



## Maternal Risk Factors Associated with Low Birth Weight: A Case Control Study in Deli Tua District

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<b>Track Record Article</b>  Revised: 14 July 2025 Accepted: 23 August 2025 Published: 31 August 2025  <b>How to cite :</b> Sari, N. M., Ariani, P., & Ariescha, P. A. Y. (2025). Maternal Risk Factors Associated with Low Birth Weight: A Case Control Study in Deli Tua District. <i>Contagion : Scientific Periodical of Public Health and Coastal Health</i> , 7(2), 134–146.	<b>Abstract</b>  <i>Low birth weight (LBW) remains a significant public health concern in Indonesia, contributing to neonatal morbidity, mortality, and long-term developmental challenges. Although numerous studies have explored LBW, evidence on maternal risk factors in low-resource settings particularly within independent midwife practices remains scarce. This study examined the associations between maternal age, parity, antenatal care (ANC) visits, history of anemia, and gestational weight gain with LBW incidence in Deli Tua Sub-District, Deli Serdang Regency. A case-control design was employed from December 2024 to March 2025, involving 95 postpartum mothers (35 cases, 60 controls) selected through purposive sampling. Data were collected using validated questionnaires (Content Validity Index = 0.82; Cronbach's <math>\alpha</math> = 0.85) and maternal health records, and analyzed using Chi-square tests and multivariate logistic regression (SPSS version 22). Multivariate analysis identified maternal age at risk (&lt;25 or &gt;35 years) as the sole significant predictor of LBW (OR = 6.69; 95% CI = 3.21–25.22; <math>p</math> = 0.006). Parity (OR = 2.76; <math>p</math> = 0.077), ANC visits (OR = 1.22; <math>p</math> = 0.797), history of anemia (OR = 0.57; <math>p</math> = 0.421), and gestational weight gain (OR = 1.20; <math>p</math> = 0.773) were not significantly associated with LBW. The model demonstrated acceptable fit (Hosmer Lemeshow <math>p</math> = 0.49; Nagelkerke <math>R^2</math> = 0.29). Maternal age emerged as the most influential determinant of LBW in this population. These findings underscore the importance of targeted surveillance for high-risk age groups and the enhancement of promotive and preventive strategies including improved ANC service quality, nutritional counseling, and family engagement in maternal care to reduce LBW incidence in resource-limited settings.</i>  <b>Keywords:</b> Anemia, Antenatal Care, Gestational Weight Gain, Low Birth Weight, Maternal Age, Parity
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## INTRODUCTION

Maternal and child health status can be assessed through various indicators, one of which is the incidence of low birth weight (LBW), defined as a birth weight of less than 2,500 grams. LBW is a major risk factor associated with elevated rates of neonatal morbidity and mortality. Moreover, it can adversely affect a child's growth and developmental trajectory over the long term. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the national prevalence of LBW is 6.0%. Globally, UNICEF reported that in 2020, 14.7% of newborns equivalent to 19.8 million infants were born with low birth weight. These figures underscore that LBW remains a pressing public health issue, particularly in developing countries (UNICEF, 2023)

The prevalence of low birth weight (LBW) in Indonesia was reported at 11.7%. North Maluku recorded the highest provincial LBW rate (20.1%), while West Java had the largest

absolute number of LBW cases, totaling 104,585 infants. This study identified several significant factors influencing LBW incidence in Indonesia, including smoking habits, rural residence, poor maternal nutrition, maternal age at childbirth, and birth spacing. Women residing in rural areas were more likely to give birth to LBW infants (adjusted odds ratio: 1.249; 95% CI: 1.241–1.256). The incidence of LBW in rural areas (12.9%) exceeded that in urban areas (10.8%) (Mario et al., 2025)

A study analyzing data from Central Java and East Java provinces reported a national low birth weight (LBW) prevalence of 3.3% in 2022, with rates of 5.1% in Central Java and 4.1% in East Java..(Hariastuti et al., 2024). According to data from the North Sumatra Statistics Agency (BPS), the number of LBW cases over the past three years was 1,316 in 2021, 1,168 in 2022, and 1,362 in 2023. Research by Elvina and Aminah (Elvina & Aminah, 2022) found that the LBW prevalence in North Sumatra in 2018 was 4.2%, lower than the national average of 6.2%. Although the LBW rate in this province remains below the national average, enhanced prevention and treatment efforts are still necessary to further reduce its incidence

