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Relationship of Age, Body Mass Index, and Gravida in Pregnant Women With Preeclampsia in Muhammadiyah Hospital Surabaya

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ABSTRACT
Background/aim: Preeclampsia is one of the causes of increased maternal mortality. The rate in East Java Province reached 91 per 100,000 live births. The highest cause of maternal death in 2016 was preeclampsia/eclampsia, which was 30.90% or 165 people. This study aims to determine the relationship of age, body mass index (BMI), and gravida to pregnant women who have preeclampsia at Muhammadiyah Hospital in Surabaya. Materials and Methods: This case-control study uses a total sampling obtained 210 pregnant women, as many as 105 preeclampsia pregnant women and 105 normal pregnant women. Results: The results of bivariate statistical tests found that age, BMI is a risk factor for the incidence of preeclampsia (p: 0.039; p: 0.002), and gravida has no relationship (p: 0.410). Differ with the multivariate test; there was an influence of age 36-45 years on the incidence of preeclampsia with a risk of 4.060 times compared to the age of 20-35 years, obese affected with a risk of 4.696 times compared to a healthy weight and gravida influencing with a risk of 2,099 times experiencing preeclampsia. Conclusion: There is a relationship between age, BMI, and gravida in preeclampsia at Muhammadiyah Hospital in Surabaya.

Keywords: *Preeclampsia, Pregnant women, Age, BMI, Gravida*

1. INTRODUCTION

Hypertension disorders in pregnancy are the most critical problems faced by public health because they cause maternal and child morbidity and mortality. Based on WHO data, it is estimated that every day around 830 pregnant women die worldwide. Various complications at the time of delivery and high maternal mortality rates can illustrate healthcare quality in developing and developed countries. Approximately 75% of maternal deaths occur due to the emergence of a complication faced by the mother during pregnancy/childbirth, the complications in question namely: hypertension in pregnancy, bleeding, infection, and also complications due to unsafe abortion labor. Therefore maternal death can be prevented by skilled health care. Like preeclampsia, it is recommended to give magnesium sulfate drugs to prevent eclampsia [1].

In 2016, the maternal mortality rate of East Java Province reached 91 per 100,000 live births. This figure has increased compared to 2015, which reached 89.6 per 100,000 live births. The highest cause of maternal death in 2016 was preeclampsia/eclampsia, which was 30.90% or as many as 165 people. While the smallest cause is an infection by 4.87% or as many as 26 people, bleeding by 24.72%, and other causes by 28.65%. Preeclampsia/eclampsia is one of the leading causes of maternal death and tends to increase in the last three years [2].

Approximately 10% of women worldwide are affected by hypertension disorders in pregnancy and hypertension groups in pregnancy, which are intended, namely: gestational hypertension, preeclampsia, eclampsia, and chronic hypertension. This disease can cause death in both the mother and the baby. Therefore health workers optimize care and treatment of women who have hypertension in pregnancy [1].

According to previous studies, there is a relationship between age, body mass index (BMI), parity in the occurrence of hypertension in pregnancy [3], as for the risk factors that can be grouped into several risk factors as follows: primigravida, primipaternitas, hyperplacentosis, extreme age, family history ever preeclampsia/eclampsia, kidney disease and pre-existing hypertension and obesity[4]. Increasing body mass index (BMI) is

positively associated with an increased risk of PE. Women with a prepregnancy BMI of 35 kg/m^2 or above have a 30% increased risk of developing PE[5].

The rate of maternal mortality is still a complicated issue, with hypertension in pregnancy being one of the fundamental causes. The age of marriage is growing in current circumstances; life is entirely immediate, thereby increasing the incidence of obesity and the propensity to reduce deliveries. The researchers plan to investigate risk factors that may worsen the occurrence of preeclampsia under these conditions.

2. MATERIALS AND METHODS

This research is an observational analysis. The type of research uses a case-control study. The population taken was all pregnant women diagnosed with preeclampsia at Muhammadiyah Hospital Surabaya from January 2016 - December 2019.

The independent variables in this study were: age, BMI (body mass index), and gravida. The age was differentiated into 16-19 y.o, 20-35 y.o, and 36-45 y.o. BMT was categorized as normal weight (18.5-24.9 kg/m2), overweight (25.0-29.9 kg/m2), and obese (≥30.0 kg/m2). Gravida was divided into primigravida, multigravida, and grand multigravida. Simultaneously, the dependent variable is preeclampsia (hypertension in pregnancy, along with proteinuria).

