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The Relationship Between Pregnant Women's Nutritional Status and Newborn Weight

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Abstract:
Maternal nutritional status during pregnancy plays a crucial role in fetal growth and is a key determinant of newborn birth weight. Inadequate maternal nutrition increases the risk of low birth weight (LBW), which is strongly associated with increased neonatal morbidity and mortality. This study aimed to examine the relationship between maternal nutritional status during pregnancy and newborn birth weight. A facility-based analytical study with a case–control design was conducted at a Community Health Center. A total of 36 mother–newborn pairs were recruited using a 1:1 case–control ratio. Maternal nutritional status was assessed using anthropometric indicators recorded during pregnancy, and newborn birth weight was measured within 1 hour of delivery. Data were analyzed using the chi-square test with α = 0.05. The analysis revealed a statistically significant association between maternal nutritional status and newborn birth weight (p = 0.003). Mothers with adequate nutritional status were more likely to deliver infants with normal birth weight than those with poor nutritional status. Conversely, low birth weight was more frequently observed among infants born to mothers with inadequate nutritional status during pregnancy. Maternal nutritional status during pregnancy is significantly associated with newborn birth weight in this primary health care setting. Strengthening early nutritional screening and interventions for pregnant women is essential to reduce the risk of low birth weight and improve neonatal health outcomes.

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INTRODUCTION

Maternal nutritional status during pregnancy is widely recognized as a critical determinant of fetal growth and neonatal health outcomes (González-Fernández et al., 2023). Adequate maternal nutrition supports optimal placental function and ensures the proper supply of nutrients and oxygen required for fetal development (Jain et al., 2022). Several anthropometric and biochemical indicators are commonly used to assess maternal nutritional status during pregnancy, including maternal height, pre-pregnancy body mass index (BMI), gestational weight gain, mid-upper arm circumference (MUAC), and hemoglobin (Hb) levels (Jawzali et al., 2022). These indicators provide valuable information about the nutritional reserves and physiological condition of pregnant women, which directly influence fetal growth and pregnancy outcomes (Ayomide et al., 2026).

Inadequate maternal nutrition, particularly protein–energy deficiency, may disrupt normal physiological processes during pregnancy (Naaz & Muneshwar, 2023). Poor nutritional status can impair uteroplacental blood flow and limit the transfer of essential nutrients and oxygen to the fetus (Lubrano et al., 2023). As a result, fetal growth may be restricted, increasing the risk of adverse pregnancy outcomes (Apostolopoulou et al., 2023). Nutritional deficiencies during pregnancy can

also affect maternal metabolism, immune function, and overall pregnancy health, thereby creating additional risks for both the mother and the developing fetus (Talebi et al., 2024).

One of the most significant consequences of inadequate maternal nutrition is low birth weight (LBW) (Asferie et al., 2025). Low birth weight is defined as a birth weight of less than 2500 grams measured within the first hour after delivery and remains a major global public health concern (Okwaraji et al., 2024). Infants born with LBW have a higher risk of neonatal morbidity and mortality, as well as long-term health complications such as impaired physical growth, cognitive development problems, and increased susceptibility to chronic diseases later in life (Jańczewska et al., 2023). Studies have consistently shown that inadequate maternal nutritional intake during pregnancy is associated with several adverse outcomes, including preterm birth, intrauterine growth restriction, neonatal anemia, and increased vulnerability to infections (Jain et al., 2022).

Conversely, adequate maternal nutrition during pregnancy plays an essential role in supporting fetal growth and improving neonatal outcomes (Lassi et al., 2022). Sufficient intake of macronutrients and micronutrients helps maintain maternal health, promotes appropriate gestational weight gain, and supports optimal fetal development (Agroia, 2025). Women with adequate nutritional status during pregnancy are more likely to deliver infants with normal birth weight (Mohamed et al., 2022). Therefore, monitoring maternal nutritional status and providing early nutritional interventions are important strategies for preventing low birth weight and improving maternal and neonatal health outcomes, particularly in primary health-care settings (Dewidar et al., 2023).

