Preeclampsia Increases the Risk of Low Birth Weight, Case-Control Study at Gondo Suwarno Ungaran Hospital

Yulia Nur Khayati[1*], Anissa Regita[2]

[1]Universitas Negeri Semarang, Central Java, Indonesia

[2]Ngudi Waluyo University, Central Java, Indonesia

Corresponding author: yulia.farras@gmail.com

Abstract: Hypertensive disorders in pregnancy are conditions where the systolic blood pressure of pregnant women exceeds 140 mmHg and the diastolic blood pressure exceeds 90 mmHg. Hypertension in pregnancy has several types including pre-eclampsia or eclampsia, chronic hypertension during pregnancy, chronic hypertension accompanied by pre-eclampsia, and gestational hypertension. The cause of maternal death in Indonesia in 2023 is mostly hypertension in pregnancy, which is 412 cases, and in Central Java hypertension in pregnancy is the main cause of maternal death, which is 42.4%. The Health profile has not yet stated what complications in the fetus are caused by hypertension in pregnancy. Severe preeclampsia can cause uteroplacental blood circulation disorders, this will trigger oxidative stress in the placenta, increased uterine tone, and sensitivity to stimuli which ultimately causes complications in the mother and fetus. This study was conducted to find out what effects preeclampsia has on the fetus that is born. This study uses secondary data from Gondo Suwarno Ungaran General Hospital in 2023. The population in this study were all mothers who gave birth in 2023 totaling 945 and a sample of 246 mothers consisting of 82 mothers with preeclampsia and 164 mothers without preeclampsia bivariate data analysis using Chi-Square. The results of this study from the characteristics of the mother which are the factors causing preeclampsia are maternal age with p-value <0.0001 and History of Preeclampsia with p-value <0.0001. Complications in newborns related to Preeclampsia are Low birth weight babies with OR 2.110 (1.087-4.097) while there is no relationship between Preeclampsia and the incidence of Asphyxia in newborns.

Keywords: Preeclampsia, low birth weight

INTRODUCTION

Hypertensive disorders in pregnancy are conditions where the systolic blood pressure of pregnant women exceeds 140 mmHg and the diastolic blood pressure exceeds 90 mmHg. Hypertension in pregnancy has several types including pre-eclampsia or eclampsia, chronic hypertension during pregnancy, chronic hypertension accompanied by pre-eclampsia, and gestational hypertension.(Alatas, 2019; Lee et al., 2013; Tranquilli AL, Dekker G, Magee L, Roberts J, Sibai BM, Steyn W, Zeeman GG, nd)

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maternal death, which was 42.4%. In the Health profile, it has not been conveyed what complications in the fetus are caused by hypertension in pregnancy.(Central Java Health Office, 2023; Indonesian Ministry of Health, 2023)

Severe preeclampsia will affect maternal and neonatal conditions during pregnancy until delivery and postpartum. Severe preeclampsia can cause uteroplacental blood circulation disorders, this will trigger oxidative stress in the placenta, increased uterine tone, and sensitivity to stimuli which ultimately cause complications in the mother including HELLP syndrome, placental abruption, hemolysis, pulmonary edema, liver necrosis, kidney disorders, Disseminated Intravascular Coagulation (DIC), and other complications such as bitten tongue, trauma, and fractures due to falls during eclamptic seizures. This condition can even lead to maternal death. In addition to complications during labor and postpartum, preeclampsia also has long-term effects on the mother, one of which is the potential for heart and kidney disorders at a young age.(Turbeville & Sasser, 2020). In the fetus, the impact of preeclampsia includes Intrauterine Growth Restriction (IUGR) or fetuses experiencing growth arrest, oligohydramnios, prematurity, low birth weight (LBW), and placental abruption. According to long-term studies, babies with IUGR have a higher risk of developing hypertension, coronary artery disease, and diabetes in adulthood. The cause of this problem is the narrowing of blood vessels, which reduces blood flow to the placenta and interferes with placental function. In addition, narrowed blood vessels can affect the mother's vital organs, which can cause serious health problems.(Hidayati et al., 2018; Komalasari et al., 2021; Turbeville & Sasser, 2020).

Fetal growth disorders can occur due to retroplacental circulation disorders where arteriole spasms leading to important organs in the body cause small blood flow to the retro placenta, resulting in impaired exchange of CO2, O2 and nutrients in the fetus. In severe preeclampsia, uteroplacental perfusion is reduced, causing an increased incidence of Intra Uterine Growth Retardation (IUGR), fetal hypoxia and perinatal death. Intra Uterine Growth Retardation (IUGR) is one manifestation of LBW(Turbeville & Sasser, 2020; Wiles et al., 2020)

Babies born with low birth weight (LBW) are one of the risk factors that contribute to infant mortality, especially during the perinatal period. Birth weight is the result of the interaction of various factors through a process that occurs during pregnancy. One of the ultimate goals of pregnancy is to give birth to a baby with normal weight. If a baby is born with low weight, various problems will be experienced during his life and can even cause death.(Eves et al., 2021; Jebasingh & Thomas, 2022; Shulman et al., 2017).

