DETERMINANTS OF PREECLAMPSIA AMONG PREGNANT WOMEN IN INDONESIA: A CROSS-SECTIONAL STUDY

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ABSTRACT

This study aims to identify the factors associated with the incidence of preeclampsia among pregnant women in Indonesia in 2023. A quantitative study was conducted using a cross-sectional design in April 2023. A total of 391 pregnant women participated in this study, selected through appropriate inclusion criteria. Data on relevant variables were collected through medical record observations. The variables examined included parity, maternal age, history of hypertension, history of obesity, and education level. Statistical analysis was performed using the Chi-Square test via SPSS to explore the relationship between each independent variable and the incidence of preeclampsia. Of the five variables assessed, four were found to be significantly associated with the occurrence of preeclampsia. These were parity ($p = 0.000$), maternal age ($p = 0.000$), history of hypertension ($p = 0.000$), and history of obesity ($p = 0.001$). These findings suggest that women with higher parity, advanced maternal age, a previous history of hypertension, or obesity are at increased risk of developing preeclampsia. On the other hand, education level was not found to have a statistically significant association with the incidence of preeclampsia ($p = 0.144$). The study concludes that parity, maternal age, history of hypertension, and obesity are significant predictors of preeclampsia among Indonesian pregnant women. Educational attainment, however, does not appear to play a significant role. These findings may inform targeted interventions and risk assessment strategies in maternal healthcare settings.

Keywords*:* Preeclampsia, Education, Parity, Maternal Age, History of Hypertension, History of Obesity

I. INTRODUCTION

Preeclampsia is a hypertensive disorder exclusive to pregnancy, characterized by a range of systemic complications with complex and multifactorial origins. It is a condition unique to humans and remains a major contributor to both maternal and perinatal illness and death. This condition leads to notable pathological alterations in the maternal and fetal vascular systems, as well as the placenta—manifesting in forms such as decidual arteriolopathy, infarctions, ischemic changes, and placental abruption (Yuni, 2018).

Recognized as one of the significant causes of maternal mortality, preeclampsia is often linked to several risk factors. These include multiple gestations, preexisting hypertension, diabetes mellitus, molar pregnancies, obesity, limited socioeconomic resources, and extremes in maternal age or parity—particularly among young primigravida women under the age of 20 and those above 35 years old (Nur & Adhar, 2017). Although the precise etiology remains unclear, maternal age and parity are among the contributing factors believed to influence its occurrence (Novianti, 2018).

According to data from the World Health Organization (2020), the global maternal mortality rate reached approximately 303,000 deaths (World Health Organization, 2020). Within the ASEAN region, this figure stood at 235 deaths per 100,000 live births (Kemenkes RI, 2020). The 2017 Indonesian Demographic and Health Survey (SDKI)

reported a maternal mortality ratio of 305 per 100,000 live births, accounting for a total of 14,623 maternal deaths (Badan Pusat Statistik, 2017). The leading causes of these deaths, making up around 75%, included hemorrhage, infection, preeclampsia or eclampsia, prolonged labor, and unsafe abortions (Kemenkes RI, 2019). In 2021, COVID-19 emerged as the most prominent factor, associated with 2,982 maternal deaths, followed by hemorrhage (1,330 cases) and hypertensive disorders in pregnancy (1,077 cases) (Kemenkes RI., 2021).

A study by (Dewie et al., 2020) found a statistically significant relationship between gestational age and the incidence of preeclampsia ($p < 0.001$), as well as between obesity and preeclampsia ($p < 0.001$; OR = 9.9). This indicates that pregnant women with obesity face approximately 9 to 10 times higher risk of developing preeclampsia than those with normal body weight. The condition can have severe consequences for both mother and child. For the fetus, it increases the likelihood of preterm delivery, asphyxia, low birth weight, and other life-threatening complications. In mothers, preeclampsia may progress to eclampsia—characterized by seizures during pregnancy—which poses a significant risk of mortality (Yuni, 2018).

Given the ongoing threat preeclampsia poses to maternal and neonatal health, especially within developing nations such as Indonesia, this research aims to identify and analyze the key factors that contribute to the incidence of preeclampsia among pregnant women in Indonesia in the year 2023. By examining demographic, clinical, and socioeconomic variables associated with the condition, the study seeks to provide a deeper understanding of its risk profile. The findings are intended to support health professionals and policymakers in formulating more effective screening strategies, targeted interventions, and educational programs to mitigate the prevalence and adverse outcomes of preeclampsia.

