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NEONATAL OUTCOMES IN PREECLAMPSIA DURING PREGNANCY

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ABSTRACT
Preeclampsia is a pregnancy complication signified by the raise of blood pressure accompanied by proteinuria, maternal organ and uteroplacental dysfunction that occurs after 20 weeks of gestation. Preeclampsia is one of the main causes of maternal and neonatal morbidity and mortality worldwide. The effect of preeclampsia on neonatal outcomes is still a major concern, as preeclampsia contributes to poor neonatal outcomes. Objective: This study aims to analyze the impact of preeclampsia on neonatal outcomes in terms of weight, length, and APGAR score in the first minute. Method: The research used a retrospective approach with a case-control design. This research was conducted by collecting data at Dr. R. Soedjati Soemodiardjo Purwodadi General Hospital, Central Java, in 2021. The total sample was 204 pregnant women selected by simple random sampling, consisting of 102 pregnant women with preeclampsia and 102 without preeclampsia. The dependent variable was preeclampsia. The independent variables were neonatal outcomes regarding weight, length, and APGAR score in the first minute. Results: There is a significant effect of preeclampsia on body weight (p=0.011), body length (p<0.001), and APGAR score in the first minute (p=0.022) in neonates at Dr. R. Soedjati Soemodiardjo Purwodadi General Hospital in 2021. Conclusions: Neonates from mothers with preeclampsia tend to have lower weight, shorter length, and lower APGAR scores in the first minute compared to neonates from mothers without preeclampsia.

Keywords: neonatal outcomes; pregnancy; preeclampsia

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INTRODUCTION

Preeclampsia is a pregnancy complication marked by hypertension or elevated blood pressure accompanied by proteinuria, maternal organ dysfunction, and uteroplacenta that occurs after 20 weeks of gestation. Preeclampsia often occurs in the third trimester and can also occur during the early weeks after the baby is born. The increase in blood pressure that occurs in preeclampsia reaches >140/90 mmHg accompanied by an increase in systolic 30mmHg and diastolic 15mmHg and can increase to >160/110 mmHg in severe preeclampsia cases (Mustafa et al., 2012). Another important indication for diagnosing preeclampsia is the presence of urinary protein that reaches >300 mg/day, organ dysfunction which includes impaired liver function, thrombocytopenia, pulmonary swelling, renal failure or central nervous disorders and uteroplacental dysfunction which can lead to fetal growth restriction (Matyas et al., 2022). These conditions can seriously affect both the mother and the fetus. Data from WHO, during 2020 there were 342,000 pregnant women suffering from preeclampsia, which means that there are around 934 cases every day (WHO, 2020). Preeclampsia is one of the main causes of maternal and neonatal morbidity and mortality worldwide (Fox et al., 2019). According to WHO in 2020, a total of 287,000 women died both during pregnancy and after childbirth. It means that every day almost 800 lives are lost, where 75% are caused by complications, including preeclampsia and eclampsia (WHO, 2024). By

2022, a total of 2.3 million neonatal deaths, or about 6,300 every day, were caused by pregnancy complications and premature births. (UNICEF, 2024).

The high rate can have serious effects on pregnant women and their fetus. Preeclampsia that is not treated properly can lead to eclampsia or seizures in the mother (Espinoza et al., 2020). This has a fatal impact on the blood flow to the brain and a high risk to the mother's cardiovascular health in the future. Proteinuria in patients with preeclampsia can lead to decreased kidney function and can progress to acute renal failure (Wu et al., 2017) (Özkara et al., 2018). In addition, preeclampsia can also cause mothers to develop HEELP syndrome or Hemolysis, Elevated Liver Enzymes, Low Platelets Count (Bossung et al., 2020). Under these conditions, erythrocytes will break more easily, disrupting the oxygen transportation process which destroys cells in the liver. When liver cells are damage, enzymes such as ALT (alanine aminotransferase) and AST (aspartate aminotransferase) will be released into the bloodstream causing liver enzyme levels to increase sharply. The increase of liver enzyme levels is an indication of impaired liver function (Gardikioti et al., 2022). This syndrome also causes the mother's platelets to drop significantly causing disturbances in the clotting system and blood clots. Clinical manifestations that can occur are chest pain, abdominal pain and bleeding in the liver. This situation is very threatening to the mother's life if not treated immediately.

