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The relationship between pregnant women's nutritional status and the interpretation of fetal weight

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ABSTRACT

Introduction: Inadequate nutritional intake during pregnancy can impact fetal weight, increasing the risk of low birth weight (LBW), i.e., less than 2500 grams. Low birth weight is a contributing factor to increased infant mortality rates (IMR), and the success of maternal health efforts can be measured by the maternal mortality rate (MMR). Fetal weight estimation is a crucial indicator for neonatal and infant survival, not only as a parameter of physical growth and mental development, but also as a general benchmark for assessing health, nutritional, and socioeconomic status. **Objectives**: This study aimed to find out the relationship between the nutritional status of pregnant women and the estimated fetal weight in Songgokerto. **Methods**: This research approach uses Cross Sectional. The population in this study was 30 pregnant women. The sample taken was 30 pregnant women. The instruments used were questionnaires, KIA books, nutritional status observation sheets. The sampling technique was total sampling. Data analysis using simple linear regression. **Results**: The calculated t value of the nutritional status variable of pregnant women is 39.205 > t table 2.045, meaning there is a significant relationship between the nutritional status of pregnant women and the estimated fetal weight. The calculated F value of 1537.026 > from the F value of 0.05 (4.20) means that there is a significant simultaneous relationship between the nutritional status of pregnant women and the estimated fetal weight. **Conclusion**: There is a significant relationship between the nutritional status of pregnant women and the interpretation of fetal weight.

KEYWORD: Fetal; nutritional status; pregnant women; weight estimation

INTRODUCTION

The high maternal and infant mortality rates are influenced by various factors. According to the Indonesian Ministry of Health (Kemenkes RI, 2021), neonatal complications are the leading direct cause of infant mortality. These contributing factors include direct causes related to both the infant and the mother. For infants, direct causes include low estimated fetal weight, prematurity, asphyxia, tetanus, sepsis, congenital abnormalities, and infectious diseases (Gyimah et al., 2020). For mothers, direct causes encompass maternal age, education level, parity, pregnancy and childbirth complications, pregnancies occurring at a young or advanced maternal age, short birth intervals, and poor nutritional intake. These factors collectively contribute to the high maternal and infant mortality rates by creating high-risk conditions(Han et al., 2015).

Inadequate nutritional intake during pregnancy can affect estimated fetal weight, increasing the risk of low fetal weight, defined as less than 2,500 grams(Sayuri, P., y Fujimori, 2012). Low estimated fetal weight is one of the contributing factors to increased Infant Mortality Rate (IMR), while the Maternal Mortality Rate (MMR) is a key indicator of the success of maternal health efforts (El-Masri, 2014). MMR refers to the number of maternal deaths during pregnancy, childbirth, and postpartum periods, excluding accidental or incidental causes, measured per 100,000 live births (Kemenkes RI, 2021).

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Estimated fetal weight is a critical indicator for neonatal and infant survival, not only serving as a parameter of physical growth and mental development but also as a general benchmark for assessing health, nutrition, and socioeconomic status (Candra Rukmana & Irene Kartasurya, 2014). Birth length is also closely associated with the mother's nutritional status during pregnancy. Infants with a birth length of less than 48 cm are at risk of stunting a condition of impaired growth in toddlers due to chronic malnutrition during the first 1,000 days of life (HPK) which may eventually lead to short stature for age. These findings are supported by Anggrenisa (2018), who stated that birth length significantly affects subsequent stages of growth in infants (Tran et al., 2019).

In addition to the risk of stunting, infants with low estimated fetal weight are also at a higher risk of morbidity and mortality, with long-term effects that may extend into adulthood (Miele et al., 2021). The consequences of low fetal weight include impaired physical and cognitive development, reduced intelligence levels, increased susceptibility to infectious diseases, potential degenerative conditions in adulthood, and diminished quality of life (Shin et al., 2016). Long-term impacts also include decreased productivity and income, as well as broader social implications for future generations (Nucci et al., 2001).

