



## Factors related to the incidence of low birth weight

Maghrisa Rahmadani<sup>1\*</sup>, Novalia Widiya Ningrum<sup>1</sup>, M. Fajriannor TM<sup>1</sup> Winda Maolinda<sup>2</sup>

<sup>1</sup>Department of Midwifery, Faculty of Health, Sari Mulia University, Banjarmasin

<sup>2</sup>Department of Midwife Profession, Faculty of Health, Sari Mulia University, Banjarmasin

\*Corresponding author: [ichaluphz90@gmail.com](mailto:ichaluphz90@gmail.com)

ARTICLE INFO	ABSTRACT
<p><b>Article history:</b>  Received 18 July 2024  Accepted 29 August 2024  Publish 31 August 2024</p> <p><b>Keywords:</b>  Neonatal mortality  Anemia in pregnancy  Low birth weight  Pregnancy induced  Hypertension  Premature rupture of  membranes  Maternal risk factors</p>	<p><b>Background:</b> Low birth weight (LBW) remains a significant concern, particularly for newborn mortality in the neonatal period. It serves as a crucial public health indicator for maternal health, nutrition, access to healthcare services, and poverty. LBW is not solely influenced by pre-pregnancy maternal characteristics, but also by risk factors encountered during pregnancy.</p> <p><b>Objective:</b> Knowing the factors related to the incidence of low birth weight in laboring mothers.</p> <p><b>Method:</b> This analytic observational study employed a cross-sectional approach. A sample of 308 mothers giving birth were recruited using purposive sampling at Idaman Hospital, Banjarbaru. Categorical data is systematically presented in a frequency distribution table, and the associations between variables are statistically analyzed using the Chi-square test, utilizing SPSS software for accurate computation and interpretation of results.</p> <p><b>Results:</b> The results showed that 71.8% of mothers delivering babies were not at risk (20-35 years old), 72.1% were not anemic, 77.3% did not experience pregnancy-induced hypertension, 78.6% did not have premature rupture of membranes and 76% did not deliver LBW babies. Statistical analysis revealed significant relationships between age (p-value = 0.024), anemia (p-value = 0.009), pregnancy-induced hypertension (p-value = 0.014), and premature rupture of membranes (p-value = 0.031) with the incidence of LBW.</p> <p><b>Conclusion:</b> This study shows the association between age, anemia, pregnancy-induced hypertension, and premature rupture of membranes with the incidence of LBW.</p>

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### 1. Introduction

The quality of human resources is a critical factor for a country's development. One of the Sustainable Development Goals (SDGs) targets reducing the infant mortality rate, aligned with the third goal of ensuring healthy lives and promoting well-being for all ages. This is complex challenge due to the increasingly intricate causes of infant mortality. In Indonesia, the Infant Mortality Rate (IMR) remains relatively high at 16.85 per 1,000 live births. According to Maternal Perinatal Death Notification (MPDN) data from September 21, 2021, low birth weight (LBW) is the leading cause of

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infant mortality (29.21%), followed by asphyxia (27.44%) and infection (5.4%). Notably, most infant deaths (92.41%) occur in hospitals (Kemenkes RI, 2023). Low birth weight (LBW) remains a significant concern, particularly for newborn mortality in the neonatal period (Neldis, 2021).

According to the World Health Organization (WHO) definition, low birth weight is defined as a birth weight less than 2500 grams, regardless of gestational age. Data from the United Nations International Children's Emergency Fund (UNICEF) and the WHO in 2020 show that 1 in 7 births are LBW. Nearly two-thirds of the 19.8 million LBW babies born in 2020 were born in Asia (UNICEF and WHO, 2023).

In Indonesia, data reported from 34 provinces to the Directorate of Nutrition and Maternal and Child Health in 2021 identified 111,719 newborns (2.5%) with LBW (Kemenkes RI, 2022). This figure differs from the 6.2% prevalence of LBW reported in the 2018 Basic Health Research (Ministry of Health Republic of Indonesia, 2018). South Kalimantan Province reported a lower LBW rate of 5.1% in their 2020 Health Profile (South Kalimantan Health Service, 2021).

