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The Relationship between Maternal Risk Factors and the Incidence of Preeclampsia in Primigravida Pregnant Women in the Third Trimester at Tilamuta Community Health Center

Merlin Salim[1], Widia Shofa Ilmiah[2*]
[1]Tilamuta Health Care, Indonesia
[2]Institut Teknologi Sains dan Kesehatan Rs. dr. Soepraoen Malang, Indonesia
[*]*Corresponding Author: merlinsalim19@gmail.com[2]*

Abstract. Preeclampsia remains a major contributor to maternal and perinatal morbidity and mortality, particularly in low- and middle-income countries where early detection at the primary healthcare level is often limited. This study aimed to analyze the relationship between maternal risk factors and the incidence of preeclampsia among third-trimester pregnant women at Tilamuta Primary Health Center. An analytical observational study with a cross-sectional design was conducted in 2025 involving 45 pregnant women selected using total sampling. Data were collected from antenatal care registers and maternal medical records. The independent variables included maternal age, gravidity, educational level, history of hypertension, and history of diabetes mellitus, while the dependent variable was the incidence of preeclampsia. Data analysis was performed using chi-square tests and logistic regression with a significance level of 0.05. The prevalence of preeclampsia in this study was 42.2%, indicating a high burden of hypertensive disorders during pregnancy. Maternal age and educational level were significantly associated with preeclampsia ($p < 0.05$). A history of hypertension showed a significant association with preeclampsia and remained the strongest independent predictor in multivariate analysis. In contrast, gravidity and history of diabetes mellitus were not significantly associated with preeclampsia. These findings highlight the importance of strengthening antenatal screening, particularly for women with pre-existing hypertension, to support early detection and prevention of preeclampsia at the primary healthcare level.

Keywords: Antenatal Screening; Educational Level; Hypertension History; Maternal Age; Preeclampsia Incidence

1. INTRODUCTION

Preeclampsia remains a major obstetric complication and a leading cause of maternal and perinatal morbidity and mortality worldwide. It is clinically characterized by the onset of hypertension accompanied by proteinuria or signs of organ dysfunction after 20 weeks of gestation. Despite advances in antenatal care, preeclampsia continues to pose serious health risks, particularly in low- and middle-income countries, where limitations in early detection and comprehensive maternal care persist. The condition not only threatens maternal health through complications such as eclampsia, stroke, and organ failure, but also significantly increases adverse perinatal outcomes, including preterm birth, intrauterine growth restriction, low birth weight, and perinatal mortality (Aksari et al., 2022).

In Indonesia, preeclampsia remains one of the primary contributors to maternal mortality, alongside hemorrhage and infection. The burden of preeclampsia is influenced by a wide range of maternal risk factors, socio-demographic characteristics, and disparities in access to quality antenatal services. These variations underscore the importance of identifying context-specific risk factors to improve preventive strategies at the primary healthcare level.

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Early identification of high-risk pregnant women is essential to reduce severe complications and improve maternal and neonatal outcomes (Handayani & Sania, 2024).

Primigravidity has consistently been identified as a significant risk factor for the development of preeclampsia. From a biological perspective, the first pregnancy involves complex immunological and vascular adaptations between the maternal system and the placenta (Amalia Efendy et al., 2024). In primigravida women, the lack of prior immunological tolerance to paternal antigens expressed by the placenta may result in abnormal placentation and impaired uteroplacental perfusion, which are central mechanisms in the pathogenesis of preeclampsia. As a result, primigravida women are more vulnerable to endothelial dysfunction, systemic inflammation, and hypertensive disorders during pregnancy (Rahman et al., 2023).

Previous studies have provided substantial evidence regarding the association between maternal risk factors and preeclampsia. A study by Suardi et al., (2023) reported that primigravidity, advanced maternal age, and elevated body mass index significantly increased the risk of preeclampsia, emphasizing the multifactorial nature of the disorder. Similarly, Duckitt and Harrington demonstrated that first-time mothers were at a higher risk of developing preeclampsia compared to multigravida women, particularly in the presence of additional risk factors such as obesity and pre-existing hypertension. Another study by Abdul et al., (2023) highlighted that maternal age extremes and poor maternal health status were strongly associated with hypertensive disorders of pregnancy.

