



ANALYSIS OF MATERNAL RISK FACTORS FOR LOW-BIRTH-WEIGHT INFANTS AT THE PUBLIC HEALTH CENTER

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ABSTRACT

Infants weighing less than 2500 grams are classified as low birth weight (LBW) and have a high mortality rate in the first few days of life, as well as various complications over time. It is necessary to identify maternal risk factors that influence this condition so that it can be prevented early on. Objective: This study aimed to analyze the influence of maternal age, antenatal care (ANC) visits, anemia, smoking history, infectious diseases, and psychosocial factors on the occurrence of low birth weight in Kotawaringin Barat District Health Centers. Method: This inferential study used a retrospective observational design and was conducted from August to October at Semanggang Health Center. The study analyzed data from medical records and relevant documents collected between January and October 2024, involving 242 respondents. Data processing included organization, cleaning, and coding to ensure accuracy. Regression analysis was conducted to examine relationships between independent and dependent variables, supported by descriptive statistics to summarize respondent characteristics. Results: The results showed that maternal factors that positively contributed to preventing LBW were ANC visits (increasing birth weight by 134,421 times), Hb levels above 10 gr% (increasing birth weight by 65,506 times), and maternal age (increasing birth weight by 2,243 times) from 1500 grams, assuming other variables were constant. Meanwhile, maternal factors that negatively contributed to preventing LBW were infectious diseases (decreasing birth weight by 382,863 times), psychosocial factors (decreasing birth weight by 18,778 times), and smoking (decreasing birth weight by 5,064 times) from 1500 grams, assuming other variables were constant. Conclusions: In conclusion Adequate ANC visits, Hb levels above 10 gr%, and optimal maternal age significantly increase birth weight. Conversely, infections, psychosocial factors, and smoking increase the risk of low birth weight.

Keywords: low birth weight; maternal; risk factors

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INTRODUCTION

Birth weight is one of the most crucial factors in assessing an infant's development, survival, and future health. It serves as a key determinant of both physical and brain development, as well as an indicator of intrauterine growth. Consequently, infants born with LBW require more intensive care compared to those born with normal weight (Novitasari et al., 2020). LBW is defined by the World Health Organization (WHO) as a birth weight of less than 2,500 grams, regardless of gestational age (Ramadityo, 2021). Each year, around 20 million newborns (17% of live births) have a birth weight below 2,500 grams, with over 90% of these cases occurring in developing countries. LBW contributes to 40–60% of neonatal deaths worldwide (Moradi et al., 2021). WHO estimates that over 20 million births annually (15–20%) involve LBW. The highest burden is in South Asia (26.4%), Southeast Asia (12.2%), and Sub-Saharan Africa (14%), while East Asia has a lower LBW rate of 5.3% (Kholifah et al., 2023). According to WHO's 2022 report (cited by Pitriani et al., 2023), preterm and LBW infants account for 60–80% of all neonatal deaths. Compared to full-term babies, preterm and LBW infants face a mortality risk 2–10 times higher. WHO aims to reduce LBW cases by 30% by 2025, and progress has been observed, with LBW births

declining from 20 million to 14 million annually (Pitriani et al., 2023).

In Indonesia, the prevalence of LBW was recorded at 6.2% in the 2018 Basic Health Research. The 2022 Indonesian Nutrition Status Survey (SSGI) reported a prevalence of 6.0%. Estimates from WHO and UNICEF indicate that preterm birth rates in Indonesia are around 10%. Although there has been a decrease, LBW remains a significant public health concern due to its association with long-term health issues and infant mortality (Ministry of Health, Republic of Indonesia, 2022). LBW management requires both hospital and community-based care, particularly within the first two months and the first two years of life. In Indonesia, neonatal deaths within the first six days are primarily caused by asphyxia (36%), LBW (32%), and neonatal sepsis (12%). From days 7–28, common causes include sepsis (22%), congenital abnormalities (19%), and pneumonia (17%) (Ministry of Health, Republic of Indonesia, 2019). Indonesia has committed to reducing LBW prevalence by 30% by 2025, and between 2012 and 2019, a 2.9% decrease was observed (Kholifah et al., 2023). LBW is closely linked to increased infant mortality, particularly in the first days of life. Studies show that infants weighing less than 2,500 grams at birth have significantly lower survival rates. The neonatal mortality risk is 25–30 times higher for LBW infants compared to those with normal birth weight, and the lower the birth weight, the greater the risk (Sari, 2021). Additionally, LBW infants have a 20-times higher risk of fatal complications (Sharma et al., 2016), with neonatal sepsis and respiratory distress syndrome being the leading causes of death (Desta et al., 2019).

