

Association Between Maternal Nutritional Status During Pregnancy and Infant Birth Weight: A Cross-Sectional Study

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ABSTRACT

Background: Maternal nutritional status during pregnancy plays a fundamental role in fetal growth and is a major determinant of infant birth weight. Poor maternal nutrition increases the risk of low birth weight (LBW), which remains a significant public health concern due to its association with neonatal morbidity, mortality, impaired growth, and long-term health complications. Understanding the relationship between maternal nutritional status and birth weight is essential for strengthening maternal and child health interventions.

Research Objective: This study aimed to determine the association between maternal nutritional status during pregnancy and infant birth weight in the working area of the Tamalanrea Community Health Center, Makassar.

Methods: A quantitative study with a cross-sectional design was conducted in July 2025. The study included 25 mothers selected through purposive sampling. Secondary data were obtained from maternal and child health records and medical records at the Tamalanrea Community Health Center. Maternal nutritional status was categorized as good or poor, while infant birth weight was classified as normal birth weight or low birth weight. Descriptive statistics were used for univariate analysis, and the Chi-square test was performed to assess the association between variables at a significance level of $p < 0.05$.

Results: Among the respondents, 60.0% had good nutritional status, while 40.0% had poor nutritional status. Most infants (68.0%) were born with normal birth weight, whereas 32.0% had low birth weight. The Chi-square analysis revealed a statistically significant association between maternal nutritional status and infant birth weight ($p = 0.021$). Mothers with poor nutritional status were more likely to deliver low birth weight infants than mothers with adequate nutritional status.

Conclusion: Maternal nutritional status during pregnancy is significantly associated with infant birth weight. Strengthening nutritional screening, nutrition education, and routine antenatal care is essential to improve maternal nutritional status and reduce the incidence of low birth weight.

Keywords: Maternal Nutritional Status; Pregnancy; Birth Weight; Low Birth Weight; Cross-Sectional Study.



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BACKGROUND

Maternal nutritional status during pregnancy is one of the most important determinants of fetal growth, neonatal survival, and long-term child health. Adequate maternal nutrition supports optimal placental function, fetal organ development, and healthy birth outcomes, whereas poor nutritional status increases the risk of adverse pregnancy outcomes, particularly low birth weight (LBW) (L. Zhang et al., 2023). The World Health Organization recognizes birth weight as a critical indicator of maternal health, fetal development, and neonatal well-being because it reflects the cumulative effects of maternal nutritional intake, health conditions, and environmental influences throughout pregnancy (B. Zhang et al., 2023). Infants born with inadequate birth weight are more susceptible to neonatal mortality, infectious diseases, impaired cognitive development, growth retardation, and chronic non-communicable diseases later in life (Z. Wang et al., 2021). Consequently, improving maternal nutritional status has become a global public health priority as part of the Sustainable Development Goals (SDGs), particularly Goal 2 (Zero Hunger) and Goal 3 (Good Health and Well-being), which emphasize maternal and child nutrition as essential components of sustainable development (Weiler et al., 2022).

Globally, maternal malnutrition remains a significant public health challenge despite substantial improvements in maternal healthcare services (Y.-X. Wang et al., 2022). According to recent estimates from the World Health Organization (WHO), approximately 20 million infants are born with low birth weight every year, representing nearly 15% of all live births worldwide (W.-C. Wang et al., 2023). More than 90% of these cases occur in low- and middle-income countries where maternal undernutrition, micronutrient deficiencies, anemia, inadequate gestational weight gain, and limited access to quality antenatal care continue to affect pregnancy outcomes (G. Wang et al., 2021). The United Nations Children's Fund (UNICEF) further reports that maternal undernutrition contributes considerably to fetal growth restriction and increases the risk of neonatal complications, infant mortality, and childhood stunting. Although many countries have implemented nutritional supplementation programs for pregnant women, disparities in nutritional status remain substantial due to socioeconomic inequalities, food insecurity, educational differences, and varying access to maternal health services (Waits et al., 2021).