II. METHOD

Study Design

This research employed a quantitative methodology with a cross-sectional design, aimed at exploring the factors associated with the incidence of preeclampsia among pregnant women in Indonesia. The cross-sectional approach was chosen to allow simultaneous measurement of exposure factors and outcomes within the study population, providing a snapshot of the relationship between various risk factors and preeclampsia at a single point in time.

Population

The study was carried out at three primary healthcare centers located in different regions of Indonesia: Batujaya Health Center in Karawang Regency, Cisauk Health Center in Tangerang Regency, and Cariu Health Center in Bogor Regency. These sites were selected to capture a more representative sample across diverse geographic and sociodemographic contexts. The target population consisted of all pregnant women attending antenatal care (ANC) services in Indonesia during the period of data collection.

Sample and Sampling Technique
A total of 391 pregnant women were selected as the study sample. This sample size was determined based on a proportion estimation formula with confidence and precision parameters, ensuring sufficient statistical power to detect significant associations. Participants were recruited through consecutive sampling, targeting all eligible pregnant women who met the inclusion criteria and provided informed consent at the selected health centers during the study period.

Instruments and Measurement
The primary variable of interest, preeclampsia, was assessed using data obtained from medical record reviews, which were cross-verified with responses from a structured questionnaire developed specifically for this study. The questionnaire included items related to demographic characteristics, obstetric history, and clinical indicators. Prior to implementation, the instrument underwent a rigorous validation and reliability testing process, including expert review and pilot testing, to ensure content relevance, clarity, and consistency. The validated tool demonstrated acceptable reliability coefficients.

Data Collection Procedures
Data collection was conducted over a defined time frame by trained enumerators with a background in health sciences. After obtaining consent, participants were interviewed using the structured questionnaire, and their medical records were examined to confirm or rule out a diagnosis of preeclampsia. The data collection team adhered to standardized procedures to maintain data accuracy and reduce potential interviewer bias.

Data Analysis
All data were processed and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were used to summarize demographic and clinical characteristics. For inferential analysis, bivariate analysis was performed using the Chi-Square (x^2) test to examine the association between categorical independent variables (e.g., age, parity, obesity, socioeconomic status) and the presence of preeclampsia. A significance level of $p < 0.05$ was applied to determine statistical significance.

Ethical Considerations
Prior to data collection, ethical approval for this study was obtained from the appropriate Institutional Review Board (IRB) or health ethics committee. All participants were informed of the study's purpose, procedures, and their rights, including the right to withdraw at any time without any consequence. Informed consent was obtained in writing from each participant. Data confidentiality was strictly maintained, and all identifying information was anonymized to protect participant privacy.

III. RESULTS

Table 1. Frequency Distribution of Preeclampsia Incidents in Pregnant Women in Indonesia

No	Variables	Frequency (f)	Presentation(%)
1	**Pre Eclampsia Incident**		
	Yes	50	12.8
	No	341	87.2
2	**Educational background**		
	Low (≤ High School)	353	90.3
	Higher (College)	38	9.7
3	**Parity**		
	Height (> 4)	56	14.3
	Low (1-3)	335	85.7
4	**Mother's Age**		
	High Risk (<20, >35)	74	18.9
	No Risk (20-35)	317	81.1
5	**History of Hypertension**		
	Yes	30	7.7
	No	361	92.3
6	**History of Obesity**		
	Yes	80	20.5
	No	311	79.4
	Total	**391**	**100**

Based on table **1 on** the variable of preeclampsia occurrence, there were 50 pregnant women (12.8 %) who experienced preeclampsia. In the variable of Education History, most pregnant women (90.3%) were educated <high school . Then for the parity variable, there were 335 low parity pregnant women (85.7%). Furthermore, in the variable of maternal age, the majority of mothers had an age that was not at risk (81.1%) . Then in the variable of hypertension history, most (92.3 %) pregnant women do not have a history of hypertension . Then for the variable of obesity history, there are 311 pregnant women (79.5%) have no history of obesity .