A preliminary study at Semanggang Public Health Center in West Kotawaringin Regency showed fluctuating LBW trends, with a general increase over time. Between 2020 and 2021, LBW rates were 6.3% and 6.2%, respectively. These high rates coincided with the COVID-19 pandemic and lockdown policies in palm oil plantation areas. In 2022, an anomaly occurred, with LBW prevalence dropping to 2.2%, below the 3% target. However, in 2023, LBW cases surged again to 6.7%. One possible explanation is that after pandemic restrictions were lifted, many residents traveled to Java for family visits, potentially affecting maternal health care access and birth outcomes. Maternal age plays a crucial role in LBW risk. Pregnant women under 20 years old are more likely to have LBW infants, as early marriage and pregnancy negatively impact both maternal and fetal health. Teenage mothers have a 4.1-times higher risk of delivering LBW infants compared to women aged 20 years or older (Nuzula et al., 2020). Additionally, pregnancies in women over 40 years old also increase LBW risk (Apriani et al., 2020).

A preliminary study in Semanggang showed that early marriage is common in the area. Regular ANC visits contribute to LBW prevention by enabling early detection of risk factors. Pregnant women who attend fewer than four ANC visits have a 1.15-times higher risk of delivering LBW infants. Poor ANC quality also increases LBW risk by 2.58 times (Fatimah et al., 2017). A study in Malang found that non-adherence to ANC increased LBW risk by 10.7 times (Kholifah et al., 2023), while in Palembang, mothers receiving substandard ANC were 1.4 times more likely to have LBW infants (Kurniasari et al., 2023). The 2023 spike in LBW cases in Semanggang coincided with the post-pandemic transition, suggesting disrupted ANC services during the pandemic may have played a role. Maternal anemia significantly contributes to LBW. A systematic review by Wahyuni et al. (2021) found that 92.3% of LBW cases involved anemic mothers. Iron deficiency was the leading cause (46.1%), followed by low education levels (7.6%), poor socioeconomic status (7.6%), and inadequate nutrition (7.6%). Anemia restricts oxygen supply to the fetus, leading to intrauterine growth restriction and LBW (Figueiredo et al., 2018). Maternal smoking poses severe risks to fetal health, including LBW and preterm birth (Sari et al., 2021). Exposure to cigarette smoke reduces

oxygen availability to the fetus, slowing fetal growth and increasing LBW risk (Hermince, 2022). In Semanggang, many residents work on palm oil plantations, where smoking is prevalent among laborers. Maternal infections during pregnancy can lead to extreme LBW (<1,000 grams). Diseases such as HIV, reproductive tract infections, and pneumonia increase the likelihood of LBW. HIV-infected mothers have double the risk of delivering LBW infants due to premature rupture of membranes (Kornia et al., 2023). A study found that while the COVID-19 pandemic saw an increase in preterm and LBW births, no direct correlation was established between COVID-19 infection and LBW (Dharmapatni et al., 2023).

LBW survivors often face cognitive and neurological impairments, as well as an increased risk of hypertension, lung disease, high cholesterol, kidney damage, and weakened immunity (Desta et al., 2019). LBW is also linked to developmental disorders, learning disabilities, and chronic diseases in adulthood (Moradi et al., 2021). In Indonesia, LBW has been identified as a contributing factor to stunting (Alba et al., 2021; Murti et al., 2020; Trisiswati et al., 2021). Given its significant impact on infant survival, health outcomes, and economic costs, identifying maternal risk factors for LBW is crucial. This study aims to analyze the maternal risk factors contributing to LBW births at the Public Health Center in West Kotawaringin Regency.

METHOD

This study employs an inferential quantitative approach to examine the factors influencing the incidence of low birth weight (LBW). Using an observational design with a retrospective approach, the research analyzes past data from medical records at Puskesmas Semanggang and maternal health books. This method allows for a comprehensive assessment of maternal health conditions and their potential impact on birth outcomes. The study focuses on mothers who gave birth to live babies in 2023, with a total population of 239 individuals. To ensure the study remains manageable while maintaining representativeness, a sample of 60 mothers was selected, comprising 25% of the total population. A simple random sampling technique was applied, ensuring that each individual had an equal chance of selection. To determine the sample, specific exclusion criteria were established. Mothers who had moved out of the Puskesmas service area, had medical records that were missing or unreadable, or whose data lacked consistency were excluded from the study. The sample was then divided into two groups: 16 mothers who gave birth to LBW infants formed the case group, while the remaining 44 mothers were selected as the control group through a random lottery conducted by community health volunteers to prevent bias.

