

The Association Between Maternal Age and the Incidence of Preeclampsia in the Working Area of Penana'e Community Health Center in 2026

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Preeclampsia is one of the leading causes of maternal morbidity and mortality, characterized by elevated blood pressure after 20 weeks of gestation and may be accompanied by proteinuria and other organ dysfunctions. Maternal age is one of the risk factors associated with the occurrence of preeclampsia. This study aimed to determine the relationship between maternal age and the incidence of preeclampsia in the working area of Penana'e Public Health Center, Bima City, in 2025. This research employed an observational analytic method with a case-control design. The study population consisted of 273 pregnant women registered in the working area of Penana'e Public Health Center from January to June 2025. A total of 73 respondents were selected as samples, comprising case and control groups. Data were obtained from medical records and the e-Cohort database of Penana'e Public Health Center. The independent variable was maternal age, while the dependent variable was the incidence of preeclampsia. Data were analyzed using univariate and bivariate analyses through the Chi-Square test and Odds Ratio (OR) calculation. The results showed that most respondents were aged 20–35 years (44 respondents; 60.3%), while 13 respondents (17.8%) were aged below 20 years and 16 respondents (21.9%) were aged above 35 years. The case group (preeclampsia) consisted of 32 respondents (43.8%), whereas the control group (non-preeclampsia) consisted of 41 respondents (56.2%). The Chi-Square test indicated a significant relationship between maternal age and the incidence of preeclampsia ($p = 0.005$). Odds Ratio analysis revealed that pregnant women aged below 20 years had a 4.27 times greater risk of developing preeclampsia compared to those aged 20–35 years, while pregnant women aged above 35 years had an 8 times greater risk. It can be concluded that there is a significant relationship between maternal age and the incidence of preeclampsia. Therefore, healthcare providers are expected to strengthen screening, education, and pregnancy monitoring among women in high-risk age groups to prevent preeclampsia and reduce maternal morbidity and mortality.

Keywords: maternal age, preeclampsia, risk factors, case-control study, pregnancy.

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1. Introduction

Pregnancy is a physiological process that may develop into a pathological condition when accompanied by complications, one of which is preeclampsia. Preeclampsia is a multisystem disorder characterized by the onset of hypertension after 20 weeks of gestation, accompanied by signs of maternal organ dysfunction and/or uteroplacental insufficiency[1]. Despite advances in maternal healthcare, preeclampsia remains one of the leading causes of maternal and perinatal morbidity and mortality worldwide, accounting for approximately 76,000 maternal deaths and 500,000 infant deaths annually. The condition not only threatens maternal survival but also increases the risk of preterm birth, fetal growth restriction, and long-term cardiovascular complications in both mothers and offspring.

In Indonesia, hypertensive disorders during pregnancy, including preeclampsia and eclampsia, continue to be among the major contributors to maternal mortality. The Indonesia Health Profile reported that 24.4%

of the 4,005 maternal deaths recorded in 2022 were associated with hypertensive disorders during pregnancy. Similarly, in West Nusa Tenggara Province, the number of preeclampsia cases increased from 368 cases in 2022 to 412 cases in 2023, indicating that the burden of this condition remains substantial and requires effective preventive interventions[2].

The pathophysiology of preeclampsia is complex and multifactorial. Current evidence suggests that abnormal placentation during early pregnancy leads to inadequate remodeling of the spiral arteries, resulting in reduced uteroplacental perfusion and placental ischemia. This condition triggers the release of antiangiogenic factors, inflammatory mediators, and oxidative stress markers into the maternal circulation, causing endothelial dysfunction and systemic hypertension[3]. Maternal age has been identified as one of the important determinants of these pathological processes. Pregnancies among adolescents (≤ 20 years) are associated with biological and reproductive immaturity, incomplete uterine vascular development, and inadequate adaptation to pregnancy, which may impair placental implantation. Conversely, pregnancies among women aged 35 years or older are often accompanied by age-related vascular changes, decreased endothelial function, and a higher prevalence of chronic conditions such as hypertension and metabolic disorders, all of which increase susceptibility to preeclampsia[4].

Several previous studies have demonstrated a significant association between maternal age and the incidence of preeclampsia. A systematic review reported that women aged 35 years and above have a higher risk of developing hypertensive disorders during pregnancy compared with women aged 20–34 years[5]. Similarly, Basyiar et al. found that both adolescent and advanced maternal age pregnancies were associated with increased odds of preeclampsia. Research conducted in several regions of Indonesia has also shown that mothers aged below 20 years and above 35 years are more likely to experience preeclampsia than those in the optimal reproductive age group. However, the magnitude of risk varies across settings due to differences in demographic characteristics, socioeconomic conditions, healthcare access, and maternal health profiles [6].

