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RISK FACTORS FOR PREECLAMPSIA INCIDENTS AT PROF. DR. MARGONO SOEKARJO HOSPITAL AUGUST 2023 – JULY 2024

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ABSTRACT

Background: Preeclampsia is the leading cause of maternal death in Central Java in 2023. Preeclampsia is known to be associated with risk factors such as gemelli, maternal age, gravida, parity, diabetes mellitus (DM), and maternal nutritional status before pregnancy, although there are still differences in the relationship values in several research center. Therefore, research is needed to determine the relationship of preeclampsia risk factors with the incidence of preeclampsia at RSUD Prof. Dr. Margono Soekarjo. Objective: This study aims to determine the relationship between maternal nutritional status before pregnancy, DM, maternal age, gravida, parity, and gemelli with the incidence of preeclampsia at RSUD Prof. Dr. Margono Soekarjo August 2023 – July 2024. Methodology: This study was conducted using a cross-sectional study design with a sample of 392 pregnant women. The independent variables in this study were gemelli, maternal age, gravida, parity, DM, and maternal nutritional status before pregnancy, the dependent variable was the diagnosis of preeclampsia, and the potential confounding variable controlled was bacteriuria. Results: The results of multivariate analysis showed that gemelli ($p= 0.008$), age <20 years ($p= 0.009$), age >35 years ($p<0.001$), overweight ($p<0.001$), obesity ($p<0.001$), chronic energy defficient ($p<0.001$), nulliparous ($p<0.001$), and multiparous or grandemultiparous ($p<0.001$) were significantly associated with the incidence of preeclampsia at RSUD Prof. Dr. Margono Soekarjo in August 2023 – July 2024. Conclusion: Gemelli were the risk factor that most influenced the incidence of preeclampsia at RSUD Prof. Dr. Margono Soekarjo in August 2023 – July 2024.

Keywords: Risk factors, Preeclampsia, RSUD Prof. Dr. Margono Soekarjo.

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INTRODUCTION

Preeclampsia is one of the major pregnancy complications that significantly contributes to maternal morbidity and mortality. This condition is characterized by elevated blood pressure ≥140/90 mmHg after 20 weeks of gestation accompanied by evidence of organ dysfunction, such as renal, hepatic, or hematological impairment (Magee et al., 2022). Preeclampsia not only affects the mother but also poses a high risk of serious complications, including eclampsia, HELLP syndrome, organ failure, and an increased risk of cardiovascular disease later in life. In the fetus, this condition may lead to prematurity, intrauterine growth restriction (IUGR), and even perinatal death.

Globally and nationally, preeclampsia remains a major public health concern. In Indonesia, hypertensive disorders of pregnancy constitute one of the leading causes of maternal mortality. In Central Java, the maternal mortality ratio (MMR) in 2023 was recorded at 76.15 per 100,000 live births, with 42.4% of deaths attributed to hypertensive disorders of pregnancy (Suminar et al., 2024). This figure remains above the 2030 Sustainable Development Goals (SDGs) target of fewer than 70 deaths per 100,000 live births (Ministry of Health of the Republic of Indonesia, 2024).

At the regional level, the incidence of preeclampsia also remains high. In Banyumas Regency, 949 cases of preeclampsia/eclampsia were reported in 2024, while Dr. Prof. Margono Soekarjo General Hospital recorded 302 referral cases of preeclampsia/eclampsia in 2021 (Grehastuti et al., 2025; Sumarni & Prabandari, 2023). The persistently high incidence indicates that preeclampsia remains a significant clinical challenge in referral healthcare facilities, highlighting the need for a context-specific analysis of risk factors within the hospital population. Pathophysiologically, preeclampsia is associated with abnormal placentation leading to inadequate uteroplacental perfusion. This condition triggers systemic endothelial dysfunction, oxidative stress, and an exaggerated inflammatory response. These processes contribute to vasoconstriction, elevated blood pressure, and target organ damage. This mechanism explains the broad clinical spectrum of preeclampsia and its potential progression to severe complications.