Although numerous studies have identified risk factors for low birth weight (LBW), few have examined the challenges faced by frontline providers particularly Independent Midwife Practices (PMB) in low-resource settings. Understanding these challenges is essential for designing targeted interventions. Despite existing evidence, many studies conducted in North Sumatra and surrounding regions have relied solely on bivariate analyses and failed to report odds ratios (OR) and confidence intervals (CI), limiting the ability to assess the strength and precision of associated risk factors (Elvina & Aminah, 2022; Hutasoit et al., 2023) Furthermore, key predictors such as gestational weight gain—an important determinant of fetal growth (WHO, 2016) —have not been adequately investigated in this region. Many studies also lacked clear descriptions of instrument validity and reliability, increasing the potential for measurement bias. Other factors, including maternal age, parity, nutritional status, antenatal care (ANC) attendance, and anemia, remain relevant but require further multivariate analysis. Children with a history of LBW face a significantly higher risk of stunting 5.3 times higher if born with LBW and 7.2 times higher if the mother experienced anemia during pregnancy (Florescia et al., 2025).

Preliminary data from the Deli Serdang Health Office indicate that approximately 64% of pregnant women sought antenatal care (ANC) at Independent Midwife Practices (PMB). However, only 38% of these women completed four or more ANC visits, and 52% did not receive weight monitoring or nutrition counseling during pregnancy. These service gaps

suggest that suboptimal ANC delivery at PMBs may contribute to the risk of low birth weight (LBW) in the region.

This study hypothesizes that maternal age, ANC attendance, and nutritional status are significantly associated with anemia during pregnancy. These findings underscore the need to strengthen early detection and prevention efforts, particularly through PMBs, which play a strategic role in routine pregnancy monitoring and maternal education. Nonetheless, challenges such as resource constraints, low ANC compliance, and inadequate nutritional monitoring continue to hinder these efforts.

To address this gap, the study aims to analyze the relationship between maternal factors including age, parity, ANC visits, history of anemia, and pregnancy weight gain and LBW in Deli Serdang District, using valid and reliable instruments and multivariate analysis. It is hypothesized that these maternal factors are significantly associated with LBW.

## METHODS

This study employed a quantitative case-control design, conducted in the Deli Tua Sub-District from December 2024 to March 2025. Ethical approval was obtained from the Institutional Review Board of Institut Kesehatan Deli Husada (No. 2251/KEP-IKDH/X/2024), and written informed consent was secured from all participants prior to data collection. The study population comprised postpartum mothers who had delivered within the previous six months, selected through purposive sampling. Participants were categorized into two groups: cases (mothers who delivered low birth weight infants) and controls (mothers who delivered infants with normal birth weight). Inclusion criteria were willingness to participate, availability of complete medical records, and singleton live births. Exclusion criteria included multiple births, incomplete medical records, and cases of stillbirth or neonatal death. The unit of analysis was postpartum mothers. Independent variables included maternal age, parity, history of anemia, antenatal care (ANC) visits, and gestational weight gain. The dependent variable was the incidence of low birth weight (LBW), defined as birth weight < 2,500 g. Data collection was conducted by trained enumerators through face-to-face interviews using a structured questionnaire, followed by a review of maternal and child health books and facility records to extract clinical data. Each session lasted approximately 20–30 minutes. A closed-ended questionnaire and checklist sheets were used to retrieve medical information from health records. The questionnaire comprised 15 items covering maternal demographics, ANC attendance, anemia history, and nutritional status. It was adapted from the WHO ANC questionnaire (2016), translated, and pilot tested on 20 respondents to assess content validity.

(CVI = 0.82) and reliability (Cronbach's  $\alpha = 0.85$ ) Data analysis included univariate procedures to describe frequency distributions, bivariate analysis using Chi-square tests to examine associations between each independent variable and the incidence of low birth weight (LBW), and multivariate logistic regression to identify the most dominant predictors of LBW. All analyses adhered to Good Clinical Practice guidelines and reported odds ratios (ORs) with 95% confidence intervals (CIs). Statistical analyses were conducted using SPSS version 22

