RESEARCH ARTICLE

pISSN: 0126-074X | eISSN: 2338-6223
https://doi.org/10.15395/mkb.v55n4.3277
Majalah Kedokteran Bandung. 2023;55(4):227–231

Majalah Kedokteran Bandung (MKB)

Received: March 10, 2023
Accepted: August 22, 2023
Available online: December 31, 2023

# Impact of Severe Preeclampsia on the Incidence of Low-Birth-Weight Babies

**Emi Ferawati,[1,2] Kadar Kuswandi,[1] Nela Karmila[3]**
[1]Polytechnic of Health Ministry of Health Republic of Indonesia Banten, Serang, Indonesia
[2]Postgraduated of Master Program in Midwifery, Faculty of Medicine Universitas Padjadjaran, Bandung, Indonesia
[3]Dr. Dradjat Prawiranegara Hospital, Serang, Indonesia

**Abstract**

Infant birth weight is an important indicator of survival, growth potential, and developmental capacity. Maternal health plays an important role in determining the well-being of newborns. A complicated pregnancy, inclusive of conditions such as preeclampsia, elevates the risk of giving birth to a low birth weight (LBW) baby. This study aimed to compare the impact of severe preeclampsia on the incidence of LBW babies in Dr. Dradjat Prawiranegara General Hospital Serang, Indonesia. This case-control analysis included 148 parturients recruited randomly from June to October 2022. Logistic regression was used as the analytical tool, with P=0.000 considered as demonstrating a significant association. The incidence rates of LBW and severe preeclampsia in 2018 were 19.84% and 14.15%, respectively. The case group recorded LBW within the weight range of 1,000-2,450 g, with 38% of them were Small for Gestation Age (SGA), while 50% and 12% were Appropriate for Gestational Age (AGA), and Large for Gestational Age (LGA), respectively. In contrast, the control group, with birth weights ranging from 2,600-4,500 g, 13.50% were SGA, while 77% and 9.50% were AGA and LGA, respectively. Parity was a confounding factor influencing the incidence of LBW, while maternal age did not present a significant correlation. Pregnancies with severe preeclampsia were found to have a 29-fold increased likelihood of delivering LBW babies compared to the control group when controlling for parity (P=0.000, CI 95%). Hence, women with severe preeclampsia pregnancies have a higher risk for delivering LBW babies of 29 times higher than the control.

**Keywords:** Battaglia and Lubchencho, fetal growth restriction, low birth weight, severe preeclampsia, uteroplacental insufficiency

## Introduction

Birth weight of babies is an important indicator in assessing the prospects of survival as well as the potential for growth and developmental capacity.[1] The World Health Organization (WHO) has defined low birth weight (LBW) as birth weight <2,500 g regardless of gestation age since 1976. This classification has been refined to show very low (VLBW) ranging from 1,000 to 1,499 g and extremely low (ELBW) birth weight less than 1,000 g at birth. [2] LBW can be an effect of preterm (<37 weeks gestation age) or dysmature due to fetal growth restriction, or both.[2, 3] Based on gestational age, Battaglia and Lubchencho divided BW into three subgroups of babies. These include, large, appropriate, and small for gestational age, (LGA): babies >90th percentile, gestational age (AGA): babies between 90th and 10th percentile, and gestational age (SGA): babies <10th percentile. [4]

In 2015, 20,5 million (UR 17.4–24.0 million) live births were LBW, while 91% were from low-and-middle-income countries, mainly southern Asia (48%) and sub-Saharan Africa (24%).[5] Factors influencing LBW include maternal age (specifically <16/18 years of age or >40 years)[5-8] and parity.[7, 8] Preeclampsia is a predominant factor predictor for LBW and can affect perinatal survival.[3, 9]

Preeclampsia is a specific disease during pregnancy and commonly occurs after 20 weeks of gestation age.[10, 11] This condition significantly contributes to fetal-related complications associated with prematurity,[10] including acute or chronic placental insufficiency leading to fetal growth restriction, fetal distress, intrauterine fetal death (IUFD), and increased mortality rates.[12] The limited interventions available for the management and prevention of fetal complications associated with preeclampsia

