



Original Article

Analysis of the impact of nutritional status of pregnant women on neonatal complications

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A B S T R A C T

Background: Neonatal complications are a health problem that affects neonatal mortality. Most deaths occur in the first week of life; the causes are asphyxia, infection, jaundice, and congenital abnormalities. The nutritional status of pregnant women has a significant influence on neonatal complications. However, few studies still explore the combined impact of the analysis of three factors of maternal nutritional status on various neonatal complications.

Objective: This study aims to analyse the impact of the nutritional status of pregnant women on neonatal complications.

Method: This study is an observational analytical study with a cross-sectional design conducted in the Ngemplak I Health Centre area, Sleman, DIY. The study sample consisted of 140 pregnant women who met the inclusion criteria, selected using a purposive sampling technique. Data were collected through questionnaires and KIA books, and then analysed using the Chi-Square test with a significance value of $p < 0.05$.

Results: The results showed that maternal BMI was significantly associated with asphyxia ($p = 0.011$; OR = 1.168) and jaundice ($p = 0.045$; OR = 0.320), while anaemia and CED were not significant for neonatal complications.

Conclusion: The Nutritional status of pregnant women, BMI significantly affects neonatal complications, while anaemia and chronic energy disease do not significantly affect neonatal complications.

INTRODUCTION

One in ten babies is born prematurely worldwide. Prematurity is the leading cause of infant death. By 2022, 47% of all child deaths will occur in the first 28 days of life. Prematurity can be prevented by emphasising maternal health, nutrition, and skilled antenatal care. Neonatal survival depends on essential newborn care with thermal protection through skin-to-skin contact, hygiene in umbilical cord care, early breastfeeding, regular health care, immunisation, and treatment of common neonatal problems.¹

The main causes of neonatal complications are premature birth (35%), problems that occur during labour (24%), infection (15%), and congenital defects (11%).¹ Nutritional problems of pregnant women, such as chronic energy disease (CED), abnormal Body Mass Index (BMI), and anaemia, are known to contribute to adverse effects on

mothers and babies, namely an increased risk of low birth weight (LBW), premature birth, and congenital abnormalities. CED with an upper arm circumference < 23.5 cm is associated with an increased risk of LBW and other adverse effects on neonates.^{2,3} Likewise, BMI before pregnancy significantly affects the weight and length of newborns, and anaemia, especially iron deficiency anaemia, is common in pregnant women with poor nutritional status.^{4,5,6} Efforts that have been made to prevent neonatal complications include assessing nutritional status during pregnancy to ensure optimal health.⁷

Based on the results of previous studies, it shows a significant relationship between the nutritional status of pregnant women and neonatal complications.^{8,9,10} In addition, decreased maternal nutritional status increases the risk of giving birth to babies with neonatal complications.¹¹ Furthermore, pregnancies with CED have a higher risk of giving birth to babies with LBW and asphyxia.^{12,13} Not only that, but studies also show that BMI

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and anaemia increase the risk of LBW. In addition, mothers with CED are 3.634 times more likely to experience anaemia than mothers who do not experience CED,¹⁴ which further emphasises the importance of monitoring maternal nutrition to prevent complications in infants. Although research on maternal nutritional status and neonatal complications has been conducted, the shortcoming of previous research is the lack of exploration of the impact of the combination of maternal nutritional status on various neonatal complications, which are more diverse.

The novelty of this study is combining the analysis of three factors of maternal nutritional status (CED, BMI, and anaemia) simultaneously and examining their impact on various neonatal complications (asphyxia, jaundice, infection, and congenital abnormalities). Efforts to prevent and treat neonatal complications are often focused on treating a single factor, whereas a combination of maternal nutritional status factors has a broader impact.^{15,16} This study aims to analyze the nutritional status of pregnant women with CED, BMI and anemia can affect the neonatal, with a focus on broader complications, such as asphyxia, jaundice, infection, and congenital abnormalities.

METHOD

Study Design

The research design is an observational analytic with a cross-sectional design.¹⁷

Setting and Respondent

This study was conducted in the Ngemplak I Health Center area, Sleman DIY, during the data collection period between September and October 2024. The population in this study was all pregnant women, while the sample used in this study was 140 pregnant women, with the inclusion criteria being mothers who were willing to be respondents and had a KIA book. The exclusion criteria were all pregnant women with incomplete KIA books and mothers with Diabetes Mellitus. Sampling was carried out using a purposive sampling technique based on certain considerations according to the desired criteria.¹⁷

The Variable, Instrument, and Measurement

The independent variable in this study was the nutritional status of pregnant women, as seen from CED status, BMI, and anemia status. The dependent variable was neonatal complications, including asphyxia, jaundice, infection, and congenital abnormalities. The instruments used in this study were KIA books and questionnaires. The instruments included information on maternal nutritional status, such as CED, BMI, and anemia, as well as neonatal complications, namely asphyxia, jaundice, infection, and congenital abnormalities.

Data Analysis

Univariate analysis was conducted to describe the characteristics of the respondents and each research variable using frequency and percentage distributions.