Despite numerous studies conducted to understand the impact of preeclampsia on the mother, the impact on neonatal outcomes remains a major concern. Pregnant women with preeclampsia or eclampsia are more likely to experience poor neonatal outcomes (Bossung et al., 2020; Lawrence et al., 2022). Neonatal outcomes are defined as the health status of the newborn baby, include neonatal death, disability, low birth weight, premature rupture of membranes and other medical complications. Preeclampsia can cause placental dysfunction (Matyas et al., 2022). Preeclampsia disrupts the process of placental formation commonly referred to as remodeling of the spinal arteries causing the blood vessels to become narrow and insufficient capacity to drain blood. As a result, the placenta is unable to fulfill the nutritional and oxygen needs of the fetus. Poor nutrition and oxygen fulfillment can result in intrauterine growth retardation or IUGR where the fetus has a smaller size and weight than its gestational age (Almuhaytib et al., 2023). The worst impact that can occur is IUFD (Intrauterine Fetal Death) or fetal death in the womb after 20 weeks of gestation. If the condition of the mother and fetus is considered too risky, the doctor will decide to perform early delivery or premature delivery with Caesarean method. Babies born premature tend to experience long-term developmental problems such as motoric, cognitive, metabolic disorders, low birth weight and also respiratory problems due to lungs that are not completely developed (Hervianto, 2017; Lawrence et al., 2022). Babies will experience trouble breathing and lack of oxygen supply resulting asphyxia at birth.

Previous studies have shown that pre-eclampsia can cause disruptions in placental blood flow, inhibit the growth of the fetus optimally, and cause defects in the vital organs of the unborn baby. However, there are still many aspects that need to be understood in further to evaluate how pre-eclampsia contributes to poor neonatal outcomes as well as the risk factors that affect neonatal outcomes, the severity of preeclampsia that impacts the baby, and the medical intervention role to reduce the negative impact of preeclampsia on newborns.Based on the mentioned background, this study aims to analyze the effect of preeclampsia on neonatal outcomes such as body weight, body length, and APGAR score in the first minute.

METHOD

This study used a retrospective approach by collecting data from the medical records of mothers and babies who were hospitalized at Dr. R. Soedjati Soemodiardjo Purwodadi General Hospital in 2021. The data collected included information on the mother's presence of preeclampsia, maternal characteristics (age, gravida, type of childbirth), and neonatal outcome such as APGAR score, weight, and length. Univariate analysis showed the frequency of each variable. Bivariate analysis evaluated the effect of pre-eclampsia and neonatal outcomes. The population of this study were pregnant mothers with preeclampsia at Dr. R. Soedjati Soemodiardjo Purwodadi General Hospital from January to June (1st semester) 2021 with a total of 135 cases. The samples in this study were mothers with preeclampsia as a case group and mothers without preeclampsia as a control group. The number of samples was determined by simple random sampling with a ratio of 1: 1 using the Slovin formula. By using the Slovin formula, the number of samples were 102 both in the case group and control group. Inclusion criteria in the case and control groups include: pregnant women have complete medical record status, pregnant women with a single baby. Exclusion criteria included: pregnant women with gemelli or more babies, mothers with chronic energy deficiency and anemia. The dependent variable was preeclampsia. The independent variables were neonatal outcomes in terms of weight, length, and APGAR score in the first minute. Univariate analysis of this study describes the characteristics of pregnant women in age, gravida, type of childbirth in the control and case groups. Bivariate analysis of the study showed the effect of pre-eclampsia on neonatal outcomes such as APGAR score in the first minute, body weight, body length. Before analyzing the bivariate test (independent sample T test), a normality test was carried out using the Kolmogorov Smirnov test on neonatal output data. Then, parametric or non-parametric differential tests are carried out based on the results of the normality test.

