

Association Between Antenatal Care and the Incidence of Low Birth Weight (LBW) in Palu City

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ARTICLE INFO	ABSTRACT
Article History: Received : 6 May 2026 Accepted : 25 May 2026 Published online	Low Birth Weight (LBW) remains one of the major perinatal health problems, particularly in developing countries. LBW is defined as infants born with a birth weight of less than 2500 grams regardless of gestational age. One of the important efforts in preventing LBW is through antenatal care (ANC) services. Antenatal care is a health service provided regularly to pregnant women to monitor pregnancy conditions, enable early detection of risk factors, and prevent complications during pregnancy and childbirth. This study aimed to determine the relationship between antenatal care and the incidence of Low Birth Weight (LBW) in Palu City. The research employed an analytical method with a case-control approach. The case group consisted of mothers who delivered LBW infants, while the control group consisted of mothers who delivered infants with normal birth weight. Risk factor assessment was conducted retrospectively. The results showed that there was a statistically significant relationship between antenatal care and the incidence of LBW in Palu City. Mothers who did not receive adequate ANC had a higher risk of delivering LBW infants compared to those who received adequate ANC.
Keywords: Antenatal Care; Low Birth Weight; Palu City. This is an open access article under the  CC-BY-SA license.	

INTRODUCTION

Low birth weight (LBW) is defined as a newborn weighing less than 2,500 grams at birth, regardless of gestational age. This condition is associated with an increased risk of neonatal morbidity and mortality and has long-term consequences for child growth and development, including learning difficulties, impaired cognitive function, and an increased risk of health problems later in life.^{1,2}

The World Health Organization (WHO) reports that approximately 15–20% of infants worldwide are born with LBW, with more than 96% of these cases occurring in developing countries. It is estimated that over 20 million infants are born with low birth weight each year.³

In Indonesia, according to the 2018 Basic Health Research (Riskesdas), the prevalence of LBW was 6.2%, representing an increase from 5.7% in 2013 and 5.4% in 2007 (Riskesdas, 2022). These data indicate that LBW remains a significant public health concern requiring serious attention.⁴

In Central Sulawesi Province, LBW remains one of the leading causes of neonatal mortality. Data from the Central Sulawesi Provincial Health Office showed that in 2020, LBW accounted for approximately 33.90% of neonatal deaths, exceeding other causes such as birth asphyxia and congenital anomalies. In Palu City, according to reports from the Palu City Health Office, there were 222 cases of LBW in 2020, which decreased to 152 cases in 2021. Despite this decline, the number of cases indicates that the incidence of LBW in Palu City remains relatively high and continues to require sustained preventive efforts.³

One of the key factors in the prevention of low birth weight (LBW) is the provision of adequate antenatal care (ANC). Antenatal care refers to the routine healthcare services provided to pregnant women to monitor the progress of pregnancy, facilitate the early detection of risk factors, and prevent complications during pregnancy and childbirth.⁴ ANC visits also serve as an opportunity for interaction between healthcare providers, particularly midwives, and pregnant women through information exchange, observation, physical and general examinations,

as well as comprehensive assessments of maternal health and well-being throughout pregnancy.⁵

Based on the foregoing, this study was conducted to examine the association between antenatal care and the incidence of low birth weight in Palu City. The findings of this study are expected to provide scientific evidence to support efforts aimed at improving the quality of antenatal care services and to serve as a reference for policymakers and healthcare professionals in developing strategies to reduce the incidence of low birth weight in Palu City.

The objective of this study was to determine the association between antenatal care and the incidence of low birth weight (LBW) in Palu City.

MATERIAL AND METHOD

Study Design

This study employed an analytical case-control design. A case-control study is an observational analytical approach in which individuals with the outcome of interest (cases) are compared with individuals without the outcome (controls). Potential risk factors are then assessed retrospectively to determine whether the cases and controls had been exposed to the factors under investigation.

Setting

The study was conducted in 13 community health centers (Puskesmas) in Palu City, Indonesia. Data collection was centralized at the Palu City Health Office, located at Jl. Balai Kota Utara No. 2, Tanamodindi Village, Mantikulore District, Palu City, Central Sulawesi, Indonesia.