Despite growing attention to maternal nutrition, the relationship between maternal nutritional status and newborn birth weight remains an important issue in many communities, especially in resource-limited settings where maternal malnutrition may still be prevalent (Shenoy et al., 2023). Evidence from community-based health services is essential to strengthen early detection and intervention programs for pregnant women (Reshid & Anato, 2024). Therefore, this study aims to examine the relationship between maternal nutritional status during pregnancy and newborn birth weight at the community health center level.

METHOD

Research Design

This study employed a facility-based case–control design conducted from May to June 2025 at three Community Health Centers in Malang Regency, Indonesia. The case–control approach was used to examine the association between maternal nutritional status during pregnancy and newborn birth weight. Cases were defined as mothers who delivered infants with low birth weight (<2500 g), while controls were mothers who delivered infants with normal birth weight (≥2500 g). A 1:1 case–control ratio was applied to ensure balanced comparison between groups.

Participants

The study population consisted of all mothers who delivered at the selected Community Health Centers during the study period. Eligible participants were mothers of singleton live births with a gestational age of 37-42 weeks. Mothers with major chronic diseases and infants with congenital anomalies were excluded to minimize potential bias related to medical complications. The required sample size was calculated using OpenEpi software for a two-proportion comparison, assuming a statistical power of 80%, a significance level of $\alpha = 0.05$, and an expected exposure proportion of 60% in cases and 25% in controls. The calculation yielded a minimum of 17 participants per group. To account for potential data incompleteness, 36 mothers were recruited via simple random sampling, yielding 18 cases and 18 controls.

Data Collection

Data collection was performed using information obtained from antenatal care records and newborn medical records. Maternal nutritional status was assessed using mid–upper arm circumference (MUAC) measured during the third trimester of pregnancy. Poor maternal nutritional status was defined as a MUAC value of < 23.5 cm, based on established nutritional risk thresholds for pregnant women. The outcome variable was newborn birth weight, measured within 60 minutes after delivery using a calibrated digital scale with a measurement precision of ±10 grams. In addition to the main variables, several potential confounding factors were also collected, including maternal age, parity, education level, smoking status, and iron–folic acid supplementation during pregnancy.

Data Analysis

All statistical analyses were performed using Stata version 17. Descriptive statistics were used to summarize the characteristics of study participants. Bivariate analysis was conducted using the chi-square test to examine the association between maternal nutritional status and newborn birth weight. Furthermore, logistic regression was used to estimate crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs). A two-sided p-value < 0.05 was considered statistically significant.

Ethical Clearance

Ethical approval for this study was obtained from the Health Research Ethics Committee of the Institute of Technology, Science and Health, Dr. Soepraoen Hospital (Approval No. 025/KEPK-ITSK/IV/2025). Prior to participation, all respondents received an explanation regarding the study objectives and procedures. Written informed consent was obtained from each participant to ensure voluntary participation and confidentiality of personal information.

RESULT

Table 1. Frequency Distribution of Characteristics of Mothers Giving Birth Based on Age, Parity, and Occupation

Variables	Frequency (n)	Percentage (%)
Age		
15 – 19 Years	2	7%
20 – 35 Years	20	67%
> 35 Years	8	26%
Parity		
Primipara	6	20%
Multipara	20	67%
Grandemulti	4	13%
Occupation		
Private	10	33%
Self-employed	5	17%
Civil servant	4	13%
Does not work	11	37%

Based on Table 1, almost all mothers who gave birth were between 20 and 35 years old (67%), most had more than one child (67%), and almost half worked as private employees (33%).

Table 2. Frequency Distribution of Maternal Nutritional Status and Newborn Birth Weight

Nutritional Status	Baby Birth Weight				Total	
	≤2500gr		>2500gr			
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Good	2	8.3	22	91.7	24	100
Not enough	4	66.6	2	33.4	6	100
Total	6	20	24	80	30	100

Based on Table 2, almost all mothers with good nutritional status gave birth to babies weighing more than 2500g, namely 22 babies (91.7%). However, a small number of mothers with good nutritional status gave birth to babies weighing ≤ 2500g, namely 2 babies (8.3%). Most mothers with poor nutritional status gave birth to babies weighing ≤ 2500g (4 babies, 66.6%), but some gave birth to babies weighing > 2500g (33.4%).