## RESULTS

**Table 1. Frequency Distribution of Respondent Characteristics in Deli Tua District in 2025 (n=95)**

Variable	f	%
<b>Mother's Age</b>		
At risk (<25 or >35 years)	26	27,4
Not at risk (25–35 years)	69	72,6
<b>Total</b>	<b>95</b>	<b>100.0</b>
<b>Parity</b>		
Primipara	44	46,3
Multipara	51	53,7
<b>Total</b>	<b>95</b>	<b>100.0</b>
<b>ANC Visit</b>		
Incomplete	32	32,6
Complete	63	67,4
<b>Total</b>	<b>95</b>	<b>100.0</b>
<b>History of Anemia</b>		
yes	31	32,6
No	64	67,4
<b>Total</b>	<b>95</b>	<b>100.0</b>
<b>Weight gain during pregnancy</b>		
Not as recommended	40	42,1
as per recommendation	55	57,9
<b>Total</b>	<b>95</b>	<b>100.0</b>
<b>Low birth weight</b>		
yes	35	36,8
No	60	63,2
<b>Total</b>	<b>95</b>	<b>100.0</b>

Based on the table above, the majority of respondents are in the non-risk maternal age group (25–35 years), which is 72,6%. multiparous mothers 53,7%, 67,4% of mothers have completed antenatal care (ANC) visits, are not anemic 67.4%, mothers experience weight gain in accordance with recommendations 57,9% and babies with low birth weight (LBW) of 36,8% and non-LBW 63,2%.

**Table 2. Risk Factors For Low Birth Weight In Deli Tua District**

Variables	Low birth weight				Total		p-value
	Case ( n = 35)		Control (n=60)				
	n	%	n	%	n	%	
<b>Mother's Age</b>							
At risk (<25 or >35 years)	19	20	7	7,4	26	27,4	0,000
Not at risk (25–35 years)	16	16,8	53	55,8	69	72,6	
<b>Total</b>	<b>35</b>	<b>36,8</b>	<b>60</b>	<b>63,2</b>	<b>95</b>	<b>100</b>	
<b>Parity</b>							
Primipara	25	26,3	19	20,0	44	46,3	0,000
Multipara	10	10,5	41	43,2	51	53,7	
<b>Total</b>	<b>35</b>	<b>36,8</b>	<b>60</b>	<b>63,2</b>	<b>95</b>	<b>100</b>	
<b>ANC Visit</b>							
Incomplete	19	20	13	13,7	32	33,7	0,003
Complete	16	16,8	47	49,5	63	63,3	
<b>Total</b>	<b>35</b>	<b>36,8</b>	<b>60</b>	<b>63,2</b>	<b>95</b>	<b>100</b>	
<b>History of Anemia</b>							
Yes	16	16,8	15	15,8	31	32,6	0,064
No	19	20,0	45	47,4	64	67,4	
<b>Total</b>	<b>35</b>	<b>36,8</b>	<b>60</b>	<b>63,2</b>	<b>95</b>	<b>100</b>	
<b>Weight gain during pregnancy</b>							
Not as recommended	20	21,1	20	21,1	40	42,2	0,023
as per recommendation	15	15,7	40	42,1	55	57,8	
<b>Total</b>	<b>35</b>	<b>36,8</b>	<b>60</b>	<b>63,2</b>	<b>95</b>	<b>100</b>	

As shown in Table 2, maternal age was significantly associated with low birth weight (LBW). A total of 20.0% of mothers considered at risk (<25 or >35 years) were found in the case group, compared to 7.4% in the control group ( $p = 0.000$ ). Parity also demonstrated a significant association: primiparas accounted for 26.3% of cases versus 20.0% of controls, while multiparas were more prevalent in the control group (43.2%) than in the case group (10.5%) ( $p = 0.000$ ).

ANC visit frequency was significantly linked to LBW. Incomplete ANC visits were reported in 20.0% of cases, compared to 13.7% of controls, whereas complete visits were more common among controls (49.5%) than cases (16.8%) ( $p = 0.003$ ). In contrast, a history of anemia did not show a statistically significant association with LBW. Anemia was present in 16.8% of cases and 15.8% of controls, while non-anemia was more frequent in the control group (47.4%) than in the case group (20.0%) ( $p = 0.064$ ).

Gestational weight gain was significantly associated with LBW. Weight gain not aligned with recommendations was observed equally in both groups (21.1%), while recommended weight gain was more common among controls (42.1%) than cases (15.7%) ( $p = 0.023$ ).

