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Original Research

Sleep, anxiety, and preeclampsia: A correlational study in Banjarmasin

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ABSTRACT

Background: Preeclampsia remains one of the leading causes of maternal morbidity and mortality worldwide. Emerging evidence suggests that psychological and behavioral factors, particularly anxiety and poor sleep quality, may contribute to the development of preeclampsia through neuroendocrine, inflammatory, and vascular mechanisms. However, evidence from primary healthcare settings in Indonesia remains limited.

Objective: This study aimed to analyze the correlation between anxiety level and sleep quality with the incidence of preeclampsia among pregnant women attending the Pekauman Public Health Centre, Banjarmasin.

Method: A quantitative analytical study with a cross-sectional design was conducted among 34 pregnant women with gestational age ≥20 weeks, selected using accidental (consecutive) sampling. Anxiety level was measured using the Hamilton Anxiety Rating Scale (HARS), sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), while preeclampsia was determined based on blood pressure measurement and proteinuria examination. Data were analyzed using descriptive statistics and the Spearman Rank Correlation test with a significance level of $p < 0.05$.

Results: Among the respondents, 61.8% experienced mild anxiety, 47.1% had poor sleep quality, and 38.2% were diagnosed with preeclampsia. A statistically significant strong positive correlation was found between anxiety level and preeclampsia incidence ($r = 0.780$; $p < 0.001$). In addition, poor sleep quality demonstrated a statistically significant very strong positive correlation with preeclampsia incidence ($r = 0.835$; $p < 0.001$). Pregnant women with severe anxiety and poor sleep quality were more likely to develop preeclampsia than those with lower anxiety levels and good sleep quality.

Conclusion: Higher anxiety levels and poorer sleep quality were significantly associated with an increased incidence of preeclampsia among pregnant women.

1. Introduction

Preeclampsia (PE) remains a serious global health challenge, affecting approximately 2–8% of pregnancies worldwide and contributing significantly to maternal morbidity and

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mortality (Akbar et al., 2025; Umam et al., 2026). In Indonesia, preeclampsia is one of the leading causes of maternal death, with a maternal mortality rate of 249 per 100,000 live births reported in 2020. A recent multicenter cohort study across 30 Indonesian hospitals found that preeclampsia accounted for 5.3% of births, with a maternal mortality rate of 1.33% among cases with complete data (Akbar et al., 2025). This highlights the persistent burden of preeclampsia in the Indonesian healthcare setting.

Preeclampsia is a serious health problem that can cause maternal death. Preeclampsia is a condition characterised by high blood pressure >140/90 mmHg that appears after 20 weeks of pregnancy, accompanied by symptoms such us swelling of the face and extremities or proteinuria (ACOG, 2019). If left untreated, it can progress to eclampsia, pulmonary edema, HELLP syndrome, acute kidney injury, and maternal death (Akbar et al., 2025; Ashique et al., 2022; Miller, 2019; Pivato et al., 2023). Women with preeclampsia have a twofold increased risk of death. This risk is greater if preeclampsia develops early in pregnancy compared to later in pregnancy (Neerukonda et al., 2020).

Recent evidence has highlighted the role of psychological and behavioral factors in the pathogenesis of hypertensive disorders of pregnancy. A systematic review found that anxiety significantly increases the risk of preeclampsia, with an odds ratio of 1.522 (95% CI: 1.214–1.882). The proposed mechanisms include activation of the hypothalamic-pituitary-adrenal (HPA) axis, increased cortisol and catecholamine levels, enhanced renin-angiotensin system activity, and proinflammatory cytokine release (e.g., TNF-α, IL-6) that impairs vascular endothelial function (Liu et al., 2025; Soundararajan et al., 2025). Similarly, sleep disturbances—particularly obstructive sleep apnea (OSA)—have been associated with a fivefold increased risk of cardiovascular morbidity in women with preeclampsia, likely through sympathetic overactivation, oxidative stress, and endothelial dysfunction (Malhamé et al., 2022). A literature review of studies published between 2020–2025 confirmed that high stress levels and poor sleep quality were significantly associated with increased preeclampsia risk through hormonal imbalance, autonomic nervous system activation, inflammatory responses, and endothelial dysfunction (Azkiatunnisak & Wulandari, 2026).

