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Maternal BMI and pregnancy outcomes: An analytical basis for health promotion strategies

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ABSTRACT

Background: *The nutritional status of pregnant women, as assessed by Body Mass Index (BMI), plays a crucial role in influencing the process and outcomes of childbirth. BMI is used as an indicator of maternal nutritional status, categorized as underweight (<18.5), normal (18.5–24.9), and overweight (≥25). BMI has been shown to be associated with various maternal complications. Although BMI demonstrates a significant impact on maternal outcomes, further research is needed to serve as a basis for health promotion strategies in antenatal care services.*
Objective: *This study aims to analyze the relationship between maternal BMI and pregnancy outcomes, and to establish an analytical basis for health promotion strategies.*
Methods: *This study used an observational analytical design with a cross-sectional approach and was conducted in the working area of Ngemplak I Health Center, Sleman, Special Region of Yogyakarta. The research sample was 98 pregnant women who met the inclusion criteria, selected using a purposive sampling technique. Data were collected through questionnaires sourced from the KIA book, then analyzed using the Chi-Square test with a significance level of p <0.05.*
Results: *The study showed a significant relationship between maternal BMI and type of delivery (p = 0.037), while no significant associations were found with hemorrhage (p = 0.620), premature labor (p = 0.820), and prolonged labor (p = 0.825).*
Conclusion: *There is a significant relationship between maternal nutritional status based on BMI and the type of delivery. However, no significant relationship was observed with hemorrhage, premature labor, or prolonged labor. These findings can serve as a basis for health promotion strategies, particularly in nutritional education during pregnancy to prevent delivery complications.*

KEYWORD: *BMI; health promotion; maternal outcomes; nutritional status; pregnant women*

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INTRODUCTION

Globally, the prevalence of pregnant women with an overweight or obese Body Mass Index (BMI) continues to increase. Currently, around 14.9% of women in the world are obese, while 9.7% are underweight(1,2). Although the incidence of obesity continues to increase, many countries still face the problem of malnutrition, especially in developing countries(3). In the United States, for example, it is recorded that around 18–38% of pregnant women are obese. On the other hand, in various developing countries, the prevalence of underweight BMI due to malnutrition in women of childbearing age is still quite high, indicating a significant risk to pregnancy and childbirth(1,2). In Indonesia, the prevalence of obesity in women of childbearing age shows a significant increasing trend, from 28% to 37.8% in 2018 [4]. This condition reflects the importance of attention to the nutritional status of women before and during pregnancy as a strategic step in preventing maternal complications.

Maternal complications are also a serious global health issue. Around 21% of deliveries worldwide are by cesarean section, with figures even exceeding 40% in some countries such as Brazil and Egypt. In addition, obesity in pregnant women is also associated with an increased risk of complications such as prolonged labor and impaired uterine contractions (5,6). The nutritional status of pregnant women is one of the key factors that determines the success of pregnancy and childbirth. Body Mass Index (BMI) is widely used as an indicator of nutritional status before and during pregnancy. BMI is used as an indicator of the nutritional status of pregnant women, with BMI categories of thin (<18.5), normal (18.5–24.9), and obese (≥25). Inappropriate BMI, either too thin or too fat, has been shown to be associated with various maternal complications.

Research has shown that maternal body mass index (BMI) has a significant impact on pregnancy outcomes. While some studies did not find a significant association between maternal BMI and perinatal outcomes in women with preeclampsia(7) others reported a significant association between maternal BMI and delivery outcomes(8). Obese BMI has been associated with an increased risk of cesarean delivery, longer labor duration, and various adverse maternal outcomes during labor (6, 9,10,11).

Pregnant women with a BMI category of obese (≥25) show an increased risk of various obstetric complications, one of which is the type of delivery. Obese women have twice the risk of undergoing a cesarean section compared to those with a normal BMI(12). In addition, obesity also increases the possibility of labor induction due to uterine contraction disorders. Excess fat accumulation in pregnant women can affect the ability of the uterus to contract effectively during labor, increasing the risk

of bleeding. Although research results vary, obesity has a higher risk of experiencing labor before 37 weeks of gestation, especially when accompanied by comorbid medical conditions such as hypertension, bleeding, and gestational diabetes(13). Obesity is also associated with the risk of prolonged labor; the active phase of labor tends to last longer in mothers with an obese BMI, which is thought to be related to physiological changes and decreased response to oxytocin (6,9,14).

