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‘’The Relationship Between Gestational Hypertension and Hemoglobin Levels and The Incidence of Low Birth Weight (LBW)’’

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Abstract

Low birth weight (LBW) infants are one of the main factors contributing to morbidity and mortality in the neonatal period. Gestational hypertension and hemoglobin levels during pregnancy are two maternal factors that can affect fetal growth and increase the risk of low birth weight babies. Analyzing the relationship between gestational hypertension and hemoglobin levels in pregnant women and its impact on the incidence of low birth weight babies at Blambangan Banyuwangi Regional General Hospital. This study implemented an observational analytical design using a cross-sectional approach. The study involved 41 mothers who had just given birth, selected using total sampling. The variables analyzed included gestational hypertension, hemoglobin levels, and the incidence of low birth weight. Data collection was conducted using observation sheets, and analysis was performed by applying the chi-square test at a significance level of $\alpha = 0.05$. The results of the study on gestational hypertension show that the majority, namely 27 individuals, or 65.9% of the total sample, experienced hypertension. Hemoglobin level analysis indicates that the majority, namely 23 individuals, were within the normal range, covering 56.1% of the entire sample. Analysis of LBW cases indicated that the majority of babies had normal weight, with a total of 32 babies identified, covering 78% of the entire sample. Statistical analysis indicated a significant relationship between gestational hypertension and hemoglobin levels on LBW cases ($p < 0.05$). There exists a correlation between gestational hypertension and hemoglobin levels and the incidence of low birth weight infants. Regular monitoring of blood pressure and hemoglobin levels in pregnant women, as well as intensive education, are necessary to prevent the risk of low birth weight (LBW) babies.

Keywords: Low Birth Weight, Gestational Hypertension, Pregnant Women, Hemoglobin Level

INTRODUCTION

Low Birth Weight (LBW) was a condition in which infants were born weighing less than 2,500 grams, and it remained a major global public health problem due to its high risk of neonatal morbidity and mortality [1]. LBW infants were more vulnerable to growth disorders, infections, developmental delays, and neonatal death, which reduced quality of life and increased the burden on health services [2]–[4]. This issue became increasingly important because most LBW cases occurred in developing countries, including Indonesia. Therefore, efforts to prevent LBW through early detection of maternal risk factors during pregnancy were crucial in mitigating pediatric illnesses disease prevalence and death rates [5].

The United Nations Children's Fund (UNICEF) estimates that the global prevalence of low birth weight (LBW) is roughly 19.8 million babies, constituting about 14.7% [6]. In Indonesia, the prevalence of LBW exceeded 15.5%, making it one of the countries with the highest LBW rates worldwide [7]. Data from the 2021 Indonesian Health Profile showed that although the prevalence of LBW declined from 3.4% in 2019 to 2.5% in 2021, LBW remained the leading cause of neonatal death, contributing 34.5% of total newborn mortality [8]. In Banyuwangi Regency, particularly at Blambangan Regional Hospital, more than 10 LBW cases were recorded each month. This indicated that LBW was not only persistent but also occurred regularly,

The occurrence of LBW was influenced by various maternal, fetal, placental, and environmental factors, including maternal nutritional status, anemia, hypertension, high-risk pregnancy conditions, and inadequate prenatal care [9]. Maternal anemia (reduced hemoglobin levels) may impair fetal oxygenation and nutrition delivery, resulting in intrauterine growth restriction (IUGR) and therefore low birth weight (LBW) [10]. Furthermore, pregnancy complications such as gestational hypertension, preeclampsia, or placental circulation disorders could impair uteroplacental blood flow, reducing oxygen and nutrient transfer to the fetus. Socioeconomic factors, poor nutrition, low ANC compliance, and short birth spacing or high parity also contributed to the risk of LBW [11].

Gestational hypertension and low hemoglobin levels were two important maternal factors that contributed to an increased risk of LBW. Hypertension during pregnancy could impair placental perfusion and lead to placental insufficiency, resulting in restricted fetal growth and an elevated risk of premature delivery, both closely linked to LBW [12]. Simultaneously, maternal anemia, defined by diminished hemoglobin concentrations, reduced fetal oxygen delivery, hence elevating the risk of intrauterine growth restriction (IUGR). Various studies and meta-analyses showed that both gestational hypertension and anemia significantly increased the likelihood of mothers delivering low birth weight infants LBW infants compared to mothers without these complications [9].

Previous studies have shown that maternal factors such as gestational hypertension and anemia contribute significantly to the occurrence of low birth weight (LBW). Kasuya et al. (2022) found that preeclampsia and impaired placental perfusion increase the risk of intrauterine growth restriction [13]. Another study by Cahyani et al. (2024) reported that maternal anemia reduces oxygen supply to the fetus, thereby increasing the incidence of IUGR and LBW [10]. Research conducted by Kristiana (2025) also confirmed that gestational hypertension is closely associated with decreased uteroplacental blood flow, ultimately increasing the risk of preterm birth and LBW [14]. Thus, previous studies consistently agree that high blood pressure and low hemoglobin levels are strong predictors of LBW.

