JURNAL MULTIDISIPLIN MADANI (MUDIMA)
Homepage: https://journalmudima.my.id/index.php/mudima
ISSN: 2808-5639 (Online)
Research Article

Vol. 6, No. 8, August (2026)	DOI: https://doi.org/10.55927/mudima.v6i8.111	Page: 1088–1095

Premenstrual Syndrome Severity and Insomnia Risk in Indonesia Working Women: A Cross-Sectional Analysis

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ARTICLE INFO

Keywords: Premenstrual Syndrome; Insomnia; Working Women; Menstrual Cycle; Allopregnanolone.

Received : 3 June 2026
Revised : 17 July 2026
Accepted : 18 Agustus 2026

ABSTRACT

Sleep disturbance carries a substantial global burden, and insomnia stands out as the most prevalent manifestation, affecting between one-third and one-half of the adult population. Women bear a disproportionately greater burden, largely owing to cyclical reproductive hormonal changes throughout the menstrual cycle. Premenstrual syndrome (PMS) is hypothesized to impair sleep via three converging pathways: reduced luteal-phase serotonin synthesis, aberrant allopregnanolone modulation of GABA-A receptors, and circadian pacemaker disruption. A cross-sectional observational study enrolled 62 female employees from two financial-sector companies in Jakarta during September–October 2018. Instruments included a sociodemographic questionnaire, a validated PMS severity scale, and the Insomnia Severity Index (ISI). Fisher exact test was used for bivariate analysis ($p < 0.05$). Young adults aged 18–35 years comprised 85.5% of participants. Premenstrual symptoms were universal; 92.7% reported mild-to-moderate and 7.3% severe-to-very-severe intensity. ISI-defined insomnia was detected in 48.4% of participants. Neither age ($p = 1.000$) nor PMS severity ($p = 0.189$) reached statistical significance; however, the odds ratio for insomnia in the severe PMS subgroup was 4.77 (95% CI: 0.49–46.3). No significant associations were demonstrated, most likely because an underpowered severe-PMS subgroup precluded reliable detection. The magnitude of the odds ratio signals a clinically meaningful trend warranting prospective investigation with objective sleep measurement and systematic confounder control

INTRODUCTION

Adequate sleep quality constitutes an irreplaceable biological recovery mechanism. Disruption of this process is consistently associated with impaired cognitive function, weakened immune responses, and metabolic dysregulation that ultimately compromises health and individual productivity. Among the broad spectrum of sleep disorders, insomnia occupies a dominant position as the most frequently reported condition in the adult population. The American Academy of Sleep Medicine (AASM) defines insomnia as the inability to obtain or maintain adequate sleep—despite sufficient opportunity and time—accompanied by functional daytime impairment, occurring at least three nights per week for a minimum of three consecutive months (Edinger et al., 2021). The 2021 AASM clinical practice guideline establishes behavioural and psychological therapy as the first-line intervention, simultaneously underscoring the importance of early identification of the most vulnerable subgroups ("American Academy of Sleep Medicine," 2023).

Women consistently bear a disproportionately greater insomnia burden than men. A cross-lifespan review revealed that women face nearly twice the risk of insomnia, with peak vulnerability concentrated in the active reproductive phase and the menopausal transition (Pengo et al., 2018). A prospectively demonstrated that objectively

measured sleep variability serves as an early warning signal for suicidal ideation in high-risk young adults, while a meta-analysis (2019) aggregating 34 cohort studies confirmed insomnia as an independent predictor of mental disorders, with a relative risk of 2.10 (95% CI: 1.86–2.38) (Bernert et al., 2017; Hertenstein et al., 2019).

In women of reproductive age, cyclical hormonal fluctuations throughout the menstrual cycle form an additional biological layer that directly influences sleep regulation. Premenstrual syndrome (PMS) is one of the most clinically relevant conditions in this context. PMS is characterised by the recurrent emergence of physical and psychological symptoms during the luteal phase that subsequently remit following menstrual onset. PMS is reported to affect between 20 and 80 percent of reproductive-age women globally—a wide range reflecting heterogeneity across diagnostic instruments (Hofmeister & Bodden, 2016). When symptoms reach a threshold causing significant functional impairment, the condition meets the DSM-5 criteria for Premenstrual Dysphoric Disorder (PMDD)—an extreme form of PMS affecting approximately 3–8% of women (Tiranini & Nappi, 2022).