Several risk factors have been identified as contributing to the development of preeclampsia, including maternal age, parity, gravidity, nutritional status, multiple pregnancy (twin gestation), and diabetes mellitus (Pritasari et al., 2020). High-risk maternal age is generally defined as <20 years or >35 years. Nulliparity (primiparity) is associated with a higher risk compared to multiparity. Excess nutritional status, such as obesity (body mass index ≥30 kg/m²), as well as diabetes mellitus—either gestational or pregestational—also increases the risk of preeclampsia. Furthermore, the increasing trend of pregnancies at high-risk ages and the rising prevalence of obesity and diabetes among women of reproductive age in recent years may have contributed to the growing incidence of preeclampsia.

However, previous studies investigating the risk factors of preeclampsia have yielded inconsistent findings. Some studies reported significant associations between multiple pregnancy and nutritional status with preeclampsia, whereas others found no such associations (Parantika et al., 2021; Basyiar et al., 2021; Dewi et al., 2024). Similar inconsistencies have been observed regarding maternal age, parity, diabetes mellitus, and gravidity (Regita & Khayati, 2024; Rismawati et al., 2021; Fakhri et al., 2023; Wardani &

Sulastri, 2024). These discrepancies suggest the presence of a research gap, potentially related to differences in population characteristics, regional contexts, and study periods.

To date, no study has specifically analyzed the dominant risk factors for preeclampsia among patients at Dr. Prof. Margono Soekarjo General Hospital during the most recent period. Therefore, the research problem addressed in this study is the lack of evidence regarding the most influential risk factors for preeclampsia in this hospital population. Given the high incidence of preeclampsia, its serious clinical consequences, and the inconsistency of previous findings, a population-specific risk factor analysis is warranted. This study aims to identify the risk factors associated with preeclampsia at Dr. Prof. Margono Soekarjo General Hospital during the period of August 2023–July 2024. The findings are expected to contribute to early detection strategies, antenatal screening optimization, and the development of preventive approaches to reduce preeclampsia-related complications in clinical obstetric practice.

RESEARCH METHOD

This study was conducted at Prof. Dr. Margono Soekarjo Regional General Hospital, Indonesia. The study design used in this research was an analytic observational study with a retrospective cross-sectional approach based on medical record data. The data used were secondary data from delivery records at Prof. Dr. Margono Soekarjo Regional General Hospital from August 2023 to July 2024. The target population was all pregnant women who gave birth at the hospital during the observation period, while the accessible population consisted of pregnant women with complete medical record data. Thus, the sample used consisted of 392 pregnant women. Sampling in this study was performed using consecutive sampling, where all subjects meeting the inclusion and exclusion criteria were included until the sample size was fulfilled. This study has received ethical approval under No. 420/10405.

The inclusion criteria for this study were pregnant women with complete delivery records at Prof. Dr. Margono Soekarjo Regional General Hospital from August 2023 to July 2024. The exclusion criteria for this study were incomplete data, diagnosis of recurrent miscarriage, inter-pregnancy interval >10 years, antiphospholipid syndrome, systemic lupus erythematosus, tuberculosis, sexually transmitted infections, and chronic kidney disease. The minimum sample size was calculated using the proportion formula for analytic studies with a 95% confidence interval and 80% power, based on the estimated prevalence of preeclampsia from previous studies.

The data collection and management were conducted through editing, coding, entry, and data cleaning, followed by analysis using statistical software. Variables analyzed included pre-pregnancy nutritional status, multiple pregnancy (gemelli), maternal age, gravidity, parity, and diabetes mellitus as independent variables, preeclampsia diagnosis as the dependent variable, and bacteriuria as the controlled confounding variable. Data with missing variables were eliminated from the analysis using complete case analysis.

