

# Case-Control Study: Differences in Maternal Blood Pressure between Low Birth Weight and Non-Low Birth Weight Cases at Bungkal Health Center, 2022-2024

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## Abstract

**Background:** Hypertension in pregnancy is one of the complications that increases the risk of low birth weight (LBW) due to impaired placental perfusion. At Bungkal Health Center, cases of hypertension among pregnant women and LBW incidence remain relatively high. This study aims to analyze differences in maternal blood pressure between LBW and non-LBW cases at Bungkal Health Center.

**Methods:** This study employed an analytical observational design with a case-control approach. A total of 94 respondents were included, consisting of 47 mothers who delivered low birth weight infants (case group) and 47 mothers who delivered non-low birth weight infants (control group), selected using simple random sampling. Data were obtained from medical records and analyzed using the Chi-square test and the Independent Sample t-test.

**Results:** The mean birth weight of infants born to mothers with high blood pressure was 2,282.25 grams, whereas infants born to mothers with normal blood pressure had a mean birth weight of 2,857.74 grams. Statistical analysis showed a p-value < 0.001, indicating a significant difference between the two groups.

**Conclusion:** There was a significant difference in birth weight between infants born to mothers with high blood pressure and those born to mothers with normal blood pressure. Pregnant women with hypertension had nearly a 40-fold higher risk of delivering low birth weight infants compared with women with normal blood pressure.

**Keywords:** Blood Pressure; Pregnant Women; Gestational Hypertension; Low Birth Weight

## 1. Introduction

Hypertension in pregnancy is an obstetric complication that significantly contributes to increased maternal and neonatal morbidity and mortality, primarily through impaired uteroplacental perfusion that may result in low birth weight (LBW) [1, 2].

Globally, hypertensive disorders of pregnancy affect approximately 10% of all pregnancies and remain a leading cause of maternal mortality, including in Indonesia [1]. At the regional level, East Java Province reports hypertension in pregnancy as a dominant factor contributing to maternal deaths, with a rising trend in recent years [3]. Locally, Ponorogo Regency has also identified hypertensive disorders of pregnancy as one of the causes of maternal mortality and LBW, including within the service area of Bungkal Primary Health Center [4].

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Physiologically, elevated blood pressure during pregnancy can reduce uteroplacental blood flow, thereby decreasing fetal oxygen and nutrient supply. This disturbance may lead to intrauterine growth restriction and subsequently low birth weight, as reported in several previous studies [5, 6].

Although the association between hypertensive disorders of pregnancy and LBW has been widely documented, empirical evidence derived from primary healthcare settings remains limited and demonstrates variability across regions. Therefore, this study aimed to analyze differences in maternal blood pressure between women who delivered LBW infants and those who delivered non-LBW infants in the Bungkal Primary Health Center service area during the period 2022–2024. The study hypothesized that maternal blood pressure is significantly associated with the occurrence of LBW, as indicated by differences in mean birth weight and an increased risk of LBW among pregnant women with high blood pressure compared to those with normal blood pressure. The findings of this study are expected to strengthen the scientific basis for monitoring maternal blood pressure during pregnancy as a key strategy for preventing LBW at the primary healthcare level.

## 2. Material and methods

This study was an analytical observational study with a case–control design conducted in the service area of Bungkal Primary Health Center, Ponorogo Regency, using medical record data from 2022 to 2024. The sample consisted of 94 pregnant women, including 47 mothers who delivered low birth weight infants (<2,500 g) and 47 mothers who delivered normal birth weight infants ( $\geq 2,500$  g), selected through simple random sampling based on predefined inclusion and exclusion criteria. The independent variable was maternal blood pressure, while the dependent variable was infant birth weight. Data were collected using a medical record extraction form. Statistical analyses included the Chi-square test to assess the association between maternal blood pressure and the occurrence of low birth weight, the Independent Sample t-test to compare mean birth weight between mothers with normal and high blood pressure, and the calculation of odds ratios (ORs) to estimate the risk of low birth weight among pregnant women with high blood pressure compared to those with normal blood pressure, with statistical significance set at  $p < 0.05$ . This study received ethical approval from the Ethics Committee of the Faculty of Medicine, Universitas Airlangga, utilized anonymized secondary data, and did not involve experimental animals.

