REVIEW

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Association between maternal age and primigravida status with preeclampsia: a cross-sectional study

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ABSTRACT

Preeclampsia remains a major contributor to maternal morbidity and mortality, particularly in developing countries. Maternal age and primigravida status are among the most reported risk factors, yet local evidence from specific settings, such as Buleleng, Bali, remains limited. This study aims to determine the association between maternal age and primigravida status with the incidence of preeclampsia at Buleleng Regional Hospital during 2020–2023. This study employed an analytic observational design with a cross-sectional approach using secondary data from medical records at Buleleng Regional Hospital from 2020 to 2023. A total of 134 pregnant women who met the inclusion criteria were selected using purposive sampling. The independent variables were maternal age and primigravida status, while the dependent variable was the incidence of preeclampsia. Data were analyzed descriptively, and the association between variables was assessed using bivariate (Chi-square) and multivariate (logistic regression) analyses. The majority of pregnant women are in the non-risk maternal age group, and a slightly higher proportion are multigravida. Preeclampsia was observed in half of the study population. Maternal age was significantly associated with preeclampsia, with women in the high-risk age group more likely to develop the condition ($p = 0.002$; OR = 4.116). Primigravida status was also significantly associated with preeclampsia ($p = 0.003$; OR = 3.368), and both variables remained significant predictors in the multivariate analysis. Maternal age and primigravida status are important factors associated with the incidence of preeclampsia. Early identification and targeted monitoring of high-risk pregnancies are essential to reduce maternal complications.

Keywords: maternal age, preeclampsia, pregnancy, primigravida, risk factors.
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INTRODUCTION

Maternal mortality remains a major global public health challenge, particularly in low- and middle-income countries where access to quality maternal care is still limited. In 2020, approximately 295,000 women died due to complications related to pregnancy and childbirth.[1] Among the leading causes, hypertensive disorders of pregnancy, especially preeclampsia, contribute significantly alongside postpartum hemorrhage and sepsis.[1] Preeclampsia accounts for about 12% of maternal deaths worldwide and occurs more frequently in developing countries, with a prevalence of up to 2.8% compared to 0.4% in developed regions.[1] These findings highlight the importance of early identification and management of preeclampsia to reduce maternal mortality.

In Indonesia, maternal mortality remains a significant concern, with hypertensive disorders of pregnancy identified as one of the leading causes of death.[2] The incidence of preeclampsia is estimated to account for approximately 5.3% of all pregnancies, indicating a substantial burden on maternal health services.[2] At the regional level, Bali has experienced fluctuations in maternal mortality rates, with preeclampsia contributing to maternal deaths in several districts, including Buleleng.[3] This variation suggests the importance of understanding local risk factors and patterns of disease occurrence.

Preeclampsia is defined as a hypertensive disorder that develops after 20 weeks of gestation, characterized by blood pressure ≥140/90 mmHg accompanied by proteinuria or signs of organ dysfunction in previously normotensive women.[4] This condition can lead to serious complications, including renal impairment, hepatic dysfunction, and intrauterine growth restriction, which increase both maternal and fetal risks.[5] Although widely studied, the exact pathophysiology of preeclampsia remains unclear and is considered multifactorial.[6]

Several risk factors have been associated with preeclampsia, including primigravida status and maternal age. Primigravida women are at higher risk due to immunological maladaptation during early pregnancy, which may interfere with normal placental development.[7,8] In addition, maternal age plays an important role, with both younger (<20 years) and older (>35 years) women showing increased risk of complications.[9] Younger women may not have fully developed reproductive maturity, while older women are more likely to experience vascular changes that contribute to hypertension during pregnancy.[10]

Previous studies have demonstrated that maternal age and gravida status are significantly associated with the occurrence of preeclampsia, highlighting their importance as key risk factors.[11] However, most studies have been conducted in different populations, limiting their applicability to specific local settings. At Buleleng Regional Hospital, preeclampsia cases remain relatively high, yet research examining these associations in this setting is still limited.[3] Therefore, this study aims to determine the association between maternal age and primigravida status with the incidence of preeclampsia at Buleleng Regional Hospital during 2020–2023.