Despite growing evidence linking anxiety and sleep quality to hypertensive disorders, studies examining the combined effect of both factors on preeclampsia incidence in primary care settings remain limited. A randomized controlled study confirmed that preeclamptic

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pregnant women experience clinically significant insomnia and anxiety, with non-pharmacological interventions such as massage shown to reduce both symptoms (Kırca & Çetin, 2024). However, the association between anxiety level, sleep quality, and preeclampsia incidence in Indonesian community health centres has not been extensively investigated.

At the Pekauman Public Health Centre in Banjarmasin, preliminary data from the Banjarmasin City Health Office indicate that the number of pregnant women with preeclampsia increased from 14 cases in 2023 to 18 cases in 2024. This rising trend, combined with the high number of pregnant women served by this health centre, signals a growing clinical concern requiring further investigation. Therefore, this study aims to analyse the correlation between anxiety level and sleep quality with the incidence of preeclampsia among pregnant women at the Pekauman Public Health Centre, Banjarmasin.

2. Method

Research design

This study employed a quantitative, analytical cross-sectional design to examine the correlation between anxiety level and sleep quality with the incidence of preeclampsia. The cross-sectional approach was chosen because it allows for the assessment of exposure (anxiety and sleep quality) and outcome (preeclampsia) simultaneously at a single point in time, making it efficient for hypothesis generation in primary care settings.

Sample size

Participants were recruited using an accidental (consecutive) sampling technique, whereby all pregnant women attending antenatal care at the health centre during data collection. Each participant was measured only once to avoid duplication and ensure independent observations. The inclusion criteria were: (1) pregnant women with a gestational age of ≥20 weeks, confirmed by last menstrual period or ultrasound; (2) willingness to participate and provision of written informed consent; and (3) ability to communicate in Bahasa Indonesia. The exclusion criteria were: (1) pre-existing chronic hypertension diagnosed prior to pregnancy or before 20 weeks of gestation; (2) a history of psychiatric disorders diagnosed by a psychiatrist; (3) current use of sedative or anxiolytic medications; and (4) incomplete questionnaire responses, which would compromise data quality. All eligible participants who met the criteria and provided consent were included in the study, resulting in a final sample of 34 respondents.

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Data collection

Data were collected using four standardized instruments: the Hamilton Anxiety Rating Scale (HARS) for anxiety, the Pittsburgh Sleep Quality Index (PSQI) for sleep quality, calibrated sphygmomanometry for blood pressure, and dipstick urinalysis for proteinuria. The HARS comprises 14 items rated on a 5-point Likert scale (total score 0–56), with the Indonesian version previously validated among pregnant women (Cronbach's α = 0.87) and confirmed in this study's pilot test on 20 respondents (Cronbach's α = 0.82). The PSQI is a 19-item self-rated questionnaire assessing seven sleep components over the past month, yielding a global score of 0–21, with scores >5 indicating poor sleep quality; the Indonesian version has demonstrated good reliability (Cronbach's α = 0.78–0.82), and the pilot test yielded α = 0.79. Blood pressure was measured using a calibrated aneroid sphygmomanometer after 10 minutes of seated rest, and the average was recorded. Urine protein levels were obtained by reviewing the results of Pekauman Public Health Center laboratory tests, with values ≥1+ (≈30 mg/dL) indicating the presence of proteinuria and ≥2+ (≥100 mg/dL) requiring 24-hour urine confirmation, all performed by trained laboratory staff.