Research conducted by Iriani (2022) found a relationship between maternal nutritional status (measured by mid-upper arm circumference, MUAC) and estimated fetal weight in third-trimester pregnant women at PMB Bd. I, Bandung Regency. Another study by Hidayah (2021) examined the relationship between anxiety and nutritional status with estimated fetal weight in third-trimester pregnant women at BPM Ny. Yayuk Kalbariyanto and found a correlation coefficient (r) of 0.685, indicating a strong correlation between the variables, with a p-value of 0.000 (<0.05), signifying statistical significance. According to the 2020 Basic Health Research (Riskesdas) data, the proportion of newborns with a birth length under 48 cm in Indonesia was 4.0%. At the provincial level, Yogyakarta had the highest proportion, while Maluku and Jambi reported the lowest. In South Sumatra Province, the proportion of infants born with a weight under 2,500 grams and a length under 48 cm in 2018 was 5.1%, exceeding the national average (Kemenkes RI, 2021).

Based on recommendations from midwives in Songgokerto Village in February 2025, attention has been focused on monitoring the nutritional status of pregnant women to improve fetal weight estimations, which have frequently been found to be suboptimal in the region. Midwives reported that many cases of low estimated fetal weight are due to inadequate maternal nutritional status. Patient data showed that many third-trimester pregnant women had low estimated fetal weights, indicating underlying nutritional issues potentially affecting fetal growth. Research Objective to determine the relationship between the nutritional status of pregnant women and estimated fetal weight in Songgokerto Village.

METHODS

Design

This study employed a correlational research design. Correlational research aims to examine the relationship between variables. Researchers seek to identify, explain, estimate, and test relationships based on existing theories. The objective of correlational research is to reveal the quantitative association between variables. This study applied a cross-sectional approach, which emphasizes the measurement or observation of both the independent and dependent variables at a single point in time. Through this design, the prevalence or effect of all observed phenomena can be analyzed in relation to their potential causes.

e-ISSN 3089-6630
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Research Questions

Is there a significant relationship between maternal nutritional status and estimated fetal weight in Songgokerto Village?

Sample and Settings

The sample of this study consisted of all pregnant women in Songgokerto Village, totaling 30 participants. The sampling technique used was total sampling, in which the entire population was included as the sample, namely 30 pregnant women.

Variables

The independent variable in this study is the maternal nutritional status, while the dependent variable is the estimated fetal weight.

Instruments

The instruments used in this study included maternal nutritional status data (from the Maternal and Child Health Book), Measurement of maternal nutritional status included Body Mass Index (BMI), based on pre-pregnancy weight and height, and Mid-Upper Arm Circumference (MUAC) using a MUAC measuring tape. Fetal weight estimation was conducted through physical examination (Leopold's palpation) or the most recent ultrasound result. Additional instruments included an observation sheet and respondent identity form. Measuring tools used were a digital scale, height meter, and MUAC tape.

Data Collections

Data for this study were collected directly from the field using a quantitative approach through observation and measurement. The data collection was conducted during the month of February- Maret, in the working area of Songgokerto Village, involving pregnant women who met the inclusion criteria.

The primary data collection process involved the following steps:

1. Identification and Selection of Respondents:
   The researcher collaborated with village midwives and community health volunteers (Posyandu cadres) to identify eligible pregnant women, specifically those in their second or third trimester, willing to participate, and without serious pregnancy complications. After receiving a clear explanation, participants signed an informed consent form.
2. Assessment of Maternal Nutritional Status:
   Nutritional status was measured using two primary indicators are Body Mass Index (BMI): Calculated using the mother's height and weight, measured directly or obtained from maternal health records (KIA book), if deemed accurate, Mid-Upper Arm Circumference (MUAC): Measured using a standard MUAC tape on the mother's left arm while standing in a relaxed position.
3. Estimation of Fetal Weight:
   Fetal weight was estimated by trained midwives or healthcare workers using: Leopold's Maneuvers, to assess fetal size and position. Ultrasound examination, if available, to improve the accuracy of fetal weight estimation.
4. Collection of Additional Data:
   Demographic information (such as maternal age, gestational age, parity, and pregnancy history) was obtained through brief interviews and review of the KIA book.
5. Data Validation and Verification:
   All collected data were reviewed and cross-checked to ensure accuracy and completeness before proceeding to analysis. The data were then analyzed to examine the relationship between maternal nutritional status and estimated fetal weight.