Operational Definition of Variables

The operational definitions of the variables in this study are as follows:

- **Maternal nutritional status**: determined based on pre-pregnancy Body Mass Index (BMI) recorded in medical records, categorized according to WHO/Asia Pacific criteria (underweight, normal, overweight, obese), ordinal scale.
- **Maternal age**: mother's age during pregnancy, categorized into high risk (<20 years or >35 years) and low risk (20–35 years), nominal scale.

- **Parity**: number of previous live births, categorized into primipara and multipara, nominal scale.
- **Gravidity**: number of times the woman has been pregnant, categorized by the total number of pregnancies, ordinal scale.
- **Multiple pregnancy (Gemelli)**: twin or multiple pregnancy based on a physician's diagnosis in the medical records (yes/no), nominal scale.
- **Diabetes Mellitus (DM)**: diagnosis of gestational or pregestational DM based on clinical records, nominal scale.
- **Preeclampsia**: diagnosis of preeclampsia based on clinical criteria (blood pressure (140/90) mmHg after 20 weeks of gestation accompanied by organ damage) as recorded in medical records, nominal scale.
- **Bacteriuria**: presence of bacteria in the urine based on laboratory test results, nominal scale.

Tools and Materials The data collection tool used in this study was the delivery records at Prof. Dr. Margono Soekarjo Regional General Hospital from August 2023 to July 2024. Data validity is ensured as medical records were completed by healthcare professionals in accordance with the hospital's standard operating procedures.

Research Procedures The study was conducted over a 4-month period. Research permits were processed from October 2025 to December 2025. Data collection was performed at Prof. Dr. Margono Soekarjo Regional General Hospital to obtain delivery records. The researchers then compiled the data until the required sample size was reached based on the inclusion and exclusion criteria. Data processing and analysis were subsequently carried out in December 2025.

Bias Control Efforts

Efforts to control bias in this study included:

- **Selection bias**: minimized by including all subjects who met the inclusion and exclusion criteria (consecutive sampling).
- **Information bias**: minimized by utilizing standardized hospital medical record data that had been systematically documented.
- **Confounding**: controlled through multivariate analysis using logistic regression.

Data Analysis The collected data were processed using SPSS software and analyzed in three stages: univariate, bivariate, and multivariate analysis. Univariate analysis was used to describe the frequency distribution of the research subjects' characteristics. Bivariate analysis was employed to determine the relationship between each risk factor and the incidence of preeclampsia using the Chi-square or Fisher's exact test.

Multivariate analysis was performed using logistic regression to identify the relationship between independent variables that had a p-value (<0.25) in the bivariate analysis. The results are presented as Odds Ratio (OR) with a 95% Confidence Interval (95% CI). Logistic regression assumption tests included multicollinerarity tests and goodness-of-fit tests using the Hosmer–Lemeshow test. A significant relationship was determined based on a p-value (<0.05).

RESULT AND DISSCUSSION

Result

The results of the univariate analysis conducted on 392 study subjects are as follows:

Table 1. Characteristics of Pregnant Women

No	Variable	Frequency(n)	Percentage (%)
1	Maternal age		
	a <20 years	8	2%
	b 20-35 years	309	78,8%
	c >35 years	75	19,1%
2	Pre-pregnancy maternal nutritional status		
	a KEK	22	5,6%
	b Normal	243	62%
	c Overweight	79	20,2%
	d Obese	48	12,2%
3	Gravidity		
	a Primigravida	127	32,4%
	b Multigravida	259	66,1%
	c Grandemutigravida	6	1,5%
No	**Variable**	**Frequency(n)**	**Percentage (%)**
4	Parity		
	a Nulliparous	140	35,7%
	b Primiparous	131	33,4%
	c Multiparous or grand multiparous	121	30,9%
5	Preeclamsia diagnosis		
	a No preeclamsia	266	67,9%
	b Preeclamsia	126	32,1%
6	Diabetes Mellitus		
	a Non Diabetes Mellitus	380	96,9%
	b Diabetes Mellitus	12	3,1%
7	Multiple pregnancy		
	a No multiple pregnancy	381	97,2%
	b Multiple pregnancy	11	2,8%
8	Bacteriuria		
	a No bacteriuria	349	89%
	b Bateriuria	43	11%

