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Original Article

Analysis of factors influencing low birth weight incidence

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***Abstract*:**
Low birth weight (LBW) remains a major maternal and child health problem because it increases neonatal morbidity, mortality, and long-term developmental risk. Maternal age, parity, pregnancy spacing, gestational age, anemia, nutritional status, chronic disease, and twin pregnancy may contribute to LBW, but local evidence is needed to guide primary health care prevention. Objective: This study analyzed factors associated with LBW incidence in the working area of the Dambalo Public Health Center. Methods: This study used an analytic retrospective case-control design based on secondary maternal and newborn records from three urban public health centers in Dambalo. The accessible population consisted of 93 delivery records. Records with complete data were selected according to inclusion and exclusion criteria, resulting in 66 analyzable records. Cases were newborns with birth weight below 2,500 g, and controls were newborns with birth weight of 2,500 g or higher. Data were collected using a structured checklist from maternal cohort registers and maternal-child health books. Data analysis used univariate analysis, chi-square tests, and logistic regression. Results: Bivariate analysis showed that gestational age was associated with LBW ($p = 0.009$). Parity ($p = 1.000$), maternal age ($p = 0.292$), pregnancy spacing ($p = 0.588$), anemia ($p = 0.205$), nutritional status ($p = 1.000$), chronic disease or preeclampsia history ($p = 1.000$), and twin pregnancy ($p = 0.087$) did not reach statistical significance in bivariate analysis. Multivariate analysis identified twin pregnancy as the dominant factor associated with LBW ($p = 0.029$), while anemia remained clinically important but did not meet the conventional significance threshold ($p = 0.188$). Conclusion: Twin pregnancy was the strongest factor associated with LBW in this dataset. Prevention should prioritize early risk screening, anemia control, nutritional monitoring, and focused antenatal care for multiple pregnancy.

***Keywords*:**
anemia, antenatal care, gemelli, low birth weight, maternal risk factor

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INTRODUCTION

Low birth weight (LBW) refers to a newborn's birth weight below 2,500 grams, regardless of gestational age. This indicator remains one of the most practical markers of maternal health, fetal growth, the quality of antenatal care, and the risk of neonatal survival. LBW may result from preterm birth, intrauterine growth restriction, or a combination of both. Infants with LBW have higher risks of

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hypothermia, infection, respiratory distress, feeding difficulties, delayed growth, impaired neurodevelopment, stunting, and death during the neonatal period. The risk also extends beyond infancy because restricted fetal growth can influence metabolic, cardiovascular, cognitive, and physical outcomes later in life (Blencowe et al., 2019; Jańczewska et al., 2023; WHO, 2024).

The global burden of LBW remains high. The joint UNICEF and WHO estimates indicate that, in 2020, about 14.7% of newborns, equal to approximately 19.8 million babies, were born with LBW worldwide. Global progress remains too slow to achieve the World Health Assembly target of a 30% reduction in LBW by 2025. Most LBW births occur in low-income and middle-income countries, where maternal malnutrition, limited antenatal care, adolescent pregnancy, infectious disease, environmental exposure, and socioeconomic inequity persist (Okwaraji et al., 2024; UNICEF, 2023; UNICEF & WHO, 2023). This global pattern shows that LBW is not only a clinical problem but also a health-system and social-determinant problem.

Indonesia still faces a measurable LBW burden. The Indonesian Health Survey 2023 reported that the national proportion of LBW among children aged 0-59 months was 6.1% based on documents and 6.2% based on documents or respondent recall (Badan Kebijakan Pembangunan Kesehatan, 2023). A national policy analysis also shows that LBW risk differs by maternal residence, age, marital status, education, employment, parity, and wealth, which means that prevention must target women with clinical and social vulnerabilities (Wulandari et al., 2023). Recent Indonesian research using large datasets also highlights maternal anemia, irregular antenatal care, multiparity, and preterm birth as important correlates of LBW (Sari et al., 2025). These findings support the need to combine clinical surveillance with community-based risk mapping.