Table 2 Relationship Between Various Risk Factors and Pre-Eclampsia in Pregnant Women, Indonesia, 2023

Risk Factor	Category	Pre-Eclampsia Incident (N)	Pre-Eclampsia Incident (%)	Pre-Eclampsia Not Incident (N)	Pre-Eclampsia Not Incident (%)	p-value
Education	Low	48	96.0	35	84.9	0.144
	High	25	44.0	36	10.6	<0.001
Parity	High parity	28	56.0	22	44.0	<0.001
	Low parity	28	4.0	313	91.8	<0.001
Maternal Age	Advanced age	25	50.0	25	50.0	<0.001
	Younger age	49	14.4	292	85.6	<0.001

History of Hypertension	Yes	29	58.0	31	42.0	<0.001
	No	31	62.0	280	82.1	0.001
History of Obesity	Yes	-	-	-	-	
	No	-	-	-	-	

Table 2 illustrates the association between various maternal risk factors and the incidence of pre-eclampsia among pregnant women in Indonesia in 2023. The factors examined include education level, parity, maternal age, history of hypertension, and history of obesity. The results show that women with low education levels accounted for 96% of pre-eclampsia cases, while only 4% were from the higher education group. However, this association was not statistically significant ($p = 0.144$), suggesting that education level may not influence the risk of pre-eclampsia. In contrast, parity showed a significant association ($p < 0.001$), with 56% of women with high parity developing pre-eclampsia compared to only 4% of those with low parity. Maternal age was also found to be a significant factor ($p < 0.001$), as women of advanced maternal age exhibited a 50% incidence rate of pre-eclampsia, while younger mothers showed a much lower rate (14.4%). A history of hypertension was strongly associated with pre-eclampsia as well ($p < 0.001$); 58% of affected women had a prior history of hypertension. Although detailed data on obesity were incomplete in the table, previous analysis indicated a significant relationship between obesity and pre-eclampsia ($p = 0.001$). These findings highlight that high parity, older maternal age, hypertension, and obesity are significant predictors of pre-eclampsia, whereas education level does not appear to have a meaningful impact.

IV. DISCUSSION

The Influence of Education on the Incidence of Preeclampsia

Based on the results of the study, it was found that most pregnant women who experienced preeclampsia (96.0%) had low education, while pregnant women who had higher education were only 4.0%. The results of the analysis obtained a p-Value of 0.144 ($p <0.05$). This shows that there is no relationship between educational status and the incidence of preeclampsia in pregnant women at the Batujaya Health Center, Karawang Regency in 2023.

This result is in line with research (Hipni, 2019) which shows that of mothers who experience PEB, 22% have low education and (19%) have moderate education and (9%) have high education. The p-value = 0.121 means there is no significant relationship between the two variables (0.121>0.05). Other researchers (Basyiar et al., 2021) from the results of the analysis of education level with the incidence of preeclampsia p-value 0.436 then Ho failed to be rejected meaning there is no relationship between the independent variable and the dependent variable.

Meanwhile, in the study (Veftisia & Khayati, 2018), it was found that mothers with basic education mostly did not suffer from Preeclampsia and also mothers with advanced education, some of whom suffered from Preeclampsia, the results of the study showed that mothers with basic education (elementary-junior high school) had a risk of experiencing preeclampsia during pregnancy of 4.1 times and had a significant relationship ($p = 0.004$).

Educational theory states that education is an activity or effort to improve personality, so that the process of behavioral change leads to maturity and the perfection of human life. The results of the study found that mothers with high and low education have the same chance of getting preeclampsia (Hipni, 2019).

The Effect of Parity on the Incidence of Preeclampsia

The results of the analysis based on the results of this study indicate that pregnant women who experience preeclampsia Most (56.0%) have high parity. The p-Value results were 0.000 (p <0.05). This shows that there is a relationship between parity and the incidence of preeclampsia in pregnant women. at the Batujaya Health Center, Karawang Regency in 2023.

In line with the results of the research that has been conducted (Novianti, 2018) using the chi-square test, the Pearson chi-square value was 8.687 and the p value = 0.000> 0.05 from these results Ho was rejected and Ha was accepted, it can be concluded that there is a significant influence between parity factors and the risk of preeclampsia, these results are possible that there are still many parities. Based on the analysis of the OR value = 2.117 and CI 95%, it means that primigravida and grandemultigravida parity pregnant women have a 2.117 times chance of experiencing preeclampsia compared to multigravida pregnant women. OR value >1, it means that maternal parity is a risk factor for preeclampsia. The same study by Fitriani (2021) and Ari (2024), showed that the probability value (p-value) did not have a significant relationship (p = 0.702) and most primiparous mothers did not experience preeclampsia and a small number of multiparous mothers experienced preeclampsia, so it can be stated that there is no significant relationship between parity and the incidence of preeclampsia.

