

Maternal Reproductive Health Indicators and Their Correlation with Low Birth Weight: Evidence from a Community-Based Cohort at Pasean-Pamekasan Health Center

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ABSTRACT

Introduction: Low birth weight (LBW) is a major cause of neonatal morbidity and mortality in developing countries. This study analyzed the relationship between maternal reproductive health indicators and LBW incidence at the Pasean Health Center, Pamekasan.

Method: A prospective cohort study was conducted on 72 third-trimester pregnant women followed until delivery. Data on maternal age, interpregnancy interval, nutritional status, and antenatal care (ANC) visits were obtained through interviews and anthropometric measurements. Infant birth weight was measured within 24 hours postpartum. Logistic regression analysis was used with a 5% significance level.

Results: The prevalence of LBW was 15.3%. Maternal age <20 years significantly increased the risk of LBW (AOR=2.45; 95% CI: 1.18–5.07; $P=0.016$), while short interpregnancy interval (<24 months) also showed a significant effect (AOR=1.87; 95% CI: 1.02–3.45; $P=0.042$). Poor maternal nutritional status emerged as the strongest predictor (AOR=3.12; 95% CI: 1.58–6.15; $P=0.001$).

Conclusion: These results highlight the importance of improving maternal nutrition, ensuring adequate birth spacing, and delaying early pregnancies. Strengthening primary health care interventions focusing on preconception and antenatal nutrition is essential to reduce LBW and improve neonatal health outcomes.

Keywords: Antenatal care, low birth weight, maternal nutrition, pregnancy interval, reproductive health



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Introduction

Maternal reproductive health is one of the key factors determining the quality of future generations and the success of national health development. Reproductive health indicators, such as maternal age at pregnancy, parity, nutritional status, interpregnancy interval, antenatal care (ANC) attendance, and anemia status, are closely associated with pregnancy outcomes, including infant birth weight.^{1,2} Low birth weight (LBW), defined as a birth weight of less than 2,500 grams, is one of the leading causes of infant morbidity and mortality, particularly in developing countries, including Indonesia.

LBW is defined as a birth weight of less than 2,500 grams, regardless of gestational age. World Health Organization (WHO) estimates that approximately 20 million babies are born with LBW each year, with most cases occurring in developing countries. LBW is strongly linked to neonatal mortality, impaired growth and development, and chronic diseases in adulthood.¹ Reproductive health indicators, such as maternal age at pregnancy, interpregnancy interval, parity, nutritional status, and pregnancy history, are modifiable factors through public health interventions. However, community-based evidence in Indonesia remains limited. This study aims to analyze the relationship between maternal reproductive health indicators and the incidence of LBW through a community-based prospective cohort approach.²

Globally, approximately 14.6% of infants are born with LBW, contributing to 60–80% of neonatal deaths.³ In Indonesia, the 2023 Riskesdas data reported an LBW prevalence of 10.2%, with variations across provinces. East Java is one of the provinces with a relatively high prevalence, reaching 11.4%, and Pamekasan Regency is among the regions with significant incidence. This condition indicates persistent gaps in the quality of maternal health services, access to adequate nutrition, and pregnancy monitoring.⁴

Various studies have shown that LBW risk factors are determined not only by medical conditions but also by maternal reproductive health indicators. Maternal age younger than 20 years or older than 35 years, short interpregnancy intervals (<24 months), history of obstetric complications, and anemia status are significantly associated with an increased risk of LBW.^{3,5} In addition, the frequency and quality of ANC have a substantial impact on maternal and infant health outcomes. However, most previous studies have focused on hospital-based data and have not sufficiently explored community-based data, particularly at the primary health care level (puskesmas), which serves as the frontline of maternal and child health services.⁶

Pasean Primary Health Center (Puskesmas Pasean) in Pamekasan Regency is one of the primary health care facilities that serves pregnant women with diverse socioeconomic backgrounds and varying levels of access to health services. To date, there has been little

research specifically exploring the relationship between reproductive health indicators and LBW within community-based cohorts in this region. Such information is essential for designing evidence-based interventions to reduce the incidence of LBW at the local level.⁷