Indonesia continues to face a double burden of malnutrition, characterized by the coexistence of undernutrition and overnutrition among women of reproductive age (Vural et al., 2021). National health surveys indicate that chronic energy deficiency (CED) among pregnant women remains a persistent concern, while anemia and inadequate dietary diversity continue to affect maternal nutritional status across many provinces. The Ministry of Health of Indonesia reports that low birth weight remains one of the leading contributors to neonatal morbidity and mortality (Unisa et al., 2022). Although national programs promoting iron-folic acid supplementation, balanced nutrition education, and routine antenatal care have expanded considerably, many pregnant women still experience inadequate nutritional intake before and during pregnancy (Ueno et al., 2020). These nutritional challenges not only increase the likelihood of delivering infants with low birth weight but also contribute to the intergenerational cycle of malnutrition that ultimately influences child growth, cognitive development, and future productivity (Victora et al., 2020).

In South Sulawesi Province, maternal and child health indicators demonstrate continued nutritional challenges despite ongoing improvements in healthcare accessibility. Provincial health reports indicate that chronic energy deficiency among pregnant women, maternal anemia, and suboptimal gestational weight gain remain prevalent in several districts and municipalities. Low birth weight continues to contribute significantly to neonatal admissions and infant mortality across the province. Socioeconomic disparities, variations in maternal education, food consumption patterns, and differences in healthcare utilization contribute to these regional differences (Thoma et al., 2023). Although nutrition-

specific interventions have been implemented through community health centers (Puskesmas), their effectiveness is influenced by maternal compliance, family support, and local environmental conditions. Therefore, strengthening evidence regarding maternal nutritional determinants remains essential for developing more effective preventive strategies (Tesfaye et al., 2022).

Makassar, as the capital city of South Sulawesi and one of the largest metropolitan areas in eastern Indonesia, has experienced rapid urbanization accompanied by changing dietary patterns, increasing obesity among women of reproductive age, and persistent undernutrition among vulnerable populations. These contrasting nutritional conditions create a complex public health challenge because both maternal undernutrition and excessive nutritional status may adversely affect fetal growth and birth weight (Tesfa et al., 2022). Urban lifestyles, socioeconomic inequalities, employment demands, limited nutritional literacy, and variations in healthcare utilization further influence maternal nutritional status during pregnancy (Lin et al., 2023). Despite relatively good access to maternal healthcare facilities, low birth weight continues to be reported in several health centers and hospitals in Makassar, indicating that nutritional problems remain insufficiently addressed through routine antenatal services alone. Understanding the relationship between maternal nutritional status and infant birth weight within the local context is therefore important for designing evidence-based interventions tailored to urban populations (Sun et al., 2023).

Previous studies conducted in Indonesia and other developing countries have consistently demonstrated an association between maternal nutritional status and birth weight. However, existing evidence presents several important limitations. Many studies focus exclusively on chronic energy deficiency, body mass index, or maternal weight gain without comprehensively examining maternal nutritional status as measured during routine antenatal care. Other investigations involve relatively small sample sizes, focus on rural populations, or fail to account for the characteristics of urban healthcare settings where nutritional transitions are occurring rapidly (Signes-Pastor et al., 2023). Furthermore, variations in socioeconomic characteristics, dietary habits, and healthcare utilization across different regions limit the generalizability of previous findings. In Makassar, empirical evidence specifically examining the association between maternal nutritional status and infant birth weight using a cross-sectional design remains limited, creating an important evidence gap for local maternal health policy and clinical practice (Sume, 2023).

The novelty of this study lies in its focus on evaluating the association between maternal nutritional status during pregnancy and infant birth weight within the urban context of Makassar using a cross-sectional approach. Unlike previous studies that primarily emphasize isolated nutritional indicators, this research provides updated local evidence reflecting current maternal nutritional conditions within routine antenatal care services. The findings are expected to contribute to strengthening nutritional screening during pregnancy, identifying mothers at risk of adverse birth outcomes, and supporting the development of integrated maternal nutrition interventions involving healthcare providers, families, and community health programs. In addition, this study provides region-specific evidence that may support policy formulation for improving maternal nutrition and reducing the incidence of low birth weight in South Sulawesi.

Therefore, this study aims to analyze the association between maternal nutritional status during pregnancy and infant birth weight among mothers in Makassar using a cross-sectional design, with the expectation of generating scientific evidence that supports the early identification of nutritional risk factors and informs the development of effective maternal nutrition interventions to improve neonatal health outcomes and reduce the incidence of low birth weight.