Several studies have also emphasized the critical role of the third trimester as a period when preeclampsia most commonly manifests and progresses to severe forms. According to Sibai, inadequate monitoring during late pregnancy may delay diagnosis and increase the likelihood of maternal and fetal complications. These findings suggest that focused surveillance of primigravida women during the third trimester is crucial for preventing adverse outcomes.

Despite the growing body of literature on preeclampsia, most existing studies have been conducted at tertiary care hospitals or have focused on general pregnant populations without distinguishing gravidity status (Saadah et al., 2025). Limited research has specifically examined maternal risk factors associated with preeclampsia among primigravida women in the third trimester at the primary healthcare level, particularly in rural or semi-rural settings (Pangesti & Fauzia, 2022). This represents an important research gap, as maternal characteristics and healthcare delivery at primary health centers may differ substantially from those in referral hospitals.

Preliminary data collected in October 2025 at Tilamuta Primary Health Center revealed a concerning prevalence of preeclampsia among primigravida women in the third trimester. Out of 45 primigravida pregnant women, 19 cases (42.2%) were diagnosed with preeclampsia, indicating a high burden of hypertensive disorders in this group. This finding suggests that maternal risk factors may play a significant role in the occurrence of preeclampsia and highlights the need for targeted investigation in this specific population.

Therefore, this study aims to analyze the relationship between maternal risk factors and the incidence of preeclampsia among third-trimester primigravida women at Tilamuta Primary Health Center. The findings are expected to contribute to a better understanding of locally relevant risk factors and to support the development of effective preventive strategies, early detection, and improved antenatal care services for primigravida women at the primary healthcare level.

2. RESEARCH METHOD

This study employed an analytical observational design with a cross-sectional approach to examine the relationship between maternal risk factors and the incidence of preeclampsia among primigravida women in the third trimester. The research was conducted at Tilamuta Primary Health Center in 2025. The study population consisted of all pregnant women in their third trimester registered at the health center, while the study sample included primigravida women who met the inclusion criteria, namely gestational age of 28 weeks or more and complete medical records. A total sampling technique was applied to ensure comprehensive representation of the target population.

The dependent variable in this study was the occurrence of preeclampsia, defined based on clinical diagnosis recorded in medical records. The independent variables included maternal risk factors such as maternal age, blood pressure status, and maternal health history. Data were collected through secondary data sources, including antenatal care registers and maternal health records. All data were systematically recorded using a structured data extraction form to ensure consistency and accuracy.

Data analysis was performed using statistical software. Descriptive analysis was conducted to summarize maternal characteristics and the prevalence of preeclampsia. Inferential analysis was carried out using the chi-square test to assess the association between maternal risk factors and preeclampsia. A p-value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the relevant institutional authority, and confidentiality of participants' data was strictly maintained throughout the study.

3. RESULTS AND DISCUSSION

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Table 1. Distribution of Maternal Age among Third-Trimester Pregnant Women.

Maternal Age (Years)	Frequency (n)	Percentage (%)
< 20 years	16	35.6
20–35 years	24	53.3
> 35 years	5	11.1
Total	45	100.0

Table 1 shows that the majority of respondents were within the optimal reproductive age range of 20–35 years, accounting for more than half of the sample (53.3%). However, a considerable proportion of pregnant women were younger than 20 years (35.6%), which represents a vulnerable age group in pregnancy. Only a small proportion of respondents were aged above 35 years (11.1%). These findings indicate that although most pregnancies occurred within the ideal reproductive age, a substantial number of women were exposed to age-related pregnancy risks.

Table 2. Distribution of Gravidity Status.

Gravidity Status	Frequency (n)	Percentage (%)
Primigravida	37	82.2
Multigravida	4	8.9
Grand multipara	4	8.9
Total	45	100.0

As presented in Table 2, most respondents were primigravida (82.2%), indicating that the study population was dominated by women experiencing their first pregnancy. Multigravida and grand multiparous women each accounted for only 8.9% of the sample. This distribution emphasizes the relevance of focusing on primigravida women, who are known to have a higher biological risk of developing preeclampsia due to limited physiological adaptation to pregnancy.