e-ISSN 3089-6630
Journal of Midwivery Vol 1 (2) July 2025, page 59-67
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Data Analysis

To analyze the data in this study, descriptive analysis (cross-tabulation) was used, along with a simple linear regression model. with α= 0.05 significance level 5%.

Ethical Consideration

Before data collection was conducted, the researcher provided an explanation to the respondents regarding the purpose, benefits, procedures of the study, and their rights during participation. Respondents were asked to sign an informed consent form as proof of their voluntary willingness to participate in the study without any coercion. Participation in this research was entirely voluntary. Respondents had the right to refuse or withdraw from participation at any time without facing any negative consequences of any kind. Personal identities of the respondents were kept confidential and used solely for research purposes. The data collected was securely stored and would not be published individually. In reporting the results, data was presented in aggregate form or using anonymous codes.

RESULTS

Based on the results, the characteristics of the respondents can be explained as follows:

1. **Respondent Characteristics**

Table 1. Respondent Characteristics Based on Age and pregnancy trimester

Age	Trimester Responden	Frequency (F)	Presentantion (%)
20-35 years old	Trimester II	28	93,3
> 35 years old	Trimester III	2	6,7
Jumlah	Trimester I	30	100

Based on Table 1, out of 30 pregnant women in Songgokerto Subdistrict, 14 respondents (46.6%) were in the second trimester, 8 respondents (26.7%) were in the third trimester, and 8 respondents (26.7%) were in the first trimester.

2. **Respondents' Nutritional Status Frequency Distribution**

Table 2. Frequency Distribution of Respondents' Nutritional Status

Nutritional Status	Frequency (f)	Presentantion (%)
Normal	18	60
Overweight	7	23,3
Underweight	5	16,7
Total	30	100

Based on Table 2, it can be seen that out of 30 pregnant women in Songgokerto Village, 18 respondents (60%) had normal nutritional status, 7 respondents (23.3%) were overweight, and 5 respondents (16.7%) were underweight.

3. **Frequency Distribution of Estimated Fetal Weight of Respondents**

Table 3. Characteristics of Respondents Based on Estimated Fetal Weight

Estimated Fetal Weight	Frequency (f)	Presentantion (%)
Normal	18	60
Overweight	7	23,3
Underweight	5	16,7
Total	30	100

Based on Table 3, it can be seen that out of 30 pregnant women in Kelurahan Songgokerto, 18 respondents (60%) had an estimated fetal weight in the normal

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category, 7 respondents (23.3%) had an estimated fetal weight in the low category, and 5 respondents (16.7%) had an estimated fetal weight in the very low category.

4. Analysis of Test Results

The data analysis in this study aims to measure "the relationship between the nutritional status of pregnant women and the estimated fetal weight in Kelurahan Songgokerto", as presented in the following tables:

Table 4. Mean values of maternal nutritional status and estimated fetal weight

Variable	N	Score			R square	T_{count}	T_{table}
		Lowest	Highest	Average			
Maternal nutritional status	30	2	6	3,47	0,982	39,205	2,045
Estimated fetal weight	30	6	18	10,33			

Based on Table 4, it was found that the lowest value of the maternal nutritional status variable (X) was 2, and the highest value was 6, with a mean of 3.47. The fact that the mean is close to the minimum value indicates that there are significant issues related to the nutritional status of pregnant women in Kelurahan Songgokerto. For the estimated fetal weight variable (Y), the lowest value was 6, and the highest was 18, with a mean of 10.33. Similarly, the mean being closer to the minimum value shows that there are many problems regarding the estimated fetal weight among pregnant women in Kelurahan Songgokerto. The simple linear regression analysis on the relationship between maternal nutritional status and estimated fetal weight in Kelurahan Songgokerto is as follows:

$$Y = a + bX$$

$$Y = 0.121 + 3.016X$$

From this equation, both the constant and the regression coefficient are positive. This means that as the nutritional status of pregnant women improves, the estimated fetal weight also increases accordingly and vice versa. Specifically, for every one-unit increase in variable X, variable Y increases by 3.016, with a constant value of 0.121.