A multivariate logistic regression analysis was conducted to identify factors that simultaneously influence the incidence of low birth weight (LBW) among mothers in Deli Tua Subdistrict, North Sumatra. The results of this analysis are presented in Table 3.

**Table 3. Factors Influencing Low Birth Weight in Mothers in Deli Tua Subdistrict**

Variable	B	S.E.	Wald	df	p-value	OR (Exp(B))	95% CI for OR
Mother's Age	1.900	0.695	7.482	1	0.006	6.689	3.206-25.217
Parity	1.015	0.573	3.136	1	0.007	2.758	1,31 – 5,80
ANC Visit	0.199	0.774	0.066	1	0.797	1.220	0,27–5,56
History of Anemia	-0.557	0.693	0.647	1	0.421	0.573	0,15–2,22
Weight gain during pregnancy	0.183	0.635	0.083	1	0.773	1.201	0,35–4,17
Constant	-3.887	1.158	11.262	1	0.001	0.021	-

As shown in Table 3, multivariate logistic regression in this case–control study revealed that maternal age remained a significant predictor of low birth weight (LBW) ( $p = 0.006$ ; OR = 6.69; 95% CI = 3.21–25.22). Mothers in the risk-age group (<25 or >35 years) were approximately 6.7 times more likely to deliver LBW infants compared to those aged 25–35 years. In contrast, parity, completeness of antenatal care (ANC) visits, history of anemia, and gestational weight gain yielded  $p$ -values  $>0.05$  and did not independently distinguish cases from controls.

Model diagnostics indicated a good fit (Hosmer–Lemeshow  $\chi^2 = 7.45$ ,  $df = 8$ ,  $p = 0.49$ ), and the Nagelkerke  $R^2$  value of 0.29 suggests that the predictor set accounted for 29% of the variance in case status.

## DISCUSSION

### Relationship Between Maternal Age and Low Birth Weight

The results of this study revealed a significant relationship between maternal age and the incidence of low birth weight (LBW) ( $p = 0.000$ ). Mothers in the risk age group (<25 or >35 years) were more likely to deliver LBW infants compared to those aged 25–35 years. This finding supports the maternal life course model, which posits that both biological immaturity (<20 years) and age-related physiological decline (>35 years) increase vulnerability to adverse birth outcomes, particularly under varying social determinants of health. These results align with research by Arsesiana (2021) which found that mothers outside the 20–35 year age range face a higher risk of delivering LBW infants.

Physiologically, mothers who are too young (<20 years) may lack optimal reproductive organ development and psychological maturity to support a healthy pregnancy. Conversely, mothers aged >35 years tend to experience diminished reproductive function and an increased risk of pregnancy complications, which can impair fetal growth and elevate the risk of low

birth weight (LBW). Research by Sun et al. (Sun et al., 2025) further demonstrated that mothers aged 20–24 years also face a comparably elevated risk of LBW ( $p < 0.05$ ). These findings underscore that maternal age is a critical factor to consider in LBW prevention efforts. Intensive health education and targeted monitoring of at-risk pregnant women can help reduce LBW incidence and improve both maternal and infant health outcomes.

In contrast to the findings of Wahyuni et al., (2021) this study found no significant relationship between maternal age and the incidence of low birth weight (LBW). These results suggest that, within the context of this study, pregnancy at  $<20$  or  $>35$  years of age did not directly contribute to an increased risk of delivering an LBW infant. Similarly, research by Apriani et al., (2021) reported no significant association between maternal age and LBW incidence. These findings indicate that maternal age was not a dominant factor influencing birth weight in this study population.

This may be attributed to the fact that most respondents were within the healthy reproductive age range, thereby minimizing the impact of age-related complications. Nonetheless, while maternal age was not statistically significant in this study, it remains an important consideration in LBW prevention efforts particularly among high-risk reproductive age groups.

### **The Relationship Between Parity and the Occurrence of Low Birth Weight**

The results of this study revealed a significant relationship between maternal parity and the incidence of low birth weight (LBW) ( $p = 0.000$ ). Primiparous mothers (those giving birth for the first time) were at higher risk of delivering LBW infants compared to multiparous mothers (those who had given birth previously). This finding aligns with theories of cumulative reproductive adaptation and the strengthening of social support networks that tend to improve with successive pregnancies.