Based on Table 1, the dominant characteristics of the research subjects were as follows: 309 subjects (78.8%) were aged 20–35 years, 243 subjects (62%) had a normal pre-pregnancy nutritional status, 259 subjects (66.1%) were multigravida, and 140 subjects (35.7%) were nulliparous. Furthermore, 380 subjects (96.9%) did not have DM, 381 subjects (97.2%) did not have a multiple pregnancy (gemelli), and 349 subjects (89%) did not have bacteriuria. In addition, 266 subjects (67.9%) did not experience preeclampsia.

The results of the bivariate analysis are presented in the following cross-tabulation in table 2:

Tablel 2. Bivariat analysis

Variable	Preeclampsia				*p-value*	PR (95% CI)
	Preeclampsia		No Preeclampsia			
	n	%	n	%		
Diabetes Mellitus						
Diabetes Mellitus	8	66,7%	4	33,3%	0,022	2,146 (1,4-3,289)
Non Diabetes Mellitus	118	31,1%	262	68,9%		
Multiple pregnancy						
Multiple pregnancy	11	100%	0	0%	<0,001	3,311 (2,84-3,861)
No multiple pregnancy	115	30,2%	366	69,8%		
Maternal age						
<20 years	5	62,5%	3	37,5%		
20-35 years	70	22,7%	239	77,3%	<0,001	-
>35 years	51	68%	24	32%		

Variable	Preeclampsia				*p-value*	PR (95% CI)
	Preeclampsia		No Preeclampsia			
	n	%	n	%		
Maternal nutritional status before pregnancy						
KEK	12	54,5%	10	45,5%	<0,001	-
Normal	40	16,5%	203	83,5%		
Overweight	41	51,9%	38	48,1%		
Obese	33	68,8%	15	31,3%		
Gravidity						
High-risk gravidity (Primigravida or grand multigravida)	48	36,1%	85	63,9%	0,278	1,199 (0,894-1,605)
Multigravida	78	30,1%	181	69,9%		
Parity						
Nulliparous	49	35%	91	65%	<0,001	-
Primiparous	18	13,7%	113	86,3%		

Multiparous or grand multiparous	59	48,8%	62	51,2%		
Bacteriuria						
Bacteriuria	43	100%	0	0%	<0,001	4,202 (3,484-5,076)
No bacteriuria	83	23,8%	266	76,2%		

Based on Table 2, the risk factors significantly associated with preeclampsia (p<0,05) were Diabetes Mellitus (p= 0,022), multiple pregnancy (p<0,001), maternal age (p<0,001), pre-pregnancy nutritional status (p<0,001), parity (p<0,001), and bacteriuria (p<0,001), Conversely, the risk factor that was not significantly associated with preeclampsia was gravidity (p= 0,278)

The results of the multivariate analysis are presented in the following in table 3:

Table 3. Final Logistic Regression Model with Firth's Correction

Variabel	**Regression coefficient**	***Standart error***	***p-value***	**Exp(B)**	**95% CI for Exp(B)**	
					Lower	**Upper**
Diabetes Melitus	0,401	1,024	0,695	1,494	0,201	11,112
Multiple pregnancy	4,225	1,603	0,008	68,403	2,956	1582,849
Bacteriuria	5,982	1,457	<0,001	396,632	22,782	6905,97
Maternal age <20	2,183	0,841	0,009	8,868	1,706	46,102
Maternal age >35	2,505	0,416	<0,001	12,248	5,417	27,685
KEK	2,791	0,65	<0,001	16,309	4,559	58,32
Overweight	1,638	0,429	<0,001	5,144	2,22	11,919
Obesity	2,652	0,476	<0,001	14,189	5,579	36,096
Nulliparous	2,193	0,531	<0,001	8,96	3,166	25,354
Multiparous or grand multiparous	2,169	0,5	<0,001	8,747	3,284	23,289
Constant	-4,585	0,543	<0,001			