On the other hand, Pregnant women with a BMI in the underweight category have a higher risk of experiencing various pregnancy complications, such as preeclampsia, oligohydramnios, intrauterine growth retardation, premature birth and the birth of babies with low birth weight (9,15,16). These findings emphasize the importance of maintaining BMI within the normal range during pregnancy to minimize the risk of complications and optimize pregnancy outcomes for both mother and baby(9,10). This study shows that although BMI has been widely used as an indicator of nutritional status, there are still differences in results between studies, showing a significant and an insignificant association between BMI and labor complications, reflecting a gap in research that can be done.

Given these various impacts, it is important to further examine the relationship between BMI before pregnancy and the incidence of maternal complications, especially the type of delivery, postpartum hemorrhage, premature delivery, and prolonged labor. This study aims to analyze the relationship between maternal nutritional status based on BMI and maternal outcomes as a basis for health promotion strategies for pregnant women. It is hoped that BMI can be used as an effective early screening indicator in health promotion strategies for pregnant women, thereby contributing to early detection of the risk of complications in maternal outcomes.

MATERIALS AND METHODS

This type of research is quantitative research with a cross-sectional approach. The data analysis technique uses the chi-square statistical test. This research was conducted in the Ngemplak I Health Center area, Sleman, Yogyakarta. Data collection was from September to October 2024. The population in this study was all pregnant women, while the sample used was 98 pregnant women with inclusion criteria, mothers who were willing to be respondents and had a KIA book. The exclusion criteria were all pregnant women with incomplete KIA books. Sampling was carried out using a purposive sampling technique. The research instrument was a questionnaire sourced from KIA book data, therefore, testing was not carried out.The independent variable in this study was the nutritional status of pregnant women as seen from BMI, and the dependent variable in this study was maternal outcomes consisting of

type of labor, bleeding, premature labor, and prolonged labor. This research has obtained ethical approval from the Health Research Ethics Commission of the Faculty of Health Sciences, Respati University of Yogyakarta, with registration number 059.3/FIKES/PL/PL/VI/2024.

RESULTS AND DISCUSSION

Univariate Analysis

This study used 98 respondents **Table 1** describes the frequency distribution of respondents based on type of delivery, hemorrhage, Premature Labor, prolonged Labor, and BMI.

Table 1. Frequency distribution based on type of delivery, hemorrhage, premature labor, prolonged labor, and BMI (n=98)

Variable	f	%
Type of Delivery		
Cesarean Section	35	36
Vaginal (Normal)	63	64
Hemorrhage		
Yes	5	6
No	93	94
Premature Labor		
Yes	10	10
No	88	90
Prolonged Labor		
Yes	8	8
No	90	92
Body Mass Index (BMI)		
Underweight (<18.5)	15	15
Normal (18.5 - 24.9)	51	52
Overweight/Obese (≥25.0)	32	33

Table 1 shows that the type of delivery most respondents gave birth normally (64%), the majority of respondents did not experience hemorrhage (94%), the majority did not experience premature labor and prolonged labor respectively (90% and 92%). BMI with normal category (52%), while the underweight category has the smallest percentage (15%).

Bivariate Analysis

Based on **Table 2**, in the group of mothers with underweight BMI (<18.5), 10.4% underwent normal delivery and 5.1% underwent cesarean delivery. In the normal BMI group (18.5-24.9), most (38.4%) gave birth normally, while 13.4% underwent a section cesarean. Conversely, in the overweight/obese group (≥25), the percentage of cesarean delivery (17.5%) was higher than normal delivery (15.2%). This distribution shows a tendency for increased cesarean delivery in mothers with higher BMI. Based on the results of statistical tests, there is a significant relationship between BMI and type of delivery, p = 0.037, (p-value ≤0.05). Based on the results of the study, it was found that the BMI of pregnant women was significantly related to the type of delivery. This finding is in line with studies by (17,18, 19,20), which showed that obesity increases the likelihood of cesarean delivery in mothers compared to normal BMI. In addition, in Pakistan revealed that BMI is positively associated with complications of cesarean delivery, such as deep vein thrombosis, endometritis, fever, and wound