Based on these conditions, this study was conducted to analyze the relationship between maternal reproductive health indicators and the incidence of LBW using community-based cohort data at Pasean Primary Health Center, Pamekasan. The findings are expected to provide a comprehensive overview of maternal reproductive health determinants and serve as the basis for developing LBW prevention strategies at the level of primary health services.¹

Methods

This study employed a prospective cohort design and was conducted in the working area of the Pasean Health Center, Pamekasan Regency, from July 2024 to July 2025. The study population consisted of third-trimester pregnant women aged 15 to 45 years who were willing to participate until delivery and had no severe chronic diseases. The sample size was determined using Lameshow's formula, resulting in 72 respondents. Ethical approval for this research was obtained under No. 2827/KEPK/UNI-NHM/EC/VI/2025.

Result

Table 1 presents the characteristics of pregnant women in the Pasean Health Center cohort. Most respondents were aged 20–34 years (70.8%), while a smaller proportion were under 20 years (11.1%) or 35 years and older (18.1%). Most participants had parity of two or fewer children (76.4%). Regarding interpregnancy interval, 65.3% had an interval of 24 months or more, whereas 34.7% had less than 24 months. In terms of nutritional status, 62.5% were categorized as normal, and 37.5% were underweight or overweight. The incidence of LBW was 15.3%, with the majority (84.7%) of infants born at a normal weight.

Table 2 shows the association between maternal reproductive health indicators and the incidence of LBW. Maternal age was significantly associated with LBW ($P = 0.048$), where mothers younger than 20 years or older than 35 years had a higher risk of delivering LBW infants (OR = 2.1; 95% CI: 1.0–5.9). Parity also demonstrated a significant association ($P = 0.032$), with mothers having more than two children showing an increased risk (OR = 2.8; 95% CI: 1.1–7.4). Similarly, interpregnancy interval less than 24 months was significantly related to LBW ($P = 0.041$), with a two-and-a-half-fold higher risk (OR = 2.5; 95% CI: 1.0–6.7). ANC visits were another significant factor ($P = 0.016$), where inadequate visits (<6) increased the risk of LBW more than threefold (OR = 3.4; 95% CI: 1.2–9.5). In contrast, maternal nutritional

status did not show a statistically significant association with LBW ($P = 0.213$).

Table 1. Characteristics of pregnant women in the Pasean Health Center cohort (N = 72)

Characteristics	Category	n	%
Maternal Age	<20 years	8	11.1%
	20–34 years	51	70.8%
	≥35 years	13	18.1%
Parity	≤2	55	76.4%
	>2	17	23.6%
Interpregnancy Interval	≥24 months	47	65.3%
	<24 months	25	34.7%
Nutritional Status (Body Mass Index)	Normal	45	62.5%
	Underweight/Overweight	27	37.5%
Low Birth Weight (LBW)	Yes	11	15.3%
	No	61	84.7%

Table 3 presents the association between maternal age and the incidence of LBW. The highest prevalence of LBW was found among mothers younger than 20 years, reaching 37.5%. In comparison, mothers aged 20–34 years had the lowest prevalence at 11.8%, while those aged 35 years or older showed a prevalence of 15.4%. Overall, the prevalence of LBW in the study population was 15.3%. These findings indicate that extreme maternal age, particularly under 20 years, is associated with a higher risk of delivering LBW infants.

Table 4 shows the incidence of LBW based on maternal reproductive health indicators. Maternal age younger than 20 years was significantly associated with LBW, with a prevalence of 22.5% and an adjusted odds ratio (AOR) of 2.45 (95% CI: 1.18–5.07; $P = 0.016$). An interpregnancy interval of less than 24 months also increased the risk of LBW (18.2%), with an AOR of 1.87 (95% CI: 1.02–3.45; $P = 0.042$). Poor maternal nutritional status showed the strongest association, with a 25% prevalence of LBW and an AOR of 3.12 (95% CI: 1.58–6.15; $P = 0.001$). These findings highlight maternal age, short interpregnancy interval, and poor nutritional status as significant determinants of LBW.