Although numerous studies have examined maternal age as a risk factor for preeclampsia, evidence at the local level remains limited, particularly in Bima City and the working area of Penana'e Community Health Center. Most previous studies were conducted in hospital settings or at provincial and national levels, while community-based evidence reflecting local population characteristics is still scarce. Furthermore, the increasing trend of preeclampsia cases in the Penana'e Community Health Center area has not been accompanied by empirical investigations examining the contribution of maternal age to the occurrence of preeclampsia. This gap highlights the need for context-specific research to provide evidence for identifying high-risk groups and strengthening prevention strategies through early detection and targeted antenatal care interventions[7].

In the working area of Penana'e Community Health Center, Bima City, preeclampsia cases have shown an increasing trend in recent years. A total of 31 cases were reported in 2021, 29 cases in 2022, and 45 cases in 2023. Considering the growing burden of preeclampsia and the importance of maternal age as a potentially modifiable risk indicator through early screening, this study aims to analyze the relationship between maternal age and the incidence of preeclampsia among pregnant women in the working area of Penana'e Community Health Center, Bima City. The findings are expected to contribute to evidence-based maternal health programs and support efforts to reduce the incidence of preeclampsia and its associated complications[8].

2. Methods

This study employed an observational analytic method with a case-control design and was conducted from June to August 2025 in the working area of Penana'e Community Health Center, Bima City. The study population consisted of all pregnant women registered in the maternal health records of Penana'e Community Health Center from January to June 2025, totaling 273 individuals.

The sample size was determined using the formula for unmatched case-control studies, taking into consideration a 95% confidence level, 80% statistical power, and an estimated odds ratio based on previous studies examining maternal age as a risk factor for preeclampsia. The minimum sample size requirement was fulfilled by including all eligible preeclampsia cases identified during the study period and selecting controls from pregnant women without preeclampsia. A total of 73 respondents met the eligibility criteria and were included in the study, consisting of 32 pregnant women with preeclampsia (case group) and 41 pregnant women without preeclampsia (control group).

The inclusion criteria for the case group were: (1) pregnant women diagnosed with preeclampsia by healthcare professionals according to the clinical criteria documented in medical records, (2) registered in the e-Cohort and maternal health records of Penana'e Community Health Center during January–June 2025, and (3) having complete data on maternal age and pregnancy outcomes. The inclusion criteria for the control group were: (1) pregnant women without a diagnosis of preeclampsia during pregnancy, (2) registered in the e-Cohort and maternal health records during the same period, and (3) having complete medical record data relevant to the study variables. The exclusion criteria for both groups were incomplete medical records, missing information regarding maternal age or preeclampsia status, multiple pregnancies, and records with inconsistent or unverified clinical information.

Sampling was conducted using purposive sampling, whereby respondents were selected based on the predefined inclusion and exclusion criteria. The case group included all eligible pregnant women diagnosed with preeclampsia, while the control group consisted of pregnant women without preeclampsia selected from the same population source to ensure comparability between groups.

The independent variable in this study was maternal age, while the dependent variable was the incidence of preeclampsia. Secondary data were obtained from medical records and the e-Cohort system of Penana'e Community Health Center. Maternal age was categorized into three groups: <20 years, 20–35 years, and >35 years, and was measured on an ordinal scale. The incidence of preeclampsia was categorized as preeclampsia (case group) and non-preeclampsia (control group), measured on a nominal scale.

Data analysis was performed using univariate analysis to describe the distribution of respondent characteristics and study variables. Bivariate analysis was conducted using the Chi-square test to assess the association between maternal age and the incidence of preeclampsia. The strength of the association was estimated by calculating the Odds Ratio (OR) and its 95% Confidence Interval (CI). Statistical significance was determined at a p-value of less than 0.05.

This study was approved by the relevant institutional authority, and all data were analyzed anonymously to ensure confidentiality. Several limitations should be acknowledged, including the reliance on secondary data, which depended on the completeness and accuracy of medical record documentation, the relatively short observation period, and the limited geographical coverage confined to a single community health center service area, which may affect the generalizability of the findings.

3. Results And Discussion

This study was conducted in the working area of Penana'e Community Health Center, Bima City, from June to August 2025. The study focused on examining the association between maternal age and the incidence of preeclampsia among pregnant women registered at the health center between January and June 2025. A case-control design was employed, involving 73 respondents who were divided into case and control groups based on their preeclampsia status. Data were collected from medical records and the e-Cohort system of Penana'e Community Health Center. The analysis aimed to identify whether maternal age was associated with the occurrence of preeclampsia and to estimate the magnitude of risk among different maternal age groups.