The case group's inclusion criteria in this study are pregnant women diagnosed with preeclampsia, maternal age 16-45 years, 20-42 weeks gestational age. Sedangkan Inclusion criteria for the control group are the normotensive match pregnancy. These patients have complete medical record data, single pregnancy, and trimesters II and III. While the exclusion criteria in this study are patients who do not have a complete medical record, patients with gestational diabetes, multifetus pregnancy, have previous vascular disease, kidney disease, mothers with a history of diabetes mellitus, and history of smoking. The minimum size of the research sample is 70 people using the Lemeshow sample size formula.

3. RESULT

The pregnant women who suffer from preeclampsia in 3 years from 2016 to 20for 19 recorded at Medical Record at Muhammadiyah Hospital Surabaya. The sum is 172 people, 67 people were included in the exclusion criteria, so this study used a sample of 105 preeclampsia pregnant women and added 105 normal pregnant women in the same period.

3.1. Univariate Analysis

Distribution of Pregnant Women's Age, BMI, and Gravida

3.1.1. The Proportion of Pregnant Women Based on Mother's Age at the Muhammadiyah Hospital Surabaya

Table 1: Distribution of pregnant women's age

Age	Frequence	%
16-19 years old	19	9
20-35years old	152	72,4
36-45 years old	39	18,6
Total	210	100

The majority of pregnant women aged 20-35 years, amounting to 152 people (72.4%), 39 people (18.6%) aged 36-45 years, and the smallest number of pregnant women were vulnerable aged 16-19 years as many as 19 people (9%).

3.1.2. The Proportion of Pregnant Women Based on BMI at the Muhammadiyah Hospital Surabaya

Table 2: Distribution of pregnant women's BMI

BMI	Frequence	%
Normalweight	37	17,6
Overweight	113	53,8
Obese	60	28,6
Total	210	100

Pregnant women in this study, their BMI is mostly at the level of overweight (18.5-24.9) as many as 113 people (53.8%), and pregnant women who obese are 60 people (28.6 %).

3.1.3. The Proportion of Pregnant Women Based on Gravida at the Muhammadiyah Hospital Surabaya

Table 3: Distribution of pregnant women's gravida

Gravida	Frequence	%
Primigravida	77	36,7
Multigravida	111	52,9
Grande Multigravida	22	10,5
Total	210	100

The data in Table 3 shows that pregnant women, mostly 111 people (52.9%), are multigravida.

3.2. Bivariate analysis

3.2.1 Relationship between Pregnant Women's Age and the Incidence of Preeclampsia at the Muhammadiyah Hospital Surabaya

Table 4: Relationship between pregnant women's age and the incidence of preeclampsia

Age	Preeclampsia				Correlation coefficient	p-value
	Yes		No			
	N	%	N	%		
16-19 y.o	11	10,5	8	7,6	0,173	0,039
20-35 y.o	68	64,8	84	80		
36-45 y.o	26	24,8	13	12,4		
Total	105	100	105	100		
Contingency Coefficient Correlation Test						

Based on Table 4, the results of the analysis of the relationship of age with the incidence of preeclampsia were obtained by 210 pregnant women who examined 105 patients who had preeclampsia, including 37 people (35.3%) aged 16-19 and 36-45 years which is the age at risk of preeclampsia. Statistical test results obtained a p-value of 0.039 <0.05, which shows a relationship between age and preeclampsia incidence.

3.2.2. Relationship Between BMI and the Incidence of Preeclampsia at the Muhammadiyah Hospital Surabaya

Table 5. Relationship between pregnant women's BMI and the incidence of preeclampsia

BMI	Preeclampsia				Correlation coefficient	p-value
	Yes		No			
	N	%	n	%		
Normalweight	13	12,4	24	22,9		
Overweight	51	48,6	62	59	0,236	0,002
Obese	41	39	19	18,1		
Total	105	100	105	100		
Contingency Coefficient Correlation Test						

Based on table 5, the analysis of the relationship between BMI with the incidence of preeclampsia shows that of the 105 pregnant women who experienced preeclampsia, where the BMI with had overweight and obese BMI was 87,6%. The statistical test results, the value of the p-value, are 0.002 <0.05, which shows there is a significant relationship.

3.2.3. Relationship between pregnant women's gravida and the incidence of preeclampsia at Muhammadiyah Hospital Surabaya

Table 6: Relationship between pregnant women's gravida and the incidence of preeclampsia

Gravida	Preeclampsia				Correlation coefficient	p-value
	Yes		No			
	N	%	n	%		
Primigravida	43	41	34	32,4	0,092	0,410
Multigravida	51	48,6	60	57,1		
Grandem ulti Gravida	11	10,5	11	10,5		
Total	105	100	105	100		
Contingency Coefficient Correlation Test						

Table 6 shows that patients suffering from preeclampsia are 41% pregnant women with a primigravida. The most are multigravida with preeclampsia, 51 (48.6%) people. In contrast, grand multigravida with preeclampsia is 11 (10.5%) people. Statistical test results obtained p-value 0.410 show no significant relationship between gravida risk factors for preeclampsia incidence in Muhammadiyah Hospital Surabaya.