Bivariate analysis was performed using the Chi-Square test with a significance level of less than 0.05. Furthermore, conclusion verification was conducted.

Ethical Consideration

This study obtained ethical approval from the Health Research Ethics Commission of the Faculty of Health Sciences, Respati University, Yogyakarta, with registration number 059.3/FIKES/PL/PL/VI/2024.

RESULTS

Table 1 shows the characteristics of the study respondents. The majority were between 20 and 35 years old (80%) and did not suffer from anemia (85%). Most respondents had MUAC \geq 23.5 cm (86.4%) and abnormal BMI (58%). Regarding neonatal complications, most neonates did not experience asphyxia (88.6%) or jaundice (86.4%). Infection was only found in 2.1% of neonates, while congenital abnormalities occurred in 2.9%.

Table 1. Characteristics of Respondents (n =140)

Characteristics	Result
Age	
<20 Years	11 (7.9%)
20-35 Years	112 (80.0%)
>35 Years	17 (12.1%)
Anaemia	
Yes	21 (15.0%)
No	119 (85.0%)
MUAC	
<23.5 CM	19 (13.6%)
\geq 23.5 CM	121 (86.4%)
BMI	
Normal	59(42%)
Underweigth	81(58%)
Asphyxia	
Yes	16 (11.4%)
No	124 (88.6%)
Jaundice	
Yes	19 (13.6%)
No	121 (86.4%)
Infection	
Yes	3 (2.1%)
No	137 (97.9%)
Congenital Abnormalities	
Yes	4 (2.9%)
No	136 (97.1%)

Tables 2 and 3 show the association between maternal nutritional status and the risk of neonatal asphyxia and jaundice. Maternal BMI was significantly associated with neonatal asphyxia (P= 0.011; OR= 1.168) and jaundice (P = 0.045; OR= 0.320). In contrast, maternal anaemia and CED (LILA) were not significantly associated with neonatal asphyxia (P= 0.074; OR = 1.155 and P= 0.894; OR = 0.899, respectively) or jaundice (P= 0.557; OR= 0.632 and P= 0.293; OR= 1.884, respectively).

Table 2. Effect of Maternal Nutritional Status on Asphyxia

Variable	Asphyxia		Total	OR	p-value
	Yes	No			
Anaemia					
Yes	0(0%)	21(15%)	21(15%)	1.155	0.074
No	16(11%)	103(74%)	119(85%)		
MUAC				0.899	0.894
< 23.5 CM	2(1,4%)	17(12,2%)	19(13,6%)		
≥ 23.5 CM	14(10%)	107(76,4%)	121(86,4%)		
BMI				1.168	0.011
Normal	2(1,4%)	57(40,6%)	59(42%)		
Underweighth	14(10%)	67(48%)	81(58%)		

Table 3. Effect of Maternal Nutritional Status on Jaundice

Variable	Jaundice		Total	OR	p-value
	Yes	No			
Anaemia				0.632	0.557
Yes	2(1,4%)	19(13,6%)	2(1,4%)		
No	17(12,1%)	102(72,9%)	17(12,1%)		
MUAC				0.899	0.894
< 23.5 CM	4(2,9%)	15 (10,7%)	19(13,6%)		
≥ 23.5 CM	15(10,6%)	106(35,8%)	121(86,4%)		
BMI				0.320	0.045
Normal	4(3%)	55(39%)	59(42%)		
Underweighth	15(11%)	66(47%)	81(58%)		

Table 4. Effect of Maternal Nutritional Status on Infection

Variable	Infection		Total	OR	p-value
	Yes	No			
Anaemia				1.026	0,462
Yes	0(0%)	21(15%)	21(15%)		
No	3(2%)	116(83%)	119(85%)		
MUAC				1.025	0,488
< 23.5 CM	0(0%)	19(13,6%)	19(13,6%)		
≥ 23.5 CM	3(2%)	118(84%)	121(86,4%)		
BMI				2.807	0,573
Normal	2(1%)	57(58%)	59(42%)		
Underweighth	1(0,8%)	80(57,2%)	81(58%)		

Table 5. Effect of Maternal Nutritional Status on Congenital Abnormalities

Variable	Congenital Abnormalities		Total	OR	p-value
	Yes	No			
Anaemia				1.035	0,394
Yes	0(0%)	21(15%)	21 (15%)		
No	4(3%)	115(82%)	119 (85%)		
MUAC				1.034	0,421
< 23.5 CM	0(0%)	19(13,6%)	19 (13,6%)		
≥ 23.5 CM	4(2,9%)	117(83,5%)	121 (86,4%)		
BMI				1.052	0,083
Normal	0(0%)	59(42%)	59 (42%)		
Underweighth	4(2,9%)	77(55,1%)	81 (58%)		

Tables 4 and 5 show no significant association between maternal nutritional status measured by anaemia, CED, and BMI status and the incidence of neonatal infections or congenital abnormalities. Maternal anaemia was not significantly associated with infection (P= 0.462; OR= 1.026) or congenital abnormalities (P= 0.394; OR= 1.035). Similarly, CED (MUAC) was not significantly associated with infection (P= 0.488; OR= 1.025) or congenital

abnormalities (P= 0.421; OR= 1.034). Abnormal BMI was also not significantly associated with infection (P= 0.573; OR= 2.807) or congenital abnormalities (P= 0.083; OR = 1.052).

