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THE LINK BETWEEN NUTRIENT INTAKE AND PREECLAMPSIA INCIDENCE IN PREGNANT WOMEN AT PUSKESMAS UMBULHARJO 1 YOGYAKARTA

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Abstract

This study addresses the relatively high maternal mortality rate in Indonesia, where in 2023 there were 4,460 cases, with hypertension during pregnancy as a leading cause. It aims to examine the relationship between nutrient intake, maternal age, parity, and nutritional status and the incidence of preeclampsia at Umbulharjo 1 Public Health Center in Yogyakarta. Using a quantitative cross-sectional design, the study involved 45 respondents selected through accidental sampling based on Slovin's formula, with data collected באמצעות the Semi-Quantitative Food Frequency Questionnaire (SQFFQ). The findings revealed that 33.3% of respondents experienced preeclampsia, with most showing inadequate intake of protein, fat, carbohydrates, sodium, and potassium, but relatively adequate fiber intake. The majority were within the non-risk maternal age group, had low-risk parity, and exhibited poor nutritional status. Bivariate analysis using Fisher's exact test indicated significant associations between preeclampsia and fat intake, fiber intake, sodium intake, maternal age, parity, and nutritional status, while no significant relationships were found with protein, carbohydrate, or potassium intake. Overall, the study concludes that several nutritional and maternal factors are significantly linked to the occurrence of preeclampsia, highlighting the importance of dietary and maternal health considerations in its prevention.

Keywords: Preeclampsia, Nutrition, Nutritional Status, Parity, Maternal Age

Introduction

Pregnancy is a natural process that brings about various physiological and environmental changes in a woman's body. During this period, the body undergoes fundamental adaptations to support fetal growth and development (Chandra & Paray, 2024; Murray & Hendley, 2020). However, complications can arise at any stage of pregnancy and may have serious consequences for both the mother and the fetus. High-risk pregnancies are associated with increased maternal and fetal morbidity and mortality (Correa-de-Araujo & Yoon, 2021). In 2023, Indonesia recorded 4,460 maternal deaths, with hypertension during pregnancy identified as the leading cause (412 cases). In the Special Region of Yogyakarta, maternal mortality reached 162 cases in 2021 (Kemenkes RI, 2023).

Preeclampsia is a condition characterized by elevated blood pressure, proteinuria, and edema occurring after 20 weeks of gestation or within 48 hours postpartum, with urinary protein levels ≥300 mg per 24 hours (Hauspurg & Jeyabalan, 2022; Overton et al., 2022). The exact cause of preeclampsia remains unclear; however, hypertension during pregnancy is a major contributing factor that can lead to adverse outcomes for both mother and fetus (Chang et al., 2023). Maternal

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complications include placental abruption, hemolysis, cerebral hemorrhage, cardiac disorders, HELLP syndrome, and renal dysfunction (Patel et al., 2025). For the fetus, preeclampsia may result in low birth weight due to reduced placental blood flow caused by arteriolar spasm in the decidua, leading to impaired placental function, restricted fetal growth, and even intrauterine fetal death.

Nutritional problems during pregnancy can increase the risk of metabolic disorders such as dyslipidemia, insulin resistance, diabetes, and hypertension (Jiang et al., 2022). These conditions may contribute to atherosclerosis and cardiovascular dysfunction, which can impair placental blood circulation and lead to placental dysfunction. This dysfunction is a key factor in the development of preeclampsia. Therefore, maintaining a balanced nutritional intake from early pregnancy is essential to support maternal health and optimal fetal development.

Maternal nutrient intake is one of the contributing factors to pregnancy complications, including preeclampsia (Kinshella et al., 2022). Previous studies have shown that nearly half of pregnant women with preeclampsia have nutrient intake levels below the recommended dietary allowances. These studies also demonstrated a significant association between nutrient intake and the incidence of preeclampsia (Gebreyohannes et al., 2021; Tampubolon et al., 2021).

A preliminary study involving brief interviews with five pregnant women attending antenatal care revealed that three women with a history of preeclampsia had poor dietary patterns, characterized by high fat intake and low fiber consumption. These initial findings, supported by existing literature and background evidence, motivated the researcher to conduct a more in-depth analysis of the relationship between nutrient intake and the risk of preeclampsia at Umbulharjo 1 Public Health Center, Yogyakarta.

Method

This study employed a quantitative research design with a cross-sectional approach and was conducted at Umbulharjo 1 Public Health Center, Yogyakarta. The study population consisted of pregnant women attending antenatal care at the health center during the study period. A total of 45 respondents were selected using a non-probability sampling technique, specifically accidental sampling. The sample size was determined prior to data collection.

The inclusion criteria for this study were pregnant women aged 17–45 years and those with a gestational age of more than 20 weeks. Data were collected from primary sources using a Semi-Quantitative Food Frequency Questionnaire (SQFFQ) with a one-month reference period to assess nutrient intake.