RESULT

Table 1.
Characteristics of respondents (n=204)

Variable		Group				Total	
		Case		Control			
		f	%	f	%	f	%
Age	Healthy Reproductive Age	75	73.5	81	79.4	156	76.5
	Unhealthy Reproductive Age	27	26.5	21	20.6	48	23.5
Gravida	Primi	34	33.3	26	25.5	60	29.4
	Multi	62	60.8	72	70.6	134	65.7
	Grande	6	5.9	4	3.9	10	4.9
Type of childbirth	Cesarean Section	69	67.6	52	51	121	59.3
	Vaginal delivery	33	32.4	50	49	83	40.7

Table 1 shows the characteristics of respondents based on age in the case and control groups; most of them are of healthy reproductive age (73.5% and 79.4%). While the percentage of unhealthy reproductive age in the case group was slightly higher than the control group, 26.5% compared to 20.6%. In the gravida category, the case and control groups were dominated by multipara respondents (60.8% and 70.6%). In the case group, the percentage of primipara respondents were 34 (33.3%) and in the control group were 26 (25.5%). The type of delivery in majority of the case group was C-section (67.6%), while in the control group, the percentage of C-section and vaginal delivery was not significantly different (51% and 49%).

Before conducting bivariate analysis, a normality test was conducted to determine whether the research data was normally distributed or not. The test was using Kolmogorov-Smirnov test. The Kolmogorov-Smirnov test was chosen because the total number of research samples was more than 50. The results of the normality test analysis on the three variables:

Table 2.
Normality Test Results

Variable	p-value/ sig		Independent Comparison Test
	Case	Control	
Body Weight	0.057*	0.035**	Nonparametric
Body Length	<0.001**	<0.001**	Nonparametric
APGAR score	<0.001**	<0.001**	Nonparametric

Table 2 shows that of the three variables which are neonatal outcomes, all are not normally distributed, hence the bivariate analysis uses a nonparametric test on unpaired sample groups, the Mann-Whitney test.

Table 3.
Neonatal Outcomes Differential Test

Variable	Neonatal Outcomes				Mean Difference	p-value
	Case		Control			
	Mean Rank	Mean	Mean Rank	Mean		
Body Weight	92.05	2962.75	112.95	3124.51	161.76	0.011*
Body Length	88.96	48.46	116.04	49.28	0.82	<0.001*
APGAR score	93.98	8.21	111.02	8.40	0.19	0.022*

In table 3, the mean rank of body weight in the case group was 92.05 lower than that of the control group 112.95. In the case group, the mean rank of body length was 88.96 lower than the control group 116.04. The mean rank of APGAR score in the case group was 93.98 lower than the mean rank of the control group 111.02. These results are in line with the mean difference between the case group and the control group in each neonatal outcome; body weight 161.76 grams, body length 0.82 cm, and APGAR score 0.19. This indicates that the case group had lower body weight, body length, and APGAR score in the first minute compared to the control group. Based on the Mann-Whitney test, the p-value of body weight was 0.011 ($p<0.05$), body length was 0.001 ($p<0.05$), and APGAR score in the first minute was 0.022 ($p<0.05$). The p-value results indicate that there is a significant difference in neonatal outcomes (weight, length and APGAR score in the first minute) between the case group and the control group, where the group of pregnant women with preeclampsia tends to have lower weight, length, and first minute APGAR score compared to the group of pregnant women without preeclampsia.

DISCUSSION

The univariate analysis showed that the characteristics of pregnant women who were at unhealthy reproductive age were higher in the group of pregnant women with preeclampsia 27 people compared to the group of pregnant women without preeclampsia 21 people. Unhealthy reproductive age is pregnancy in women with ages less than 20 years and more than 35 years. According to gravida, the group of pregnant women with preeclampsia had more primipara and grande multipara women compared to the group of pregnant women without preeclampsia. Primiparas are women who have given birth to 1 healthy child, while grande multipara are women who have given birth to more than 4 healthy children. The age range from 20-35 years is a healthy reproductive age to get pregnant because at that age there are minimal pregnancy complications. At the age of less than 20 years, uterine growth is still immature, the size has not reached the normal size for pregnancy, so it can increase the risk of preeclampsia (Denantika et al., 2015). Pregnancy at the age of 35 years has a higher risk of preeclampsia due to a degenerative process that affects peripheral blood vessels which contributes to blood pressure changes (Dianing Tyas et al., 2019; Gilboa et al., 2023; Sudarman et al., 2021).