DISCUSSION

Based on the result of statistical tests, it can be conclude

that only BMI has a significant relationship with the incidence of asphyxia and jaundice. At the same time, anaemia and CED do not show a significant relationship with these neonatal complications. These results are from previous studies showing that maternal nutritional status, especially suboptimal BMI, has a significant impact on the risk of neonatal complications, including asphyxia and jaundice.¹⁰ In this case, increased maternal BMI in early pregnancy is known to affect poor pregnancy outcomes, including an increased risk of asphyxia.¹⁸ This strengthens the findings that babies born to mothers with poor nutritional status, including low BMI, are more likely to experience respiratory disorders after birth.¹⁹ This asphyxia incident can be caused by various factors that occur before, during, or after delivery, such as premature birth or problems in the delivery process that affect the baby's health status.²⁰ However, this study shows that anaemia and CED do not have a significant effect on the incidence of complications such as jaundice, infection, and congenital abnormalities in infants ($p > 0.05$).

This finding is contrary to several previous studies that reported that anaemia and CED in pregnant women can increase the risk of neonatal complications. Anaemia, especially iron deficiency, can increase the likelihood of premature birth, low birth weight (LBW), and complications such as jaundice and asphyxia in infants.^{8,9,10} However, the absence of a significant association in this study may be influenced by external factors not explained in this study, such as better medical management, use of nutritional supplements, or maternal socioeconomic factors that can affect newborn health. On the other hand, a study conducted provides a more complex picture of the relationship between maternal nutritional status and neonatal outcomes, where mothers with poor nutritional status, including anaemia and CED, are at higher risk of preterm birth and other neonatal complications, such as jaundice and asphyxia.²

These findings underscore the importance of attention to maternal nutritional status before and during pregnancy, as malnutrition can have a major impact on fetal health and cause significant perinatal complications.²¹ Therefore, although anaemia and CED in this study did not show a significant relationship, further research with more complete data collection and more structured interventions is needed to understand better the long-term impact of maternal malnutrition on the baby to be born. The implications of these findings are related to the theory that maternal nutritional status affects pregnancy outcomes and infant health, which is in line with the hypothesis that poor nutritional status can increase the risk of complications in newborns, especially asphyxia and jaundice. This study emphasizes the importance of monitoring and intervening in maternal nutritional status during pregnancy, including early detection of BMI, anaemia, and CED. Although anaemia and CED did not show a significant relationship in this study, these results emphasize the need for special attention to mothers with poor nutritional status during antenatal examinations, with a holistic approach and risk management to prevent neonatal complications. Further

research is needed to explore other factors that may influence neonatal complications so that the increasing maternal mortality rate in Indonesia and West Java can be overcome.²²

Factors such as nutritional status before pregnancy influence the weight and length of the baby at birth.²³ Maternal nutritional status has a significant impact on neonatal outcomes. For example, maternal obesity is associated with increased risk of cesarean section, hypertension, and lower Apgar scores in newborns.²⁴ Conversely, adequate maternal nutrition, including higher levels of zinc, calcium, vitamin B1, folate, and protein, is correlated with higher birth weight.²⁵ Nutrient intake, especially energy, protein, calcium, and vitamin C, is important in determining birth outcomes.²⁶ These findings emphasize the importance of appropriate nutritional education and pre-pregnancy counselling to improve pregnancy outcomes and reduce complications. Maternal nutritional status, especially haemoglobin levels, positively impacts birth outcomes such as newborn weight and length.²⁷ Obstetric nutritional risks in high-risk pregnant women are associated with increased neonatal morbidity and worse outcomes.²⁸ Balanced protein-energy supplementation and food distribution programs during pregnancy reduce adverse maternal, neonatal, and child outcomes in low- and middle-income countries.²⁹ Maternal nutrition during pregnancy, including haemoglobin, protein, and cholesterol levels, significantly impacts fetal development and birth weight.³⁰ Therefore, the results of this study can prevent unwanted complications of childbirth.

CONCLUSIONS AND RECOMMENDATION

This study concluded that maternal nutritional status, especially Body Mass Index (BMI), plays an important role in increasing the risk of neonatal complications such as asphyxia and jaundice. These results highlight the importance of attention to maternal nutritional status during pregnancy to prevent complications that can endanger neonatal health. Further researchers are advised to explore other factors that may affect the incidence of asphyxia, jaundice, infection, and congenital abnormalities in babies, such as diet, genetic factors, environmental factors, socioeconomic factors, and maternal medical history. Using larger and more diverse samples and considering interactions between variables are also important to increase the validity of the results. In addition, further research focuses on interventions to improve maternal nutritional status, especially related to BMI.

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