Table 3 Chi-Square Test Results

Variable Relationship	Statistical Test	p-value	α	Interpretation
Maternal nutritional status and newborn birth weight	Chi-square test	0.003	0.05	Significant association ($p < \alpha$)

The results of the chi-square test showed that $p = 0.003$ and $\alpha = 0.05$. This means that $p < \alpha$, so there is a significant relationship between nutritional status and birth weight in the Puskesmas work area in May–June 2025.

DISCUSSION

The findings of this study demonstrate a significant association between maternal nutritional status during pregnancy and newborn birth weight. Mothers with poor nutritional status were more likely to deliver infants with low birth weight compared with mothers who had adequate nutritional status. This result highlights the critical role of maternal nutrition in supporting optimal fetal growth and development during pregnancy. Adequate maternal energy and nutrient reserves are essential to sustain physiological adaptations in pregnancy and to ensure sufficient nutrient supply to the developing fetus (Molina-Recio, 2022).

From a biological perspective, maternal undernutrition may adversely affect placental development and function, thereby reducing the transfer of oxygen and essential nutrients to the fetus. Insufficient intake of macronutrients and key micronutrients, including protein, iron, calcium, and vitamin D, can contribute to placental insufficiency and alterations in fetal metabolism. These physiological disturbances may ultimately result in fetal growth restriction and an increased risk of low birth weight. Mid–upper arm circumference (MUAC) is widely used as a practical indicator of maternal nutritional status and reflects maternal energy reserves. A MUAC value below 23.5 cm indicates chronic energy deficiency in pregnant women, which may compromise fetal growth and increase the likelihood of delivering an infant with low birth weight (Hasan, 2025).

Although most participants in this study were within the healthy reproductive age range of 20–35 years, maternal age remains an important contextual factor influencing pregnancy outcomes. Pregnancies occurring at very young or advanced maternal ages are often associated with increased nutritional vulnerability. Younger mothers may experience competing metabolic demands between their own growth and fetal development, while older mothers may have reduced physiological reserves that can affect nutrient utilization during pregnancy. These factors may partially explain the

occurrence of low birth weight even among mothers who had MUAC measurements within the normal range (Zhou et al., 2023).

The findings provide important implications for maternal and child health services, particularly in primary health care settings. Routine screening of maternal nutritional status using MUAC during antenatal care visits can be a simple, cost-effective way to identify pregnant women at risk of undernutrition. Early identification allows health workers to provide timely nutritional counseling and targeted interventions to improve maternal dietary intake during pregnancy. Community midwives also play a key role in strengthening nutrition education and monitoring maternal health throughout pregnancy (Ermiati et al., 2024). Future research should explore the effectiveness of community-based nutritional interventions, such as balanced protein–energy supplementation programs, in reducing the risk of low birth weight in high-risk populations.

Several limitations should be considered when interpreting the findings of this study. First, the study was conducted in a limited number of health facilities and had a relatively small sample size, which may limit the generalizability of the results to broader populations. Second, some information, particularly related to maternal dietary intake, relied on self-reported data and may be subject to recall bias. In addition, residual confounding cannot be entirely ruled out, as some relevant factors, such as maternal infection, anemia severity, or socioeconomic conditions, were not fully measured. Furthermore, the observational nature of the analysis limits the ability to establish a causal relationship between maternal nutritional status and birth weight.

CONCLUSION

This study identified a significant association between maternal nutritional status during pregnancy and newborn birth weight. Mothers with inadequate nutritional status were more likely to deliver infants with low birth weight compared with mothers who had adequate nutritional status. These findings highlight the critical importance of early nutritional assessment as part of routine antenatal care. Strengthening MUAC screening at community health centers can be a simple, cost-effective strategy to identify pregnant women at risk of undernutrition and to facilitate timely nutritional counseling and interventions that improve maternal health and neonatal birth outcomes.

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