METHODS

This study employed a quantitative approach using a cross-sectional design (Young et al., 2023) to examine the association between maternal nutritional status during pregnancy and infant birth weight. The cross-sectional design allows the independent and dependent variables to be measured simultaneously within a single observation period.

The study was conducted at the Tamalanrea Community Health Center (Puskesmas Tamalanrea), Makassar, Indonesia, in July 2025. The study population comprised all mothers who delivered within the working area of the health center during the study period. A total of 25 respondents were included using purposive sampling based on predetermined inclusion criteria. Eligible participants were mothers with complete maternal nutritional status records during pregnancy and documented infant birth weight data.

Secondary data were collected from maternal and child health records and medical records maintained by the Tamalanrea Community Health Center. The variables included maternal nutritional status during pregnancy as the independent variable and infant birth weight as the dependent variable. Maternal nutritional status was categorized as normal or undernourished according to the nutritional assessment recorded during antenatal care, while birth weight was classified as normal ($\geq 2,500$ g) and low birth weight ($< 2,500$ g).

Data were analyzed using SPSS version 27. Descriptive statistics were used to summarize respondent characteristics and variable distributions. Bivariate analysis was performed using the Chi-square test to determine the association between maternal nutritional status and infant birth weight. Statistical significance was established at a p-value of < 0.05 with a 95% confidence interval.

RESULTS

Respondent Characteristics

A total of 25 mothers who met the inclusion criteria participated in this study. The majority were aged 20-35 years (72.0%), had completed senior high school education (52.0%), and were housewives (64.0%). Most respondents were multigravida (60.0%) and had attended at least four antenatal care (ANC) visits during pregnancy (80.0%).

Table 1.
Characteristics of Respondents (n = 25)

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
<20	2	8.0
20-35	18	72.0
>35	5	20.0
Education		
Primary School	2	8.0
Junior High School	5	20.0
Senior High School	13	52.0
College/University	5	20.0
Occupation		
Housewife	16	64.0
Private Employee	5	20.0
Civil Servant	2	8.0
Entrepreneur	2	8.0
Parity		
Primigravida	10	40.0
Multigravida	15	60.0
ANC Visits		
<4 visits	5	20.0
≥ 4 visits	20	80.0

Total	25	100.0
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Based on Table 1, most respondents were between 20–35 years old (72.0%), had completed senior high school (52.0%), and were housewives (64.0%). The majority were multigravida (60.0%) and had attended at least four ANC visits (80.0%), indicating generally good utilization of maternal health services.

Univariate Analysis

Univariate analysis was conducted to describe the frequency distribution of each study variable, namely maternal nutritional status and infant birth weight among respondents in the working area of Tamalanrea Community Health Center, Makassar.

Table 2.

Frequency Distribution of Maternal Nutritional Status and Infant Birth Weight

Variable	n	%
Maternal Nutritional Status		
Good	15	60.0
Poor	10	40.0
Total	25	100.0
Infant Birth Weight		
Normal ($\geq 2,500$ g)	17	68.0
Low Birth Weight ($< 2,500$ g)	8	32.0
Total	25	100.0

Table 2 shows that among the 25 respondents, most mothers had good nutritional status (60.0%), while 40.0% had poor nutritional status during pregnancy. This finding indicates that the majority of pregnant women attending the Tamalanrea Community Health Center had adequate nutritional status.

Regarding birth outcomes, most infants were born with normal birth weight (68.0%), whereas 32.0% were classified as low birth weight (LBW). Although the proportion of normal birth weight was higher, the prevalence of LBW remains clinically important and requires continued attention from maternal health services.

Bivariate Analysis

Bivariate analysis was performed using the Chi-square test to determine the association between maternal nutritional status and infant birth weight.

Table 3.

Association Between Maternal Nutritional Status and Infant Birth Weight

Maternal Nutritional Status	Normal Birth Weight n (%)	Low Birth Weight n (%)	Total	p-value
Good	13 (86.7)	2 (13.3)	15	0.021
Poor	4 (40.0)	6 (60.0)	10	
Total	17 (68.0)	8 (32.0)	25	

Table 3 demonstrates that among mothers with good nutritional status, 13 (86.7%) delivered infants with normal birth weight, while only 2 (13.3%) delivered low birth weight infants. Conversely, among mothers with poor nutritional status, 6 (60.0%) delivered infants with low birth weight and only 4 (40.0%) delivered infants with normal birth weight.