Distribution of Pregnant Women by Educational Level

Table 1. Distribution of Respondents by Maternal Education Level

Maternal Education	Frequency (n)	Percentage (%)
Primary Education (Elementary and Junior High School)	46	63.0
Secondary Education (Senior High School)	27	37.0
Higher Education (College/University)	0	0.0
Total	73	100.0

Based on Table 1, the majority of respondents had a primary education level (elementary and junior high school), accounting for 46 respondents (63.0%). Respondents whose highest educational attainment was senior high school numbered 27 (37.0%). This indicates that most respondents had a relatively low educational background.

Distribution of Pregnant Women by Age

Table 2. Distribution of Respondents by Maternal Age

Age Group	Frequency (n)	Percentage (%)
< 20 years (1)	13	17.8
20–35 years (2)	44	60.3
> 35 years (3)	16	21.9
Total	73	100.0

Table 2 shows that the majority of respondents were in the 20–35 years age group, totaling 44 respondents (60.3%), while 13 respondents (17.8%) were aged below 20 years and 16 respondents (21.9%) were aged above 35 years.

Distribution of Respondents by Case and Control Status

Table 3. Distribution of Respondents by Case and Control Status

Respondent Status	Frequency (n)	Percentage (%)
Cases (Preeclampsia)	32	43.8
Controls (Non-Preeclampsia)	41	56.2
Total	73	100.0

Based on Table 3, 32 respondents (43.8%) were included in the case group (preeclampsia), while 41 respondents (56.2%) were included in the control group (non-preeclampsia).

Association Between Maternal Age and the Incidence of Preeclampsia

Table 4. Association Between Maternal Age and the Incidence of Preeclampsia

Age Group	Cases (Preeclampsia) n (%)	Controls (Non-Preeclampsia) n (%)	Total n (%)	OR	p-value
<20 years	8 (61.5)	5 (38.5)	13 (100)	4.27	0.005
20–35 years	12 (27.3)	32 (72.7)	44 (100)	1.00	
>35 years	12 (75.0)	4 (25.0)	16 (100)	8.00	
Total	32 (43.8)	41 (56.2)	73 (100)		

Based on Table 4, the proportion of preeclampsia was 61.5% among pregnant women aged below 20 years and 75.0% among those aged above 35 years. In contrast, the 20–35 years age group had the lowest proportion of preeclampsia cases, at 27.3%.

The Chi-Square test yielded a p-value of 0.005 ($p < 0.05$), indicating a statistically significant association between maternal age and the incidence of preeclampsia. The Odds Ratio (OR) analysis showed that pregnant women aged below 20 years had approximately 4.27 times higher odds of developing preeclampsia compared to those aged 20–35 years. Furthermore, pregnant women aged above 35 years had approximately 8 times higher odds of developing preeclampsia than those in the 20–35 years age group. Therefore, maternal age outside the optimal reproductive age range (20–35 years) is considered a risk factor for the occurrence of preeclampsia

The bivariate analysis revealed a statistically significant association between maternal age and the incidence of preeclampsia ($p = 0.005$). The proportion of preeclampsia was higher among women younger than 20 years (61.5%) and those older than 35 years (75.0%) compared with women aged 20–35 years (27.3%). Furthermore, the Odds Ratio analysis indicated that women aged below 20 years had 4.27 times higher odds of developing preeclampsia, whereas women aged above 35 years had 8.00 times higher odds compared with women in the optimal reproductive age group (20–35 years). These findings suggest that maternal age is an important determinant of preeclampsia risk and that pregnancies occurring outside the optimal reproductive age range require special clinical attention.

The increased risk of preeclampsia among pregnant women younger than 20 years may be explained by biological and reproductive immaturity. During adolescence, the reproductive organs and uterine vascular system may not have reached full physiological maturity, potentially affecting placental implantation and uteroplacental blood flow[9]. Inadequate trophoblastic invasion and incomplete remodeling of the spiral arteries can result in placental hypoperfusion and ischemia, which are recognized as key initiating events in the pathogenesis of preeclampsia. In addition, adolescent pregnancies are often associated with poor nutritional status, limited access to reproductive health information, and delayed utilization of antenatal care services, factors that may further increase vulnerability to hypertensive disorders during pregnancy[10].