The government had implemented several programs to reduce the incidence of LBW by improving maternal health, encompassing the First 1000 Days of Life (HPK) initiative, Iron Tablet Supplementation (TTD) to prevent anemia, and the High-Risk Pregnancy Monitoring Program (Bumil Risti), which focused on early detection of gestational hypertension and other pregnancy complications [15]. In addition, the government strengthened Integrated Antenatal Care (ANC) services through the Ministry of Health, requiring routine blood pressure measurement, nutritional assessment, laboratory tests such as hemoglobin levels, and maternal nutrition and health education. The implementation

of the Birth Planning and Complication Prevention (P4K) program also contributed to minimizing LBW risk by ensuring timely referral for mothers with danger signs such as hypertension and anemia. These programs demonstrated the government's commitment to reducing LBW through comprehensive interventions targeting maternal health from early pregnancy [16], [17].

This study was conducted at Blambangan Regional Hospital (RSUD Blambangan) because it is the main referral hospital in Banyuwangi Regency, where the number of high-risk pregnancies and low birth weight (LBW) cases is relatively high and varies each month, making it an ideal location for obtaining representative data on maternal factors contributing to LBW. In addition, the novelty of this research lies in its simultaneous analysis of two key maternal factors gestational hypertension and hemoglobin levels—within a single study model specifically focused on pregnant women in a referral-area population, which has rarely been examined together in previous studies within the context of a regional hospital. This study also provides added value by mapping the relationship between these two risk factors more comprehensively, thereby offering new scientific evidence to support the strengthening of early detection programs, high-risk pregnancy management, and preventive interventions in referral-level healthcare facilities such as RSUD Blambangan..

This research aimed to investigate the relationship between gestational hypertension and hemoglobin levels in relation to the occurance of low birth weight (LBW).

RESEARCH METHODOLOGY

This study utilized a quantitative approach, employing an analytical observational framework with a cross-sectional design. The cohort comprised 71 pregnant women who gave birth at Blambangan Regional Hospital. The sample size of 41 respondents was calculated with the Slovin formula. The employed sample approach was simple random sampling. The inclusion criteria were: (1) moms who delivered at Blambangan Hospital; (2) mothers with singleton pregnancies; (3) gestational age of 28 weeks or greater; (4) full antenatal care records; and (5) readiness to engage by completing an informed consent document. The criteria for exclusion were as follows: (1) multiple pregnancies (twins); (2) infants with congenital abnormalities; (3) mothers with chronic hypertension; (4) pregnant women with severe systemic diseases; and (5) mothers after delivery.

This research was performed at Ruang Bersalin RSUD Blambangan Banyuwangi from October 2024 to September 2025.. The instruments used included an observation sheet containing maternal blood pressure records, hemoglobin concentrations and newborn birth weight. The analysis of data was conducted employing the chi-square test, adhering to a significance threshold of $\alpha = 0.05$.

RESULTS AND DISCUSSION

This subsection presented the univariate analysis results, including age, education, parity, history of anemia during pregnancy, gestational hypertension, hemoglobin concentrations, and the prevalence of low birth weight (LBW), as shown in Table 1 below.

Table 1. Distribution of respondents' frequency based on characteristics in Ruang Bersalin RSUD Blambangan Banyuwangi in 2025 (n = 41)

Characteristics	Frequency	Percentage
Age		
<20 years	6	14.6

20-35 years	27	65.9
>35 years	8	19.5
Education		
Elementary school	4	9.8
Junior High School	5	12.2
Senior High School	17	41.5
Univeristy	15	36.5
Parity		
Primigravida	20	48.8
Multigravida	21	51.2
History of Anemia		
Yes	16	39
No	25	61
Gestational Hypertension		
Hypertension	27	65.9
Non- Hypertension	14	34.1
Hemoglobin Level		
Normal (≥11 gr/dL)	23	56.1
Low (<11 gr/dL)	18	43.9
Low Birth Weight (LBW) Status		
Normal (≥ 2500 grams)	32	78
LBW (< 2500 grams)	9	22

Source: Primary Data, 2025

According to Table 1, the demographic features of respondents by age indicated that the majority, comprising 27 participants (65.9%), were aged 20–35 years. By education level, nearly half of the respondents had completed senior high school, totaling 17 participants (41.5%). By parity, most were multigravida, totaling 25 participants (51.2%). Based on the history of anemia, most had no anemia, totaling 25 participants (61%). Based on gestational hypertension, most were hypertensive, totaling 27 participants (65.9%). Based on hemoglobin concentrations, most had normal hemoglobin concentrations, totaling 23 participants (56.1%). Based on occurrence of LBW, most newborns had normal birth weight, totaling 32 babies (78%).