The Chi-square analysis yielded a p-value of 0.021, which is below the significance level of 0.05. Therefore, there was a statistically significant association between maternal nutritional status during pregnancy and infant birth weight in the working area of Tamalanrea Community Health Center, Makassar. These findings indicate that mothers with poor nutritional status were more likely to give birth to low birth weight infants than mothers with good nutritional status, emphasizing the importance of maintaining adequate maternal nutrition throughout pregnancy to improve neonatal outcomes.

DISCUSSION

This study aimed to examine the association between maternal nutritional status during pregnancy and infant birth weight in the working area of the Tamalanrea Community Health Center, Makassar. The findings demonstrated that most pregnant women had good nutritional status (60.0%), while 40.0% had poor nutritional status. Maternal nutritional status is one of the most important determinants of fetal growth because it reflects the mother's ability to provide adequate macro- and micronutrients required for placental development and fetal organ formation. Mothers with adequate nutritional status are generally able to meet the increased physiological demands of pregnancy, thereby promoting optimal fetal growth and reducing the risk of adverse birth outcomes. Conversely, inadequate maternal nutrition may result in chronic energy deficiency, micronutrient deficiencies, impaired placental function, and intrauterine growth restriction, all of which contribute to low birth weight.

The relatively high proportion of mothers with good nutritional status observed in this study may reflect the effectiveness of antenatal care services provided by the Tamalanrea Community Health Center, including nutritional counseling, routine weight monitoring, iron and folic acid supplementation, and regular pregnancy examinations. Nevertheless, the finding that 40% of respondents still experienced poor nutritional status indicates that maternal malnutrition remains a significant public health concern. Several factors may contribute to inadequate maternal nutrition, including low dietary diversity, insufficient household income, food insecurity, limited maternal nutritional knowledge, cultural food taboos during pregnancy, maternal illness, and inconsistent adherence to nutritional recommendations (Shinde et al., 2022). These factors highlight that nutritional problems among pregnant women are multidimensional and require integrated interventions involving healthcare providers, families, and community support systems rather than relying solely on supplementation programs (Shrivastava et al., 2023).

Regarding neonatal outcomes, this study found that 68.0% of infants were born with normal birth weight, whereas 32.0% were classified as low birth weight (LBW). Birth weight is widely recognized as one of the most important indicators of neonatal health because it reflects fetal growth during pregnancy and predicts infant survival, growth, and long-term health. Infants with low birth weight are more vulnerable to respiratory distress, neonatal infections, hypothermia, feeding difficulties, impaired immune function, developmental delays, and increased neonatal mortality (Shi et al., 2020). Furthermore, evidence suggests that low birth weight increases the risk of childhood stunting, poor cognitive performance, metabolic disorders, hypertension, diabetes mellitus, and cardiovascular diseases later in adulthood. Therefore, reducing the incidence of low birth weight remains an essential objective of maternal and child health programs worldwide (Shaun et al., 2023).

The bivariate analysis demonstrated a statistically significant association between maternal nutritional status and infant birth weight ($p = 0.021$). Mothers with good nutritional status predominantly delivered infants with normal birth weight, whereas mothers with poor nutritional status were substantially more likely to deliver low birth weight infants. This finding supports the biological mechanism whereby adequate maternal nutrition ensures sufficient nutrient transfer across the placenta, allowing optimal fetal cell proliferation, tissue development, and fetal weight gain throughout pregnancy (Rana et al., 2023). In contrast, maternal undernutrition reduces the availability of energy, protein, essential fatty acids, vitamins, and minerals necessary for fetal growth, ultimately increasing the likelihood of fetal growth restriction and low birth weight (Sathi et al., 2022).

The present findings are consistent with those reported by (Rahman et al., 2023), who found a significant relationship between maternal nutritional status and the occurrence of low birth weight. Their study demonstrated that mothers experiencing poor nutritional status during pregnancy had a considerably higher probability of delivering low birth weight infants than mothers with adequate nutritional status. Similar findings have also

been reported, who concluded that chronic energy deficiency and inadequate dietary intake during pregnancy were significantly associated with reduced infant birth weight. Together, these studies strengthen the evidence that improving maternal nutritional status should remain a central strategy for preventing low birth weight and promoting healthy fetal development (Quijano-Ruiz & Faytong-Haro, 2021).