Based on Table 3, the Odds Ratio (OR) for multiple pregnancy (gemelli) is 68.403, bacteriuria is 394.632, maternal age <20 years is 8.868, and maternal age >35 years is 12.248. For nutritional status, the OR for Chronic Energy Deficiency (CED) is 16.309, overweight is 5.144, and obesity is 14.189. Regarding parity, the OR for nulliparous is 8.96, while for multiparous or grand multiparous, it is 8.747. Based on this model, the regression equation is as follows :

Y Model
=DM+Multiple pregnancy+Bacteriuria+Age <20 years+Age >35 years+CED+Overweight +Obesity+Nulliparous+Multiparous or grand multiparous

Preeclampsia=68.403(Multiple pregnancy)+396.632(Bacteriuria)+8.868(Age <20 years)+12.248(Age >35 years)+16.309(CED)+5.144(Overweight)+14.189(Obesity)+8.96(Nulliparous)+8.747(Multiparous or grand multiparous)

Discussion

The results of this study indicate that DM is a risk factor for preeclampsia. This finding is consistent with previous research. According to Aulia et al. (2019), DM is a risk factor for preeclampsia with an OR of 5.8 (95% CI 1.4–23.3). Ying et al. (2025) also stated that both type 1 and type 2 DM are risk factors for preeclampsia. Furthermore, Wolka et al. (2022) found that DM during pregnancy serves as a risk factor for preeclampsia with an

RR of 1.8 (95% CI: 1.2–2.7). Diabetic conditions increase systemic inflammation due to hyperglycemic states, leading to placental ischemia and endothelial dysfunction. Placental ischemia further increases the secretion of antiangiogenic factors, which exacerbates endothelial dysfunction. This dysfunction downregulates the vascular ability to regulate blood pressure, subsequently leading to hypertension and target organ damage (Redman et al., 2020; Yang & Wu, 2022).

The study also shows that obesity and Chronic Energy Deficiency (CED) are risk factors for preeclampsia. These results align with several prior studies. Research by Arwan & Sriyanti (2020) stated that obesity is statistically significantly associated with the incidence of preeclampsia. Obesity was also identified as a risk factor in a study by Parantika et al. (2021), with an OR of 4.746 (95% CI 2.381–9.460). Additionally, Ying et al. (2025) reported that Body Mass Index (BMI) is a risk factor for preeclampsia. CED can cause impaired vascular resistance and endothelial dysfunction due to prolonged inadequate intake of macronutrients and micronutrients (Anggraini et al., 2020). Conversely, obesity can trigger systemic inflammation due to adipocyte accumulation. This systemic inflammation leads to endothelial dysfunction (Huether et al., 2019; Lockwood et al., 2023). Furthermore, a high-risk BMI is associated with preeclampsia because it increases the risk of developing DM (Ying et al., 2025).

The results demonstrate that parity has a statistically significant relationship with preeclampsia, whereas gravidity does not. This finding is in line with studies conducted by Rismawati et al. (2021), Lestari et al. (2025), Dewi et al. (2024), Vonia et al. (2025), and Regita & Khayati (2024), which stated that parity is significantly associated with preeclampsia. However, this contradicts the study by Arwan & Sriyanti (2020), which found that gravidity was significantly associated with preeclampsia. Multiparous, grand multiparous, and grand multigravida pregnancies are at risk for preeclampsia due to excessive uterine stretching, which increases the risk of placental hypoxia and cardiovascular stress (Anindya et al., 2022; Dasa et al., 2022). Additionally, nulliparous pregnancy is also a risk factor as it can increase sFLT-1 levels, subsequently causing endothelial dysfunction (Boutin et al., 2021; Arwan & Sriyanti, 2020).