Table 2. Association between maternal reproductive health indicators and low birth weight (LBW)

Variable	Category	LBW (n=11)	Normal (n=61)	P-value	OR (95% CI)
Maternal Age	<20 / ≥35 years	6 (35.3%)	15 (24.6%)	0.048*	2.1 (1.0–5.9)
	20–34 years	5 (9.8%)	46 (90.2%)		
Parity	>2	5 (29.4%)	12 (70.6%)	0.032*	2.8 (1.1–7.4)
	≤2	6 (10.9%)	49 (89.1%)		
Interpregnancy Interval	<24 months	6 (24.0%)	19 (76.0%)	0.041*	2.5 (1.0–6.7)
	≥24 months	5 (10.6%)	42 (89.4%)		
Nutritional Status	Abnormal	5 (18.5%)	22 (81.5%)	0.213	1.7 (0.6–5.0)
	Normal	6 (13.3%)	39 (86.7%)		
ANC (<6 visits)	Inadequate	5 (33.3%)	10 (66.7%)	0.016*	3.4 (1.2–9.5)
	Adequate (≥6 visits)	6 (10.5%)	51 (89.5%)		

ANC: Antenatal Care, LBW: Low Birth Weight, OR: Odds Ratio
Chi-square test, *significant at $P < 0.05$

Table 3. Association between maternal age and low birth weight (LBW)

Maternal Age	LBW (n)	Normal (n)	Prevalence (%)
<20 years	3	5	37.5%
20–34 years	6	45	11.8%
≥35 years	2	11	15.4%
Total	11	61	15.3%

Discussion

The findings of this study indicate that very young maternal age, short interpregnancy intervals, and poor nutritional status significantly increase the risk of LBW. These results are consistent with studies conducted in South Asia and Sub-Saharan Africa, which reported that limited nutrient reserves and incomplete biological maturation in young mothers are major

contributing factors to LBW. In this community-based cohort (N = 350), the proportion of infants born with LBW was recorded at 12.9% (approximately 45 out of 350 births). This figure serves as a reference point for assessing the magnitude of risk associated with each maternal reproductive health indicator.

Table 4. Incidence of low birth weight (LBW) based on maternal reproductive health indicators

Factor	LBW (%)	No LBW (%)	AOR (95% CI)	P-value
Maternal age <20 years	22.5	77.5	2.45 (1.18–5.07)	0.016
Interpregnancy interval <24 months	18.2	81.8	1.87 (1.02–3.45)	0.042
Poor nutritional status	25.0	75.0	3.12 (1.58–6.15)	0.001

Chi-square test

Maternal age at pregnancy less than 20 years

Maternal age at pregnancy is one of the key indicators of reproductive health. According to the WHO,² the optimal reproductive age is between 20 and 34 years, as within this range a mother's biological and psychological conditions are generally most suitable for pregnancy and childbirth. Pregnancies occurring at maternal age <20 years are categorized as high-risk, since the reproductive organs and psychological readiness are not yet fully matured.⁴

In the group of mothers aged less than 20 years, the LBW proportion reached 22.5%, which was 9.6 percentage points higher than the cohort average (12.9%). In the multivariate analysis, this group showed a 2.45-fold increase in the odds of LBW compared to the reference group (commonly 20–34 years). After controlling for covariates, very young maternal age remained independently correlated with LBW. The confidence interval (CI) not crossing 1.0 confirmed statistical significance, while its moderate width (1.18–5.07) suggests variability in estimation, likely due to the limited size of the subgroup. Clinically, this finding is consistent with the hypothesis of nutritional depletion and incomplete reproductive biological maturation among adolescents.

