

Correlation between Preeclampsia and Infant Low Birth Weight at Dr. Moewardi Hospital, Surakarta, Central Java, Indonesia

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ABSTRACT

Background: Preeclampsia is a pregnancy complication with a triad of symptoms including high blood pressure, proteinuria, and tissue swelling as well as convulsions and coma. Preeclampsia in pregnant women can cause disruption in the supply of nutrients and oxygen to the fetus which can inhibit fetal growth and development (intrauterine growth restriction). In several similar previous studies, there were different variations in results which could be caused by multifactorial factors. This research was conducted to determine the relationship between preeclampsia in pregnant women and low birth weight babies by including confounding factors into the research.

Subjects and Method: This was a retrospective case control study at Dr. Moewardi Hospital, Surakarta, Central Java, Indonesia. A total of 120 live birth infants was selected using purposive sampling. The dependent variable was low birth weight (LBW). The independent variables were preeclampsia, maternal age, gestational age, parity, gemelli, anemia, and asthma. Data were collected from medical records of Dr. Moewardi Hospital from January to December 2022. The data were analyzed using a multiple logistic regression.

Results: Preeclampsia increased LBW by 7.75 times compared to without preeclampsia, and this was a statistically significant (OR= 7.75; 95% CI= 2.77 to 21.71; p<0.001). In addition, there was a confounding variable of gestational age (OR= 18.47; 95% CI= 6.46 to 52.79; p<0.001).

Conclusion: Preeclampsia increases LBW, and this is a statistically significant.

Keywords: preeclampsia, low birth weight, intrauterine growth restriction.

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BACKGROUND

Preeclampsia is one of the complications of pregnancy with three classic symptoms, including high blood pressure, proteinuria, and

tissue swelling as well as convulsions and even coma. In Indonesia, the biggest cause of maternal death, namely preeclampsia, is in

the highest percentage position after bleeding (Kartasurya and Nugraheni, 2019). According to WHO (World Health Organization), cases of preeclampsia are 7 times more likely to occur in developing countries than in developed countries. In 2019 it was known that there were 1066 cases of death due to Hypertension in Pregnancy (HDK) according to the 2019 Indonesian Health Profile Data (Sudarman et al., 2021).

Preeclampsia increases the mortality rate and has an impact on pregnancy complications, especially the incidence of IUGR and premature birth which increases the risk of low birth weight (LBW) babies (Sugiantari et al., 2019). Babies with LBW can have both physical and mental impacts in the next few years as they grow and develop (Sari and Wahyuni, 2021). The percentage of LBW in Central Java increased in 2019 compared to the previous year, namely 4.7%. Surakarta City has a LBW percentage of 2.3%, where Salatiga City has the lowest percentage at 0.9% and Purworejo has the highest percentage at 12.2%. Several previous studies had varying results which could be caused by multifactorial factors. Therefore, this study will involve confounding factors to be researched to get more accurate results. It is hoped that this research will increase awareness of the risk of low birth weight babies.

This research is aimed at finding out and analyzing the relationship between preeclampsia in pregnant women and low birth weight babies at RSUD Dr. Moewardi and the risk factors that influence LBW. By conducting this research, it is hoped that it can be used for public health service purposes to prevent and carry out early detection of the incidence of preeclampsia in pregnant women and its relationship with low birth weight babies and other complications. Apart from that, it can be used to increase knowledge and sources of information and

data regarding the relationship between preeclampsia and low birth weight babies.

SUBJECTS AND METHOD

1. Study Design

This research is an analytical observational study using a retrospective case-control design to study the relationship between preeclampsia in pregnant women and low birth weight babies based on the results of the patient's medical records. Data collection was carried out from April 2 to May 2 2023 at the Medical Records Installation at Dr. RSUD. Moewardi.

2. Population and Sample

The study population included all babies born at RSUD Dr. Moewardi in the period 1 January to 31 December 2022 who met the inclusion and exclusion criteria. Sample collection was carried out using a purposive sampling method, namely the sample was selected based on the inclusion criteria, namely all live babies at RSUD Dr. Moewardi with complete medical record data and exclusion criteria which include stillbirths, babies born to mothers with antepartum hemorrhage, babies born to mothers with a gap between pregnancies of less than 2 years, and babies with a birth weight of more than 4000 grams. A sample size of 120 live birth babies was selected using purposive sampling and divided into two groups equally. 60 low birth weight babies (case group) and 60 normal birth weight babies (control group).

3. Study Variables

The variables studied included preeclampsia in pregnant women as the independent variable and low birth weight (LBW) babies as the dependent variable. Controlled confounding variables include maternal age, gestational age, parity, multiple pregnancies (gemelli), history of anemia, and maternal history of asthma.