Table 3. Distribution of Educational Level.

Educational Level	Frequency (n)	Percentage (%)
Elementary School	4	8.9
Junior High School	11	24.4
Senior High School	20	44.4
Higher Education	10	22.2
Total	45	100.0

Table 3 illustrates that nearly half of the respondents had completed senior high school (44.4%), followed by those with higher education (22.2%). A smaller proportion had junior high school education (24.4%), while only 8.9% had elementary-level education. This distribution suggests that most respondents had moderate to high educational attainment, which may influence health literacy and utilization of antenatal care services.

Table 4. Distribution of History of Hypertension.

History of Hypertension	Frequency (n)	Percentage (%)
Yes	15	33.3
No	30	66.7
Total	45	100.0

Table 4 shows that one-third of respondents (33.3%) had a history of hypertension, while the majority (66.7%) did not report such a history. The presence of pre-existing hypertension in a substantial proportion of pregnant women indicates an important clinical risk factor that may contribute to the development of preeclampsia during pregnancy.

Table 5. Distribution of History of Diabetes Mellitus.

History of Diabetes Mellitus	Frequency (n)	Percentage (%)
Yes	2	4.4
No	43	95.6
Total	45	100.0

As shown in Table 5, only a small proportion of respondents (4.4%) had a history of diabetes mellitus, while the vast majority (95.6%) did not. This finding indicates that diabetes mellitus was relatively uncommon in the study population and suggests a limited contribution of this factor to the overall burden of preeclampsia.

Table 6. Distribution of Preeclampsia Incidence.

Preeclampsia Status	Frequency (n)	Percentage (%)
Yes	19	42.2
No	26	57.8
Total	45	100.0

Table 6 demonstrates that 42.2% of respondents were diagnosed with preeclampsia, while 57.8% did not experience the condition. The high prevalence of preeclampsia observed in this study highlights a significant maternal health concern among third-trimester pregnant women at the primary healthcare level and underscores the need for improved screening and preventive strategies.

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Table 7. Association between Maternal Age and Preeclampsia Incidence.

Maternal Age (Years)	Preeclampsia (Yes) n (%)	Preeclampsia (No) n (%)	Total (n)	p-value
< 20 years	0 (0.0)	16 (100.0)	16	
20–35 years	18 (75.0)	6 (25.0)	24	
> 35 years	1 (20.0)	4 (80.0)	5	
Total	19	26	45	<0.001

Table 7 shows a statistically significant association between maternal age and the incidence of preeclampsia ($p < 0.001$). The highest proportion of preeclampsia occurred among women aged 20–35 years (75.0%), while no cases were observed in women under 20 years of age. This finding indicates that maternal age plays an important role in the occurrence of preeclampsia in this study population.

Table 8. Association between Gravidity and Preeclampsia Incidence.

Gravidity Status	Preeclampsia (Yes) n (%)	Preeclampsia (No) n (%)	Total (n)	p-value
Primigravida	15 (40.5)	22 (59.5)	37	
Multigravida	1 (25.0)	3 (75.0)	4	
Grand multipara	3 (75.0)	1 (25.0)	4	
Total	19	26	45	0.318

As presented in Table 8, gravidity was not significantly associated with the incidence of preeclampsia (p = 0.318). Although a higher proportion of preeclampsia was observed among grand multiparous women, the difference was not statistically significant. This suggests that gravidity alone may not be a determining factor for preeclampsia in this study.

Table 9. Association between Educational Level and Preeclampsia Incidence.

Educational Level	Preeclampsia (Yes) n (%)	Preeclampsia (No) n (%)	Total (n)	p-value
Elementary School	2 (50.0)	2 (50.0)	4	
Junior High School	0 (0.0)	11 (100.0)	11	
Senior High School	13 (65.0)	7 (35.0)	20	
Higher Education	4 (40.0)	6 (60.0)	10	
Total	19	26	45	0.006

Table 9 demonstrates a statistically significant association between educational level and preeclampsia incidence (p = 0.006). The highest proportion of preeclampsia was found among women with senior high school education. This finding suggests that educational level may influence pregnancy outcomes, possibly through differences in health awareness, lifestyle, or utilization of antenatal care services.