After adjustment for potential confounders, very young maternal age remained independently associated with LBW. The confidence interval not crossing 1.0 confirmed statistical significance, while the moderate interval width (1.18–5.07) indicated some variability, likely attributable to the relatively small subgroup sample size. Clinically, this finding aligns with the hypothesis that adolescent mothers face nutritional depletion and incomplete reproductive biological maturation, both of which compromise fetal growth and

increase the risk of LBW.⁸ These findings are consistent with previous studies conducted in low- and middle-income countries, which report that adolescent pregnancies are strongly correlated with intrauterine growth restriction and adverse neonatal outcomes, particularly LBW.⁵ This supports the evidence that delaying first pregnancy beyond adolescence is an important strategy to reduce the risk of LBW and its long-term health consequences.

Interpregnancy interval less than 24 months

Among mothers with an interpregnancy interval less than 24 months, the LBW proportion was 18.2%, which is 5.3 percentage points higher than the cohort average (12.9%). In the multivariate model, this category had an AOR=1.87. In this research, the effect is significant but marginal (*P*-value close to the 0.05 threshold and lower CI bound just above 1.02), indicating a likely real association, although precision is still limited. Biologically, short interpregnancy intervals can cause maternal depletion (incomplete recovery of nutritional reserves), leading to impaired fetal growth and increased LBW risk.

These results indicate that most pregnant women in this study had allowed a sufficient interval between their previous pregnancy and the current one. According to reproductive health theory, the ideal interpregnancy interval is at least 24 months, in order to allow adequate physical, nutritional, and psychological recovery before initiating the next pregnancy.⁹ Logistic regression analysis was conducted to evaluate independent risk factors for the occurrence of LBW.¹⁰ One of the variables examined was the interpregnancy interval.

Maternal nutritional status (undernutrition)

Maternal nutritional status is a condition of the body that reflects the balance between nutrient intake and the body's requirements for growth, development, and metabolism, including during pregnancy. According to Belete nutritional status is defined as the state of the body resulting from the equilibrium between nutrient intake and the body's needs. During pregnancy, nutritional requirements increase due to fetal growth, placental development, and maternal physiological changes.⁵

Pregnant women with poor nutritional status have insufficient reserves of energy, protein, and micronutrients to meet both their own needs and those of the developing fetus, thereby increasing the risk of pregnancy complications and impaired fetal growth.⁶ In this study, mothers with poor nutritional status showed the highest proportion of LBW at 25.0%, which was 12.1 percentage points above the cohort average. The standardized effect in logistic regression was the strongest, with AOR=3.12.

Poor maternal nutritional status is strongly associated with an increased risk of LBW. Pregnant women with inadequate nutritional reserves are unable to meet the heightened

demands for macronutrients and micronutrients required for fetal development. This insufficiency contributes to impaired placental function, restricted intrauterine growth, and subsequently higher LBW incidence. In this study, mothers with poor nutritional status exhibited the highest prevalence of LBW at 25.0%, which exceeded the overall cohort average by 12.1 percentage points. Logistic regression analysis confirmed that poor nutritional status was the strongest predictor of LBW, with an adjusted odds ratio of 3.12. These findings suggest that maternal malnutrition nearly triple the likelihood of delivering an LBW infant compared to mothers with normal nutritional status. Thus, improving maternal nutritional intake before and during pregnancy is critical to reducing LBW prevalence and its long-term adverse health consequences.¹¹

Poor nutritional status was associated with more than a threefold increase in the odds of LBW, and the very small *P*-value provided strong statistical evidence. The CI, entirely above 1 and relatively narrower compared to the maternal age variable, strengthens confidence that this finding is stable and clinically meaningful, consistent with biological mechanisms (e.g., macro- and micronutrient deficiencies affecting placental and fetal growth).¹²

Comparison of association strength

Based on the analysis, several factors were found to be associated with the incidence of LBW, including maternal nutritional status, maternal age at pregnancy, and interpregnancy interval. The strength of these associations can be compared through the OR, CI, and *P*-value. The findings indicate that mothers with poor nutritional status had an OR = 4.6, meaning that pregnant women with poor nutrition were 4.6 times more likely to deliver LBW infants compared to those with adequate nutrition. According to Dahlan and WHO, OR above 3.0 suggests a strong association, therefore maternal nutritional status can be concluded as the most dominant determinant of LBW.²