Table 2. Relationship between BMI and type of delivery (n=98)

Variable	Type of Delivery				Total		P Value
	Section Cesarean		Vaginal (Normal)				
	f	%	f	%	f	%	
Body Mass Index (BMI)							
Underweight (<18.5)	5	5.1	10	10.4	15	15.5	
Normal (18.5–24.9)	13	13.4	38	38.4	51	51.8	0.037
Overweight/Obese (≥ 25.0)	17	17.5	15	15.2	32	32.7	
Total	35	36	63	64	98	100	

infection (21). This study shows that obesity significantly increases the risk of these complications. Sub-Saharan Africa showed that obese women had a 1.5–4.3 times higher prevalence of caesarean delivery compared to women with a normal BMI (22). This prevalence increased to 5.9 times in women with morbid obesity overall. This evidence confirms that suboptimal BMI, especially obesity, increases the risk of caesarean delivery. These findings provide a strong analytical basis for formulating health promotion strategies in antenatal care. The significant association between BMI and delivery type suggests that maternal nutritional status is a modifiable factor. Therefore, health promotion interventions can be directed at preventing abnormal BMI from preconception through pregnancy, specifically through risk screening, nutrition counseling, and education on weight management during pregnancy. Strengthening education on weight management can help prevent cesarean deliveries. This approach aligns with WHO recommendations and previous studies showing that health promotion on nutrition education and weight management during pregnancy can reduce the risk of labor complications (31, 32).

Based on **Table 3**, in the group of mothers with underweight BMI (<18.5), no cases of hemorrhage were found, while 15.2% did not experience hemorrhage. In the normal BMI group (18.5–24.9), 3.6% experienced hemorrhage, and 48.5% did not experience hemorrhage. While in the overweight/obese group (≥25), 2.4% experienced bleeding, and 30.3% did not experience bleeding. Overall, the number of hemorrhage incidents was relatively low in all BMI groups. The results of statistical tests showed that there was no significant relationship between BMI and the incidence of hemorrhage, p = 0.620, (p-value ≥0.05). The results of the study showed that there was no significant relationship between BMI and the incidence of hemorrhage. This finding is in line with the meta-analysis of (23)′ which also reported no significant effect of BMI on hemorrhage. However, several other studies, such as (16, 24, 25), found that obesity significantly increases the risk of hemorrhage. This difference in results is

Table 3. Relationship between BMI and Hemorrhage (n=98)

Variable	Hemorrhage				Total		P Value
	Yes		No				
	f	%	f	%	f	%	
Body Mass Index (BMI)							
Underweight (<18.5)	0	0	15	15.2	15	15.2	
Normal (18.5–24.9)	3	3.6	48	48.5	51	52.1	0.62
Overweight/Obese (≥ 25.0)	2	2.4	30	30.3	32	32.7	
Total	5	6	93	94	98	100	

likely due to variations in study design, population characteristics, and other risk factors. Although this study did not show a significant link between BMI and postpartum hemorrhage, maternal nutritional status is still a modifiable factor that can impact pregnancy outcomes. Health promotion efforts should focus on achieving and maintaining a healthy BMI through pre-pregnancy counseling, nutritional guidance, and regular monitoring of weight gain during pregnancy.

These measures can help lower overall maternal risks, including bleeding complications, by supporting maternal health and preparing women for a safer delivery.

Table 4 shows that in the group of mothers with underweight BMI (<18.5), only 1.0% experienced premature labor, while 14.4% gave birth at term. In the normal BMI group (18.5–24.9), the incidence of premature labor was recorded at 5.0%, while 47.0% gave birth at term. In the overweight/obese group (≥25), there were 4.0% who experienced premature labor, and 28.6% gave birth at term. When viewed from the percentage distribution, premature labor occurred in all BMI groups, but without a striking pattern between one category and another. The results of statistical analysis showed that there was no significant relationship between BMI and the incidence of premature labor, p = 0.820, (p-value ≥0.05). Based on **Table 4**, the results of the statistical test showed no significant

Table 4. Relationship between BMI and Premature Labor (n=98)