Maternal factors shape birth weight through several pathways. Maternal age below 20 years may reflect biological immaturity, incomplete pelvic and uterine growth, limited nutritional reserves, and higher vulnerability to anemia. Maternal age above 35 years may reflect declining uteroplacental function and higher risk of chronic disease. Parity also matters because very high parity can reduce uterine and maternal nutritional reserve capacity. However, the effect of parity often depends on maternal age, birth spacing, nutritional status, socioeconomic condition, antenatal care use, and previous obstetric complications. For this reason, local analysis must examine parity together with other risk factors rather than as a single isolated determinant (Alemu et al., 2019; Tessema et al., 2021; Wulandari et al., 2023).

Gestational age is directly related to birth weight. Preterm delivery reduces the duration of fetal growth and may produce LBW even when intrauterine growth is adequate for gestational age. Preterm birth often occurs due to infection, premature rupture of membranes, multiple pregnancy, hypertensive disorders, placental insufficiency, or spontaneous preterm labor. Twin pregnancy has a strong biological link with LBW because two fetuses share uterine space and maternal nutritional supply. The uterus also experiences greater distension, which increases the probability of preterm labor. Fetal weight gain in twin pregnancy may parallel singleton pregnancy early in gestation, but after the third trimester, the growth pattern often slows due to placental and uterine limitations (Khan et al., 2020; Komariah et al., 2023; Okwaraji et al., 2024).

Anemia and maternal nutritional status also require attention. Anemia reduces oxygen delivery to maternal and fetal tissues and can impair placental oxygen transfer. Maternal undernutrition, chronic energy deficiency, inadequate gestational weight gain, and low mid-upper arm circumference can reduce nutrient supply to the fetus and increase the risk of growth restriction.

Evidence from nutritional studies shows that maternal nutritional status during pregnancy is significantly associated with newborn birth weight (Hasanah & Ilmiah, 2026; Liu et al., 2022; Mohamed et al., 2022). Antenatal nutrition education, iron and folic acid supplementation, and early detection of chronic energy deficiency therefore remain core elements of LBW prevention (Novelia et al., 2024).

Primary health care has a strategic role because risk factors for LBW can be screened through routine antenatal care. Midwives and primary care teams can identify high-risk age, short pregnancy spacing, anemia, chronic energy deficiency, hypertension, preeclampsia, infection, multiple pregnancy, and poor antenatal attendance. They can also provide health education, referral, nutrition counseling, family engagement, and home-based follow-up. Studies from other research emphasize that low-birth-weight care requires health worker performance, maternal preparation, family support, and health awareness (Abdulloh Faqih et al., 2025; Kurniyawan et al., 2023; Rahmawati et al., 2021). These concepts are relevant for Dambalo because community-level prevention needs clinical screening and family participation.

The Dambalo Public Health Center area reported many LBW cases, according to local maternal and child health records. The original program data showed that LBW and asphyxia remained major contributors to early neonatal death, with many deaths occurring in the first week of life. Local evidence is needed because national and provincial trends cannot fully explain the risk profile of each primary health care area. Differences in maternal nutrition, anemia control, referral access, family support, pregnancy spacing, and pregnancy complications may produce different LBW patterns. Therefore, this study aimed to analyze maternal and pregnancy-related factors associated with LBW incidence in the Dambalo Public Health Center's working area. The findings are expected to support targeted counseling, risk screening, referral planning, and improvements to maternal-child health programs.

METHOD

This study used a retrospective, analytic design with a case-control approach. The design was selected because the outcome, namely LBW, had already occurred, and the researcher needed to trace maternal and pregnancy-related risk factors from existing records. A retrospective approach allows health workers and researchers to use routine maternal-child health data to identify preventable factors and improve local program planning. The study was conducted in three urban public health centers in the Dambalo District Health Office area. These public health centers were selected because they reported the highest number of LBW cases in the district records.

The accessible population consisted of 93 newborn delivery records from the maternal cohort register and the maternal-child health book during the study period. The case group included newborns with birth weight below 2,500 grams. The control group included newborns with a birth weight of 2,500 grams or higher from the same health-center service area and period. The final analytic sample consisted of 66 records after screening for eligibility and data completeness. The inclusion criteria were complete maternal age, parity, pregnancy spacing, gestational age, anemia status, nutritional status, history of chronic disease or preeclampsia, multiple pregnancy status, and newborn birth weight. The exclusion criteria were stillbirth, major congenital anomalies recorded in

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the register, and incomplete or unreadable data. This screening was necessary because secondary data analysis depends on the accuracy and completeness of routine records.