Table 2 below presents the cross-tabulation results and the study of the correlation between gestational hypertension, hemoglobin levels, and the the prevalence of low birth weight (LBW).

Table 2. Relationship Between Gestational Hypertension and Hemoglobin Levels with LBW Occurrence in Ruang Bersalin RSUD Blambangan Banyuwangi in 2025

Variables	LBW Occurrence				Total		*p-value*
	Normal		LBW				
	f	%	f	%	f	%	
Gestational Hypertension							
Hypertension	24	88.9	3	11.1	27	100	0.029
Non- Hypertension	8	57.1	6	42.9	14	100	
Hemoglobin Level							
Normal	22	95.7	1	4.3	23	100	0.005
Low	10	55.6	8	44.4	18	100	

The Correlation Between Gestational Hypertension and the Prevalence of Low Birth Weight

Table 2 presents the cross-tabulation results, showing that almost all hypertensive mothers did not experience LBW, totaling 24 people (88.9%). Meanwhile, most non-hypertensive mothers also did not experience LBW, totaling 8 people (57.1%). The chi-square test analysis yielded a p-value of 0.000, which is less than α (0.05), signifying statistical significance. This indicates a correlation between gestational hypertension and the incidence of low birth weight (LBW).

The results of this study showed that most respondents were within the healthy reproductive age range, 20–35 years, totaling 27 individuals (65.9%). This age group is generally considered the most optimal for pregnancy because the risk of complications, including gestational hypertension, is lower than in women aged <20 years or >35 years. Despite the predominance of responses falling below the acceptable age range, instances of gestational hypertension were nonetheless detected, confirming that age is not the only determinant of LBW risk. This condition illustrates that mothers aged 20–35 years may still experience gestational hypertension, which can potentially affect fetal growth. Therefore, blood pressure monitoring is essential for all age groups to prevent further adverse outcomes such as LBW. A similar study conducted by Khaerunissa et al. (2025) showed that most respondents aged 20–35 years experienced gestational hypertension [18].

The educational characteristics showed that nearly half of the respondents had completed senior high school, totaling 17 individuals (41.5%). Education level can influence a mother's ability to understand health information, including danger signs of hypertension during pregnancy. Although most respondents had a secondary education, this does not fully guarantee that mothers can control pregnancy risk factors such as diet, activity level, and ANC compliance [19]. The presence of hypertension among mothers with a high school education indicates that health knowledge is not solely determined by formal education but also by access to information from healthcare providers and personal experience. Therefore, intensive education during ANC is necessary to to mitigate the risk of problems and the prevalence of low birth weight.[20]. A similar study conducted by Allatif et al. (2024) at Pangalengan Public Health Center, Bandung Regency, showed that 12.8% of pregnant women experienced gestational hypertension, with the majority having a senior high school educational background. [21].

According to the findings of the study, the researcher concludes that most respondents were multigravida, totaling 25 individuals (51.2%). Theoretically, multigravida mothers have a lower risk of certain complications compared to primigravida; however, they remain at risk of developing gestational hypertension due to factors such as age, general health status, or previous pregnancy history [22]. The fact that gestational hypertension occurred among multigravida mothers suggests that prior childbirth experience does not always offer protection against pregnancy complications. This condition may affect fetal growth if hypertension is not detected and managed properly. Therefore, close monitoring of multigravida mothers remains necessary to prevent LBW, even though they have previous pregnancy experience [23], [24]. A similar study conducted by Suciati and Wijayanti (2022) found that most of the pregnant women were multigravida and at risk of developing hypertension during pregnancy [25].

Based on the study results, the researcher concludes that maternal characteristics such as age, education, and parity contribute to the occurrence of gestational hypertension but are not single determinants of LBW incidence. Most respondents fell within the healthy reproductive age bracket of 20 to 35 years, the fact that gestational hypertension still occurred indicates that other factors, such as health status, stress, or medical history, also play a role. Likewise, the high school education level of most respondents does not fully ensure adequate understanding of hypertension prevention or the importance of ANC visits, indicating a need for strengthened health education. Among multigravida mothers, the occurrence of gestational hypertension suggests that previous pregnancy experience does not automatically reduce risk; thus, strict monitoring remains essential. Overall, the researcher believes that early detection, routine blood pressure monitoring, and comprehensive health education are key strategies to prevent gestational hypertension and its impact on LBW occurrence.