Variable	Premature Labor				Total		P Value
	Yes		No				
	f	%	f	%	f	%	
Body Mass Index (BMI)							
Underweight (<18.5)	1	1	14	14.4	15	15.4	
Normal (18.5–24.9)	5	5	46	47	51	52	0.82
Overweight/Obese (≥ 25.0)	4	4	28.6	88	32	32.6	
Total	10	10	88	90	98	100	

relationship between BMI and the incidence of preterm birth. This finding is in line with the meta-analysis (16, 26) concluded that there was no significant relationship between low BMI and the incidence of preterm labor, while overweight/obesity increased the risk of preterm labor. However, research by (27, 28) showed that obesity significantly increases the risk of preterm birth. These differences in results may be due to differences in methodology, study population, and other factors that influence the incidence of preterm birth. Although this study found no significant relationship between BMI and preterm birth, maternal nutritional status remains a modifiable factor that can affect pregnancy outcomes. Health promotion strategies should focus on achieving a healthy BMI through preconception counseling, nutrition education, and monitoring weight gain during pregnancy. These interventions can help optimize maternal health, reduce general pregnancy risks, and prepare women for safer deliveries, even if BMI is not directly linked to preterm labor in this study.

Table 5 Shows that in the group of mothers with underweight BMI (<18.5), 1.0% experienced prolonged labor, while 14.3% did not experience this condition. Mothers with normal BMI (18.5–24.9) showed a figure of 5.0% for the occurrence of prolonged labor and 47.1% for normal labor. Meanwhile, in the overweight/obese group (≥25), 2.0% experienced prolonged labor and 30.6% did not experience it. The results of statistical tests showed that there was no significant relationship between BMI and the occurrence of prolonged labor, p = 0.825, (p-value ≥0.05). Based on **Table 5,** the results of the statistical test showed that there was no significant relationship between BMI and the incidence of prolonged labor. This shows that an increase in BMI is not always directly proportional to the incidence of prolonged labor, because this condition can be influenced by many factors such as maternal age, parity, and obstetric status. Obesity was associated with prolonged labor and increased use of oxytocin, but did not always result in clinically prolonged labor (29). Longer labor duration in obese

Table 5. Relationship between BMI and Prolonged Labor (n=98)

Variable	Prolonged Labor				Total		P Value
	Yes		No				
	f	%	f	%	f	%	
Body Mass Index (BMI)							
Underweight (<18.5)	1	1	14	14.3	15	15.3	
Normal (18.5–24.9)	5	5	46	47.1	51	52.1	0.825
Overweight/Obese (?25.0)	2	2	30	30.6	32	32.6	
Total	8	8	90	92	98	100	

mothers was not always significant due to variations in labor management (30). Meanwhile, high BMI did increase the risk of labor dysfunction and medical intervention, but did not always cause prolonged labor directly (16). Although no significant association was found between BMI and prolonged labor in this study, maternal nutritional status remains an important factor that can be modified to improve pregnancy outcomes. Health promotion efforts, such as pre-pregnancy counseling, personalized nutrition guidance, monitoring weight gain during pregnancy, as well as education on physical activity, stress management, and early recognition of pregnancy complications, can support maternal well-being and optimize labor outcomes. These strategies empower pregnant women to maintain a healthy BMI, reduce overall maternal risks, and prepare for safer deliveries (32).The limitation of this study is that some of the data used comes from records in the KIA book and reports from pregnant women, thus allowing for incomplete data or information bias.

CONCLUSION AND RECOMMENDATION

Based on the results of the study, it can be concluded that there is a significant relationship between BMI and type of delivery; pregnant women with an overweight or obese BMI are more likely to undergo cesarean delivery. Meanwhile, no significant relationship was found between BMI and the incidence of postpartum hemorrhage, premature delivery, or prolonged labor. This shows that BMI is not the only factor that influences maternal outcomes. These findings provide an analytical basis for health promotion strategies in maternal care.

Suggestions for further research to consider other factors more comprehensively, previous pregnancy history, blood pressure, socioeconomic status, and access to and quality of health services, so that the relationship between maternal nutritional status and childbirth complications can be analyzed more accurately and comprehensively. Such evidence can further strengthen the development of targeted health promotion programs for pregnant women.

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