Three biological pathways underlie the link between PMS and sleep disturbance. The first involves luteal-phase oestrogen decline suppressing serotonin synthesis—an essential neurotransmitter in sleep-wake cycle regulation—thereby reducing melatonin production and impairing sleep initiation (Jehan et al., 2016). The second relates to allopregnanolone, an active progesterone metabolite that acts as a positive allosteric modulator at GABA-A receptors. A study confirmed that women with PMDD experience significantly heavier insomnia, inattention, and fatigue during the luteal phase compared to the follicular phase, consistent with this impaired GABAergic modulatory function (P.-C. Lin et al., 2021). Hantsoo et al extended this understanding by showing that PMDD involves a paradoxical neurosteroid hypersensitivity—even physiological allopregnanolone concentrations trigger excessive neural activation and worsen sleep quality (Hantsoo & Epperson, 2020). The third pathway encompasses circadian rhythm dysregulation mediated through the suprachiasmatic nucleus of the hypothalamus, which is sensitive to oscillating reproductive hormones across the menstrual cycle (Baker & Lee, 2022).

Although the biological mechanisms above have been well documented, epidemiological investigations directly examining the relationship between PMS and insomnia have yielded inconsistent findings. In workplace settings, Hardy et al reported that premenstrual symptoms exert a tangible impact on employee productivity and absenteeism, yet research specifically linking PMS severity to insomnia in this population remains scarce, particularly within the Indonesian context (Hardy & Hunter, 2021). Data from Peltzer et al indicate a significant prevalence of insomnia among the Indonesian adult population, although reproductive-specific factors such as PMS have not been adequately examined in formal workplace settings (Peltzer & Pengpid, 2019). This study was therefore designed to fill this evidence gap by analysing the association between age and PMS severity and the incidence of insomnia among female employees in Jakarta.

METHODS

Study Design, Setting, and Period. This study employed an observational analytic design with a cross-sectional approach, enabling simultaneous evaluation of the exposure variables—age and PMS severity—alongside the outcome variable of insomnia at a single point in time. Data were collected from September to October 2018 at PT. Mega Capital Sekuritas and PT. Mega Capital Investama, Jakarta. Ethical approval was obtained from the Medical Research Ethics Committee of Universitas Trisakti prior to study commencement with register number 80/KER-FK/VIII/2018.

Participants. A total sampling method was applied, enrolling all eligible full-time female employees from both companies during the study period, yielding a final sample of 62 participants. Inclusion criteria were: female sex, age 18–45 years, regular menstrual cycle (21–35 days), and provision of written informed consent. Exclusion criteria

comprised: pregnancy or lactation; use of hormonal contraceptives, sedatives, first-generation antihistamines, or antidepressants; diagnosis of a primary sleep disorder (obstructive sleep apnoea or restless legs syndrome); and a documented history of diagnosed major psychiatric disorder. These exclusion criteria were established to control for sources of bias arising from conditions independently known to affect sleep quality.

Instruments. Three measurement tools were administered simultaneously. First, a sociodemographic form recording age and income status—categorised against the 2018 DKI Jakarta Regional Minimum Wage (RMW). Second, a validated PMS severity scale with five categories: symptom-free, mild, moderate, severe, and very severe. Third, the Insomnia Severity Index (ISI)—a seven-item instrument scored 0–28 classifying insomnia into: no insomnia (0–7), subthreshold (8–14), moderate clinical (15–21), and severe clinical (22–28). The psychometric properties of the ISI, including internal consistency and construct validity, have been confirmed across diverse populations including Asian samples (C.-Y. Lin et al., 2020).

Statistical Analysis. Data were processed using SPSS version 20.0. Univariate analysis mapped frequency distributions and proportions for each variable. Bivariate analysis applied the Fisher exact test ($\alpha = 0.05$) to examine associations between each independent variable and insomnia status; this test was selected because more than 20% of cells in the contingency table had expected counts below 5 after category merging—violating the assumptions of the Chi-square test. The magnitude of association was expressed as an Odds Ratio (OR) with 95% confidence intervals (95% CI).