4. Operational Definition of Variables

Preeclampsia is a disorder during pregnancy characterized by proteinuria and hypertension which can have an impact on the mother and the fetus she is carrying. This variable uses a nominal measurement scale with the results measuring preeclampsia or no preeclampsia.

Low birth weight (LBW) babies are babies weighing less than 2500 grams who are weighed at birth until the first 24 hours after birth. This variable uses a nominal measurement scale with the results measuring low birth weight or normal birth weight.

Maternal age at birth is the age of the mother when giving birth. This variable uses a nominal measurement scale with measured results: Age <21 and >35 years or Age 21-35 years.

Gestational age is the time period between fertilization and delivery, calculated from the first day of the last menstruation (LMP). This variable uses a nominal measurement scale with the measurement results of Pregnancy <37 weeks or Pregnancy 37-42 weeks.

Parity is the number of living children or the number of pregnancies that produce fetuses capable of living outside the womb. This variable uses a nominal measurement scale with primipara or multipara measurement results.

Twin pregnancy (gemelli) is a pregnancy condition where a mother carries more than 1 fetus in the same gestational period. This variable uses a nominal measurement scale with gemelli or no gemelli measurement results.

Anemia is a condition when the body experiences a decrease in the number of red blood cells below the normal range or the red blood cells do not function properly. This variable uses a nominal measurement scale with the results measuring Anemia and No Anemia.

Asthma is a condition where the body experiences abnormalities in the form of chronic inflammation of the airways which causes narrowing of the airways. This variable uses a nominal measurement scale with results measuring Asthma and No Asthma.

5. Study Instruments

The measuring device in this study uses medical record data from patients who gave birth and their babies in the period 1 January to 31 December 2022 by looking at the patient's identity, parity status (GPA), history of complications during pregnancy, comorbidities, vital signs, hemoglobin levels, and other data which is used for research analysis. Data was taken from medical records of mothers and babies from the three trimesters of pregnancy to see the history of complications as well as their development and management.

6. Data analysis

The relationship between preeclampsia and low birth weight babies was analyzed using univariate, bivariate and multivariate analysis techniques using the SPSS program. Sample characteristic data for univariate analysis is presented in the form of a frequency table. Bivariate analysis was applied using the Chi-Square Test (X^2) statistical analysis technique. This analysis technique is used to determine the significance test between two variables. The results obtained are applied using calculations in the Chi-Square formula. The final analysis stage is multivariate with logistic regression testing

7. Research Ethics

Research ethical requirements including informed consent, identity confidentiality letters, and research permission letters have been implemented properly during the research. Ethical feasibility has been assessed and approved by the Health Research Ethics Committee of RSUD Dr. Moewardi, Surakarta on March 29, 2023 and obtained

Ethical Clearance Number 420/III/HREC/-2023.

RESULTS

1. Sample Characteristics

This research data is divided into a group of low birth weight (LBW) babies and a group of normal birth weight babies (NBW), each of which has 60 samples with a total of 120

samples. The number of preeclamptic mothers who gave birth to LBW babies was greater than that of mothers without preeclampsia. The number of preeclamptic mothers who give birth to LBW babies is also higher than mothers who give birth to LBW babies. The p-value shows that preeclampsia and gestational age have a significant difference, while other variables are not significant on LBW.

Table 1. Distribution of Sample Characteristics

Independent Variable	Birth Weight		Total	p
	LBW	NBW		
Preeclampsia				
Yes	43	16	59	<0.001
No	17	44	61	
Maternal Age				
Risky	19	19	38	1.000
No	41	41	82	
Gestational Age				
Risky	45	9	54	<0.001
No	15	51	66	
Parity				
Primipara	23	24	47	1.000
Multiparous	37	36	73	
Gemelli				
Yes	7	1	8	0.061
No	53	59	112	
Anemia				
Yes	25	21	46	0.573
No	35	39	74	
Asthma				
Yes	2	3	5	1.000
No	58	57	115	

2. Bivariate Analysis

Based on table 2, LBW risk increased with preeclampsia (OR= 6.96; 95% CI= 3.12 to 15.51; p<0.001) and risky gestational age (OR= 17.00; 95% CI= 6.79 to 42.59; p <0.001), and these results were statistically significant. Meanwhile, LBW risk did not increase with risky maternal age (OR= 1.00;

95% CI= 0.46 to 2.16; p= 1.000); parity (OR= 0.93; 95% CI= 0.45 to 1.94; p= 1.000); gemelli (OR= 7.79; 95% CI= 0.93 to 65.43; p= 0.061); anemia (OR= 1.33; 95% CI= 0.63 to 2.78; p= 0.573); and asthma (OR= 0.66; 95% CI= 0.11 to 4.07; p=1.000), and these results were not statistically significant.