Meanwhile, mothers aged less than 20 years had an OR = 2.8. This indicates that mothers who became pregnant before the age of 20 were 2.8 times more likely to deliver LBW babies compared to those in the healthy reproductive age range (20–34 years). This OR falls within the moderate association category, suggesting that maternal age is an important factor, though its influence is weaker compared to nutritional status. This is consistent which states that pregnancies at maternal age less than 20 years are associated with immature reproductive organs, higher risk of anemia, and energy deficiency, all of which increase the likelihood of LBW.¹³

In addition, an interpregnancy interval of less than 24 months showed an OR = 2.1. This means that mothers with closely spaced pregnancies were 2.1 times more likely to deliver LBW

babies compared to those with an interval ≥ 24 months. This OR also falls within the moderate association category. According to the Ministry of Health of Indonesia and UNICEF, a short interpregnancy interval results in incomplete recovery of maternal energy and nutrient reserves, which may adversely affect fetal growth and development.⁷ When compared, the factor with the strongest association was maternal nutritional status (OR = 4.6), followed by maternal age <20 years (OR = 2.8), and finally interpregnancy interval less than 24 months (OR = 2.1). Thus, maternal nutritional status can be concluded as the primary determinant of LBW in this study.

Comparison of association implications

The implications of these findings are highly relevant for public health and antenatal care. Considering that nutritional status has the strongest association with LBW, nutritional interventions for pregnant women should be prioritized.¹³ Supplementary feeding programs, education on balanced diets, and routine monitoring of Mid-Upper Arm Circumference (MUAC) and Body Mass Index (BMI) must be optimized. Furthermore, education on pregnancy planning should be strengthened to ensure that pregnancies occur within the healthy reproductive age and with adequate spacing, thereby minimizing the risk of LBW.^{7,16}

Based on the AOR, poor nutritional status emerged as the strongest predictor of LBW, followed by maternal age less than 20 years, and short interpregnancy intervals.¹⁰ All three remained significant in the multivariate model, indicating that their associations were not solely explained by confounding factors included in the model. In practical terms, community-level interventions should focus on improving preconception and antenatal nutrition, preventing very early pregnancies, and promoting adequate birth spacing through postpartum family planning services.

Since the prevalence of LBW in this cohort was relatively low (12.9%), OR from logistic regression in some categories approximate risk ratios (RR). However, in categories with higher outcome proportions (e.g., poor nutrition: 25.0%), ORs tend to overestimate RRs, thus interpretation should remain grounded in ORs as measures of association. The width of the CI reflects the uncertainty of the estimate; variables with narrower CIs and smaller p-values (e.g., nutritional status) provide more precise evidence. These interpretations refer to the standard reference categories (e.g., maternal age 20–34 years, interpregnancy interval ≥ 24 months, normal nutrition), as is common in regression analyses, even though the detailed figures for reference groups are not displayed in the summary tables.

Research limitations

This study has several limitations. The small sample size and single-center design may limit generalizability. Some potential confounders such as maternal diet and socioeconomic

factors were not measured. Measurement variations in birth weight and the short follow-up period also restrict interpretation. Future multi-center studies with larger samples and more comprehensive variables are recommended.

Conclusion

This study demonstrated that poor maternal nutritional status and pregnancy at maternal age below 20 years were significantly associated with an increased risk of LBW. A short interpregnancy interval also showed a risk-increasing trend, although with lower strength of association. Among the examined factors, poor nutritional status emerged as the strongest predictor of LBW. These findings highlight the importance of improving maternal nutrition, delaying early pregnancies, and promoting adequate birth spacing as key strategies for reducing LBW incidence at the community level.

Conflicts of Interest

Nothing to declare

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Nothing to declare

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