RESULTS AND DISCUSSION

Results

All 62 eligible female employees were successfully recruited. Complete participant profiles are presented in Table 1. The young adult group (18–35 years) dominated the sample composition at 85.5%, reflecting the age structure of the financial sector workforce in Jakarta. A recent study reported similar demographic patterns among formal-sector female employees—with young productive adults as the largest group—linking this to a higher productivity burden from premenstrual disorders (Loukzadeh et al., 2024). All respondents (100%) earned above the 2018 DKI Jakarta Regional Minimum Wage.

A striking finding in the PMS distribution was the complete absence of symptom-free respondents. The moderate category dominated (51.6%), followed by mild (40.3%), so that the combined mild–moderate group encompassed 91.9% of participants. Only 7.7% experienced severe or very severe symptoms. The universality of premenstrual symptoms aligns with a study by Gudipally et al., who documented that nearly all reproductive-age women experience at least one cyclical symptom, though the majority remain within the mild spectrum (Gudipally & Sharma, 2026).

Overall insomnia prevalence was 48.4% (30 of 62 respondents), concentrated in the mild category (41.9%; n=26) with a smaller proportion in the moderate category (6.5%; n=4). No cases of severe insomnia were identified. This figure is consistent with a study by Pengo et al., who reported that reproductive-age working women represent a group highly vulnerable to insomnia owing to the convergence of biological pressures and dual-role burden (Pengo et al., 2018).

Table 1. Respondent Characteristics (n = 62)

Variable	N	Percentage (%)	Note
Age Group			
Young Adults (18–35 years)	53	85.5	Majority
Middle Adults (36–45 years)	9	14.5	—
PMS Severity			

No symptoms	0	0	—
Mild	25	40.3	—
Moderate	32	51.6	Majority
Severe	4	6.5	—
Very severe	1	1.6	—
Insomnia (ISI)			
No insomnia (score 0–7)	32	51.6	—
Mild insomnia (score 8–14)	26	41.9	—
Moderate insomnia (score 15–21)	4	6.5	—
Severe insomnia (score 22–28)	0	0	—

Table 2 presents the bivariate analysis results. In the age variable, the proportion of insomnia was nearly equal between young adults (49.1%) and middle adults (44.4%), with no significant difference (p = 1.000). In the PMS severity variable, a more notable pattern emerged: the severe–very severe group exhibited an insomnia proportion of 80.0%—far exceeding the 45.6% in the mild–moderate group—with OR = 4.77 (95% CI: 0.49–46.3), though it did not reach the significance threshold (p = 0.189).

Table 2. Bivariate Analysis: Association of Age and PMS Severity with Insomnia (n = 62)

Variable	**No Insomnia**		**Insomnia**		**p value**	**OR (95% CI)**
	N	**%**	**N**	**%**		
Age Group						
Young adults (18–35 yrs)	27	50.9	26	49.1	1.000*	—
Middle adults (36–45 yrs)	5	55.6	4	44.4		
PMS Severity						
Mild–moderate	31	54.4	26	45.6	0.189*	4.77 (0.49–46.3)
Severe–very severe	1	20.0	4	80.0		

**Fisher exact test; significant if p < 0.05.*
OR: Odds Ratio; CI: Confidence Interval.

Discussion

The insomnia rate of 48.4% detected in this study exceeds general population estimates and warrants contextualisation. The respondents were financial sector employees facing high performance demands and a professional-domestic dual burden. Pengo et al explicitly identified reproductive-age working women as the group carrying the highest insomnia burden, arising from the convergence of

three determinants: cyclical hormonal oscillations, occupational psychological pressure, and domestic responsibilities (Pengo et al., 2018). Loukzadeh et al reinforced this by demonstrating that premenstrual disorders measurably reduce the productivity and functional work capacity of female employees, underscoring the need for sleep screening in formal workplace settings (Loukzadeh et al., 2024).

The absence of a significant association between age and insomnia ($p = 1.000$) in the 18–45 year range can be interpreted through two lenses. First, ageing-mediated deterioration of sleep architecture—encompassing reduced melatonin secretion and diminished slow-wave sleep—typically only manifests clinically in individuals older than 55 years, well beyond this study's sample boundary. Data from Indonesian older adults support this view: insomnia prevalence is relatively stable below age 55 before rising sharply thereafter (Pengpid & Peltzer, 2019). Second, within the productive age range, psychosocial factors such as occupational stress and dual-role burden are far more determinative of sleep patterns than chronological age. A study in 2019 confirmed through meta-analysis that psychiatric comorbidity—not age—is the strongest predictor of insomnia in adult populations (Hertenstein et al., 2019).