**Corresponding Author:**
Emi Ferawati,
Polytechnic of Health Ministry of Health Republic of Indonesia Banten, Serang, Indonesia,
Email: ferawatie80@gmail.com

contribute to its responsibility for approximately 20% to 30% of all preterm births. The pathogenesis is intricate, including dysfunctional placentation, oxidative stress, and systemic inflammation. This leads to chronic ischemia of the placenta and reduced uteroplacental perfusion to the fetus, impacting fetal growth restriction and gestational age.[12]

LBW is a significant global public health concern, with over 80% of neonatal deaths attributed to newborns, comprising two-thirds preterm and one-third term SGA babies. An elevated risk of morbidity, stunting, hindered long-term development, lower IQ, and compromised physical health was also experienced.[5] The health of mothers is an important role in determining the well-being of babies.[3] Therefore, this study aimed to analyzed and discussed the magnitude of severe preeclampsia's impact on LBW. Furthermore, it investigated the impact of severe preeclampsia on LBW based on Battaglia and Lubchencho's curve.

## Methods

This case-control study compared the impact of severe preeclampsia in both case-control groups. The study was conducted in RSDP Serang, Banten, Indonesia from June to October 2022.

The populations were all parturients that registered in the register book's patients in RSDP (2018). Inclusion criteria for eligible participants in the cases group were parturients with gestational age ≥24 weeks, babies' birth weight <2,500 g, singleton fetuses, and all types of labor spontaneously or terminated pregnancy. Inclusion criteria for eligible participants in the control group were parturients with gestational age ≥24 weeks, babies' birth weight ≥2,500 g, singleton fetus, and all types of labor spontaneously or terminated pregnancy. Exclusion criteria were <24 weeks gestational age, multiple fetuses, and maternal pregnancy complications, such as Diabetes Mellitus (DM), chronic lung disease, renal, and heart disease.

This study is a retrospective case control, sample size determination was calculated on the formulation for the case control based on the Lemeshow. Data collection techniques were carried out from secondary data, namely by analyzing the patient's medical record according to the criteria. The instrument used in this study was the checklist and each group consisted of a sample size of n=74, resulting in a total of 148 selected through a random process. The collected data were analyzed descriptively and analytically. Descriptive calculation presents statistical measures, namely amounts and percentages for categorical data, while analytic uses a Logistic Regression statistical test with risk factors. This study has received approval from the Ethical Committee of Polytechnic of the Health Ministry of Health of the Republik of Indonesia Tanjungkarang, Bandar Lampung, Indonesia, No. 018/KEPK-TJK/X/2022.

## Results

The incidence rate of LBW in RSDP in 2018 was 19.84% and severe preeclampsia rate was 14.15%. In the cases group, LBW ranged from an average of 1,000 to 2,450 g, comprising 38% SGA, 50% AGA, and 12% LGA. In contrast, the control group showed birth weights ranging from 2,600 to 4,500 g, with 13.50% classified as SGA, 77% AGA, and 9.50% LGA.

Table 1 showed that maternal age was not confounding to the incidence of LBW, while parity was confounding to LBW due to OR change in the primary variable exceeding 10%.

Table 2 showed that pregnant women who experienced severe preeclampsia had 29 times greater chances of delivering LBW babies than pregnant women who did not experience severe preeclampsia after being controlled by the parity variable.

According to Table 3, characteristics of subjects in the case group found that advanced maternal ages ≥35 years lower than <35 years

**Table 1 Confounding Test's Result for Age and Parity Category Regarding the Incidence of LBW for Maternity Women in Dr. Dradjat Prawiranegara Hospital Serang 2018**

| Variable | OR* Main Variable | OR Changes | OR Change Magnitude | Information |
|---|---|---|---|---|
| Severe Preeclampsia | 28.129 | - | - | - |
| Age category | Excluded | 29.283 | 4.10 % | Not Confounding |
| Parity category | Excluded | 17.912 | 36.32 % | Not Confounding |

*OR=Odds Ratio

**Table 2 Final Model Test Result Impact of Severe Preeclampsia on The Incidence of LBW on Maternity Women in Dr. Dradjat Prawiranegara Hospital Serang 2018**

| Variable | B | p-value | OR | 95% CI | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Severe Preeclampsia | 3.377 | 0.000 | 29.283 | 11.204 | 76.539 |
| Parity category | 2.665 | 0.000 | 14.364 | 4.012 | 51.421 |
| Constant | -10.072 | 0.000 | 0.000 | | |