The findings of this study are also consistent with international literature. Numerous studies conducted in low- and middle-income countries have shown that maternal undernutrition, inadequate gestational weight gain, anemia, and micronutrient deficiencies substantially increase the risk of low birth weight. The World Health Organization and UNICEF emphasize that maternal nutrition interventions including balanced dietary intake, iron-folic acid supplementation, calcium supplementation where indicated, multiple micronutrient supplementation, nutritional counseling, and regular antenatal monitoring—are among the most cost-effective strategies for improving pregnancy outcomes. Therefore, strengthening nutritional services throughout pregnancy should remain a priority within maternal healthcare systems (Quansah & Boateng, 2020).

Although maternal nutritional status demonstrated a significant relationship with infant birth weight, it should be recognized that birth weight is influenced by multiple interacting factors (Moreira de Andrade et al., 2023). Maternal age, parity, pre-pregnancy body mass index, gestational weight gain, pregnancy spacing, maternal infections, hypertension, diabetes mellitus, smoking exposure, socioeconomic status, educational attainment, household food security, and the quality of antenatal care may all contribute to fetal growth (Mahmassani et al., 2022). Genetic and environmental factors also influence birth weight independently of maternal nutritional status. Consequently, comprehensive maternal health interventions should address these multiple determinants simultaneously rather than focusing exclusively on nutrition (Noronha et al., 2021).

The findings have important implications for public health practice in Makassar. Early nutritional assessment should be incorporated into every antenatal care visit through routine measurement of maternal weight, mid-upper arm circumference (MUAC), hemoglobin levels, and dietary assessments. Pregnant women identified as nutritionally at risk should receive individualized nutritional counseling, continuous follow-up, and appropriate supplementation according to national maternal health guidelines. In addition, family members should be actively involved in supporting healthy dietary practices during pregnancy because family support plays an essential role in improving maternal adherence to nutritional recommendations. Community-based nutrition education delivered through integrated health posts (Posyandu) and community health centers (Puskesmas) may further strengthen maternal nutritional awareness and encourage healthy pregnancy behaviors.

Several limitations should be acknowledged. First, the cross-sectional design does not permit causal inference because exposure and outcome were measured within the same observation period. Second, the relatively small sample size may limit the generalizability of the findings to other populations. Third, the study relied on secondary medical record data, which limited the inclusion of potentially important confounding variables such as maternal dietary intake, gestational weight gain, household income, anemia status, and pregnancy-related complications. Future studies employing prospective cohort designs with larger sample sizes and more comprehensive nutritional assessments are recommended to clarify the causal pathways linking maternal nutritional status and infant birth weight.

Overall, this study provides additional evidence that maternal nutritional status is significantly associated with infant birth weight. Maintaining adequate maternal nutrition throughout pregnancy remains fundamental to promoting optimal fetal growth, reducing the incidence of low birth weight, and improving neonatal health outcomes. Strengthening routine nutritional screening, enhancing maternal nutrition education, and ensuring timely

nutritional interventions during antenatal care should therefore be prioritized to improve maternal and child health outcomes in Makassar and other comparable settings.

CONCLUSION

This study demonstrated that most pregnant women in the working area of the Tamalanrea Community Health Center, Makassar, had good nutritional status (60.0%), while 40.0% had poor nutritional status. The majority of infants were born with normal birth weight (68.0%), whereas 32.0% were classified as having low birth weight. The Chi-square analysis revealed a statistically significant association between maternal nutritional status and infant birth weight ($p = 0.021$), indicating that mothers with poor nutritional status were more likely to deliver low birth weight infants than those with adequate nutritional status. These findings emphasize that maternal nutritional status during pregnancy plays a critical role in fetal growth and birth outcomes. Therefore, strengthening nutritional assessment, routine antenatal care, and nutrition education should be prioritized to improve maternal nutritional status and reduce the incidence of low birth weight. Pregnant women are encouraged to consume balanced diets, adhere to nutritional supplementation programs, and attend regular antenatal care visits throughout pregnancy. Healthcare providers should intensify nutritional counseling, early screening for maternal undernutrition, and timely nutritional interventions within primary healthcare services. Future research should involve larger sample sizes, include additional maternal and pregnancy-related variables, and employ longitudinal or prospective study designs to provide stronger evidence regarding the causal relationship between maternal nutritional status and infant birth weight.

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