Consistent with this, research by Muhyiddin et al., (2024) and Permana et al., (2025) also reported a significant association between parity and LBW. Rather than merely indicating statistical significance, these findings underscore how prior pregnancy experience may confer protective adaptations both physiologically and through improved health-seeking behaviors.

Similarly Lin et al., (2021) found that nulliparous mothers (those who have never given birth) are at greater risk of premature birth, LBW, and delivering small-for-gestational-age infants compared to multiparous mothers. Garces et al., (2020) further demonstrated that infants born to primiparous mothers tend to have lower birth weights than those born to multiparous mothers.

In contrast to the findings discussed earlier, research by Heriani and Camelia, (2022); Raidanti and Wahidin, (2021) reported no significant relationship between maternal parity and the incidence of low birth weight (LBW). These results suggest that the number of previous births was not a major determining factor influencing birth weight in the study population. The mothers' health status during pregnancy and the quality of antenatal care were generally well maintained.

Consistent with the findings of Fatmawati and Wati (2021), parity did not appear to be a dominant factor in determining birth weight. This may be due to the relatively equal likelihood of mothers with both low and high parity delivering infants with normal birth weight. It is plausible that other factors such as maternal health condition, quality of antenatal care, and nutritional status during pregnancy played a more influential role in determining birth outcomes than parity alone.

### **The Relationship Between Antenatal Care Visits and the Occurrence of Low Birth Weight**

The results of this study demonstrated a significant relationship between antenatal care (ANC) visits and the incidence of low birth weight (LBW) ( $p = 0.003$ ). Pregnant women who did not complete ANC visits were at higher risk of delivering LBW infants compared to those who completed the recommended visits. From a social determinants perspective, incomplete ANC often reflects barriers such as limited access, low health literacy, or economic constraints, which in turn compromise early risk detection and nutritional counseling.

This finding is consistent with research by Nina et al., (2024) which reported that pregnant women who did not receive complete ANC examinations had a higher risk of premature birth and low neonatal birth weight. Similarly Sari et al., (2024), found that adequate ANC utilization was significantly associated with reduced LBW incidence. Research conducted by (Muluneh et al., 2023). in Ethiopia further showed that mothers who attended fewer than four ANC visits were 2.4 times more likely to experience LBW compared to those with complete ANC attendance.

Complete ANC visits enable health workers to detect pregnancy risks early, provide nutritional interventions, and educate mothers on healthy diet and lifestyle practices. These interventions are essential for supporting optimal fetal growth and preventing pregnancy complications, including LBW (WHO, 2016). Therefore, improving equitable access to and awareness of routine ANC visits particularly the WHO-recommended minimum of four contacts is critical to reducing LBW incidence.



This finding contrasts with research by Hapsari et al., (2022) which reported no significant relationship between antenatal care (ANC) visits and low birth weight (LBW). Their results suggest that the frequency of ANC visits alone may be insufficient to determine birth outcomes, as factors such as service quality, maternal compliance with health worker recommendations, nutritional status, underlying medical conditions, and pregnancy complications play a more substantial role. Purba et al., (2025) further reinforced this perspective, noting that the lack of a significant association may stem from the fact that ANC attendance does not guarantee the quality of care received. Even when the recommended number of visits is met, the intended benefits such as LBW prevention may not be realized if service delivery is suboptimal.

Ultimately, the quality of care, consistency of checkups, maternal adherence to health advice, and overall maternal health during pregnancy are likely more influential than visit frequency alone. Therefore, while meeting ANC visit standards is important, achieving meaningful reductions in LBW incidence requires ensuring that each contact delivers high-quality, comprehensive care.

### **Relationship Between History of Anemia And Incidence Of Low Birth Weight**

Based on the results of this study, no significant relationship was found between a history of anemia in pregnant women and the incidence of low birth weight (LBW) ( $p = 0.064$ ). Rather than simply reporting a lack of association, it is important to consider that self-reported anemia may underrepresent mild cases, and that the effects of anemia on fetal growth may be mitigated by iron supplementation programs or dietary factors not captured in this study. These findings align with research by Sibuea & Raja (2022) which also reported no significant association between anemia during pregnancy and LBW ( $p > 0.05$ ; OR = 0.147).