Table 2. Results of bivariate tests of factors influencing birth weight

Independent Variables	LBW		NBW		Crude OR (95% CI)	P
	n	%	n	%		
Preeclampsia						
Yes	43	71.7	16	26.7	6.96	<0.001
No	17	28.3	44	73.3	(3.12 to 15.51)	
Maternal Age						
Risky	19	31.7	19	31.7	1.00	1.000
No	41	68.3	41	68.3	(0.46 to 2.16)	
Gestational Age						
Risky	45	75	9	15	17.00	<0.001
No	15	25	51	85	(6.79 to 42.59)	
Parity						
Primipara	23	38.3	24	40	0.93	1.000
Multiparous	37	61.7	36	60	(0.45 to 1.94)	
Gemelli						
Yes	7	11.7	1	1.7	7.79	0.061
No	53	88.3	59	98.3	(0.93 to 65.43)	
Anemia						
Yes	25	41.7	21	35	1.33	0.573
No	35	58.3	39	65	(0.63 to 2.78)	
Asthma						
Yes	2	3.3	3	5	0.66	1.000
No	58	96.7	57	95	(0.11 to 4.07)	

3. Multivariate analysis

Table 3 shows that there is a n influence between preeclampsia dan gestational age on the risk of low birth weight babies in RSUD Dr. Moewardi, Surakarta in 2022. Mother with preeclampsia increases risk of LBW by 7.75 times compread to mother without preeclampsia, and this result is statistically significant (OR= 7.75; 95% CI= 2.77 to 21.71;

p<0.001). Risky gestational age increased risk of LBW by 18.47 times compared to normal gestational age, and this result was statistically significant (OR= 18.47; 95% CI= 6.46 to 52.79; p<0.001). Meanwhile, gemelli birth increased risk of LBW by 6.50 times compared to single birth, but this was not statistically significant (OR= 6.50; 95% CI= 0.46 to 91.28; p= 0.165).

Table 3. Results of multiple logistic regression of factors influencing the LBW

Independent Variables	OR	95% CI		P
		Lower limit	Upper limit	
Preeclampsia (Yes)	7.75	2.77	21.71	<0.001
Gestational Age (Risk)	18.47	6.46	52.79	<0.001
Gemelli (Yes)	6.50	0.46	91.28	0.165
N observations = 120				
-2 log likelihood = 101.65				
Negelkerke R ² = 56%				

DISCUSSION

1. Characteristics of research subjects

According to the 2015 Indonesian Demographic and Health Survey (SDKI), the prevalence of LBW in Indonesia was reported to be 9%. According to 2018 data from the Indonesian Ministry of Health, the prevalence of preeclampsia in Indonesia is 2.1% of all pregnancies. Meanwhile, the prevalence of LBW in Dr. Moewardi in 2022 is 9% with the highest prevalence in the 2nd trimester with a prevalence of 11%. This study aims to determine the relationship between preeclampsia in pregnant women and low birth weight babies along with the risk factors for LBW at RSUD Dr. Moewardi Surakarta.

2. The relationship between preeclampsia in pregnant women and low birth weight babies

Preeclampsia is significantly associated with LBW. These results are in line with *case control* research by Mallisa and Towidjojo (2017) which states that preeclampsia is related and is a 2.48 times greater risk factor for LBW with a P value of 0.003

The cause of low-birth-weight babies begins with dysfunction in the maternal endothelium in mothers with preeclampsia. This causes disruption of placental circulation and placental ischemia occurs. As a result of disruption of placental circulation, the supply of oxygen and nutrients to the fetus is hampered, which can then affect the growth and development of the fetus, one of which is low birth weight (Primadevi and Susanti, 2022).

Preeclampsia also causes disturbances in kidney function which can affect the balance of fluids and electrolytes in the body of the mother and fetus. The blood clotting system can also be disrupted and increase the risk of thrombosis, which if not treated immediately can threaten the lives of the mother and fetus. The increased risk of LBW in mothers with preeclampsia can also be

caused by other pregnancy complications such as infection, antepartum bleeding and hyperemia gravidarum (Faadhillah and Helda, 2020).

3. The relationship between maternal age at birth and low birth weight babies

Maternal age at birth was not significantly related to LBW. These results are in line with research by Wulandari et al. (2022) found that mothers with a risky birth age, under 20 years or over 35 years, did not have a higher LBW birth rate.

There are several factors including education level, blood type, maternal nutrition and other factors that can influence research results (Agedew and Chane, 2015). Even though a pregnant mother has a birthing age beyond the safe reproductive limit (20-35 years), the risk of having a LBW baby can be minimized if the mother has good and balanced nutrition, does not smoke, avoids alcohol and drug consumption, and regularly manages medical conditions. if you have a history of comorbidities (Dewata et al., 2023).

4. The relationship between gestational age and low birth weight babies

Gestational age is significantly related to LBW. These results are in line with case control research by Sholiha and Sumarmi (2016) which states that gestational age is significantly related and increases the risk 66 times of experiencing LBW.