Research conducted in 2022, showed that there is an association between pre-eclampsia and gravida status, where primipara and grande multipara have a high risk of pre-eclampsia (Riset et al., 2022). The increased risk of pre-eclampsia in primigravida is associated with immunologic reasons. The strongest hypothesis for this reason is that the existence of non-optimized adaptation of pregnant women to fetal or paternal alloantigens can indirectly cause uteroplacental blood flow disorders, which in turn play a role in the pathogenesis of preeclampsia (Chang et al., 2023). The characteristics in the group of pregnant women with preeclampsia, 67.6% went through C-section delivery, higher than the C-section delivery in the group of pregnant women without preeclampsia. This result is in line with a study conducted in Bangkok in 2023 that showed that the incidence of preeclampsia increases the risk for C-section delivery. This prevalence is also in line with research conducted in China, where the prevalence of C-section delivery in pregnant women with pre-eclampsia reached 66%. Although preeclampsia is not the main indication for C-section delivery, obstetricians and pregnant women are more likely to worry that the clinical condition of the mother and fetus will get worse during vaginal delivery in pregnancies with preeclampsia (Xu et al., 2021).

Based on the results of bivariate analysis using the Mann-Whitney test, it can be concluded that preeclampsia has a significant effect on neonatal outcomes. Neonates from mothers with preeclampsia tend to have lower body weight, shorter body length, and lower APGAR score in the first minute compared to neonates from mothers without preeclampsia. Preeclampsia contributes to poor fetal growth and development. In preeclampsia, trophoblast cells fail to invade the myometrial segment of the spiral arteries. Abnormally narrow blood vessels can reduce uteroplacental perfusion and can lead to placental ischemia (Staff, 2019). Reduced uteroplacental perfusion triggers the mother's adaptive response to increase blood pressure in order to maintain blood flow to the fetus, which results in hypertension (Chaiworapongsa et al., 2014). Unoptimized uteroplacental perfusion causes oxygen and nutritional demands for the fetus are not fulfilled which can cause fetal growth restriction (Surico et al., 2019).

Fetal growth restriction can cause low birth weight, small for gestational age, lower baby fat-free mass, APGAR score less than seven in the early minutes, stillbirth and neonate death (Bisson et al., 2023; Calek et al., 2023; Liu et al., 2021). Preeclampsia can also lead to fetal asphyxia (Utami et al., 2020). Abnormal spiral artery blood vessels cause poor blood flow that results in impaired oxygen and carbon dioxide exchange, leading to fetal asphyxia (Zamaun et al., 2021). Asphyxia in neonates is measured using the APGAR score, where neonates of preeclamptic mothers have a high risk of low APGAR scores in the first 5 minutes after birth (Ulfsdottir et al., 2024).The results of our study are in line with a study concerning the relationship between preeclampsia and low birth weight performed with a case control design on 280 pregnant women, which concluded that pregnant women with preeclampsia have a higher risk of giving birth to underweight neonates (Wahyuni & Puspitasari, 2021). These results are also in line with research in 2022, preeclampsia can have negative impacts on the fetus such as nutrition deficiencies and asphyxia due to inadequate blood flow between the uterus and placenta (Azza et al., 2022). The risk of asphyxia in the fetus increases with preeclampsia, low birth weight, and premature birth (Kusumaningrum et al., 2019). Premature neonates from mothers with preeclampsia have lower APGAR scores in the first and fifth minute (Pragitara et al., 2020). Several studies have also shown that neonates from mothers with preeclampsia are mostly born shorter than infants from mothers without preeclampsia (Gunnarsdottir et al., 2018; Siwabessy & Wija, 2022). The limitation of our study is that we did not include factors that might have made childbirth more difficult, such as cervical condition, fetal presentation, or other obstetric complications that might have

contributed to neonatal outcomes. Future research could consider these factors to provide a more comprehensive understanding of the relation between preeclampsia and neonatal outcomes.

CONCLUSION

Preeclampsia has a significant effect on neonatal outcomes such as weight, length and first minute APGAR score. Pregnant women who experience preeclampsia tend to have babies with lower body weight, shorter body length, and lower first minute APGAR score compared to mothers who do not experience preeclampsia. Facilities and health workers are expected to improve the management of pregnant women with preeclampsia by routinely monitoring the general condition, blood pressure, fetal growth in the womb and childbirth planning as well as providing education about daily care to pregnant women with preeclampsia in order to minimize complications that may occur in neonatal outcomes.

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