METHODS

Study Design and Setting

This study employed an analytic observational design with a cross-sectional approach to assess the association between maternal age, primigravida status, and the incidence of preeclampsia. The study was conducted at Buleleng Regional Hospital, Bali, Indonesia, using secondary data obtained from medical records. The data covered a four-year period from January 1, 2020, to December 31, 2023. The research protocol has ethical clearance from the Universitas Pendidikan Ganesha Research Ethics Committee, letter number 027/EC/KEPK-RSB/VII/2024.

Study Population

The study population included all pregnant women recorded at Buleleng Regional Hospital during the study period. A purposive sampling technique was applied to select subjects who met the inclusion criteria, which consisted of pregnant women with complete medical records containing information on maternal age, gravida status, and preeclampsia diagnosis. Patients with incomplete or missing data were excluded to ensure data quality and reduce information bias. A total of 134 subjects met the eligibility criteria and were included in the final analysis.

Data Source and Measurement

Data were obtained from hospital medical records and collected using a structured data extraction form. The dependent variable in this study was the incidence of preeclampsia, categorized as yes or no based on physician diagnosis. Preeclampsia was defined as blood pressure ≥140/90 mmHg after 20 weeks of gestation accompanied by proteinuria or signs of maternal organ dysfunction.[4] The independent variables included maternal age and primigravida status. Maternal age was categorized into risk (<20 years and >35 years) and non-risk (20–35 years) groups, while primigravida was defined as a woman experiencing her first pregnancy and categorized as yes or no. All variables were recorded as documented in the medical records without modification, which may introduce misclassification bias due to potential inaccuracies or inconsistencies in documentation. If any missing data is found during the data processing, those records will be excluded from the study.

Statistical Analysis

Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 25.0. Univariate analysis was conducted to describe the distribution of variables using frequencies and percentages. Bivariate analysis was performed using the Chi-square test to assess the association between maternal age, primigravida status, and preeclampsia. Variables were then included in multivariate logistic regression analysis to determine the strength of association, expressed as odds ratios (OR) with 95% confidence intervals. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Participant Characteristics

A total of 134 pregnant women who met the eligibility criteria were included in this study. Based on maternal age, the majority of participants were in the non-risk age group (20–35 years), while a smaller proportion were categorized as high-risk (<20 years or >35 years). In terms of gravida status, both primigravida and multigravida women were represented, with multigravida constituting a slightly larger proportion of the study population. Regarding the outcome variable, a proportion of participants were diagnosed with preeclampsia, while the remaining participants did not develop the condition during pregnancy, as shown in Table 1.

Table 1. Characteristics of included participants

Variable	Frequency (n)	Percentage (%)
Age Group		
At Risk	32	23.9
Not at Risk	102	76.1
Parity Category		
Primigravida	43	32.1
Non-Primigravida	91	67.9
Preeclampsia Incidence		
Yes	67	50.0
No	67	50.0

Table 2. Cross-tabulation between maternal age and primigravida with preeclampsia incidence

Variables	Preeclampsia Incidence (n[%])		p	OR
	Yes	No		
Maternal Age				
At Risk	24 (75)	8 (25)	0.002	4.116
Not at Risk	43 (42.2)	59 (57.8)		
Primigravida				
Yes	30 (69.8)	13 (30.1)	0.003	3.368
No	37 (40.6)	54 (59.4)		

OR, odd ratio.

Association Between Maternal Age and Primigravida with Preeclampsia

The analysis showed a significant association between maternal age and the incidence of preeclampsia, as presented in Table 2. Pregnant women in the high-risk age group (<20 years or >35 years) were more likely to develop preeclampsia compared to those in the non-risk age group (p = 0.002). A significant association was also found between primigravida status and the incidence of preeclampsia (p = 0.003).