The value of $p = 0.189$ in the PMS–insomnia association warrants more nuanced interpretation. An OR of 4.77 indicates nearly five times greater odds of insomnia in the severe–very severe PMS group; however, the very wide confidence interval (0.49–46.3) reflects estimation instability arising from the extremely small subgroup size ($n = 5$). Hardy & Hunter note that studies of female employees with severe premenstrual symptoms face genuine recruitment challenges, as this group tends to take more sick leave and is underrepresented in workplace-based surveys—a limitation that likely also influenced the composition of this study's sample (Hardy & Hunter, 2021).

The neurobiological basis of the clinical trend observed in the data is supported by recent evidence. A study by Lin et al., using a prospective three-cycle design, found that women with PMDD objectively experience heavier insomnia, attention deficits, and fatigue during the luteal phase—changes absent in controls and closely correlated with PMDD symptom severity (P.-C. Lin et al., 2021). Hantsoo & Epperson deepened this understanding by showing that the underlying mechanism is not simply an allopregnanolone deficit, but a paradoxical neurosteroid hypersensitivity—even physiological concentrations induce neural excitability and worsen sleep quality (Hantsoo & Epperson, 2020). From a circadian perspective confirmed in their most recent review that luteal-phase sleep changes are more pronounced in women with premenstrual symptoms, consistent with disrupted suprachiasmatic nucleus entrainment by oestrogen and progesterone fluctuations (Baker & Lee, 2022). A study in 2016 had previously identified this as a third pathway worsening sleep initiation in women with PMDD (Jehan et al., 2016).

From a clinical guideline perspective, Riemann et al in the European guideline for insomnia management affirm that evaluation of reproductive-age women should systematically include premenstrual symptom screening as a mandatory component of the diagnostic algorithm (Riemann et al., 2017). A meta-analysis, further demonstrated that cognitive-behavioural therapy for insomnia (CBT-I) consistently improves quality of life, suggesting that protocol adaptation according to the menstrual cycle phase may optimise therapeutic efficacy in populations with premenstrual disorders (Alimoradi et al., 2022).

Five methodological limitations merit acknowledgement. First, the cross-sectional design prevents determination of the temporal sequence between PMS and insomnia—whether PMS precedes or exacerbates insomnia, or vice versa, cannot be established. Second, the severe PMS subgroup ($n = 5$) was too small, rendering the analysis underpowered to detect a biologically plausible association. Third, no control for key psychosocial confounders was available—occupational stress via the Perceived Stress Scale, depression via PHQ-9, or anxiety via GAD-7—which may conceal or inflate the true magnitude of

association. Fourth, PMS diagnosis was not confirmed prospectively over two full cycles as required by DSM-5 PMDD criteria and the ISPMD protocol (Ismaili et al., 2016; Tiranini & Nappi, 2022). Fifth, sleep outcomes were assessed exclusively through self-report; A study demonstrated that subjective and objective sleep assessments do not always correlate among women with premenstrual symptoms, particularly in the severe subgroup (Baker & Lee, 2022).

CONCLUSION

This study found no statistically significant association between age ($p = 1.000$) or PMS severity ($p = 0.189$) and the incidence of insomnia among female employees in Jakarta. Nevertheless, two signals emerging from the data must not be dismissed: first, a high insomnia prevalence (48.4%) in the young working female population; and second, an OR of 4.77 in the severe PMS subgroup which—despite failing to reach statistical significance—indicates a biologically plausible association that the current study design could not adequately detect.

To address the unanswered questions, future research should adopt five methodological strategies: (1) a longitudinal prospective design with daily symptom recording across at least two complete menstrual cycles per the ISPMD protocol; (2) a priori sample size calculation ensuring an adequate proportion of severe-PMS respondents for a sufficiently powered analysis; (3) confounder measurement using validated instruments—PSS, PHQ-9, GAD-7; (4) use of actigraphy or polysomnography for objective sleep confirmation; and (5) application of DSM-5 PMDD criteria for valid PMS diagnosis. Given the high insomnia burden identified, integrating sleep and premenstrual symptom screening into occupational health programmes represents a practical early-detection measure warranting wider adoption.

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