**Table 3 Distribution of Subjects by Age, Parity, Gestational Age, Birth Weight, and The Birthweight Classification Based on Battaglia & Lubchencho on Case Group**

| | Maternal Age (Years) | | Parity | | Gestation Age (Week) | | Birth Weight (Gram) | | Battaglia & Lubchencho Birth Weight Classification | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ≥35 | <35 | P≥3 | P<3 | <37 | ≥37 | <2,500 | ≥2,500 | LBW SGA | LBW AGA | LBW LGA |
| Amount | 35 | 39 | 45 | 29 | 45 | 29 | 74 | 0 | 28 | 37 | 9 |
| Total (%) | 47 | 53 | 61 | 39 | 61 | 39 | 100 | 0 | 38 | 50 | 12 |

(47% vs. 53%); parity ≥3 higher than parity <3 (61% vs. 39%); gestation ages <37 weeks greater than ≥37 weeks (61% vs. 39%); birth weights <2,500 g (100 %) (LBW); LBW in case group with LBW SGA 38%, LBW AGA 50%, LBW LGA 12%.

From Table 4, characteristics of subjects in the control group found that advanced maternal ages ≥35 years lower than <35 years (20% vs. 80%); parity ≥3 lower than parity <3 (27% vs. 73%); gestation ages <37 weeks lower than ≥ 37 weeks (2.70% vs. 97.30%); birth weights ≥2,500 g (100%); BW in control group with BW SGA 13.50%, BW AGA 77%, and BW LGA 9.50%.

## Discussion

In this study, the incidence of LBW in RSDP was 19.84%. Simultaneously, the incidence of severe preeclampsia in RSDP in 2018 was reported as 14.15%. Regarding the fetal and maternal conditions, the management included either expectant or termination of pregnancy (TOP) and the only definitive treatment was delivery. However, the decision on whether to delay or proceed with immediate delivery is dependent on various factors, including gestational age, the severity of maternal complications, and the well-being of the fetus.[13] In France, when severe preeclampsia cases arise between 24 to 26 weeks of gestational age, the decision between TOP and expectant management is subject to discussion, particularly when maternal disease severity is a concern, specifically when linked to fetal growth restriction. Conversely, in cases of severe preeclampsia occurring before 24 weeks of gestation age, patients receive counseling favoring TOP due to the increased risk of maternal complications and reduced perinatal survival. TOP is legally authorized and can be performed at any gestational stage when there is a potential risk leading to a life-threatening condition for the maternal or unborn baby, particularly when facing an incurable severe complication.[13, 14] The fetal complications' frequency differs related to the onset of preeclampsia. Early onset is related to significantly higher rates of adverse outcomes

**Table 4 Distribution of Subjects by Age, Parity, Gestational Age, Birth Weight, and the Birthweight Classification Based on Battaglia & Lubchencho on the Control Group**

| | Maternal Age (Years) | | Parity | | Gestation Age (Week) | | Birth Weight (Gram) | | Battaglia & Lubchencho Birth Weight Classification | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ≥35 | <35 | P≥3 | P<3 | <37 | ≥37 | <2,500 | ≥2,500 | SGA | AGA | LGA |
| Amount | 15 | 59 | 20 | 54 | 2 | 72 | 0 | 74 | 10 | 57 | 7 |
| Total (%) | 20 | 80 | 27 | 73 | 2.70 | 97.30 | 0 | 100 | 13.50 | 77 | 9.50 |

for the fetus, including fetal growth restriction and death.[12] This study only divided maternal age and parity into two categories due to knowing the risk factors or odd ratio (OR).

Table 1 showed that maternal age was not confounding to the incidence of LBW, while parity was confounding to LBW due to OR change in the primary variable exceeding 10%.