Table 10. Association between History of Hypertension and Preeclampsia Incidence.

History of Hypertension	Preeclampsia (Yes) n (%)	Preeclampsia (No) n (%)	Total (n)	p-value
Yes	10 (66.7)	5 (33.3)	15	
No	9 (30.0)	21 (70.0)	30	
Total	19	26	45	0.019

Table 10 indicates a statistically significant association between a history of hypertension and preeclampsia (p = 0.019). Women with a history of hypertension had a markedly higher proportion of preeclampsia compared to those without such history. This finding confirms hypertension as a major risk factor for preeclampsia.

Table 11. Association between History of Diabetes Mellitus and Preeclampsia Incidence.

History of Diabetes Mellitus	Preeclampsia (Yes) n (%)	Preeclampsia (No) n (%)	Total (n)	p-value
Yes	2 (100.0)	0 (0.0)	2	
No	17 (39.5)	26 (60.5)	43	
Total	19	26	45	0.091

As shown in Table 11, there was no statistically significant association between a history of diabetes mellitus and the incidence of preeclampsia (p = 0.091). Although all women with diabetes mellitus developed preeclampsia, the small number of cases limited the statistical power to detect a significant relationship.

Discussion

The findings of this study demonstrate that preeclampsia remains a major maternal health problem among third-trimester pregnant women at the primary healthcare level. The prevalence of preeclampsia observed in this study (42.2%) is substantially higher than the global average reported in the literature, which generally ranges between 2% and 10% of pregnancies. Similar concerns have been highlighted by Blud & Kota, (2023), who emphasized that hypertensive disorders of pregnancy continue to disproportionately affect women in low- and middle-income countries due to delayed diagnosis, limited antenatal surveillance, and insufficient risk stratification during routine care. The high prevalence found in this study suggests that preeclampsia in the study setting may not be adequately detected or prevented during earlier stages of pregnancy.

Maternal age showed a statistically significant association with preeclampsia, with the highest proportion of cases occurring among women aged 20–35 years. At first glance, this finding appears to contradict the conventional understanding that extreme maternal age particularly advanced maternal age is the strongest age-related risk factor for preeclampsia. However, several previous studies have reported similar patterns. Suardi et al., (2023) explained that although women at extreme ages have a higher individual risk, the majority of preeclampsia cases often occur among women of optimal reproductive age simply because this group accounts for the largest proportion of pregnancies. This phenomenon reflects a population-attributable risk rather than individual susceptibility alone. Additionally, Abdul et al., (2023) noted that even physiologically optimal pregnancies can develop preeclampsia if placental implantation and vascular remodeling are impaired, reinforcing the multifactorial nature of the disorder.

The absence of preeclampsia cases among women younger than 20 years in this study should be interpreted cautiously. While several studies, including Pagirik et al., (2024), have reported increased risk among adolescent pregnancies, the small sample size and contextual factors such as antenatal care coverage may explain the discrepancy observed in this study. This highlights the importance of contextualizing epidemiological findings within local demographic and healthcare conditions rather than applying generalized risk assumptions.

Gravidity was not significantly associated with preeclampsia in this study, although primigravida women constituted the majority of cases. This finding diverges from the well-established evidence identifying primigravidity as a major risk factor for preeclampsia. Duckitt and Harrington (2005) reported that primigravida women have a two- to three-fold increased risk compared to multigravida women. Similarly, Rahayu (2023) proposed that immunological maladaptation during the first pregnancy contributes to abnormal placentation and endothelial dysfunction. The lack of statistical significance in the present study may be explained by the limited representation of multigravida and grand multiparous women, which reduced statistical power. Nevertheless, the predominance of preeclampsia cases among primigravida women supports the biological plausibility of gravidity-related risk and underscores the need for intensified surveillance in first pregnancies.