## 3. Result

**Table 1** Characteristics of Study Subjects in the Case and Control Groups

| Characteristics | Case (LBW) n (%) | Control (non-LBW) n (%) |
|-----------------|------------------|-------------------------|
| Infant Sex      |                  |                         |
| Male            | 19 (40,4%)       | 26 (55,3%)              |
| Female          | 28 (59,6%)       | 21 (44,7%)              |
| Maternal Age    |                  |                         |
| <20 years       | 1 (2,1%)         | 1 (2,1%)                |
| 20-35 years     | 37 (78,7%)       | 40 (85,1%)              |
| >35 years       | 9 (19,1%)        | 6 (12,8%)               |
| Gravidity       |                  |                         |
| Primigravida    | 23 (48,9%)       | 20 (42,6%)              |
| Multigravida    | 24 (51,1%)       | 27 (57,4%)              |
| Total           | 47 (100%)        | 47 (100%)               |

Table 1 shows that in the case group (LBW), the majority of infants were female (59.6%), whereas in the control group, most infants were male (55.3%). Maternal age in both groups was predominantly between 20 and 35 years, accounting for 78.7% in the case group and 85.1% in the control group. Based on gravidity status, the majority of mothers in both the case and control groups were multigravida, at 51.1% and 57.4%, respectively.

**Table 2** The Relationship Between Maternal Blood Pressure and the Occurrence of LBW and the Risk of LBW

| Maternal Blood Pressure                                 | Case (LBW) n (%) | Control (non-LBW) n (%) | p-value | Odds Ratio |
|---------------------------------------------------------|------------------|-------------------------|---------|------------|
| Normal (Systolic <140 mmHg or Diastolic <90 mmHg)       | 17 (36,2%)       | 45 (95,7%)              | <0,001  | 39,706     |
| Hypertensive (Systolic ≥140 mmHg or Diastolic ≥90 mmHg) | 30 (63,8%)       | 2 (4,3%)                |         |            |
| Total                                                   | 47 (100%)        | 47 (100%)               |         |            |

Table 2 shows a significant relationship between maternal blood pressure and the incidence of LBW based on the Chi-square test ( $p < 0.001$ ). The proportion of pregnant women with high blood pressure was higher in the case group (63.8%) compared to the control group (4.3%), whereas normotensive mothers were more frequently found in the control group (95.7%). Odds ratio analysis indicated that pregnant women with high blood pressure had a 39.7 times higher risk of giving birth to an LBW infant compared to normotensive mothers.

**Table 3** Mean Infant Birth Weight by Maternal Blood Pressure

| Maternal Blood Pressure                                 | n  | Mean Birth Weight of Infants (grams) | Standard Deviation | p-value |
|---------------------------------------------------------|----|--------------------------------------|--------------------|---------|
| Normal (Systolic <140 mmHg or Diastolic <90 mmHg)       | 62 | 2857,74                              | 469,49             | <0,001  |
| Hypertensive (Systolic ≥140 mmHg or Diastolic ≥90 mmHg) | 32 | 2286,25                              | 217,58             |         |

Table 3 shows a significant difference in the mean birth weight of infants between normotensive and hypertensive pregnant women based on the Independent Sample T-Test ( $p < 0.001$ ). The mean birth weight of infants in the normotensive group was 2,857.74 grams (SD 469.49), whereas in the hypertensive group it was 2,286.25 grams (SD 217.58).