All pregnant women attending antenatal care were screened for eligibility, and eligible participants provided written informed consent after receiving comprehensive study information. The HARS and PSQI were self-administered in a quiet room (15–20 minutes), with research assistants reading questions aloud for participants with literacy difficulties. Physical examinations included blood pressure measurement and oedema assessment (graded as absent, mild, moderate, or severe). Urine samples were analysed on-site by trained staff, and all data were recorded on case report forms and double-entered into a password-protected electronic database.

Data analysis

Data were analysed using SPSS version 26.0. Descriptive statistics, including frequencies and percentages, were computed to summarize participant characteristics and variable distributions. The Spearman Rank Correlation Test was employed to examine the relationships between anxiety level, sleep quality, and preeclampsia incidence. Results were presented in cross-tabulated tables displaying the distribution of anxiety categories and sleep quality scores across preeclampsia cases and non-cases, with statistical significance set at $p < 0.05$. Correlation strength was interpreted using Cohen's criteria (0.00–0.19: very weak; 0.20–

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0.39: weak; 0.40–0.59: moderate; 0.60–0.79: strong; 0.80–1.00: very strong).

Ethical clearance

This research has received ethical permission from the Research Ethics Commission of Universitas Sari Mulia, Banjarmasin, Indonesia, number 457/KEP-UNISM/VIII/2025.

3. Results

Respondent characteristics

Table 1 presents the demographic and clinical characteristics of the respondents. the majority of respondents were in the non-risky age category (76.5%, n = 26), while 23.5% (n = 8) were in the risky age group (<20 or >35 years). Regarding gravidity, more than half of the participants were multigravida (55.9%, n = 19), followed by primigravida (29.4%, n = 10) and grande multigravida (14.7%, n = 5). Most respondents were in the third trimester of pregnancy (64.7%, n = 22), with the remainder in the second trimester (35.3%, n = 12).

Table 1. Distribution of participant characteristics (n = 34)

Characteristic	Category	Frequency (n)	Percentage (%)
Age	No risk (20–35 years)	26	76.5
	Risky (<20 or >35 years)	8	23.5
Gravidity	Primigravida (first pregnancy)	10	29.4
	Multigravida (2nd–4th pregnancy)	19	55.9
	Grande Multigravida (≥5th pregnancy)	5	14.7
Gestational Age	Second trimester (13–27 weeks)	12	35.3
	Third trimester (28–40 weeks)	22	64.7
Blood Pressure	<140/90 mmHg	21	61.8
	≥140/90 mmHg	5	14.7
	≥160/100 mmHg	8	23.5
Urine Protein	Negative (-)	21	61.8
	Positive 1 (+)	9	26.5
	Positive 2 (+)	4	11.8
Oedema	No oedema	21	61.8
	Pedal oedema	11	32.4
	Hand oedema	1	2.9
	Facial oedema	1	2.9

In terms of clinical parameters, 61.8% (n = 21) of participants had normal blood pressure (<140/90 mmHg), while 14.7% (n = 5) presented with hypertension (≥140/90 mmHg) and 23.5% (n = 8) had severe hypertension (≥160/100 mmHg). Urine protein testing revealed that 61.8% (n = 21) had negative results, 26.5% (n = 9) showed 1+ proteinuria, and 11.8% (n = 4) had 2+ proteinuria. Additionally, the majority of respondents (61.8%, n = 21) presented with

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no oedema, while pedal oedema was observed in 32.4% (n = 11), and facial or hand oedema was observed in 2.9% (n = 1) each.

Distribution of anxiety levels, sleep quality, and preeclampsia incidence

Table 2 presents the distribution of the main study variables, including anxiety levels, sleep quality, and preeclampsia incidence among the 34 respondents. The majority of respondents experienced mild anxiety (61.8%, n = 21), followed by severe anxiety (20.6%, n = 7) and moderate anxiety (17.6%, n = 6). Notably, no respondents were classified as having acute anxiety (0.0%, n = 0). Regarding sleep quality, slightly more than half of the participants reported good sleep quality (52.9%, n = 18), while 47.1% (n = 16) had poor sleep quality. In terms of preeclampsia incidence, 61.8% (n = 21) of respondents did not have preeclampsia, whereas 38.2% (n = 13) were diagnosed with preeclampsia based on the established criteria.