The dependent variable was LBW status. Newborns with a birth weight below 2,500 grams were coded as LBW, while newborns with a birth weight of 2,500 grams or higher were coded as non-LBW. The independent variables were maternal age, parity, pregnancy spacing, gestational age, anemia, nutritional status, history of chronic disease or preeclampsia, and twin pregnancy. Maternal age was grouped into risk and non-risk categories based on obstetric risk. Parity was grouped into risk-parity and non-risk-parity. Pregnancy spacing was grouped according to whether the interval allowed adequate maternal recovery. Gestational age was classified as preterm or term based on the 37-week threshold. Anemia status was based on hemoglobin data recorded during pregnancy. Nutritional status was based on mid-upper arm circumference or on documented chronic energy deficiency. A twin pregnancy was identified from antenatal or delivery records.

Data were collected using a structured checklist developed from the study variables. The checklist included the mother's identity code, health center source, birth outcome, birth weight, maternal age, parity, pregnancy spacing, gestational age, anemia status, nutritional status, chronic disease or preeclampsia status, and twin pregnancy status. The researchers did not use direct interviews because this study relied on secondary records. Data abstraction was conducted by reviewing maternal cohort books, KIA books, and delivery records. Each record was checked twice to reduce transcription errors. When information differed across sources, the delivery register and maternal cohort were prioritized because they served as the primary health center records.

Data processing consisted of editing, coding, entry, cleaning, and tabulation. Univariate analysis described each variable using frequency and percentage. Bivariate analysis used the chi-square test or Fisher's exact test when cell counts were small. A p-value below 0.05 was interpreted as statistically significant in bivariate analysis. Variables with clinical relevance or p-values below the screening threshold were included in the multivariate analysis. Logistic regression was used to identify dominant factors associated with LBW. The final interpretation considered both statistical significance and clinical plausibility because several maternal risk factors, such as anemia and nutritional status, remain important even when statistical significance is limited by sample size.

The study followed ethical principles for secondary data research. Personal identifiers were not reported in the final article. Records were coded to maintain confidentiality. The analysis used existing routine records and did not change maternal or newborn care. The main methodological limitation was reliance on the completeness and accuracy of health center documentation. Some variables, such as nutritional intake, quality of antenatal counseling, household socioeconomic condition, environmental exposure, and family support, were not available in the routine records and therefore could not be included in the model. Despite these limitations, the design remains useful for generating local evidence for primary health care planning and LBW prevention.

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RESULT

The results are presented in three parts: respondent characteristics, bivariate analysis, and multivariate analysis. The study used secondary records from three urban public health centers in the Dambalo District Health Office area.

Table 1. Distribution of maternal and pregnancy-related risk factors

Variable	Category	Frequency (n)	Percentage (%)
Maternal age	Low-risk age	42	63.2
	Risk age	24	36.8
Parity	Low-risk parity	63	95.6
	High-risk parity	3	4.4
Pregnancy spacing	Low-risk interval	56	85.3
	High-risk interval	10	14.7
Gestational age	Term	51	77.9
	Preterm	15	22.1
Anemia status	Anemia	47	70.6
	No anemia	19	29.4
Nutritional status	Low-risk nutritional status	47	70.6
	High-risk nutritional status	19	29.4
Chronic disease or preeclampsia	Present	1	1.5
	Absent	65	98.5
Twin pregnancy	Yes	2	3.0
	No	64	97.0

Table 1 shows that most records were from mothers in the low-risk age, low-risk parity, and low-risk pregnancy spacing groups. Most births were term births. Anemia was recorded in most maternal records, while documented chronic disease or preeclampsia and twin pregnancy were less frequent.

Table 2. Bivariate analysis of factors associated with LBW

Variable	Statistical test	p-value	Interpretation
Parity	Chi-square/Fisher exact	1.000	Not significant
Maternal age	Chi-square/Fisher exact	0.292	Not significant
Pregnancy spacing	Chi-square/Fisher exact	0.588	Not significant
Gestational age	Chi-square/Fisher exact	0.009	Significant
Anemia	Chi-square/Fisher exact	0.205	Not significant
Nutritional status	Chi-square/Fisher exact	1.000	Not significant
Chronic disease or preeclampsia	Chi-square/Fisher exact	1.000	Not significant
Twin pregnancy	Chi-square/Fisher exact	0.087	Not significant

The bivariate test showed that gestational age was significantly associated with LBW ($p = 0.009$). Other variables did not reach the $p < 0.05$ threshold in bivariate testing.