3.3. Multivariate Analysis

Based on the results of the logistic regression test in table 7, it was found that the age of 36-45 years affected the incidence of preeclampsia with a p-value: 0.003 <0.05, age 36-45 years of risk of 4.060 times experiencing preeclampsia compared to pregnant women aged 20-35 years. The age of 16-19 years has no effect on the incidence of preeclampsia (p-value 0.335), and the OR value is 1.426; this value indicates that subjects who are aged 16-19 years have a 1.426 times chance have preeclampsia compared to reproductive age that is safe for pregnancy.

The logistic regression analysis results in table 7 show that mothers with obesity (BMI ≥30.0) could influence preeclampsia incidence with a p-value: 0.001 <0.05. Pregnant women with obesity had a risk of 4.696 times, having preeclampsia compared to a healthy weight. This analysis also found that overweight had no effect on preeclampsia incidence with a p-value: 0.282 >0.05. Nevertheless, statistically, mothers with an overweight BMI have a 1,552 chance of developing preeclampsia than healthy BMI.

The regression analysis in Table 7 shows that mothers with primigravida affected preeclampsia incidence. Primigravida had a risk of 2.099 times having preeclampsia compared to multigravida. In contrast, grand multigravida did not affect preeclampsia incidence (p-value: 0.260).

Grand multigravida had a 0.515 chance of developing preeclampsia compared to multigravida. Of these variables, the one most at risk for preeclampsia is obesity, were 4,696 times the risk of preeclampsia. The nagelkerke R square value in this analysis is 15.5%, which means that these three risk factors can represent a variation of the risk factors in preeclampsia by 15.5%, while 84.5% explained by other factors not examined.

Table 7: Results of multivariate analysis between pregnant women's age, BMI, and gravida to the incidence of preeclampsia

Variable		B	p-value	OR	95% CI
Age	16 - 19 y.o	0,335	0,508	1,426	0,498 – 4.081
	36 - 45 y.o	1,401	0,003	4,060	1,600 – 10,298
BMI	*Overweight*	0,439	0,282	1,552	0,697 – 3,457
	Obese	1,547	0,001	4,696	1,879 – 11,738
Gravida	Primigravida	0,741	0,031	2,099	1.069 – 4.123
	Grandemulti gravida	-0,664	0,260	0,515	0.162 – 1.635
Konstanta	-1,164				
Nagelkerke R squere = 15,5% Hosmer & Lemeshow test = 0,866					

Based on the results of the multivariate analysis test, the formula is as follows:

y = -1,164 + 0,335*(16-19y.o) + 1,401*(36-45y.o) + 0,439*(*overweight*) + 0,001*(*obese*) + 0,741*(primigravida) - 0,664*(grandemultigravida)

Thus the probability formula is:

$$p: \frac{1}{1+e^{-y}}$$

4. DISCUSSION

4.1. The Relationship of Age to the Incidence of Preeclampsia

From the bivariate analysis results, age was found to be significantly related to the incidence of preeclampsia. The multivariate analysis results also obtained the age of 36-45 years affected the incidence of preeclampsia and 2.420 times the risk of preeclampsia. Novianti [6] and Tinta *et al*. [7] obtained that the occurrence of preeclampsia is linked to age. Since the uterus' size has not met the average size for pregnancy and the maternal age >35 years of blood vessels, undergo peripheral dysfunction and structural changes from the degenerative phase, the age of <20 years in pregnancy is vulnerable to preeclampsia. This study is by the research of Bilano, Ganchimeg, Mori, and Souza [8] that there is a relationship between the incidence of preeclampsia and age >=35 years at 1.95 times the risk of experiencing preeclampsia. Sheen *et al.* obtained the proportion of women with preeclampsia aged 15 to 24 years decreased from 42.3% (1998) to 30.1% (2014), while preeclampsia among those 30 to 54 years increased 32.9 to 43.7%[9]. Furthermore, this study is not in line with the research of Sutrimah, Mifbakhuddin, and Wahyuni [10] that there is no relationship between age and the incidence of preeclampsia.