Body weight at birth is one of the determinants of physical growth and brain development in children. However, babies with LBW are at increased risk of death and other health problems. The risk of death in LBW is 25 to 30 times greater than normal birth weight babies. Therefore, the lower the weight at birth, the higher the risk of death (Khazaei et al., 2021). LBW also have a greater risk of stunting and developing noncommunicable diseases as adults, such as diabetes, hypertension, and heart disease ((Ministry of Health Republic of Indonesia, 2022). Research shows that children with a history of LBW have an 18.8 times higher risk of stunting (Arif et al., 2022).

LBW is an important public health indicator for maternal health, nutrition, access to healthcare services, and poverty. LBW is associated with not only basic maternal characteristics during pre-pregnancy but also with risk factors encountered during pregnancy (Diabelková et al., 2022). Data from the Banjarbaru Health Office shows that the percentage of LBW births in Banjarbaru was 3.7% in 2020, 3.5% in 2021, and 6.0% in 2022. LBW can be caused by various factors, including maternal factors such as diseases directly related to pregnancy, maternal age, and socioeconomic status (Banjarbaru Health Service, 2023). Maternal conditions during pregnancy (teenage pregnancy, malnutrition, and pregnancy complications), multiple births, fetal abnormalities or congenital conditions, and intrauterine growth restriction (IUGR) can also contribute to LBW ((Ministry of Health Republic of Indonesia, 2022).

A preliminary study at the Idaman District Hospital of Banjarbaru revealed that the number of LBW births increased from 205 in 2021 to 251 in 2022 (a 22.4% increase). From January to October 2023, there have already been 236 LBW births. This data indicates a rising trend of LBW incidence at the hospital. To support the reduction of IMR in Indonesia and improve the quality and competitiveness of human resources, reducing the risk of LBW births is crucial. Identifying risk factors for LBW is the first step towards achieving this goal, allowing for preventive and early detection efforts.

## 2. Method

### Research design

This study employed an analytical observational method with a cross-sectional approach. The research design was chosen to assess the relationships between multiple independent variables (such as age, anemia, pregnancy-induced hypertension, and premature rupture of membranes) and

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the dependent variable, which is the incidence of LBW in newborns. By using this design, the study captured data at a single point in time, allowing for the analysis of associations without inferring causality.

### Sample

This study was conducted at Idaman District Hospital of Banjarbaru in January 2024. Based on hospital medical records, the study population included all mothers who delivered at the hospital between January and October 2023, totaling 1,348 datas. A purposive sampling technique was used to select samples based on specific inclusion and exclusion criteria established by the researchers, resulting in a sample of 308 individuals. These criteria were designed to ensure that the selected sample accurately represented the population and was appropriate for addressing the research objectives.

### Data collection

Data were collected using a checklist. The checklist was designed to capture relevant data on the independent variables (age, anemia, pregnancy-induced hypertension, and premature rupture of membranes) and the dependent variable (incidence of low birth weight). The checklist allowed for systematic data collection and ensured that the data were consistent and reliable.

### Data analysis

The data were presented in a distribution table, and the relationships between the independent and dependent variables were analyzed using Chi-square tests with a significance level of 0.05. This statistical method was selected to assess whether significant associations existed between the independent variables and the incidence of low birth weight among the respondents. SPSS software was employed to facilitate the data analysis, ensuring both accuracy and efficiency in managing the dataset.

### Ethical consideration

This research adhered to ethical standards and received ethical approval from two bodies: the Research Ethics Commission of Sari Mulia University Banjarmasin (certificate number 017/KEP-UNISM/I/2024) and the Health Research Ethics Committee of Idaman District Hospital of Banjarbaru (certificate number RS00690/KEPK-RSDI/01/2024). Ethical considerations included ensuring the confidentiality of the respondents' data, obtaining informed consent, and conducting the research in a manner that respected the rights and well-being of the participants.

## 3. Results

Based on the medical records, the majority of the 308 mothers were categorized as not at risk according to various key health indicators (look at Table 1). Specifically, 71.8% of the mothers were within the optimal age range of 20-35 years, 72.1% did not experience anemia during pregnancy, 77.3% did not have PIH, and 78.6% did not experience PROM. These findings indicate that most mothers in this study were within safe health parameters during labor. Despite these favorable conditions, the incidence of LBW was recorded in 24% of cases, indicating that even among mothers categorized as low-risk, LBW remains a concern. This data underscores the importance of continuous monitoring and comprehensive maternal care to address factors that may contribute to LBW, even in seemingly low-risk populations. This analysis highlights the need for targeted



interventions to further reduce the incidence of LBW and improve neonatal outcomes in this healthcare setting.