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Table 3. Multivariate analysis of factors associated with LBW

Variable	p-value	Interpretation
Parity	0.596	Not significant
Maternal age	0.998	Not significant
Pregnancy spacing	0.467	Not significant
Gestational age	0.997	Not significant in final model
Anemia	0.188	Clinically relevant, not statistically significant
Nutritional status	0.879	Not significant
Chronic disease or preeclampsia	1.000	Not significant
Twin pregnancy	0.029	Dominant significant factor

The multivariate model identified twin pregnancy as the dominant factor associated with LBW ($p = 0.029$). Anemia remained clinically relevant in the model, but its p-value did not meet the conventional threshold for statistical significance.

DISCUSSION

This study found that gestational age was significantly associated with LBW. This result is biologically plausible because preterm birth shortens the duration of intrauterine fetal growth. A fetus that is born before 37 weeks has less time to gain fat mass, muscle mass, and organ maturity. Preterm infants are therefore more likely to weigh below 2,500 grams even when fetal growth follows an appropriate pattern for gestational age. This finding aligns with global evidence that LBW often results from preterm birth, intrauterine growth restriction, or both (Blencowe et al., 2019; Okwaraji et al., 2024). It also supports Indonesian evidence that preterm birth is one of the strongest correlates of LBW (Sari et al., 2025). In the Dambalo health center context, this result indicates that LBW prevention should not focus solely on weight monitoring at birth. It should also focus on preventing preterm labor through early detection of infection, premature rupture of membranes, hypertension, anemia, nutritional deficiency, and multiple pregnancy.

The multivariate model identified twin pregnancy as the dominant factor associated with LBW. Twin pregnancy increases fetal growth demand because two fetuses share maternal nutrient supply, uterine space, and placental resources. The uterus also experiences excessive distension, which increases the risk of preterm labor. Twin fetuses may gain weight similarly to singleton fetuses during earlier gestation, but growth often slows in the later trimester because placental and uterine capacity become limited. As a result, twin newborns are more often born with a birth weight below 2,500 grams. Although the bivariate p-value for twin pregnancy did not reach 0.05, the multivariate result showed a significant association. This pattern suggests that the effect of twin pregnancy became clearer after the model adjusted for other variables. Health workers should treat twin pregnancy as a high-priority risk marker for LBW and should provide closer antenatal monitoring, nutritional counseling, referral planning, and birth preparedness.

Anemia remained clinically important in the model, although it did not meet the conventional statistical significance threshold. This distinction matters. A non-significant p-value does not prove that anemia has no effect. It may reflect a small sample size, incomplete hemoglobin documentation, limited variation in anemia severity, or confounding by gestational age and nutrition. Biologically, anemia can reduce oxygen transport to the placenta and fetus. Iron deficiency anemia may impair maternal work capacity, increase fatigue, and reduce fetal oxygen supply. Previous evidence indicates that maternal hemoglobin concentration is associated with birth weight, LBW, and small-for-gestational-age risk (Garzon et al., 2020; Liu et al., 2022). Therefore, local programs should not ignore anemia only because the p-value in this dataset was above 0.05. Iron and folic acid supplementation, hemoglobin screening, dietary counseling, and adherence monitoring should remain core components of LBW prevention.

Maternal nutritional status did not show a significant relationship with LBW in this study. This result should be interpreted cautiously. Nutritional status in routine records is often recorded as mid-upper arm circumference or a chronic energy deficiency classification. These indicators are useful for screening, but they may not capture dietary diversity, micronutrient adequacy, gestational weight gain, food insecurity, infection, or household support. Studies from other research show that maternal nutritional status during pregnancy contributes to newborn birth weight (Hasanah & Ilmiah, 2026; Mohamed et al., 2022). Nutrition interventions for pregnant women with chronic energy deficiency also aim to reduce adverse outcomes such as preterm birth and LBW (Aini et al., 2023; Novelia et al., 2024). The lack of statistical significance in this study may indicate measurement limitations rather than biological irrelevance.