Table 2. Distribution of anxiety levels, sleep quality, and preeclampsia incidence (n = 34)

Variable	Category	Frequency (n)	Percentage (%)
Anxiety level	Mild Anxiety (14–20)	21	61.8
	Moderate Anxiety (21–27)	6	17.6
	Severe Anxiety (28–34)	7	20.6
	Acute Anxiety (≥35)	0	0.0
Sleep quality	Good (PSQI ≤5)	18	52.9
	Poor (PSQI >5)	16	47.1
Preeclampsia incidence	No Preeclampsia	21	61.8
	Preeclampsia	13	38.2

Correlation between anxiety levels and preeclampsia incidence

As presented in Table 3, the majority of respondents without preeclampsia were classified as having mild anxiety (55.9%, n = 19), while only 5.9% (n = 2) of those with mild anxiety developed preeclampsia. Among participants with moderate anxiety, 5.9% (n = 2) did not have preeclampsia, whereas 11.8% (n = 4) were diagnosed with preeclampsia. Notably, all respondents with severe anxiety (20.6%, n = 7) were in the preeclampsia group, with no cases of severe anxiety found among non-preeclamptic participants. No respondents were classified as having acute anxiety.

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Table 3. Cross-tabulation of anxiety level and preeclampsia incidence (n = 34)

	Preeclampsia Incidence				Total		p-value	Correlation Coefficient
	No Preeclampsia		Preeclampsia					
Anxiety Levels	n	%	n	%	n	%		
Mild Anxiety	19	55,9	2	5,9	21	61.8		
Moderate Anxiety	2	5,9	4	11,8	6	17.6		
Severe Anxiety	0	0	7	20,6	7	20.6	<0.001	0.780
Acute Anxiety	0	0	0	0	0	0		
Total	21	61,8	13	38,2	34	100		

The Spearman Rank correlation test revealed a statistically significant positive correlation between anxiety level and preeclampsia incidence ($r = 0.780$; $p < 0.001$). The correlation coefficient of 0.780 indicates a strong positive correlation, suggesting that higher anxiety levels are associated with an increased likelihood of preeclampsia. The p-value ($p < 0.001$) confirms that this association is statistically significant at the $\alpha = 0.05$ level.

Correlation between sleep quality and preeclampsia incidence

As presented in Table 4, all respondents with good sleep quality (52.9%, n = 18) were in the non-preeclampsia group, with no cases of preeclampsia observed among this category (0.0%, n = 0). In contrast, among participants with poor sleep quality, the majority (38.2%, n = 13) were diagnosed with preeclampsia, while only 8.8% (n = 3) did not have preeclampsia. This indicates a clear disparity in preeclampsia incidence based on sleep quality status.

Table 4. Cross-tabulation of sleep quality and preeclampsia incidence (n = 34)

	Preeclampsia Incidence				Total		p-value	Correlation coefficient
	No Preeclampsia		Preeclampsia					
Sleep Quality	n	%	n	%	n	%		
Good	18	52,9	0	0,0	18	52,9		
Poor	3	8,8	13	38,2	16	47,1	<0,001	0,835
Total	21	61,8	13	38,2	34	100		

The Spearman Rank correlation test revealed a statistically significant positive correlation between poor sleep quality and preeclampsia incidence ($r = 0.835$; $p < 0.001$). The correlation coefficient of 0.835 indicates a very strong positive correlation, suggesting that poorer sleep quality is associated with a substantially increased likelihood of preeclampsia. The p-value ($p < 0.001$) confirms that this association is statistically significant at the $\alpha = 0.05$ level.