#### 4. Discussion

This study demonstrates a significant relationship between maternal blood pressure and the incidence of low birth weight (LBW) in the working area of Bungkal Community Health Center during the period 2022–2024. The Chi-square test results showed a  $p$ -value  $< 0.001$ , indicating that maternal blood pressure is significantly associated with the occurrence of LBW. In addition, the odds ratio (OR) of 39.706 indicates that pregnant women with high blood pressure have nearly 40 times higher risk of giving birth to an LBW infant compared to normotensive pregnant women. The magnitude of this OR suggests that hypertension during pregnancy is a very strong risk factor for LBW in the context of primary healthcare services.

The high risk of LBW in mothers with elevated blood pressure can be explained through the pathophysiological mechanisms of hypertension in pregnancy. Increased blood pressure causes systemic vasoconstriction, including in the uteroplacental vessels, resulting in reduced placental perfusion. Consequently, oxygen and nutrient supply to the fetus becomes suboptimal, which inhibits intrauterine fetal growth and increases the likelihood of fetal growth restriction leading to LBW. This mechanism aligns with theories stating that endothelial dysfunction and impaired placental angiogenesis in hypertensive mothers play a critical role in reducing infant birth weight [2, 5, 7].

The results of this study also showed that the majority of pregnant women in the case group (LBW) had high blood pressure during pregnancy (63.8%), whereas in the control group (non-LBW), most mothers were normotensive (95.7%). This distribution pattern reinforces the statistical test results, which indicate a significant association between maternal blood pressure and LBW. These findings highlight that blood pressure control during pregnancy is an important component in preventing LBW, especially at the primary healthcare level.

Beyond categorical associations, this study also revealed a significant difference in the mean birth weight of infants between normotensive and hypertensive mothers. The mean birth weight in the normotensive group was 2,857.74 grams, while in the hypertensive group it was 2,286.25 grams, with the difference being statistically significant ( $p <$

0.001). This difference indicates that hypertension during pregnancy not only increases the risk of LBW but also has a substantial impact on reducing the mean birth weight of infants. This finding is consistent with the study by Getaneh et al. [8], which reported that infants born to mothers with high blood pressure tend to have lower birth weights compared to those born to normotensive mothers.

Considering the characteristics of the study subjects, the majority of mothers in both case and control groups were within the safe reproductive age range (20–35 years) and most were multigravida. This suggests that maternal age and gravidity in this study were relatively homogeneous and were not dominant factors in the differences in LBW incidence. Therefore, the differences in infant birth weight outcomes in this study are more strongly associated with maternal blood pressure during pregnancy. These findings support previous research indicating that maternal blood pressure is an important determinant of fetal growth, even among mothers with relatively safe age and parity [9].

Furthermore, these results are consistent with national reports stating that hypertension during pregnancy remains one of the leading causes of obstetric complications and adverse perinatal outcomes in Indonesia, including LBW [10]. Overall, the findings of this study align with theoretical frameworks and previous research, indicating that hypertension during pregnancy significantly contributes to LBW through mechanisms involving impaired placental perfusion and function. The consistency between these results and existing theory strengthens the scientific evidence that maternal blood pressure is a critical biological factor determining fetal growth and infant birth weight.

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## 5. Conclusion

Based on the results of the study on the differences between normal and high blood pressure during pregnancy and their effects on infant birth weight in the working area of Bungkal Community Health Center, it can be concluded that there is a significant relationship between maternal blood pressure and the incidence of low birth weight (LBW). Pregnant women with high blood pressure have nearly 40 times higher risk of giving birth to an LBW infant compared to normotensive pregnant women. In addition, there is a significant difference in the mean birth weight of infants between the two groups. Infants born to mothers with high blood pressure had a mean birth weight of 2,282.25 grams, classified as LBW, whereas infants born to normotensive mothers had a mean birth weight of 2,857.74 grams, classified as normal birth weight. These findings emphasize that hypertension during pregnancy plays a critical role in reducing infant birth weight and is a major risk factor for LBW.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors declare that there is no conflict of interest related to the publication of this article.

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