Similarly, advanced maternal age (>35 years) has been consistently associated with a higher risk of preeclampsia. Several biological mechanisms may explain this relationship. Aging is accompanied by progressive endothelial dysfunction, reduced vascular elasticity, increased oxidative stress, and chronic low-grade inflammation, all of which contribute to impaired cardiovascular adaptation during pregnancy [11]. Furthermore, women of advanced maternal age are more likely to have pre-existing conditions such as chronic hypertension, obesity, diabetes mellitus, and metabolic syndrome. These conditions may exacerbate placental dysfunction and increase the likelihood of developing preeclampsia. Current evidence suggests that age-related vascular changes may enhance the release of antiangiogenic factors from the

placenta, leading to systemic endothelial injury and hypertension, which are hallmark features of preeclampsia[12]

The findings of this study are consistent with previous research reported that women younger than 20 years and older than 35 years were significantly more likely to develop preeclampsia than women aged 20–35 years [13]. Similarly, Ningsih et al. (2020) found a significant association between maternal age and preeclampsia incidence among pregnant women in Indonesia. A systematic review conducted also concluded that both adolescent pregnancy and advanced maternal age are important risk factors for hypertensive disorders of pregnancy across diverse populations [14].

However, not all studies have reported similar findings. Several researchers have found that maternal age was not independently associated with preeclampsia after adjusting for confounding variables such as parity, body mass index, socioeconomic status, pre-existing hypertension, and diabetes mellitus[15]. For example, some cohort studies conducted in developed countries reported that the association between advanced maternal age and preeclampsia became weaker after controlling for maternal comorbidities and lifestyle factors. These contrasting findings suggest that maternal age may interact with other biological and social determinants of health rather than acting as an isolated risk factor. Therefore, although maternal age remains a useful screening indicator, comprehensive risk assessment should also consider other maternal characteristics that may influence the development of preeclampsia.

The practical implications of these findings are important for maternal health services, particularly at the primary healthcare level. Maternal age is an easily identifiable characteristic that can be assessed during the first antenatal visit and used as an initial screening indicator for preeclampsia risk. Pregnant women aged below 20 years and above 35 years should be classified as high-risk groups and receive enhanced antenatal surveillance. Such surveillance may include more frequent blood pressure monitoring, routine urine protein examinations, assessment of clinical symptoms suggestive of preeclampsia, and counseling regarding pregnancy danger signs[16].

In addition, community health centers should strengthen risk-based antenatal care programs by prioritizing pregnant women within high-risk age categories for early detection and preventive interventions. Health education programs targeting adolescents and women planning pregnancy at advanced ages may also contribute to reducing the incidence of preeclampsia. Furthermore, integrating maternal age screening into routine maternal health information systems, including the e-Cohort platform, could facilitate early identification of high-risk pregnancies and improve referral mechanisms for timely management[17].

Overall, the findings indicate that maternal age is a significant predictor of preeclampsia among pregnant women in the working area of Penana'e Community Health Center. The substantially higher risk observed among women younger than 20 years and older than 35 years highlights the need for targeted screening strategies, strengthened antenatal care services, and continuous health education to reduce maternal and fetal complications associated with preeclampsia.

4. Conclusion

Based on the results of this study on the association between maternal age and the incidence of preeclampsia in the working area of Penana'e Community Health Center, Bima City, in 2025, it was found that the majority of respondents were in the 20–35 years age group, totaling 44 respondents (60.3%). Meanwhile, 13 respondents (17.8%) were younger than 20 years and 16 respondents (21.9%) were older than 35 years. Based on the case-control study design, the respondents consisted of 32 pregnant women with preeclampsia (case group) and 41 pregnant women without preeclampsia (control group). The results of the bivariate analysis using the Chi-Square test revealed a statistically significant association between

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maternal age and the incidence of preeclampsia ($p = 0.005$; $p < 0.05$). Odds Ratio (OR) analysis showed that pregnant women younger than 20 years had a 4.27-fold higher risk of developing preeclampsia compared with women aged 20–35 years. Furthermore, pregnant women older than 35 years had an eightfold higher risk of developing preeclampsia than those in the 20–35 years age group. Therefore, maternal age outside the optimal reproductive age range is considered a significant risk factor for preeclampsia. This study is expected to serve as a reference for future researchers in exploring additional risk factors associated with preeclampsia by including variables such as parity, nutritional status, history of hypertension, comorbid diseases, and socioeconomic factors to obtain more comprehensive findings. For pregnant women, the results of this study are expected to increase awareness and knowledge regarding the risk of preeclampsia, particularly among high-risk age groups, namely those younger than 20 years and older than 35 years. For Penana'e Community Health Center, it is recommended to strengthen health promotion programs, risk-factor screening, and intensive antenatal monitoring for pregnant women within these high-risk age categories. In addition, the findings may be used by educational institutions as a reference in midwifery and maternal health education, particularly regarding maternal age as a risk factor for preeclampsia.

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