Low birth weight births are caused by nutrient deficiencies by the mother during pregnancy which disrupts maternal-fetal circulation and has a negative impact on growth and development after being born outside the womb, where babies who survive have a higher incidence of infectious diseases, malnutrition and retardation in cognitive development which is characterized by a decrease in Intelligence Quotient (IQ) points, thus posing a threat to the quality of human resources in the future (Yang et al., 2021).

Risk factors for pre-eclampsia include occupation, the gap between marriage and pregnancy, weight gain during pregnancy, gestational age, maternal age, maternal education level, history of genetic disease, number of children ever born (parity), stress level, physical activity, history of pre-eclampsia or eclampsia in previous pregnancies, pregnancy with diabetes mellitus (DM), hydatidiform mole, kidney disorders, and twin pregnancies.(Bartsch et al., 2016; Yang et al., 2021)Cunningham, 2010;Rubiati et al., 2022).

Complications of preeclampsia in the fetus will affect the quality of life later, therefore good management is needed so that the effects of preeclampsia can be minimized so that babies born from mothers with preeclampsia can survive with better quality, therefore research needs to be conducted related to the condition of babies born to mothers with preeclampsia.

METHOD

This study is a secondary data analysis using a case-control design. This study used data labor at the Gondo Suwarno Ungaran Regional General Hospital in 2023 totaling 945 deliveries. This study has received an ethical permit from the KEP of Ngudi Waluyo University with the number 375/KEP/EC/UNW/2024. This study used case and control samples with a ratio of 1:2. The cases in this study were mothers who gave birth with preeclampsia complications totaling 82 mothers who were the total sampling and the controls in this study were mothers who gave birth without preeclampsia totaling 164 mothers who were taken randomly. The data collection technique was by looking at the labor records in the medical records and collected using a master table. The independent variables in this study were preeclampsia which was categorized as "preeclampsia" and "not preeclampsia" and 2 dependent variables were birth weight categorized as "Low Birth Weight (LBW)" and "Normal Birth Weight (BBLN)" and the incidence of asphyxia categorized as "Yes" and "No". This study also analyzed maternal characteristic data. The collected data were analyzed using univariate data analysis with frequency distribution and bivariate data analysis with chi-square using IBM SPSS version 25.0.

RESULTS

The mother's characteristics of the mother in this study were subjected to univariate and bivariate analysis on the incidence of preeclampsia. The results of the analysis are presented in Table 1.

Table 1. Characteristics of mothers based on mothers with preeclampsia and those without preeclampsia

Characteristics of the mother	Total	Preeclampsia (n : 82)	No Preeclampsia (n :164)	P Value	OR (CI 95%)
Age					
<20 years	8 (3.3%)	3 (3.7%)	5 (3.0%)	<0.0001*	5.463
20-35 Years	195 (79.3%)	49 (59.8%)	146 (89.0%)		(2,826-10,560)
>35 years	43 (17.5%)	30 (36.6%)	13 (7.9%)		
Work					
Yes	134 (54.5%)	44 (53.7%)	90 (54.9%)	0.856	0.952
No	112 (45.5%)	38 (46.3%)	74 (45.1%)		(0.559-1.621)
Anemia					
Yes	38 (15.4%)	13 (15.9%)	25 (15.2%)	0.901	1,048
No	208 (84.6%)	69 (84.1%)	136 (84.8%)		(0.505-2.173)
History of Preeclampsia					
Yes	41 (16.7%)	27 (32.9%)	14 (8.5%)	<0.0001*	5.260
No	205 (83.3%)	55 (67.1%)	150 (91.5%)		(2,571-10,759)

*p=<0.05

From the results of maternal characteristics, it was found that the factors associated with the incidence of preeclampsia were maternal age with a p value <0.0001 and OR 5.463.(2,826-10,560) which means that mothers age less than 20 years and more than 35 years can increase the incidence of preeclampsia 5.46 times greater than mothers aged 20-35 years. History of preeclampsia is also related to the occurrence of preeclampsia in subsequent pregnancies with p value <0.0001 and OR 5.260 (2.571-10.759) this means that mothers with a history of preeclampsia in previous pregnancies have a 5.26 times greater chance of experiencing preeclampsia compared to mothers who do not have a history of preeclampsia. Mothers who work and experience anemia are not statistically significant to experience preeclampsia in pregnancy, this is indicated by the p-value results of 0.865 for maternal employment and 0.901 for maternal anemia.

The results of the study related to babies born to mothers showed that mothers who experienced preeclampsia increased the risk of low birth weight with a p-value of 0.025 and OR 2.110 (1.087-4.097) and preeclampsia in mothers with asphyxia in babies was declared statistically insignificant. The results of this study are shown in Table 2.