The study examines several maternal factors that may contribute to LBW. The independent variables include maternal age, antenatal visits, anemia, smoking history, infectious diseases, and psychosocial conditions. The dependent variable is the incidence of LBW. By analyzing these factors, the study aims to identify potential risks and inform strategies for improving maternal and neonatal health. The research is conducted at Puskesmas Semanggang, located in Kotawaringin Barat Regency. The data collection process spans from August to October 2024, allowing sufficient time for thorough record reviews and interviews. The study relies on both primary and secondary data sources. Primary data is extracted from maternal medical records at Puskesmas Semanggang, while secondary data is gathered from maternal and child health books, health volunteer records, and interviews with mothers, health workers, and family members. The data collection process involves a systematic review of medical records, with information being recorded in a structured research table. For completeness and validation, short interviews are conducted with selected mothers to confirm the accuracy of recorded data. In cases where information is incomplete, additional interviews are held with mothers, health volunteers, and family members to obtain missing details, particularly

regarding key risk factors such as antenatal care visits, anemia, smoking, and infectious disease history. Once all data is collected, a final review is conducted to ensure completeness and consistency before proceeding with analysis.

The study utilizes both univariate and multivariate statistical analyses to examine the relationship between maternal factors and the incidence of low birth weight (LBW). Univariate analysis summarizes data distribution by presenting frequency distributions and percentages of key variables. For multivariate analysis, multiple linear regression is employed to assess the influence of maternal factors on LBW incidence. Prior to regression analysis, classical assumption tests—including normality, multicollinearity, and heteroscedasticity tests—are conducted to ensure the model’s validity and reliability. If these assumptions are not met, an alternative statistical method, the Chi-Square test, will be used to analyze the association between each independent variable and LBW incidence individually. This approach ensures a flexible yet rigorous statistical analysis. Ethical principles are strictly adhered to throughout the research process. Informed consent is obtained from all participants before data collection, ensuring that they fully understand the study’s purpose and implications. Anonymity is maintained by coding participant data instead of using personal identifiers. Confidentiality is upheld by restricting access to research data and ensuring that no sensitive information is disclosed to unauthorized individuals. The study also carefully weighs potential risks and benefits, aiming to minimize harm while maximizing the positive impact on maternal and child health.

RESULT

The average age of the respondents is 27.7 years, with a standard deviation of ±6.17 years. The majority of respondents were within a typical adult age range and received adequate prenatal care, with 83.5% having 6 or more ANC visits. Most did not experience health risks, as 96.3% did not have anemia, 98.3% did not smoke, and 97.5% did not report infections during pregnancy. Additionally, 83.1% experienced mild psychosocial stress, indicating that severe stress was uncommon among the participants.

Table 1.
Respondent characteristics (n= 242)

Respondent characteristics	Category	Frequency or Mean	% or Standar Deviation
Age	-	27.70	±6.17
ANC Visitation	< 6 times	40	16,5
	≥ 6 times	202	83,5
Anemia	No	233	96,3
	Yes	9	3,7
Smoking	No	238	98,3
	Yes	4	1,7
Infectious Diseases	No	236	97,5
	Yes	6	2,5
Psychosocial Status	Mild	201	83,1
	Moderate	25	10,3
	Heavy	16	6,6

The regression analysis presented in Table 2 sheds light on the significant maternal factors influencing neonatal birth weight, emphasizing the role of maternal characteristics and behaviors in determining fetal growth outcomes. The analysis indicates that ANC visitation (p = 0.000), anemia (p = 0.004), infectious disease (p = 0.001), and psychosocial status (p = 0.000) significantly influence the outcome variable. ANC visitation and anemia show a positive association, suggesting that more ANC visits and the presence of anemia increase the likelihood of the outcome. Conversely, infectious disease and psychosocial status have a negative relationship, indicating that their presence decreases the outcome variable.

Meanwhile, age ($p = 0.386$) and smoking ($p = 0.669$) are not statistically significant, suggesting they do not have a meaningful impact in this analysis.