Multivariate Analysis

Multivariate logistic regression analysis confirmed that both maternal age and primigravida status were independently associated with the incidence of preeclampsia. Maternal age was a significant predictor of preeclampsia, with an OR of 4.415 (95% CI = 1.753 – 11.121), indicating that women in the high-risk age group had approximately 4.4 times higher odds of developing preeclampsia compared to those in the non-risk age group. Primigravida status was also found as a significant risk factor, with an OR of 3.597 (95% CI = 1.606 – 8.055). This suggests that women experiencing their first pregnancy had approximately 3.6 times higher odds of developing preeclampsia compared to those with previous pregnancies. Each variable remained statistically significant after adjustment within the model, indicating that both factors contribute independently to the risk of developing preeclampsia.

DISCUSSION

This study aimed to determine the association between maternal age and primigravida status with the incidence of preeclampsia at Buleleng Regional Hospital. The findings showed that both maternal age and primigravida status were significantly associated with preeclampsia. Pregnant women in the high-risk age group (<20 years or >35 years) and those experiencing their first pregnancy had a higher likelihood of developing preeclampsia compared to their counterparts. These results indicate that both factors play an important role in the occurrence of preeclampsia in this population.

The significant association between maternal age and preeclampsia observed in this study is consistent with previous research. Women at younger ages may not yet have reached full reproductive maturity, which can increase vulnerability to complications during pregnancy.[9] On the other hand, advanced maternal age is associated with degenerative changes in the vascular system, reduced endothelial function, and a higher prevalence of comorbid conditions, all of which contribute to an increased risk of hypertensive disorders during pregnancy.[10] These physiological changes may lead to impaired placental perfusion and endothelial dysfunction, which are central mechanisms in the development of preeclampsia.[6]

Similarly, primigravida status was found to be significantly associated with preeclampsia, which is in line with findings from previous studies.[7,11] This relationship is often explained by immunological factors, particularly the process of maternal adaptation to fetal antigens during the first pregnancy. In primigravida women, this adaptation may not occur optimally, leading to inadequate trophoblast invasion and abnormal placental development.[8] As a result, placental ischemia and the release of antiangiogenic factors may occur, contributing to the clinical manifestations of preeclampsia. In contrast, multigravida women are believed to have developed better immunological tolerance from previous pregnancies, which may reduce their risk.

The results of this study support the concept that preeclampsia is a multifactorial condition influenced by both biological and demographic factors.[12–14] The combination of maternal age and primigravida status may further increase the risk through overlapping mechanisms,[15,16] including vascular dysfunction and impaired placentation.[12,17,18] These findings emphasize the importance of early identification of high-risk pregnancies, particularly among women with extreme maternal age and those experiencing their first pregnancy, to allow for closer monitoring and timely intervention.[13,19]

Despite these findings, several limitations should be considered. The cross-sectional design of this study limits the ability to establish a causal relationship between the studied variables and preeclampsia. Additionally, the use of secondary data from medical records may introduce information bias due to incomplete or inaccurate documentation. The absence of other important variables, such as comorbidities, nutritional status, and lifestyle factors, may also have influenced the results. Furthermore, as this study was conducted in a single hospital setting, the generalizability of the findings to other populations may be limited.

Overall, this study provides evidence that maternal age and primigravida status are significantly associated with the incidence of preeclampsia. These findings highlight the need for increased awareness and targeted screening strategies in antenatal care, particularly for high-risk groups. Future studies with larger sample sizes and more comprehensive variables are recommended to further explore the complex interactions underlying preeclampsia.

CONCLUSION

Maternal age and primigravida status were found to be significantly associated with the incidence of preeclampsia among pregnant women at Buleleng Regional Hospital. Women at high-risk maternal age and those experiencing their first pregnancy were more likely to develop preeclampsia compared to their counterparts. These findings highlight the importance of early identification of high-risk groups during antenatal care to enable closer monitoring and timely management. Strengthening screening strategies and improving awareness among healthcare providers and patients are recommended to reduce the risk of complications associated with preeclampsia. Future studies incorporating a wider range of variables and larger populations are needed to further explore the determinants of this condition.

CONFLICT OF INTEREST

All authors declared that there is no conflict of interest regarding this article.

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ETHICS APPROVAL

Ethical clearance was obtained from the Universitas Pendidikan Ganesha Research Ethics Committee under number 027/EC/KEPK-RSB/VII/2024.

AUTHOR'S CONTRIBUTION

All authors contributed equally in the writing process of this article.

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