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4. Discussions

This study examined the correlation between anxiety levels and sleep quality with the incidence of preeclampsia among pregnant women at the Pekauman Public Health Centre, Banjarmasin. The findings revealed a strong positive correlation between anxiety level and preeclampsia incidence ($r = 0.780$; $p < 0.001$), as well as a very strong positive correlation between poor sleep quality and preeclampsia incidence ($r = 0.835$; $p < 0.001$). These results provide compelling evidence that both psychological and behavioral factors play significant roles in the pathogenesis of preeclampsia in this population.

Correlation between anxiety level and preeclampsia incidence

The present study found that the majority of respondents without preeclampsia were classified as having mild anxiety (55.9%, n = 19), while all respondents with severe anxiety (20.6%, n = 7) were in the preeclampsia group. The Spearman Rank correlation test revealed a statistically significant strong positive correlation between anxiety level and preeclampsia incidence ($r = 0.780$; $p < 0.001$). This finding is consistent with a systematic review by Liu et al. (2025), which reported that anxiety significantly increases the risk of preeclampsia with an odds ratio of 1.522 (95% CI: 1.214–1.882). Similarly, Soundararajan et al. (2025) confirmed that maternal anxiety symptoms are associated with hypertensive disorders of pregnancy through shared physiological mechanisms.

The pathophysiological mechanisms linking anxiety to preeclampsia have been well-documented in the literature. Liu et al. (2025) proposed that anxiety activates the hypothalamic-pituitary-adrenal (HPA) axis, increasing cortisol levels and enhancing renin-angiotensin system activity, leading to vasoconstriction and elevated blood pressure. Additionally, anxiety promotes the release of proinflammatory cytokines (e.g., TNF-α, IL-6, IL-17), impairing vascular endothelial function and promoting oxidative stress. Vianna et al. (2011) suggested that distress conditions during pregnancy may lead to preeclampsia by enhancing in vivo cortisol levels, which are associated with hypertension and endothelial dysfunction—features often observed in patients with preeclampsia. The strong correlation observed in this study ($r = 0.780$) supports the hypothesis that higher anxiety levels are associated with an increased likelihood of preeclampsia, likely through these neuroendocrine and inflammatory pathways.

It is noteworthy that no respondents were classified as having acute anxiety (0.0%), which

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may reflect the characteristics of the study population or the effectiveness of existing psychosocial support at the health centre. Nevertheless, the graded relationship between anxiety severity and preeclampsia incidence—from mild anxiety (5.9% with preeclampsia) to severe anxiety (100% with preeclampsia)—demonstrates a clear dose-response pattern that strengthens the causal inference.

Correlation between sleep quality and preeclampsia incidence

This study found that all respondents with good sleep quality (52.9%, n = 18) were in the non-preeclampsia group, with no cases of preeclampsia observed among this category. In contrast, among participants with poor sleep quality, the majority (38.2%, n = 13) were diagnosed with preeclampsia, while only 8.8% (n = 3) did not have preeclampsia. The Spearman Rank correlation test revealed a statistically significant very strong positive correlation between poor sleep quality and preeclampsia incidence ($r = 0.835$; $p < 0.001$). This finding aligns with previous research by Georgiou et al. (2019), who found that women with preeclampsia had significantly higher rates of poor sleep quality before pregnancy compared to controls (OR = 4.45; 95% CI: 1.53–12.99).

The mechanisms linking sleep disturbances to preeclampsia have been extensively investigated. Sleep disturbances, particularly obstructive sleep apnea (OSA), are associated with a fivefold increased risk of cardiovascular morbidity in women with preeclampsia, likely through sympathetic overactivation, oxidative stress, and endothelial dysfunction (Malhamé et al., 2022; Maniaci et al., 2024; Parise et al., 2023; Torres et al., 2024). Savka and Berbets (2023) demonstrated that sleep disorders in pregnant women with preeclampsia occur earlier and are more pronounced compared to women with uncomplicated pregnancies, with a significant 1.78-fold decrease in melatonin levels observed in preeclamptic women. Sleep-disordered breathing during pregnancy has been associated with intermittent hypoxia, oxidative stress, and sympathetic overstimulation, which are key stressors that drive the development of hypertension (Querejeta Roca et al., 2020). Additionally, poor sleep quality affects neuroendocrine, metabolic, and inflammatory systems, contributing to increased blood pressure and endothelial dysfunction (Aggarwal et al., 2018).