Another study (Hayati et al., 202) also stated that the results of the Chi Square test with a probability value (p-value) of 0.58 (p>0.005) which means statistically that there is no significant relationship between parity and the incidence of severe preeclampsia in pregnant women.

The first parity is related to the mother's lack of experience and knowledge in pregnancy care. Parity 2-3 is the safest parity. Parity one and high parity (more than three) are parities at risk of preeclampsia. Mothers with high parity (more than 4) have experienced a decline in reproductive system function, in addition, mothers are usually too busy taking care of the household so that they often experience fatigue and pay less attention to fulfilling their nutrition (Rahmadiani et al., 2023).

The Effect of Maternal Age on the Incidence of Preeclampsia

The results of the analysis based on the results of this study indicate that pregnant women who experience preeclampsia have a high risk of 50%. While pregnant women who do not experience preeclampsia have a low risk of 85.6%. The p-Value results were 0.000 (p <0.05). This shows that there is a relationship between maternal age and the incidence of preeclampsia in pregnant women at the Batujaya Health Center, Karawang Regency in 2023.

This is in line with the results of the study (Lijuardi et al., 202) that it is known based on the results of the analysis tested by Chi Square, a p.value of 0.001 was

found, meaning that there is a significant relationship between maternal age and the incidence of PEB. From the analysis, it is also known that the odds ratio (OR) value is 3.673, meaning that mothers who have a risky age have a 3.673 times chance of experiencing pregnancy with PEB compared to mothers who have a non-risk age. Another study (Ammarie et al., 2024) that the results of the statistical test using Chi Square obtained a p value = 0.001, so it can be concluded that there is a significant difference between the risky and non-risk ages in the incidence of pre-eclampsia, thus there is a relationship between maternal age and the incidence of pre-eclampsia. The analysis results obtained OR = 9.444, meaning that mothers with a risk age of <20 years and >35 years have a 9.444 times greater chance of experiencing pre-eclampsia compared to mothers not at risk aged 20 years – 35 years.

The reproductive age of a woman is 20-35 years. This reproductive age is the safest period for pregnancy and childbirth because at that age the risk of complications during pregnancy is lower. Ages under 20 years and over 35 years are also referred to as high-risk ages for complications during pregnancy (Novianti, 2018).

The Influence of Hypertension History on the Incidence of Preeclampsia

The results of the analysis based on the results of this study indicate that pregnant women who experience preeclampsia Most (58.0 %) have a history of hypertension, while those who do not experience preeclampsia, as many as (99.7%) do not have a history of hypertension. The p-Value results obtained 0.000 (p <0.05) which indicates a significant relationship between a history of hypertension and the incidence of preeclampsia in pregnant women at the Batujaya Health Center, Karawang Regency in 2023.

In line with the research (Hanifa, 2023) it was found that the largest number were pregnant women who did not have a history of hypertension. . Based on the calculation of the Chi Square Test, the p value = 0.000 was obtained, meaning that there was a relationship between the mother's history of hypertension and the incidence of preeclampsia. Another researcher (Retnowati et al., 2021) also said that in his study, there were (37.5%) pregnant women with preeclampsia who had a history of hypertension and (62.5%) mothers who did not have a history of hypertension. In pregnant women who did not have preeclampsia, there were (7.5%) mothers who had a history of hypertension and (92.5%) mothers who did not have a history of hypertension. From these data, it can be interpreted that many pregnant women who have a history of hypertension (37.5%) experience preeclampsia than controls (7.5%).

The results obtained by researchers (Nur & Adhar, 2017) that a history of hypertension is a risk factor for preeclampsia. Based on the results of statistical tests, the OR value was 1.591. This shows that a history of hypertension is a risk factor for preeclampsia, in other words, a history of hypertension is 1.591 times more likely to experience preeclampsia than those who do not have a history of hypertension. The lower limit value of the statistical test is 0.652 and the upper limit is 3.883. This shows that a history of hypertension is a risk factor but is stated as insignificant, because the upper lower value <1 is 0.652 while the upper limit value> 1 is 3.883. The results of the statistical analysis showed that there was no significant relationship between a history of hypertension and the occurrence of preeclampsia.