Population and Sample

The study population consisted of all women who delivered infants in Palu City in 2024, based on data obtained from the Palu City Health Office, totaling 7,294 deliveries. The sample size was determined using a case-to-control ratio of 1:2, meaning that each case was matched with two controls. All mothers who delivered infants with low birth weight (LBW) and met the inclusion criteria were included as the case group, comprising 30 participants. Accordingly, the control group consisted of 60 mothers who delivered infants without LBW, resulting in a

total sample of 90 participants. The study was conducted from October 1, 2024, to April 30, 2025.

Data Collection

Participants were selected using a purposive sampling technique from the 13 community health centers in Palu City. Data were obtained from maternal and neonatal health records maintained by the Palu City Health Office.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 25.0. Descriptive statistics were used to summarize participants' characteristics, while inferential statistical analyses were performed to examine the association between antenatal care and the incidence of low birth weight (LBW). A p-value of < 0.05 was considered statistically significant.

RESULTS

The association between antenatal care (ANC) and low birth weight (LBW) was evaluated using a composite measure of ANC that incorporated all essential components of antenatal care, including the standard of care, frequency of ANC visits, place of service, and type of healthcare provider, as presented below:

Table 1. Association Between ANC and Low Birth Weight in Palu City

Antenatal Care	Low Birth Weight Incident				Total		p-Value	POR
	LBW		Normal		n	%		
	n	%	n	%				
Complete	22	71.0	9	29.0	31	100	0,002	6.417
Incomplete	8	13.6	51	86.4	59	100		
Total	30	33.3	60	66.7	90	100		

As shown in Table 1, the majority of mothers who did not receive complete antenatal care (ANC) delivered infants with low birth weight (LBW), accounting for 22 (71.0%) of the participants, while only 9 (29.0%) mothers who did not receive complete ANC delivered infants with normal birth weight. Among mothers who

received complete ANC, 8 (13.6%) still delivered infants with LBW, whereas the majority, 51 (86.4%), delivered infants with normal birth weight.

These findings demonstrate a clear difference in the proportion of LBW between mothers who received complete ANC and those who did not. Complete ANC included adherence to the recommended standards of antenatal care, regular ANC visits to healthcare facilities, and consultations with qualified healthcare providers throughout pregnancy.

DISCUSSION

Overall, this study demonstrated a significant association between antenatal care (ANC) and the incidence of low birth weight (LBW) in Palu City. These findings are consistent with the established concept that ANC is a comprehensive maternal healthcare service aimed at monitoring pregnancy, facilitating the early detection of risk factors, and providing appropriate interventions to ensure safe pregnancy and childbirth for both the mother and the fetus.⁴

Furthermore, ANC is designed to maintain maternal health throughout pregnancy and the postpartum period while promoting the delivery of a healthy infant. It also seeks to optimize the mother's physical and psychological well-being, thereby contributing to improved maternal and neonatal health outcomes.^{6,7}

Based on the study findings, the ANC components that contributed most substantially to the occurrence of low birth weight (LBW) were the quality of ANC services (ANC standards of care), the frequency of ANC visits, and the place where ANC services were provided. Conceptually, adherence to ANC standards reflects the quality of care received by pregnant women, as it encompasses a comprehensive package of examinations and interventions aimed at monitoring maternal and fetal well-being and preventing pregnancy-related complications. These services include maternal weight measurement, blood pressure assessment, fundal height measurement, iron (Fe) supplementation, tetanus toxoid (TT) immunization, hemoglobin testing, health counseling, and referral planning when pregnancy-related risk factors are identified.⁸

The completeness of these ANC components is essential because inadequate implementation or failure to provide recommended examinations and interventions may delay the detection and management of maternal conditions that contribute to LBW, such as maternal anemia and poor nutritional status. Theoretically, maternal anemia impairs hemoglobin synthesis, reducing oxygen and nutrient delivery to the fetus, which may subsequently restrict fetal growth and increase the risk of delivering an infant with low birth weight.² Likewise, maternal undernutrition during pregnancy can lead to intrauterine growth restriction (IUGR), thereby increasing the likelihood of LBW.²

From the perspective of service utilization, the frequency of ANC visits serves as an important indicator of the continuity of pregnancy monitoring. Previous minimum service standards recommended that pregnant women receive antenatal care at least four times during pregnancy, with visits distributed across each trimester.⁴ More recent national guidelines recommend a minimum of six ANC visits, including at least two examinations conducted by a physician, one during the first trimester and another during the third trimester.