Table 1. Characteristics of labor

Variables	Category	Frequency (f)	Percentage (%)
Age	Risky (<20 and >35)	87	28.2
	Not at Risk (20-35)	221	71.8
Anemia	Anemia (Hb <11 g/dL)	86	27.9
	Not Anemia (Hb ≥11 g/dL)	222	72.1
PIH	PIH	70	22.7
	Not PIH	238	77.3
PROM	PROM	66	21.4
	Not PROM	242	78.6
Incidence of LBW	LBW	74	24
	Not LBW	234	76
Total (n)		308	100

The data presented in Table 2 provides a detailed examination of the incidence of low birth weight (LBW) in relation to various maternal health factors, including age, anemia, pregnancy-induced hypertension (PIH), and premature rupture of membranes (PROM). The table highlights the frequency and percentage of LBW and non-LBW cases within different categories of these variables, along with the corresponding p-values for statistical significance.

Table 2. Factors associated with LBW

Analysed factors		Incidence of LBW						Chi-square test
		LBW		Not LBW		Total		
		f	%	F	%	f	%	
Age	Risky (<20 and >35)	29	33.3	58	66.7	87	100	0.024
	Not at Risk (20-35)	45	20.4	176	79.6	221	100	
Anemia	Anemia (Hb <11 g/dL)	30	34.9	56	65.1	86	100	0.009
	Not Anemia (Hb ≥11 g/dL)	44	19.8	178	80.2	222	100	
PIH	PIH	25	35.7	45	64.3	70	100	0.014
	Not PIH	49	20.6	189	79.4	238	100	
PROM	PROM	23	34.8	43	65.2	66	100	0.031
	Not PROM	51	21.1	191	78.9	242	100	

The analysis reveals significant associations between LBW and each of the factors examined. Specifically, mothers categorized as "risky" in terms of age (under 20 or over 35 years) showed a higher incidence of LBW (33.3%) compared to those in the "not at risk" age group (20-35 years), who had a lower incidence of LBW (20.4%), with a p-value of 0.024 indicating statistical significance. Similarly, the presence of anemia (Hb <11 g/dL) was associated with a higher incidence of LBW (34.9%) compared to those without anemia (19.8%), with a p-value of 0.009. The occurrence of PIH also showed a significant association with LBW, where 35.7% of mothers with PIH had LBW infants, compared to 20.6% in those without PIH (p-value =



0.014). Lastly, the presence of PROM was linked to an increased incidence of LBW (34.8%) versus those without PROM (21.1%), with a p-value of 0.031.

#### 4. Discussions

The chi-square test results showed a statistically significant relationship between age and the incidence of LBW (p-value 0.024). This finding aligns with research by Helena et al. (2021), which identified age as a significant factor influencing pregnancy processes, fetal health, and delivery outcomes. Pregnant women at high risk for LBW are typically younger than 20 years old or older than 35 years old. This is because nutrient distribution from mother to fetus may be inadequate in these age groups. In younger women (<20 years), the reproductive organs may not be fully developed, while in older women (>35 years), there may be a decline in reproductive organ function and hormone regulation. Additionally, older mothers may have pre-existing conditions like hypertension and diabetes mellitus, which can further complicate pregnancy (Helena et al., 2021). In women over 35, there may also be a general decline in health, reduced pelvic floor muscle elasticity, and decreased egg quality. This can increase the risk of pregnancy complications such as preeclampsia, anemia, and premature birth, all of which can contribute to LBW (Susanti, 2020).

In this research, the risk of LBW was notably higher among mothers aged over 35 years. Among the 21 respondents in this age group, 9 (46.9%) with LBW also had complications related to PIH, while 12 (53.1%) with LBW did not experience PIH. The increased risk of PIH in mothers over 35 years can be attributed to age-related changes and the aging process. As individuals age, collagen fibers in blood vessels and arteriole walls become more rigid, leading to decreased vessel elasticity. This reduced flexibility causes the blood vessels to narrow, which can elevate average blood pressure (Sastri, 2022). Consequently, pregnant women over the age of 35 are more likely to develop PIH, which in turn increases the likelihood

The chi-square test results revealed a statistically significant association between anemia and the incidence of LBW with a p-value of 0.009. Anemia during pregnancy can adversely affect both maternal and fetal health throughout pregnancy, labor, and the postpartum period. This condition is associated with increased risks of low birth weight, stunting, and other serious complications in newborns (Dhale, 2024; Lathifah et al., 2024; Qasim et al., 2024; Saputri et al., 2023). Verma (2020) highlights that pregnant women with anemia are at a higher risk of delivering babies with LBW. Supporting this, Elmugabil (2023) found that the risk of LBW is 4.7 times higher in babies born to mothers with anemia.