Educational level was significantly associated with preeclampsia incidence, with the highest proportion observed among women with senior high school education. Previous studies have produced inconsistent findings regarding the role of education in preeclampsia. Some studies have reported that lower educational attainment increases risk due to limited health literacy and reduced access to care. In contrast, Hatini et al.(2025) emphasized that education interacts with occupational stress, lifestyle, and psychosocial factors, which may offset its protective effects. Women with moderate education levels may experience higher workloads, limited rest, and increased psychosocial stress, all of which have been associated with elevated blood pressure during pregnancy. This finding suggests that education should not be viewed as a standalone protective factor but rather as a component of a broader socio-behavioral context.

A history of hypertension emerged as the most consistent and significant risk factor for preeclampsia in this study. Women with pre-existing hypertension were significantly more likely to develop preeclampsia, a finding that aligns strongly with previous research. Sibai et al. (2005) demonstrated that chronic hypertension increases the risk of superimposed preeclampsia by up to five times. Alfitri et al., (2024)further identified chronic hypertension as one of the strongest predictors of preeclampsia in nulliparous women. The biological mechanisms underlying this association involve endothelial dysfunction, impaired nitric oxide production, and altered placental perfusion, all of which contribute to the pathophysiology of preeclampsia. The consistency of these findings across studies reinforces the importance of hypertension screening and management before and during pregnancy.

In contrast, a history of diabetes mellitus was not significantly associated with preeclampsia in this study. Although all women with diabetes mellitus developed preeclampsia, the small number of diabetic cases limited statistical inference. Previous studies have reported

mixed findings. Jellabing et al., (2025) found that diabetes mellitus increases the risk of preeclampsia through mechanisms related to insulin resistance and vascular inflammation. However, other studies have shown that the association diminishes after controlling for confounders such as obesity and hypertension. The findings of the present study suggest that diabetes mellitus may act as a contributing factor rather than an independent predictor of preeclampsia.

The multivariate analysis further confirmed that a history of hypertension remained an independent predictor of preeclampsia after adjustment for other variables. The logistic regression model explained approximately 28.5% of the variance in preeclampsia occurrence, indicating that while hypertension is a critical determinant, other unmeasured factors such as nutritional status, body mass index, stress, and genetic predisposition may also play important roles. This observation is consistent with the conceptual framework proposed by Isnawati et al., (2024), which emphasizes the complex interplay between maternal, placental, and environmental factors in the development of preeclampsia.

From a clinical and public health perspective, the findings of this study underscore the need for strengthened antenatal risk assessment at the primary healthcare level. Women with a history of hypertension should be prioritized for intensive monitoring, particularly during the third trimester when preeclampsia most commonly manifests. Early identification, regular blood pressure screening, and individualized antenatal care are essential strategies to reduce maternal and neonatal complications. Furthermore, education-based interventions should address not only knowledge but also stress management, lifestyle modification, and adherence to antenatal care schedules.

Despite its contributions, this study has several limitations that should be acknowledged. The cross-sectional design limits causal inference, and the relatively small sample size may have reduced the ability to detect associations for some variables. Nevertheless, the study provides valuable insights into preeclampsia risk factors in a primary healthcare setting, where research remains limited.

Overall, this study contributes to the existing body of literature by reinforcing the role of maternal age and pre-existing hypertension as key risk factors for preeclampsia while highlighting the contextual nature of gravidity and educational level. These findings support the implementation of targeted preventive strategies and strengthen the evidence base for improving maternal health outcomes at the primary healthcare level.

4. CONCLUSION

This study demonstrates that preeclampsia remains a significant maternal health problem among third-trimester pregnant women at the primary healthcare level. A high prevalence of preeclampsia was observed, indicating the need for improved early detection and preventive strategies. Maternal age and educational level were significantly associated with the incidence of preeclampsia, while gravidity and history of diabetes mellitus were not significantly related. A history of hypertension emerged as the most important risk factor and remained an independent predictor of preeclampsia, underscoring its critical role in the development of hypertensive disorders during pregnancy.

These findings highlight the importance of strengthening antenatal care services, particularly through early identification of women with pre-existing hypertension and other maternal risk factors. Enhanced screening, regular blood pressure monitoring, and targeted counseling during pregnancy are essential to reduce the burden of preeclampsia and its complications. The results of this study provide evidence to support the implementation of risk-based antenatal interventions at the primary healthcare level and contribute to the growing body of literature on maternal health in low- and middle-income settings.

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