Maternal age also did not show a significant association with LBW. The original theory suggests that age below 20 years and above 35 years increases pregnancy risk. Adolescents may still require nutrients for their own growth, while older pregnant women may have a higher risk of chronic disease and reduced reproductive function. However, age effects often depend on the distribution of respondents. If most women are within the low-risk reproductive age range, statistical analysis may not detect an association. The same condition may explain why parity was not significant. High-risk parity may increase LBW by reducing uterine reserve and recurrent maternal nutrient depletion, but this effect may not be evident when most mothers have low-risk parity or when antenatal care detects complications early. This finding means that age and parity should still be screened in antenatal care, but they should not stand alone as the only basis for risk prediction.

Pregnancy spacing was not significantly associated with LBW in this dataset. Short spacing can reduce maternal recovery time, deplete nutritional reserves, and increase the likelihood of adverse birth outcomes. However, the effect can vary based on breastfeeding status, maternal nutrition, contraceptive use, socioeconomic condition, and antenatal care quality. Routine records often document pregnancy spacing in broad categories, which may reduce the ability to detect a dose-response relationship. Health workers should continue family planning counseling after delivery because pregnancy spacing remains relevant for maternal recovery and future fetal growth. The result should be used to improve record completeness rather than to remove pregnancy spacing from risk screening.

Chronic disease or preeclampsia history also did not show a significant association with LBW in this study. Preeclampsia can reduce uteroplacental perfusion, cause placental ischemia, and restrict fetal growth. It can also lead to medically indicated preterm birth. The lack of statistical association may result from a small number of documented chronic disease cases, under-recording, referral of severe cases to hospitals, or the broad grouping of chronic diseases. From another research evidence on preeclampsia and premature incidence supports the biological connection between hypertensive disorders and adverse pregnancy outcomes (Komariah et al., 2023).

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Therefore, blood pressure monitoring, proteinuria screening, danger-sign education, and timely referral remain essential in primary care.

The results have practical implications for Dambalo. First, the public health center should strengthen the early identification of twin pregnancy. When a twin pregnancy is suspected, midwives should ensure complete antenatal visits, monitor maternal weight gain and anemia, assess fetal growth, and prepare a referral before complications appear. Second, anemia control should become a routine priority even when local analysis does not show statistical significance. Third, health workers should integrate LBW prevention into antenatal class activities. Research on pregnancy classes shows that structured maternal education can improve pregnant women's knowledge (Novelia et al., 2024). Improved knowledge may support adherence to iron tablets, nutrition advice, recognition of danger signs, and timely referral.

Family and community support also matter. In agricultural and semi-rural communities, pregnant women may face heavy workload, limited transport, variable food access, and delayed care-seeking. The literature emphasizes family support, family communication, health awareness, and nutrition behavior as important components of health promotion (Kurniyawan et al., 2023; Shofa et al., 2024). Although this study did not directly measure family support, the findings can inform future programs. Public health centers can involve husbands, family members, cadres, and community leaders in pregnancy risk education. This approach can help mothers attend antenatal care, consume iron tablets, maintain nutritional intake, reduce physical overload, and follow referral advice when a twin pregnancy or preterm risk appears.

This study has limitations. It used secondary records, so it depended on the completeness of the documentation. Some variables that may influence LBW, such as maternal height, pre-pregnancy body mass index, gestational weight gain, smoking exposure, pesticide exposure, dietary diversity, household income, psychological stress, quality of antenatal care, and exact referral pathway, were not available. The sample size also limited statistical power. For this reason, the findings should guide local program improvement but should not be generalized beyond the study setting without caution. Future studies should use a larger sample, include non-LBW controls from the same population, record odds ratios and confidence intervals, measure antenatal care quality, and include social and environmental factors. Despite these limitations, this study provides useful local evidence that twin pregnancy, gestational age, and anemia control deserve priority in LBW prevention at the primary health-care level.

CONCLUSION

This study found that gestational age was associated with LBW in bivariate analysis, and twin pregnancy was the dominant factor in multivariate analysis. Anemia remained clinically important, although it did not meet the conventional statistical significance threshold in the final model. The Dambalo Public Health Center should strengthen early detection of twin pregnancy, preterm birth risk, anemia, and poor nutritional status during antenatal care. Midwives should provide focused counseling, monitor high-risk pregnancies more closely, involve family members, and prepare referral pathways before delivery. Future research should use larger datasets and include variables on antenatal care quality, maternal diet, environmental exposure, and family support.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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