screening Tool (PSST) was used to assess the presence and severity of premenstrual syndrome (PMS) symptoms. The PSST comprises 19 items, including 14 premenstrual symptoms and 5 items related to functional impairment. The symptoms cover both emotional and physical domains, and the tool evaluates:

- Symptom category
- Symptom intensity
- Duration (timing in relation to menstruation)
- Frequency
- Impact on daily activities (e.g., work productivity, social interaction)

Each item is scored on a 4-point Likert scale, ranging from "not at all" (0 points) to "severe" (3 points). Higher total scores indicate greater severity of PMS symptoms (Steiner et al., 2003; Takeda et al, 2020). The classification of PMS severity is based on the following criteria:

Table 1. PMS Severity Classification Criteria

Category	Criteria	Severity
PMDD	At least one of the symptoms rated 2 or 3	Moderate to Severe
Psychological and somatic	At least four of the symptoms rated 2 or 3	Moderate to Severe
Daily functional impairment	At least one impairment rated 2 or 3	Moderate to Severe

Data Analysis Techniques

In this study, the influence of sleep quality on Premenstrual Syndrome (PMS) was analyzed using linear models (LM) implemented in R software version 4.2.2. The analysis aimed to determine the predictive impact of sleep quality and demographic factors on PMS. Three linear models were constructed to represent the three dimensions of PMS: (1) the first model assessed the influence of sleep quality and demographic variables on PMDD symptoms (Category 1); (2) the second model evaluated the impact of the same predictors on psychological and somatic symptoms (Category 2); and (3) the third model examined their effects on daily dysfunction (Category 3). The linear models provided an estimate of the relationship between each predictor and the outcome variable while controlling for other variables in the model.

Result and Discussion

This study was conducted in the sub-districts of Lubuk Basung, Tanjung Raya, and Tanjung Mutiara in Agam Regency, West Sumatra. Demographic data collected from respondents included general, reproductive, and health-related information, all of which were associated with the study's variables: sleep quality and PMS severity. The sample consisted of females aged 15 to 53, with diverse educational and occupational backgrounds and income levels ranging from Rp. 500,000 to Rp. 5,000,000. Most respondents had completed high school.

Regarding reproductive health, 57.25% of respondents did not use contraception, 62.09% were sexually active, and 57.25% had regular menstrual cycles. Health and lifestyle information such as BMI, smoking and alcohol use, and stress levels were also collected. Sleep quality was assessed using the PSQI, and PMS symptoms were measured using the PSST. The majority of respondents (84.67%) exhibited poor sleep quality (PSQI > 5), with an average score of 7.3. The main sleep issues included difficulty falling asleep within 30 minutes, sleep durations under 6 hours, and daytime dysfunction.

These findings align with research by Driver & Sloan (2017), who reported poor sleep quality among

female of reproductive age. The sleep disturbances observed were often linked to nighttime gadget use, consistent with findings by Andira et al. (2022), which show that late-night screen exposure suppresses melatonin production and disrupts circadian rhythms (Jaffer et al., 2024). Short sleep duration and daily dysfunction were also linked to caregiving and household responsibilities, particularly among housewives, echoing the results of Byun et al. (2016).

Daytime dysfunction, such as sleepiness and low productivity, may stem from circadian disruption and abnormal melatonin secretion, as supported by Shen et al., (2023). The Linear Model (LM) analysis confirmed that sleep quality significantly influences all three categories of PMS.

PMS Category 1 (PMDD)

Premenstrual Dysphoric Disorder (PMDD), categorized as PMS Category 1, is a severe mood disorder that disrupts quality of life during the luteal phase (Ediati, 2023). Linear model analysis showed that both BMI (p = 0.0290) and sleep quality (p = 0.0054) significantly influenced PMDD symptoms. Poor lifestyle factors, such as poor diet and sleep hygiene, were contributing factors. Ediati (2023) emphasized that PMDD is not solely due to hormonal fluctuations, but also results from sleep disturbances and unhealthy habits.

Table 2. Linear Model (LM) Analysis of the Influence of Sleep Quality and Demographic Factors on PMS Category 1 (PMDD) in Females in 3 Districts of Agam Regency

Variable	Estimate	Std. Error	T value	P value
Intercept	-2.9178	1.4333	-2.036	0.0441
PSQI	0.4147	0.1462	2.835	0.0054*
Age	-0.0385	0.0221	-1.745	0.0837
Stress	0.4888	0.3344	1.462	0.1465
Menstrual Cycle	0.4647	0.4678	0.993	0.3226
Underweight BMI	-0.0108	1.4509	-0.007	0.9940
Overweight BMI	0.5020	0.4782	1.050	0.2960
Obese BMI	2.1842	0.9879	2.211	0.0290*

Description: Sign (*) = Significance of sign/code (0,05) in Linear Model (LM)

Poor sleep quality, associated with circadian rhythm irregularities, reduces melatonin secretion, which can disrupt the production of gonadotropin hormones (estrogen and progesterone) and serotonin, contributing to mood disturbances like irritability, depression, and emotional instability (Jeon & Baek, 2023). Similarly, high BMI was linked to elevated estrogen due to fat mass. Excess estrogen may overactivate receptors in the hypothalamus and amygdala, further impairing emotional regulation (Paraswati et al., 2022).

Notably, in Agam Regency, females with higher BMI—particularly those aged 45 and above—are at greater risk due to slowed metabolism and increased free estradiol levels (Nisa et al., 2024). This aligns with Nisa et al. (2024), who found that females with overweight or obese BMI are more susceptible to PMS than those with normal BMI.