Our study identified anemia as a prevalent factor contributing to LBW. Among the 30 mothers with both anemia and LBW, 16 (53.3%) had mild anemia, while 14 (46.7%) had moderate anemia. Anemia in pregnant women can lead to circulatory problems due to insufficient red blood cells for transporting oxygen and nutrients to the fetus (Dwihestie et al., 2022). According to Suryani (2020), anemia reduces oxygen availability to fetal tissues and alters placental vascularization, ultimately disrupting fetal growth and increasing the risk of LBW.

Hemoglobin levels are the most common indicator for diagnosing anemia. Hemoglobin status refers to the level of hemoglobin measured in a person's blood. Levels below the normal range indicate anemia. The risk of anemia increases with advancing gestational age. During pregnancy, physiological changes lead to an imbalance between blood plasma and red blood cells, resulting in a decrease in hemoglobin levels. This is particularly concerning in the third trimester when iron demands are high due to rapid fetal growth. Low hemoglobin levels during this period can lead to reduced oxygen supply to the uterus, hindering proper intrauterine conditions and placental development, ultimately contributing to fetal growth disorders and LBW (Kelele et al., 2022).

The chi-square test results showed a statistically significant association between PIH and the

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incidence of LBW (p-value = 0.014). Hypertensive disorders lead to significant morphological changes in the placenta, including reduced weight and increased incidence of lesions such as fibrinoid necrosis, which correlate with adverse neonatal outcomes (Agustin & Afrika, 2022; Di Martino et al., 2022; Vijayakumar & Salim, 2024). Research by Basta (2022) supports this association, demonstrating a higher prevalence of LBW in mothers with PIH compared to those with normal blood pressure. This is likely due to vascular dysfunction in PIH, which disrupts placental function and reduces blood flow and nutrient supply to the fetus.

According to the theory in PIH, there is insufficient invasion of trophoblast cells into the muscular layer of the spiral arteries and surrounding matrix tissue. This stiffens the spiral artery walls, preventing dilation and proper blood flow. Consequently, there is a failure of spiral artery remodeling, leading to decreased uteroplacental blood flow, placental hypoxia, and ischemia (Lalenoh, 2018). Reduced blood flow to the placenta disrupts fetal growth, potentially resulting in LBW.

The chi-square test results yielded a statistically significant association between PROM and the incidence of LBW (p-value = 0.031). PROM can occur due to infection or biomechanical processes involving proteolytic enzymes within the amniotic membrane. A weakened amniotic membrane, lacking sufficient connective tissue and vascularization, can lead to premature birth (Siantar & Rostianingsih, 2022; Zahan et al., 2023). Additionally, PROM can cause oligohydramnios (low amniotic fluid). This condition compresses the umbilical cord, potentially leading to fetal asphyxia and hypoxia (oxygen deprivation) by reducing the flow of oxygen and nutrients to the fetus. Consequently, PROM can contribute to premature labor and LBW (Mahardika, 2020).

## 5. Conclusion

In conclusion, the analysis of maternal health records reveals that while the majority of mothers were categorized as low-risk according to age, anemia, PIH, and PROM, a significant incidence of LBW persists. Despite 71.8% of mothers being in the optimal age range, 72.1% not experiencing anemia, 77.3% not having PIH, and 78.6% not having PROM, LBW occurred in 24% of cases. The chi-square test results further highlight significant associations between LBW and each examined factor: age (p = 0.024), anemia (p = 0.009), PIH (p = 0.014), and PROM (p = 0.031). These findings underscore the importance of continuous and comprehensive maternal monitoring, as even among low-risk patients, factors such as age, anemia, PIH, and PROM contribute significantly to LBW. Targeted interventions are necessary to address these risks and improve neonatal outcomes. The data emphasizes the need for ongoing vigilance and enhanced care strategies to further reduce LBW incidence and support healthier pregnancies.

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## 7. Conflict of interest

All authors declare no conflict of interest.





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