Based on Table 4, it can be seen that there is a significant relationship between the independent variable, as indicated by the calculated t-value. The t-count for maternal nutritional status (X) is 39.205, which is greater than the t-table value of 2.045. This indicates a significant relationship between maternal nutritional status (X) and estimated fetal weight (Y). The R-squared (R^2) value is 0.982, which means that 98.2% of the variation in estimated fetal weight (Y) can be explained by maternal nutritional status (X). The remaining 1.8% is influenced by other factors not examined in this study.

Table.5 Analysis of Regression Variance on the Relationship Between Maternal Nutritional Status and Estimated Fetal Weight in Kelurahan Songgokerto

Source of variation	Sum of squares	df	Mean Asuare	F_{count}	F_{table}
Regresi	540,815	1	540,815	1537,026	4,20
Galat	9,852	28	0,352		

Based on Table 5, the analysis of regression variance shows that the calculated F-value is 1537.026, which is greater than the F-table value at $\alpha = 0.05$ (4.20). This indicates that there is a significant simultaneous relationship or influence between maternal nutritional status and estimated fetal weight.

e-ISSN 3089-6630
Journal of Midwivery Vol 1 (2) July 2025, page 59-67
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DISCUSSION

Based on the analysis results, out of 30 pregnant women in Songgokerto Village, 14 respondents (46.6%) were in the second trimester, 8 respondents (26.7%) in the third trimester, and another 8 respondents (26.7%) in the first trimester. A total of 18 respondents (60%) had normal nutritional status, 7 respondents (23.3%) were classified as overweight, and 5 respondents (16.7%) were undernourished. Regarding the estimated fetal weight, 18 respondents (60%) fell within the normal category, 7 respondents (23.3%) had a low estimated fetal weight, and 5 respondents (16.7%) had a very low estimated fetal weight. Statistical analysis showed that the t-count for the maternal nutritional status variable (X) was 39.205, which is greater than the t-table value of 2.045. This indicates a significant relationship between maternal nutritional status (X) and estimated fetal weight (Y).

These findings align with research by (Dwi Listiarini et al., 2022) titled *"The Relationship Between Nutritional Status and Estimated Fetal Weight in Third Trimester Pregnant Women at PMB Bidan I, Bandung Regency"*. The study emphasized that pregnancy is a critical period in determining the future quality of a child. Malnutrition in pregnant women reduces nutrient transfer, which can hinder fetal growth and result in low birth weight (LBW) (Abuya et al., 2012). Nutritional status was assessed using MUAC (Mid-Upper Arm Circumference), where measurements below 23.5 cm indicated chronic energy deficiency (CED), which is often associated with LBW outcomes. In that study, 6 women (13.3%) had a MUAC < 23.5 cm, while 39 women (86.7%) had MUAC > 23.5 cm. An estimated fetal weight below 2500 grams was found in 15 cases (33.3%), while 30 cases (66.7%) were above 2500 grams(Candra Rukmana & Irene Kartasurya, 2014). Statistical analysis revealed a p-value of 0.000, confirming a significant relationship between nutritional status (MUAC) and estimated fetal weight in third-trimester pregnancies(El-Masri, 2014).

Furthermore, the F-count value was 1537.026, which is greater than the F-table value of 4.20 at a 0.05 significance level, indicating a simultaneous significant relationship between maternal nutritional status (X) and estimated fetal weight (Y). The R-squared value of 0.982 suggests that 98.2% of the variation in estimated fetal weight is influenced by maternal nutritional status, while the remaining 1.8% is affected by other factors not examined in this study.