PMS Category 2 (Psychological and Somatic Symptoms)

Linear model analysis for PMS Category 2 showed that both sleep quality (p = 0.0013) and BMI (p = 0.0263) significantly influenced psychological and somatic symptoms. Poor sleep quality can increase inflammatory responses and prostaglandin production, resulting in uterine muscle contractions and pain sensitivity. This physiological response explains symptoms such as cramps, breast pain, and backaches (Jeon & Baek, 2023).

Table 3. Linear Model (LM) Analysis of the Influence of Sleep Quality and Demographic Factors on PMS Category 2 (Psychological & Somatic Symptoms) in Females in 3 Districts of Agam Regency

Variable	Estimate	Std.Error	T value	P value
Intercept	-3.6270	1.4135	-2.566	0.0115
PSQI	0.4626	0.1407	3.286	0.0013*
Age	-0.0178	0.0204	-0.876	0.3828
Stress	0.1572	0.3223	0.488	0.6264
Menstrual Cycle	0.5822	0.4406	0.321	0.1889
Underweight BMI	-1.5706	1.2662	-0.012	0.9901
Overweight BMI	0.2609	0.4384	1.595	0.5530
Obese BMI	2.0373	0.9058	2.249	0.0263*

Description: Sign (*) = Significance of sign/code (0,05) in Linear Model (LM)

Additionally, excessive fat intake linked to high BMI increases estrogen levels, causing further abdominal contractions and pain prior to menstruation (Paraswati et al., 2022). This supports Estiani & Djokosujono (2020), who found that fat mass and high BMI are critical contributors to somatic PMS symptoms.

Psychological symptoms in PMS Category 2—such as reduced interest in daily activities, social withdrawal, and concentration difficulties—mirror those in PMDD, and share the same underlying hormonal and neurochemical disturbances (Steiner et al., 2003; Itriyeva, 2022; Kim et al., 2023).

PMS Category 3 (Daily Dysfunction)

For PMS Category 3, which involves daily functional impairment, LM analysis revealed significant influences from sleep quality (p = 0.0007) and stress (p = 0.0234). Poor sleep leads to fatigue, low energy, and decreased productivity. Meanwhile, stress elevates

cortisol and reduces serotonin and dopamine, further diminishing mood and motivation (Drigas & Mitsea, 2021). Respondents averaging 33 years of age—typically in early adulthood—reported increased PMS-related dysfunction, likely due to occupational demands and household responsibilities.

Table 4. Linear Model (LM) Analysis of the Influence of Sleep Quality on PMS Category 3 (Daily Dysfunction) in Females in 3 Districts of Agam Regency

Variable	Estimate	Std. Error	T value	P value
Intercept	-3.0680	1.4876	-2.062	0.0414
PSQI	0.5227	0.1518	2.463	0.0007*
Age	-0.0060	0.0208	-1.288	0.7736
Stress	0.7821	0.3405	-2.296	0.0234*
Menstrual Cycle	0.6140	0.4532	1.355	0.1781
Underweight BMI	-0.0068	1.6608	-0.004	0.9967
Overweight BMI	0.3237	0.4531	0.715	0.4763
Obese BMI	2.6795	0.9229	1.820	0.0713

Description: Sign (*) = Significance of sign/code (0,05) in Linear Model (LM)

This finding is consistent with Alwafa et al. (2021), who observed that higher stress levels correlate with more severe PMS symptoms. As stress rises, so does the likelihood of emotional and physical disturbances interfere with daily life.

Non-significant Variables

Demographic factors such as age, education, occupation, and income did not significantly affect PMS occurrence. The results of this study indicate that age is not significantly associated with the incidence of PMS, despite the wide age range of participants (15–53 years). This finding contrasts with the study by Pedro et al. (2022), which reported that PMS symptoms vary across age groups in terms of both physical and emotional aspects. The discrepancy may be attributed to differences in cultural, physiological, or lifestyle characteristics of the study populations.

Education, occupation, and income also showed no significant association. While higher education levels may lead to better knowledge and access to healthcare, they do not necessarily prevent PMS symptoms. Contrary to several previous studies that have suggested a link between lower socioeconomic status and increased premenstrual symptoms or burden, this study did not find a significant association between income level and the incidence of PMS. This discrepancy may be due to the relatively homogeneous income distribution within the study sample, cultural factors that modulate symptom perception and reporting, or the influence of other more dominant variables such as sleep quality, BMI, and stress. These findings highlight the multifactorial nature of PMS and the importance of considering local context when examining its determinants (Liu et al., 2024). Healthy lifestyle factors such as diet, sleep, and stress management appear to play a more decisive role.

Conclusion

This study demonstrates that poor sleep quality is a significant predictor of moderate to severe Premenstrual Syndrome (PMS) symptoms among females in Agam Regency, particularly across the categories of PMDD, psychological and somatic symptoms, and daily dysfunction. Beyond sleep, elevated Body Mass Index (BMI) contributes to PMDD and psychological-somatic severity, while frequent stress is associated with increased daily functional impairment. These findings emphasize the importance of sleep hygiene, stress management, and maintaining a healthy BMI in mitigating PMS symptoms. From a practical standpoint, health education initiatives focusing on sleep quality and emotional regulation should be integrated into community and school-based programs to improve menstrual health outcomes. However, this study has limitations, including a limited sample size and a scope restricted to a single district, which may impact the generalizability of the results. Therefore, future research should explore longitudinal designs and biological mechanisms to deepen the understanding of how sleep disturbances and stress influence PMS severity. Moreover, incorporating objective measures and broader demographic profiles would further enhance the generalizability and robustness of these findings.

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Author Contributions

Conceptualization, W.N.; methodology, W.N.; data curation, I.A.K.; investigation, R.M.S.; formal analysis, R.M.S.; writing—original draft preparation, R.M.S.; writing—review and editing, R.M.S. and W.N.; supervision, A.D. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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