Regular ANC visits enable pregnant women to receive continuous maternal and fetal monitoring, timely health education, and structured counseling that enhance birth preparedness and promote effective self-care practices.⁹ Consequently, more frequent and consistent ANC attendance increases the likelihood of early identification and timely management of pregnancy-related risk factors, thereby reducing the risk of delivering an infant with low birth weight (LBW).¹⁰

Furthermore, the place where ANC services are provided plays a crucial role in determining the accessibility and comprehensiveness of care received by pregnant women. Ideally, antenatal care should be delivered through direct contact between pregnant women and healthcare providers at healthcare facilities, where more comprehensive and higher-quality services can be provided. These services include clinical examinations, laboratory investigations when indicated, health counseling, and appropriate referral mechanisms for managing pregnancy-related complications.⁴

When pregnant women do not attend ANC visits at healthcare facilities, maternal and fetal monitoring may be inadequate, reducing opportunities for the early detection and timely management of pregnancy-related complications. Consequently, the risk of adverse birth outcomes, including low birth weight (LBW), is likely to increase.¹⁰

The findings of this study reinforce the importance of optimal antenatal care (ANC), both in terms of service quality and utilization, as a protective factor against low birth weight (LBW). These results are consistent with previous studies demonstrating a significant association between ANC and the occurrence of LBW.^{1,5,9} They also support the view that adequate utilization and frequency of ANC are important determinants of LBW, as regular antenatal visits enhance maternal and fetal surveillance, facilitate the early identification of pregnancy-related risk factors, and enable timely clinical intervention.⁸

Improving the quality of ANC services at healthcare facilities—particularly through adherence to recommended standards of care, strengthening routine pregnancy monitoring in accordance with national guidelines, and expanding access to comprehensive ANC services—represents a key public health strategy for reducing the incidence of low birth weight (LBW) in Palu City.⁴

CONCLUSION AND RECOMMENDATION

Conclusion

This study demonstrated a statistically significant association between antenatal care (ANC) and the incidence of low birth weight (LBW) in Palu City. Mothers who did not receive optimal ANC services were at a higher risk of delivering infants with LBW than those who received adequate and comprehensive antenatal care.

Overall, optimal antenatal care serves as a protective factor against the occurrence of LBW. Therefore, improving the quality, accessibility, and continuity of ANC services should be considered a key strategy for preventing low

birth weight and improving maternal and neonatal health outcomes in Palu City.

Recommendation

1. For pregnant women and the community, it is recommended that available antenatal care (ANC) services provided by the government be utilized optimally to ensure regular pregnancy monitoring and the early detection of potential maternal and fetal health problems.
2. For healthcare facilities, efforts should be strengthened to improve health promotion and community education regarding the importance of comprehensive and timely ANC, thereby encouraging greater utilization of antenatal services among pregnant women.
3. For the government and the Palu City Health Office, promotive and preventive maternal health programs should be reinforced by enhancing the accessibility, quality, and coverage of ANC services across all areas of Palu City.
4. For future researchers, studies should incorporate appropriate control of potential confounding variables, including maternal nutritional status, anemia, chronic diseases, parity, and interpregnancy interval, to provide a more comprehensive understanding of factors associated with low birth weight (LBW).

AUTHOR CONTRIBUTIONS

Conceptualization, H.P.A, M.Z., N.A.A.; Methodology, H.P.A.; Validation, M.Z., N.A.A.; Formal Analysis, H.P.A.; Investigation, H.P.A., Resources, H.P.A.; Data Curation, H.P.A.; Writing-Original Draft Preparation, H.P.A., M.Z. and N.A.A.; Visualization, H.P.A. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The Author declares no Conflicts of Interest

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