Table 2.
Results of the Linear Regression Test of Maternal Variables on the Incidence of LBW at Semanggang Health Center, 2024

Variable	Coefficient	p-value
Age	0.04	0.386
ANC visitation	0.28	0.000
Anemia	0.14	0.004
Smoking	-0.21	0.669
Infectious disease	-0.17	0.001
Psychosocial status	-0.39	0.000

DISCUSSION

Maternal age is positively associated with birth weight, where an increase in age from 13 years contributes to a rise in neonatal weight. This indicates that as mothers grow older, their bodies become more physiologically prepared for pregnancy, which may enhance fetal development. Research by Sholiha & Sumarmi (2015) in Probolinggo, Sari et al. (2021) in Palembang, Pitriani et al. (2023) in the Bangka Belitung Islands, and Devaguru et al. (2023) in Mumbai, India, all reported a relationship between maternal age and the occurrence of LBW. Young mothers are still in the process of physical growth and development, which may cause nutrients that should be allocated to fetal growth to be used more for the mother's own growth. Young mothers often lack sufficient knowledge about pregnancy, nutrition, and infant care (Lestari et al., 2020). Similarly, the frequency of ANC visits significantly impacts birth weight. Each additional visit contributes to an increase, highlighting the importance of regular maternal health monitoring and early detection of potential complications. The quality of ANC services is also crucial. Health workers should provide friendly, informative, and standard-compliant services (Sari et al., 2021). ANC visits are very important in preventing low birth weight. During these visits, fetal growth will be regularly monitored through fundal height measurement and ultrasound. If there is abnormal growth according to the gestational age, interventions can be made to prevent LBW (Novitasari et al., 2020).

Hemoglobin levels also show a positive correlation with birth weight. Higher maternal Hb levels, starting from 9 gr%, support better oxygen transport and nutrient supply to the fetus, facilitating optimal growth. This underscores the role of maternal nutrition and anemia prevention in ensuring healthy pregnancy outcomes. A systematic review by Wahyuni et al. (2021), a literature study by Mulianisaa et al. (2021), and a review article by Farhan & Dhanny (2021) all reported that low Hb levels contribute to the occurrence of LBW. This is also supported by research by Novianti & Aisyah (2018) in Tasikmalaya, Aulia et al. (2019) in Palembang, Haryanti et al. (2019) in Pati Regency, Fatimah & Kania (2019) in Ciamis Regency, Khan et al. (2016) in Pakistan, Girma et al. (2019) in Nekemte, and Devaguru et al. (2023) in Mumbai. However, certain factors negatively impact birth weight. Smoking during pregnancy is associated with a decline in neonatal weight, as each additional cigarette consumed reduces birth weight. This finding reinforces the well-documented risks of tobacco exposure, which include restricted fetal growth and adverse perinatal outcomes. Similarly, maternal infections significantly contribute to lower birth weight, as illnesses during pregnancy can lead to inflammation, impaired nutrient transfer, and overall fetal stress. Systematic reviews conducted by Sari et al. (2021), research by Johnson et al. (2017) in Wales, UK, Sari (2021) in Kedungkandang, Malang, and Hermince (2022) in Malang all strengthen the finding that smoking habits contribute to LBW, although Khan et al. (2016) in Pakistan reported that smoking is not a determinant of LBW.

Psychosocial stress also emerges as a critical factor influencing birth weight. Higher stress levels are linked to reduced neonatal weight, suggesting that maternal well-being directly affects fetal development. The physiological impact of stress, including hormonal imbalances and increased cortisol levels, may interfere with fetal growth and result in lower birth weights. Infections during pregnancy, especially HIV, TB, syphilis, and hepatitis, can increase the risk of LBW. According to Sari et al. (2021), infections can interfere with the absorption of essential nutrients for the fetus, hindering fetal growth. In addition, infections can cause chronic inflammation that damages the placenta, the organ responsible for transferring nutrients and oxygen from the mother to the fetus. The regression test results show that each increase in 1 PS-10 score will decrease the birth weight of the baby by 18.778 times, or in other words, each increase in the PS-10 score increases the potential for LBW decrease by 18.778 times from 3500 grams (assuming other variables remain constant). The regression equation shows that the mother's psychosocial status has the second-largest negative contribution after infection diseases, which are likely to cause LBW.

Psychosocial stress during pregnancy can be a contributing factor to LBW. While the exact mechanism is still under investigation, several studies suggest a relationship between high stress levels in pregnant women and the risk of giving birth to LBW babies (Luthfia & Atmaja, 2020). Despite its methodological strengths, the study has certain limitations. The reliance on retrospective medical records may pose challenges in terms of data completeness and accuracy. Additionally, self-reported information from interviews may introduce recall bias. The study's findings are also specific to the population within the Puskesmas Semanggang service area, which may limit the generalizability of results to other regions. Future research could address these limitations by incorporating a larger sample size or a prospective study design

CONCLUSION

Overall, the analysis highlights the interplay between protective and risk factors in shaping neonatal health. Regular antenatal care, optimal hemoglobin levels, and maternal age contribute positively to birth weight, emphasizing the importance of maternal health interventions. On the other hand, infections, psychosocial stress, and smoking behavior pose significant risks, underscoring the need for preventive measures and targeted health programs to minimize adverse pregnancy outcomes

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