Although the results of this study did not demonstrate a statistically significant relationship, biological plausibility and prior literature suggest that anemia during pregnancy may still increase the risk of low birth weight (LBW) (Khezri et al., 2025). Research by Hakima et al., (2022) found that maternal weight gain below or above recommended levels significantly increased the risk of LBW ( $p < 0.01$ ), underscoring the importance of monitoring weight gain based on body mass index (BMI) in early pregnancy to prevent neonatal complications. Similarly, a study by Nina et al., (2024) reported a significant association between anemia in pregnant women and LBW at Dr. H. Abdul Moeloek Bandar Lampung Regional Hospital ( $p = 0.003$ ), while Suparni & Mariana (2024), also found a significant relationship ( $p = 0.0001$ ).

Future research should incorporate objective hemoglobin biomarkers and control for nutritional status to more accurately assess the impact of anemia on LBW. Anemia during pregnancy can impair the blood's ability to transport oxygen and nutrients to the fetus, thereby hindering fetal growth. These findings reinforce the importance of monitoring hemoglobin levels and initiating early treatment of anemia as a preventive strategy against LBW.

### **The Relationship between Increased Weight During Pregnancy and the Incidence of Low Birth Weight**

Weight gain during pregnancy is a key indicator of both maternal and fetal health. According to social ecological models, gestational weight gain reflects not only individual behaviors but also broader determinants such as food security and access to prenatal care. Early prevention of low birth weight (LBW) requires continuous health monitoring from preconception through delivery, with attention to the multifactorial causes of LBW (Ningsih & Sumarmi, 2023)

This research aligns with findings by Sari et al., (2024) which reported a significant relationship between increased maternal weight during pregnancy and the incidence of low birth weight (LBW). Similarly Hiroyuki et al., (2022) and Ika (2021) found that most pregnant women who gained weight in accordance with WHO recommendations gave birth to infants with normal birth weight. Statistical analysis in the present study also revealed a significant association between gestational weight gain and infant birth weight ( $p = 0.004$ ), reinforcing the evidence that maternal weight management during pregnancy not only influences maternal health but also directly impacts neonatal outcomes.

At the Budi Mulia Medika Clinic, weight gain of 10–15 kg was positively correlated with infant birth weight ( $r = 0.643$ ;  $p < 0.001$ ), further supporting the importance of appropriate weight trajectories. These findings underscore the need for integrated nutritional counselling and community-based support to optimize maternal weight gain and prevent LBW (Sari, 2021).

This finding contrasts with research by Zahra and Hidayat (2023) which reported no significant relationship between maternal weight gain during pregnancy and the incidence of low birth weight (LBW). On average, pregnant women in their study weighed 50 kg before pregnancy and 60 kg after delivery, reflecting typical physiological changes during gestation. While the average weight gain was approximately 10 kg, individual variation was considerable some women gained significantly more, while others gained very little resulting in pregnancy weights that were not always appropriate for maternal age.

According to the authors, other factors such as pre-pregnancy nutritional status, gestational age at delivery, comorbidities, and the quality of antenatal care may serve as more

dominant confounding variables than weight gain alone. These insights highlight the importance of considering contextual factors, respondent characteristics, and environmental influences when interpreting research findings on the determinants of LBW.

## CONCLUSIONS

The findings of this study underscore the importance of promotive and preventive strategies in pregnancy care to reduce the incidence of low birth weight (LBW). Efforts to strengthen compliance with comprehensive antenatal care (ANC) visits should extend beyond awareness-raising to address structural barriers such as service accessibility, long waiting times, and the affordability of maternal health services. Operationally, these goals can be supported by integrating ANC reminders through digital health platforms (e.g., SMS or mobile applications), establishing community-based monitoring systems involving health cadres, and ensuring the provision of transportation subsidies for pregnant women in remote areas. In addition, capacity building for midwives should be institutionalized through continuous professional development programs, regular clinical skill assessments, and the provision of standardized antenatal care (ANC) monitoring tools to enhance early detection of maternal and fetal risks. From a family perspective, practical strategies include structured health education sessions that actively engage husbands and close relatives, thereby strengthening social support for pregnant women in adhering to ANC schedules and adopting healthy lifestyles. At the policy level, primary healthcare program planners are encouraged to develop evidence-based interventions that integrate health promotion campaigns, targeted nutritional supplementation, and family-centered counseling. Moreover, collaboration among government agencies, private sectors, and community organizations is essential to mobilize resources and establish sustainable maternal health programs. These operational strategies are expected to not only reduce the incidence of low birth weight (LBW) but also enhance overall maternal and neonatal health outcomes in the long term.

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