Based on gestational age, the definition of the term delivery differs in Battaglia and Lubchencho's curve. The term has been referred to 38 to 41 weeks gestational age by considering two two-week possibility errors in the estimation.[4]

Table 2 showed that pregnant women who experienced severe preeclampsia had 29 times greater chances of delivering LBW babies than those who did not experience severe preeclampsia after being controlled by the parity variable; p=0.000 (CI 95%). This study found complications related to severe preeclampsia in fetuses, such as growth restriction. [12]

In this study, maternal age only compares between those <35 years old vs ≥35 years old. Based on the result, maternal age was not confounding to the incidence of LBW, while parity was confounding to LBW. Different results were reported between this study with another in Ethiopia on the effects of maternal age and parity on birth weight of newborns among single and term deliveries. The result showed that women ≥40 years were associated with a higher risk of delivering LBW newborns with an AOR of 1.96 (95% CI=1.22, 3.20) vs. women 30–34 years.[8]

Despite a separate study on the impact of maternal age and parity on birth weight of newborns among mothers with singleton pregnancies and term deliveries in Ethiopia,[8] this study found that maternal age was not a confounding factor for LBW. This is consistent with the previous cross-sectional study on changing birth weight trends with maternal age in the Xi'an City of Northwestern China. The relationships between maternal age and birth weight, risk of LBW, and risk of macrosomia were reported to be non-linear. Specifically, birth weight showed an increase of 16.204 g per year for individuals under 24 years old (95% CI: 14.323, 18.086), followed by a decrease of 0.824 g per year in those aged 24–34 years (95% CI: -3.112, 1.464). The risk of LBW decreased with increasing maternal age until 36 years old (OR=0.917, 95% CI: 0.903, 0.932 for maternal age <27 years; OR=0.965, 95% CI: 0.955, 0.976 for maternal age 27-36 years), but increased for maternal age ≥36 years (OR=1.133, 95% CI: 1.026, 1.250). Conversely, the risk of macrosomia increased with maternal age (OR=1.102, 95% CI: 1.075, 1.129 for maternal age <24 years; OR=1.065, 95% CI: 1.060, 1.071 for maternal age 24-33 years; OR=1.029, 95% CI: 1.012, 1.046 for maternal age ≥33 years). For women aged 20–40 years, the threshold for maternal age associated with LBW was 36 years old, and the risk of macrosomia increased with advancing maternal age.[15]

Based on the final model test, the parity in this study is confounding to LBW and the present result only compares parity <3 and ≥3). This found the same results between this study with another in Ethiopia on the effects of maternal age and parity on birth weight of newborns among mothers with single and mature deliveries. Grand multiparous (parity ≥5) had an AOR of 3.89 (95% CI=2.19, 6.93) vs. multiparous (p=2–4). Nulliparous (p=0) had an AOR of 0.23 (95%CI=0.19, 0.38) vs. multiparous. The primiparous (p=1) had an AOR of 0.22 (95% CI=0.16, 0.30) vs multiparous. The grand multiparous had a higher risk of LBW vs. multiparous. The primiparous and nulliparous had less risk of delivering LBW babies vs. multiparous.[8]

Birth weight of babies in LBW category within severe preeclampsia case group averaged between 1,000 and 2,450 g. The distribution among SGA, AGA, and LGA LBW babies was 38%, 50%, and 12%, respectively. In contrast, the control group showed an average birth weight ranging from 2,600 to 4,500 g. The corresponding proportions for SGA, AGA, and LGA birth weight were 13.50%, 77%, and 9.50%, as shown in Tables 3 and 4.

Severe preeclampsia, defined as a condition with systolic ≥160 mmHg or diastolic ≥110 mmHg, commonly occurs after 20 weeks gestation, or is complicated by the evidence of maternal organ or uteroplacental dysfunction, including liver or renal dysfunction, pulmonary edema, thrombocytopenia, and central nervous system disturbances.[11, 12]

The results are rooted in the pathophysiological complexity of preeclampsia, a condition that remains inadequately comprehended. Preeclampsia includes abnormal placentation, systemic inflammation, and oxidative stress. The failure of appropriate remodeling of spiral arteries contributes to dysfunctional placentation, resistance in placental blood circulation, and hypo-perfusion of the placenta. This induces chronic placental ischemia,

leading to a reduction in blood circulation to the developing fetus. Therefore, these events lead to fetal hypoxia and give rise to adverse outcomes, including preterm birth, fetal growth restriction, fetal distress, and stillbirth.[12]

Based on a health profiles study from three districts/cities in East Java, Indonesia, pregnant women who suffered from preeclampsia were found to have LBW. These women will have physiological problems such as placental and uterine alteration due to decreased vascular circulation. Placental that does not function normally can cause fetal malnutrition, increasing the risk of delivering LBW babies.[3]

The limitations of the study were confined to the investigation of maternal age and parity, with an omission of consideration for additional factors such as maternal weight gain, BMI, and nutritional status, due to incomplete data. Moreover, the absence of crucial data supporting information on maternal health status shows the necessity for its completion, enhancing maternal enhancement and facilitating subsequent study endeavors. In conclusion, pregnancies with severe preeclampsia had more risk of delivering LBW babies 29 times larger than the control.