Babies born before 37 weeks (preterm) have less time in the mother's womb to grow and develop which can cause LBW. Premature birth can also be caused by IUGR (intrauterine growth restriction) which has an impact on the baby's birth weight (Gravio et al., 2019). In the third trimester of pregnancy, fetal growth increases significantly, so that at preterm gestational age the fetus may not receive nutrition for optimal growth. In addition, at preterm age, the

placenta is not yet fully mature so it can experience functional disorders which can affect the supply of nutrients and oxygen to the fetus (Kamai et al., 2019).

5. The relationship between parity and low birth weight babies

Parity is not significantly related to LBW. These results are in line with research by Us et al. (2022) which states that parity is not significantly related to LBW. Primiparous mothers have a higher risk of giving birth to LBW babies which is caused by several factors such as inhibited placental growth. If the placenta does not develop or attach properly to the uterine wall, the supply of nutrients and oxygen to the fetus can be disrupted, resulting in stunted fetal growth (Lamasari and Tahun, 2023).

However, not all primiparous mothers will give birth to LBW babies because there are several factors that can reduce the risk of LBW. Maternal knowledge and good prenatal care can help reduce the risk because the mother's health condition during pregnancy will be routinely monitored so that complications that arise will be treated immediately. Nutritional intake and a healthy and regular diet also play an important role in the growth and development of babies, which includes at least adequate protein, vitamins and minerals (Kelele et al., 2022).

6. The relationship between gemelli and low birth weight babies

Gemelli was not significantly related to LBW. These results are in line with research in Marco et al. (2023) which states that gemelli or multiple pregnancies are not a risk factor for LBW. Twins have a higher risk of developing LBW due to several factors. One of them is competition in the womb, when there is more than one baby in one womb, they indirectly 'compete' for limited sources of nutrition and oxygen which can cause one or both babies not to grow well. Multiple pregnancies also have the risk of

causing placental abnormalities and giving birth to babies prematurely, which can affect the nutrition and growth and development of the babies (Purwanto and Wahyuni, 2017).

This risk can be reduced, one of the ways is by regular and routine prenatal care to monitor the health of the mother and the fetus she is carrying so that she can detect potential problems early and intervene on time. Consuming foods rich in nutrients such as protein, complex carbohydrates, healthy fats, fruit and vegetables is necessary to support nutrition for the mother and fetus. Monitoring for high blood pressure and diseases such as gestational diabetes is also carried out to minimize the risk of LBW in twin pregnancies (Falefi et al., 2022).

7. The relationship between anemia and low birth weight babies

Anemia is not significantly related to LBW. These results are in line with research by Yuwanti et al. (2022) which states that anemia is not significantly related to LBW. According to WHO, pregnant women are categorized as anemic if they have a hemoglobin level of less than 11 g/dL. As a result of a decrease in the number of red blood cells or hemoglobin levels in the blood, nutrients and oxygen distributed through the blood become hampered and have an impact on the growth and development of the fetus (Figueiredo et al., 2019).

As knowledge and technology develop, this risk can be reduced through several things, including adequate rest, avoiding stress and fatigue, regular prenatal care, consuming nutritious foods rich in iron, and carrying out regular checks to monitor hemoglobin levels (Azizah et al., 2022).

8. The relationship between asthma and low birth weight babies

Asthma was not significantly related to LBW. Patients with a history of asthma in this study may have received inhaled

corticosteroid treatment which can treat asthma and reduce the risk of LBW. These results are in line with research by Xu et al. (2022) which states that a history of asthma in the mother is not significantly related to LBW.

Asthma will cause a decrease in oxygen supply to the placenta which can interfere with fetal growth and development (Kemppainen et al., 2018). Meanwhile, prolonged use of some asthma medications such as beta-agonists and in high doses can affect the mother's blood flow to the fetus. Asthma is related to systemic inflammatory conditions that affect the hormonal balance and immune system of the mother and fetus (Haghighi et al., 2017).

The risk of giving birth to LBW in mothers with a history of asthma can be reduced with appropriate management and treatment and regular monitoring. Asthma medications such as inhaled corticosteroids, in appropriate doses, can help reduce airway inflammation and maintain good lung function (Real et al., 2018). An ultrasound examination needs to be carried out to monitor the condition of the fetus so that it can identify potential risks and prevent them through appropriate steps. Asthma sufferers also need to avoid trigger factors such as irritation, exposure to dangerous substances, and air pollution (Murphy, 2015).

AUTHORS CONTRIBUTION

Diaz Alifarizki Zuvarcan as research manager who collects and analyze data, carry out the research, and published the article. David Anggara Putra and Sri Martuti analyzed the data and reviewed research documents.

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CONFLICT OF INTEREST

There is no conflict of interest in this research.

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