The Correlation Between Hemoglobin Concentrations and the Prevalence of Low Birth Weight

Cross-tabulation data show mothers with normal hemoglobin levels almost entirely did not experience LBW, totaling 22 people (95.7%). Mothers with low hemoglobin levels mostly did not experience LBW, totaling 10 people (55.6%). Analysis using the chi-square test showed a p-value of $0.005 < \alpha$ (0.05), indicating significance. This means The results of this study indicate a relationship between maternal hemoglobin concentrations and the occurrence of low birth weight (LBW). The disparity in distribution suggests that moms with low hemoglobin levels are more likely to give birth to infants with low birth weight than mothers with normal hemoglobin levels. This discovery corroborates the idea that diminished hemoglobin levels can impair the delivery of oxygen and nutrients to the fetus, thereby resulting in intrauterine growth limitation. Therefore, maternal hemoglobin levels are an important factor to consider in preventing the risk of LBW.

The findings of this study are consistent with those of Amiruddin et al. (2022) at Tamangapa Health Center, which reported that all pregnant women with anemia experienced low birth weight (LBW), with a total of 28 cases. The analysis showed a significant association between anemia during pregnancy and the incidence of LBW [26]. Another study by Purnama and Kurniasari (2023) further supports these findings, showing that most pregnant women with hemoglobin levels <11 g/dL gave birth to LBW infants, totaling 27 cases (75%). The analysis concluded that a history of low hemoglobin levels is significantly associated with LBW in Bontang City. The findings from both studies confirm that anemia during pregnancy is an important factor contributing to the risk of delivering infants with low birth weight [27].

The research indicated that the majority of participants were between the ages of 20 and 35 years, totaling 27 individuals (65.9%), a reproductive age range deemed optimal for safety and associated with a reduced risk of pregnancy problems, particularly low birth weight (LBW) [28], [29]. However, cases of low hemoglobin levels were still found within this productive age group, indicating that anemia is not influenced solely by age but also by nutritional intake, overall health condition, and adherence to iron tablet consumption [30]. This emphasizes that women aged 20–35 years may still experience low hemoglobin levels that can affect fetal growth. Such conditions contribute to the risk of LBW if not managed appropriately [31].

The educational factor showed that nearly half of the respondents had completed senior high school (41.5%). Education level can influence mothers' understanding of nutrition, the importance of iron intake, and anemia risks during pregnancy. However, the fact that low hemoglobin levels were still found among those with secondary education suggests that formal education does not always correlate with health behavior [32]. Selain itu, sebagian besar responden merupakan multigravida sebanyak 25 orang (51,2%). Additionally, most respondents were multigravida (51.2%). Theoretically, multigravida mothers have better experience in managing pregnancy, including maintaining nutritional status, but this study showed that anemia can still occur in mothers with previous pregnancy experience. This indicates that lifestyle factors, ANC compliance, and adherence to iron tablet consumption are crucial components in preventing LBW [33], [34].

Based on anemia history, most respondents did not have a prior history of anemia (61%), yet low hemoglobin levels were still found, suggesting the possibility of physiological anemia in pregnancy or anemia related to nutritional factors. Although most newborns had normal birth weight (78%), the data also show that mothers with low hemoglobin levels had a higher likelihood of delivering LBW babies compared to mothers with normal hemoglobin levels [35], [36]. This aligns with the mechanism that low hemoglobin reduces oxygen and nutrient delivery to the fetus, thereby increasing the risk of intrauterine growth restriction. Thus, hemoglobin monitoring and interventions such as iron supplementation, nutritional education, and improving adherence to iron tablet consumption are essential strategies to decrease the prevalence of low birth weight [37].

The researcher indicates that maternal hemoglobin levels significantly influence the probability of low birth weight (LBW), as shown by the high proportion of mothers with normal hemoglobin levels who delivered babies with normal birth weight (95.7%), While mothers with low hemoglobin levels had an increased probability of low birth weight (LBW). Despite the majority of responders being within the healthy reproductive age (20–35 years), possessing secondary education, and being multigravida—factors typically associated with protection—low hemoglobin levels were nonetheless recorded. This suggests that anemia in pregnancy is more strongly influenced by nutritional factors, lifestyle, and adherence to iron supplementation rather than demographic characteristics. Additionally, although most respondents did not have a prior history of anemia, they still experienced low hemoglobin levels, indicating that pregnancy-related increased iron needs may not have been adequately met. This condition has the potential to impede the delivery of oxygen and essential nutrients to the fetus, resulting in restricted growth of the fetus. Consequently, the researcher emphasizes that routine hemoglobin monitoring, nutritional education, and improved adherence to iron tablet consumption are key interventions in preventing LBW.

CONCLUSION

In conclusion, a relationship is observed between gestational hypertension and hemoglobin concentrations in relation to the occurrence of low birth weight (LBW). Therefore, midwives are advised to enhance regular monitoring of pregnant women's hemoglobin concentrations and blood pressure, as well as provide intensive education regarding the prevention of anemia and gestational hypertension. In addition, midwives need

to ensure mothers' adherence to iron tablet consumption and encourage ANC visits according to standards in order to reduce the risk of LBW.

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