## References


1. Adugna DG, Worku MG. Maternal and neonatal factors associated with low birth weight among neonates delivered at the University of Gondar comprehensive specialized hospital, Northwest Ethiopia. Front Pediatr. 2022;10:1–9.
2. Cutland CL, Lackritz EM, Mallett-Moore T, Bardají A, Chandrasekaran R, Lahariya C, et al. Low birth weight: Case definition & guidelines for data collection, analysis, and presentation of maternal immunization safety data. Vaccine. 2017;35(48):6492–500.
3. Hartiningrum I, Fitriyah N. Bayi berat lahir rendah (BBLR) di Provinsi Jawa Timur Tahun 2012-2016. J Biometrika dan Kependudukan. 2018;7(2):97–104.
4. Haksari EL, Lafeber HN, Hakimi M, Pawirohartono EP, Nyström L. Reference curves of birth weight, length, and head circumference for gestational ages in Yogyakarta, Indonesia. BMC Pediatrics. 2016;16(188):1–14.
5. Blencowe H, Krasevec J, Onis Md, Black RE, An X, Gretchen A Stevens, et al. National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: a systematic analysis. Lancet Glob. 2019;7:e849–60.
6. Anil K.C, Basel PL, Singh S. Low birth weight and its associated risk factors: Health facility-based case-control study. PLoS one. 2020;15(6):1–10.
7. Oh Y, Bae J. Impact of Changes in Maternal Age and Parity Distribution on the Increasing Trends in the Low Birth Weight and Very Low Birth Weight Rates in South Korea, 2005-2015. J Prev Med Public Health. 2019;52:123–30.
8. Bekele A, Seyoum G, Tesfaye K, Fantahun Y. The effects of maternal age and parity on the birth weight of newborns among mothers with singleton pregnancies and at term deliveries. Ethiop J Health Dev. 2019;33(3):182–7.
9. Nakimulia A, Starlingb JE, Nakubulwaa S, Namagembea I, Sekikuboa M, Nakabembea E, et al. Relative impact of pre-eclampsia on birth weight in a low resource setting: A prospective cohort study. Pregnancy Hypertens. 2020;21:1–6.
10. Yang Y, Ray IL, Zhu J, Zhang J, Hua J, Reilly M. Preeclampsia Prevalence, Risk Factors, and Pregnancy Outcomes in Sweden and China. JAMA Netw. 2021;4(5):1–14.
11. Lisonkova S, Bone JN, Muraca GM, Razaz N, Wang LQ, Sabr Y, et al. Incidence and risk factors for severe preeclampsia, hemolysis, elevated liver enzymes, and low platelet count syndrome, and eclampsia at preterm and term gestation: a population-based study. Am J Obstet Gynecol. 2021;225(538):1–19.
12. Fox R, Kitt J, Leeson P, Aye CYL, Lewandowski AJ. Preeclampsia: Risk Factors, Diagnosis, Management,and the Cardiovascular Impact on the Offspring. J Clin Med 2019;8(1625):1–22.
13. Carvalho MA, Bejjani L, Francisco RPV, Patino EG, Vivanti A, Batista FS, et al. Outcomes following medical termination versus prolonged pregnancy in women with severe preeclampsia before 26 weeks. PLoS one. 2021;16(2):1–12.
14. Lecarpentier E, Haddad B, Goffinet F, Tsatsaris V. Medical approaches for managing preeclampsia. Presse Med. 2016;45(7-8): 638–45.
15. Wang S, Yang L, Shang L, Yang W, Qi C, Liyan Huang, et al. Changing trends of birth weight with maternal age: a cross-sectional study in Xi'an city of Northwestern China. BMC Pregnancy Childbirth 2020;20(744 ):1–8.