4.2. The Relationship of BMI to the Incidence of Preeclampsia

Based on bivariate analysis, a relationship between BMI and preeclampsia incidence with a p-value of 0.002. Meanwhile, according to multivariate analysis, it was found that mothers with obesity (BMI ≥30.0) could influence the incidence of preeclampsia with a p-value: 0.001 and have a risk of 4.469 times to experience preeclampsia compared to a healthy weight. This finding is the following research by Andriani, Lipoeto, and Utama [11] that there is a relationship between BMI and preeclampsia incidence. However, overweight BMI is two times more risk for preeclampsia than women who have healthy body weight. In pregnant women who are overweight, preeclampsia can occur through the mechanism of hyperleptinemia, metabolic syndrome, inflammatory reactions, and increased oxidative stress. This factor leads to damage and endothelial dysfunction and causes decreasing nitric oxide production and secretion [12]. This condition causes an imbalance of vasoconstrictor and vasodilator factors that increase maternal blood pressure [13] [14].

This finding is also supported by research from Roberts et al. [15] that concerning BMI to preeclampsia, women with obesity have a 3-fold risk of experiencing preeclampsia. About 10% of women with obesity develop preeclampsia. Robillard *et al*. [16] said that metabolic factors are associated with prepregnancy maternal corpulence. This condition is associated explicitly with late-onset preeclampsia. This finding may be a direction for future researches on the maternal preeclamptic syndrome. This reality may explain the discrepancy we face nowadays where high-income countries report 90% of their preeclampsia being late-onset preeclampsia, while it is only 60–70% in medium-low income countries. Beneventi *et al*. [17] said that In the first trimester and during pregnancy, pregnant subjects with obesity had higher serum Leptin and lower IL33 concentrations compared with lean controls. For those that later experienced preeclampsia, this disparity continued as well. The association between Leptin and IL33 maternal serum levels with the uterine artery Doppler pulsatility index strongly indicates that these two markers play a role in early placentation.

4.3. The Relationship of Gravida to the Incidence of Preeclampsia

The bivariate analysis results showed no relationship between gravida status from preeclampsia incidence with a p-value of 0.410 >0.05. However, based on multivariate analysis, primigravida influences preeclampsia incidence (p-value: 0.031) compared to multigravida, where

primigravida is at risk of 2.099 times to get preeclampsia. These bivariate analysis results are in line with Asmana, Syahredi, and Hilbertina [18] that there is no gravida relationship to preeclampsia incidence; parity 0 is a risk factor for severe preeclampsia. There are differences between this study's results and various factors included. The theory is a sample of research with parity more than one that is not a risk factor group but has an age risk factor, that is, the age is more than 35 years.

Besides, there is also the possibility of confusion in the diagnosis of preeclampsia, especially in pregnant women whose blood pressure before pregnancy or in early pregnancy is unknown; this makes it challenging to distinguish preeclampsia and chronic hypertension from superimposed preeclampsia. Not knowing the condition of blood pressure before pregnancy or previous blood pressure history will also cause escape from the sample exclusion process for patients who have a history of unknown hypertension Asmana et al. [18]. The results of this bivariate analysis are in line with research from Sunarto [19] that there is no gravida relationship to the incidence of preeclampsia with a p-value: 0.706 > 0.05, and there are differences in research results with the theory that there may be other factors such as mothers already preparing for pregnancy before pregnant women, antenatal care, nutritional intake during pregnancy, and lifestyle so that gravida does not affect the incidence of preeclampsia.

The results of this study are based on multivariate analysis in line with research. This study's results align with Novianti's [6] research that there is a parity/gravida relationship to the incidence of preeclampsia, primigravida, and grand multigravida at 2,117 times the risk of preeclampsia. The result of Tinta et al. also showed that there is a relationship between gravida and preeclampsia, especially multigravida [7], antipodes with the result of Yanuarini et al. [20]. Moreover, based on Saraswati and Mardiana's research [21] that there is a significant relationship between gravida status and the incidence of preeclampsia, where this research supports the immunological theory between mother and fetus, which states that primigravida has a higher risk of hypertension in pregnancy (preeclampsia) when compared with multigravida and primigravida have a risk of 2,173 times preeclampsia.

It is necessary to increase education and counseling to mothers about the risk factors for preeclampsia and the dangers of preeclampsia. If the mother is overweight or obese, then pregnancy can improve eating patterns and regular exercise. First-time pregnant women are advised to routinely control their pregnancies so that health workers can monitor maternal health development and need to increase preeclampsia screening as early detection for pregnant women who are at risk of preeclampsia.

5. CONCLUSION

There is a relationship between age, BMI, gravida, and the incidence of preeclampsia in Muhammadiyah Hospital, Surabaya

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