Table 2. Condition of babies born to mothers with preeclampsia and those without preeclampsia

Condition of the baby at birth	Total	Preeclampsia (n : 82)	No Preeclampsia (n :164)	P Value	OR (CI 95%)
Low Birth Weight					
Yes	44 (17.9%)	21 (47.7%)	23 (52.3%)	0.025*	2.110 (1.087-4.097)

No	202 (82.1%)	61 (30.2%)	141 (69.8%)		
Asphyxia					
Yes	19 (7.72%)	8 (42.1%)	11 (57.9%)	0.398	1,504 (0580-3,896)
No	227 (92.27%)	74 (32.6%)	153 (67.4%)		

*p=<0.05

DISCUSSION

From the research results, two maternal characteristic factors are statistically significant in relation to the incidence of preeclampsia, namely maternal age with a p-value <0.0001 and OR 5.463.(2,826-10,560) which means that mothers aged 20-35 years have a risk of experiencing preeclampsia 5.46 times greater than mothers aged 20-35 years. History of preeclampsia is also related to the occurrence of pree clampsiain subsequent pregnancies with a p value <0.0001 and OR 5.260 (2.571-10.759). This means that mothers with a history of preeclampsia in previous pregnancies have a 5.26 times greater chance of experiencing preeclampsia compared to mothers who do not have a history of preeclampsia.

Maternal age is one of the risk factors related to the quality of pregnancy. Maternal age less than 20 years is related to the mother's readiness in reproduction and the development of reproductive organs is not optimal so there will be a greater risk of complications during pregnancy, childbirth and the baby being born. While at the age of >35 years is a risky age because there is a process of decreasing the ability of reproductive organs which causes structural and functional changes, thus increasing the possibility of complications during pregnancy and childbirth.(Bartsch et al., 2016).

Mothers with a history of preeclampsia have a greater risk of experiencing preeclampsia. This is because the mother's condition when experiencing preeclampsia in a previous pregnancy can affect the health of the blood vessels and vascular system in general, thereby increasing the risk of preeclampsia in subsequent pregnancies.(Yang et al., 2021). This is supported by the theory (Mitayani, 2013) which states that pregnant women who have a history of preeclampsia are at risk of experiencing preeclampsia again than pregnant women who do not experience preeclampsia. Mothers with a history of preeclampsia are at greater risk of experiencing preeclampsia again as much as seven times greater than mothers who have never experienced preeclampsia.(Bartsch et al., 2016). Women with a history of preeclampsia pregnancy also have a high risk of experiencing end-stage kidney disease and disorders.(Khashan et al., 2019).

Research that has been conducted(Quan et al., 2018)From the results of the multivariate analysis, it was found that several factors influence the incidence of preeclampsia, including older maternal age which increases the risk of preeclampsia by 3.5 times, mothers with a history of preeclampsia increase the incidence of preeclampsia by 2.4 times compared to mothers who do not have a history of preeclampsia, high lipid levels in the blood increase the risk of preeclampsia by 3.8 times compared to mothers with low blood lipid levels, a history of diabetes mellitus (DM) increases the risk of preeclampsia by 1.2 times compared to mothers who do not have a history of DM.

The results of the study stated that mothers aged less than 35 years and more than 40 years can increase the incidence of preeclampsia, and mothers aged over 45 years are more likely to experience acute heart failure and acute kidney injury. Research in Indonesia also stated that mothers who experience preeclampsia at the age of over 35 years are more susceptible to severe labor complications including bleeding, visual impairment, and pulmonary edema, and in babies who are born are at greater risk of premature birth, intrauterine growth retardation resulting in LBW, asphyxia, and infection in neonates(Chang et al., 2023; Tyas et al., 2020).

The results of research related to the effects of pregnancy and childbirth with preeclampsia on babies can increase the incidence of LBW by 2.11 times compared to mothers who do not have preeclampsia, this is due to impaired uterine circulation which disrupts the distribution of fetal needs. Pregnancy with preeclampsia also increases the incidence of premature labor which will result in giving birth to babies who are not ready for extra-uterine life and low birth weight.(Retnakaran et al., 2021; Turbeville & Sasser, 2020). Preeclampsia is a multistage pathogenesis that will cause irregular placental implantation, damaged trophoblast invasion and impaired arterial remodeling, this will cause uteroplacental circulation to not function properly.(Wiles et al., 2020).

Complications of preeclampsia in babies born include stillbirth, premature birth, low birth weight, Apgar score less than 5 or asphyxia. Low birth weight occurs in both preeclampsia, severe preeclampsia, and gestational hypertension, but the risk increases with severe preeclampsia. Asphyxia is potentially present in mothers with preeclampsia or severe preeclampsia but the incidence is higher in mothers with severe preeclampsia.(Yang et al., 2021). The outcome of asphyxia pregnancy in preeclamptic mothers from the results of research data processing was declared statistically insignificant with a p value of 0.398 and OR 1.504 (95% CI 0.580-3.896).

CONCLUSION

From the results of this study, it was found that maternal characteristics that affect the incidence of preeclampsia are maternal age less than 20 years and more than 35 years can increase the incidence of preeclampsia and a history of preeclampsia experienced by the mother in a previous pregnancy can increase the incidence of preeclampsia. Pregnancy with preeclampsia increases the risk of low birth weight babies.

Conflict of Interest

All authors declare no conflict of interest.

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