This study also found that maternal age >35 years and <20 years are risk factors for preeclampsia, which is consistent with previous literature. According to Basyiar et al. (2021), maternal age is a risk factor for preeclampsia based on chi-squared tests with an OR of 2.61. Regita & Khayati (2024) also identified maternal age as a risk factor with an OR of 5.463 (95% CI 2.826–10.560). Furthermore, Wardani & Sulastri (2024) reported an OR of 2.325 (95% CI 1.197–4.516). Maternal age <20 years carries a risk because the uterine size may not be sufficient to support the pregnancy, increasing the risk of placental hypoxia and endothelial dysfunction (Arwan & Sriyanti, 2020). Meanwhile, maternal age >35 years is associated with an increased risk of endothelial dysfunction and other chronic diseases that heighten inflammatory status (Lopian et al., 2023).

Finally, the results show that multiple pregnancy (gemelli) is a risk factor for preeclampsia. This is consistent with research by Parantika et al. (2021), which found that multiple pregnancy is a risk factor with an OR of 15.857 (95% CI 1.899–132.384). This occurs because multiple pregnancies can increase total uterine peripheral resistance and elevate sFLT-1 secretion, leading to endothelial dysfunction (Yang et al., 2024).

The results of this study indicate that bacteriuria is a risk factor for preeclampsia, which is consistent with previous research. According to Marlina et al. (2025), bacteriuria is a risk factor for hypertension in pregnancy with an OR of 1.379 (95% CI 0.751–2.532). Aruuna & Dakshinamurthy (2025) reported that Urinary Tract Infection (UTI) is a risk factor for preeclampsia with a Relative Risk (RR) of 3.2. Furthermore, Fatima et al. (2025) stated that UTI is a risk factor for preeclampsia with an RR of 2 (95% CI 1.123–3.563). Additionally, Adeyemo et al. (2023) found that asymptomatic bacteriuria is a risk factor for preeclampsia with an OR of 1.23 (95% CI 1.12–3.14). Bacteriuria can lead to subclinical chronic inflammation, which reduces nitric oxide (NO) production and increases Renin-Angiotensin-Aldosterone System (RAAS) activity (Adeyemo et al., 2023; Marlina et al., 2025). Moreover, bacterial endotoxins can increase pro-inflammatory cytokines and oxidative stress (Fatima et al., 2025), resulting in endothelial dysfunction that impairs blood pressure regulation (Adeyemo et al., 2023).

Based on the multivariate analysis, the variables of DM, age <20 years, age >35 years, CED, overweight, obesity, nulliparous, and multiparous or grand multiparous are risk factors for preeclampsia at Prof. Dr. Margono Soekarjo Regional General Hospital from August 2023 to July 2024, after controlling for bacteriuria. The resulting model for the incidence of preeclampsia is 68.403 (multiple pregnancy) + 396.632 (bacteriuria) + 8.868 (age <20 years) + 12.248 (age >35 years) + 16.309 (CED) + 5.144 (overweight) + 14.189 (obesity) + 8.96 (nulliparous) + 8.747 (multiparous or grand multiparous). According to this model, multiple pregnancy (gemelli) is the most influential risk factor for the incidence of preeclampsia at Prof. Dr. Margono Soekarjo Regional General Hospital during the study period. This finding aligns with the research by Parantika et al. (2021), which stated that multiple pregnancy is a key risk factor for preeclampsia alongside obesity and a history of preeclampsia.

CONCLUSION

Risk factors significantly associated with preeclampsia include maternal age, multiple gestation, diabetes mellitus, and maternal nutritional status prior to pregnancy; among these, multiple gestation was the risk factor most strongly associated with the incidence of preeclampsia at Prof. Dr. Margono Soekarjo General Hospital from August 2023 to July 2024.

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