The history of hypertension experienced by the mother before pregnancy has a significant influence on the incidence of preeclampsia which can escalate to severe preeclampsia. Rozikhan's 2007 study at H. Soewondo Kendal Hospital found that pregnant women with hypertension have a 2.98 times greater risk of severe preeclampsia compared to pregnant women who do not have a history of hypertension. (Yushida,2020).

The Influence of Obesity History on the Incidence of Preeclampsia

The results of the analysis based on the results of this study indicate that mothers who experience preeclampsia, 38% have a history of obesity. While mothers who do not have preeclampsia, most 82.1% do not have a history of obesity. Based on the statistical test, the p-Value results were obtained 0.001 ($p < 0.05$). This shows that there is a relationship between a history of obesity and the incidence of preeclampsia in pregnant women.

In line with the results of the study (Aziz et al., 2022) that of the obese pregnant women respondents, those who experienced preeclampsia were (75.0%) and those who did not experience preeclampsia were 8 (25.0%). Meanwhile , in respondents who were not obese, there were (21.9%) respondents who experienced preeclampsia and (78.1%) respondents who did not experience preeclampsia. The results of the chi-square test with a confidence level of 95% showed that there was a significant relationship between the weight of pregnant women and the incidence of preeclampsia with an OR value of 9.9, which means that pregnant women with obesity are 9-10 times more at risk of experiencing preeclampsia than pregnant women who are not obese. Meanwhile, based on research (Yushidah et al., 2020) based on the calculation of body mass index before pregnancy in a study of obese pregnant women with a p value = 0.246, it means that Ho failed to be rejected and showed no relationship between the independent variable and the dependent variable.

The results of the study (Aziz, 2022) showed that obese pregnant women had (26.9%) mothers who experienced preeclampsia and from non-obese pregnant women there were (17.8%) mothers who experienced preeclampsia. Based on the calculation of the Chi Square Test, the p value was obtained = 0.281, meaning there was no relationship between maternal obesity and the incidence of preeclampsia.

Obesity is a risk factor that has been widely studied for the occurrence of preeclampsia. Obesity triggers the occurrence of preeclampsia through several mechanisms, namely superimposed preeclampsia, or through triggers of metabolites or other micro molecules. The risk of preeclampsia increases by 2-fold for every 5-7 kg/m2 increase in body weight, in addition, an increased risk of preeclampsia was found with an increase in BMI. Women with a BMI> 35 before pregnancy have a four-fold risk of developing preeclampsia compared to women with a BMI of 19-27. (Primadevi,2022).

V. CONCLUSION

This study identified several maternal risk factors associated with the incidence of preeclampsia among pregnant women in Indonesia. The analysis revealed that education level was not significantly related to the development of preeclampsia, as

supported by a p-value of 0.144. Although most affected women had a low education level, statistical findings and corroborating studies suggest that educational status alone does not influence the risk.

In contrast, parity showed a strong and statistically significant association with preeclampsia ($p < 0.001$). Women with high parity were more likely to experience preeclampsia, reinforcing findings from several studies that suggest increased reproductive burden may elevate physiological stress and risk.

Similarly, maternal age was found to be a critical factor. Women of advanced maternal age had a significantly higher incidence of preeclampsia ($p < 0.001$), aligning with previous evidence that both younger and older maternal ages are associated with increased pregnancy complications, including preeclampsia.

A history of hypertension was also significantly related to preeclampsia ($p < 0.001$). Women with previous hypertension were far more likely to develop the condition, as supported by both current and past research, although some literature notes variations in statistical significance depending on the confidence intervals and population studied.

Lastly, the study identified obesity history as a significant risk factor ($p = 0.001$). Obese women were more likely to experience preeclampsia compared to those with normal weight. While some studies did not find this relationship significant, the majority support the link between increased body mass index (BMI) and higher preeclampsia risk due to metabolic and inflammatory pathways.

Overall, the findings emphasize that parity, maternal age, history of hypertension, and obesity are significant predictors of preeclampsia, while education level does not appear to play a significant role. These insights are valuable for health professionals in prioritizing high-risk populations for early screening, education, and intervention to prevent complications associated with preeclampsia.

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