These findings are also consistent with research by (Bhowmik et al., 2019) titled *"The Relationship Between Nutritional Knowledge in Pregnant Women and Estimated Fetal Weight in the Third Trimester at Galur II Health Center, Kulon Progo, 2019."* The study concluded that LBW babies (less than 2500 grams at birth) are highly vulnerable to hypothermia, infection, and mortality. Early detection of LBW risk can begin at 24 weeks of gestation by estimating fetal weight(Mohamed et al., 2022). Maternal nutritional status during pregnancy is a key determinant of fetal growth, and maternal knowledge about nutrition plays a vital role in ensuring proper intake(Gyimah et al., 2020). The study showed that 62.2% of respondents had a high school education, 100% carried single pregnancies, 51% were not exposed to cigarette smoke, 91.1% had good nutritional knowledge, and 80% had fetal weight estimates appropriate for gestational age(Karima & Achadi, 2012). Statistical tests showed a p-value of 0.028 and a moderate correlation strength (0.547), confirming the relationship between nutritional knowledge and fetal weight estimation (Dwi Listiarini et al., 2022). Thus, this study is consistent with existing theories and previous research, and it supports the author's objective to demonstrate a significant relationship between maternal nutritional status and estimated fetal weight in Songgokerto Village.

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Strengths and Limitations

This study has several strengths, including its relevance to maternal and child health, particularly in preventing low birth weight (LBW). Data were collected directly from the community, enhancing validity. Practical measurement methods such as MUAC and estimated fetal weight using Leopold's maneuvers or ultrasound were employed, making them feasible for use in primary healthcare settings. The simple study design also allows for easy replication in other regions or facilities.

However, there are several limitations. The cross-sectional design only shows associations, not causality. Nutritional status assessment may be biased, especially if pre-pregnancy weight relies on maternal recall. Fetal weight estimation without ultrasound depends heavily on the examiner's skill. Additionally, important confounding variables such as socioeconomic status and dietary habits were not included in the analysis.

Implications for Practice

The findings of this study have significant implications for midwifery practice, particularly in antenatal care at the primary healthcare level. Simple assessments like MUAC and BMI can help midwives detect pregnant women at risk of low birth weight early, allowing for timely interventions and closer monitoring(Ling et al., 2019). These tools, along with Leopold's maneuvers, remain practical and valuable in daily practice, especially in low-resource settings where ultrasound may not be available.

Moreover, the study underscores the importance of strengthening nutritional education and counseling during ANC visits. Midwives can play a key role in promoting maternal nutrition through structured, risk-based counseling and early referrals when needed. These findings can also support the development of community-level nutrition programs, such as pregnancy classes or collaborations with public health nutritionists at local health centers.

CONCLUSIONS

That most pregnant women have normal nutritional status as assessed by BMI and MUAC, and most fetuses have estimated weights within the normal range. This is in accordance with the results of data analysis from The R-squared (R^2) value is 0.982, which means that 98.2% of the variation in estimated fetal weight can be explained by maternal nutritional status. The remaining 1.8% is influenced by other factors not examined in this study. A significant relationship was found between maternal nutritional status and estimated fetal weight mothers with good nutritional status are more likely to have fetuses with appropriate weight for gestational age, while those with poor nutrition face a higher risk of low birth weight. This highlights the critical role of maternal nutrition in supporting optimal fetal development.

To reduce the risk of low birth weight, it is recommended that nutritional monitoring be strengthened as part of routine antenatal care, especially at the community level. Midwives and primary healthcare providers should consistently assess maternal nutritional status using simple, accessible tools like MUAC and BMI, and provide targeted nutritional counseling early in pregnancy. In addition, community-based nutrition education programs should be enhanced to support healthy maternal dietary practices throughout gestation.

Conflict of Interest Statement

The author declares that there is no conflict of interest regarding the conduct of this research. All stages of the study, including data analysis and report writing, were carried out independently without any influence from external parties.

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