The finding that good sleep quality appears to be a protective factor—with zero cases of preeclampsia in this group—has important clinical implications. This observation is consistent with Kırca & Çetin (2024), who confirmed that preeclamptic pregnant women experience

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clinically significant insomnia and anxiety, and that non-pharmacological interventions such as massage can reduce both symptoms. The very strong correlation (r = 0.835) observed in this study underscores the critical importance of sleep quality assessment and intervention as part of routine antenatal care.

Clinical implication

The findings of this study have several important clinical implications. First, routine screening for anxiety and sleep disturbances should be integrated into antenatal care protocols at primary health centres. The HARS and PSQI instruments used in this study are practical, validated tools that can be easily administered in busy clinical settings. Second, pregnant women identified with elevated anxiety levels or poor sleep quality should receive targeted psychosocial interventions, such as relaxation training, yoga, mindfulness meditation, or classical foot massage, which have been shown to reduce both symptoms and potentially lower preeclampsia risk (Kırca & Çetin, 2024; Liu et al., 2025). Third, the strong correlation between sleep quality and preeclampsia incidence suggests that interventions to improve sleep hygiene—such as limiting screen time before bed, maintaining consistent sleep schedules, and managing nocturia—should be emphasized in antenatal education. Fourth, healthcare providers should be aware that sleep disturbances in the second trimester may serve as an early warning sign of pineal gland dysfunction and increased preeclampsia risk (Savka & Berbets, 2023).

Limitation and suggest for future research

Several limitations of this study should be acknowledged. First, the cross-sectional design precludes establishing causal relationships between anxiety, sleep quality, and preeclampsia; only associations can be inferred. Second, the sample size (n = 34) was relatively small, which may limit the generalizability of the findings to other populations. Third, the use of accidental sampling may introduce selection bias, as participants were recruited only from a single health centre. Fourth, self-reported questionnaires (HARS and PSQI) may be subject to recall bias and social desirability bias, although the pilot test confirmed good reliability. Fifth, the measurement of urine protein using dipstick urinalysis, rather than 24-hour urine collection, may have limited the accuracy of preeclampsia diagnosis for some participants. Despite these limitations, the study provides valuable insights into the relationship between psychological and behavioral factors and preeclampsia in an Indonesian primary care setting.

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These results underscore the importance of integrating routine screening for anxiety and sleep disturbances into antenatal care protocols and implementing targeted psychosocial and behavioral interventions to reduce preeclampsia risk. Future research with larger sample sizes, prospective cohort designs, and objective measures of sleep quality (e.g., polysomnography) is warranted to confirm these findings and elucidate the causal pathways linking anxiety and sleep disturbances to preeclampsia. Additionally, intervention studies evaluating the effectiveness of anxiety reduction and sleep improvement programs in preventing preeclampsia are needed to translate these findings into clinical practice.

5. Conclusion

This study demonstrated a statistically significant strong positive correlation between anxiety level and preeclampsia incidence ($r = 0.780$; $p < 0.001$) and a very strong positive correlation between poor sleep quality and preeclampsia incidence ($r = 0.835$; $p < 0.001$) among pregnant women at the Pekauman Public Health Centre, Banjarmasin. The findings suggest that higher anxiety levels and poorer sleep quality are associated with an increased likelihood of preeclampsia, with good sleep quality appearing to be a protective factor.

6. Conflict of interest

All authors declare no conflict of interest.

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