Data collection was carried out through direct interviews with respondents using structured questionnaires. The collected data were then processed and analyzed statistically. Univariate analysis was used to describe the characteristics of the respondents and the distribution of variables. Bivariate analysis was conducted using Fisher’s exact test to examine the relationship between independent variables and the incidence of preeclampsia. A p-value of less than 0.05 was considered statistically significant.

Results

Out of 45 respondents, 33.3% experienced preeclampsia. Most respondents were in the non-risk age group (73.3%), had low-risk parity (89.9%), and had poor nutritional status (60.0%). In terms of dietary intake, the majority had inadequate intake of protein (80.0%), fat (51.1%), carbohydrates (73.3%), sodium (75.6%), and potassium (93.3%), while more than half had adequate fiber intake (55.6%). Most respondents were housewives (60.0%) and had a senior high school education (48.9%).

Table 1. Frequency Distribution of Respondent Characteristics (n = 45)

Variable	n	%
Preeclampsia		
Yes	15	33.3
No	30	66.7
Protein Intake		
Adequate	9	20.0
Inadequate	36	80.0
Fat Intake		
Adequate	22	48.9
Inadequate	23	51.1
Carbohydrate Intake		
Adequate	12	26.7
Inadequate	33	73.3
Fiber Intake		
Adequate	25	55.6
Inadequate	20	44.4
Sodium Intake		
Adequate	11	24.4
Inadequate	34	75.6
Potassium Intake		
Adequate	3	6.7
Inadequate	42	93.3
Maternal Age		
At risk	12	26.7
Not at risk	33	73.3
Parity		
Low risk	40	89.9
High risk	5	10.1
Nutritional Status		
Good	18	40.0
Poor	27	60.0
Occupation		
Housewife	27	60.0
Self-employed	6	13.3

Variable	n	%
Teacher	6	13.3
Private employee	6	13.3
Education		
Junior high school	1	2.2
Senior high school	22	48.9
Diploma (D3)	2	4.4
Bachelor's degree	18	40.0
Master's degree	2	4.4

The bivariate analysis showed that several variables were significantly associated with the incidence of preeclampsia. Significant relationships were found for fat intake (p = 0.000), fiber intake (p = 0.000), sodium intake (p = 0.008), maternal age (p = 0.000), parity (p = 0.036), and nutritional status (p = 0.001). Mothers with inadequate fat and fiber intake, high sodium intake, at-risk maternal age, high-risk parity, and poor nutritional status were more likely to experience preeclampsia.

In contrast, no significant associations were observed between protein intake (p = 0.135), carbohydrate intake (p = 0.174), and potassium intake (p = 0.254) with the incidence of preeclampsia. These findings indicate that not all nutrient components contribute equally to the risk of preeclampsia, highlighting the importance of specific dietary factors and maternal characteristics in its development.

Table 2. Association Between Independent Variables and Preeclampsia (n = 45)

Variable	Category	Preeclampsia Yes n (%)	No n (%)	Total	p-value
Protein Intake	Inadequate	10 (27.8)	26 (72.2)	36	0.135
	Adequate	5 (55.6)	4 (44.4)	9	
Fat Intake	Inadequate	15 (65.2)	8 (34.8)	23	0.000*
	Adequate	0 (0.0)	22 (100)	22	
Carbohydrate Intake	Inadequate	9 (27.3)	24 (72.7)	33	0.174
	Adequate	6 (50.0)	6 (50.0)	12	
Fiber Intake	Inadequate	14 (70.0)	6 (30.0)	20	0.000*
	Adequate	1 (4.0)	24 (96.0)	25	
Sodium Intake	Inadequate	15 (44.1)	19 (55.9)	34	0.008*
	Adequate	0 (0.0)	11 (100)	11	
Potassium Intake	Inadequate	13 (31.0)	29 (69.0)	42	0.254
	Adequate	2 (66.7)	1 (33.3)	3	
Maternal Age	At risk	10 (83.3)	2 (16.7)	12	0.000*
	Not at risk	5 (15.2)	28 (84.8)	33	
Parity	High risk	4 (80.0)	1 (20.0)	5	0.036*
	Low risk	11 (27.5)	29 (72.5)	40	
Nutritional Status	Poor	14 (51.9)	13 (48.1)	27	0.001*
	Good	1 (5.6)	17 (94.4)	18	

Discussion

This study conducted at Umbulharjo 1 Public Health Center, Yogyakarta, found that out of 45 pregnant women, 15 (33.3%) experienced preeclampsia, while 30 (66.7%) did not. All respondents received antenatal care (ANC) services at the health center, which include routine maternal and fetal health examinations, particularly blood pressure monitoring. Pregnant women who showed elevated blood pressure during ANC visits were referred to hospitals for further evaluation.

Based on interviews with respondents, it is assumed that the occurrence of preeclampsia is influenced by several factors, including poor dietary patterns, unfavorable nutritional status, and maternal age. This assumption is supported by the statistical findings, which demonstrate significant associations between several independent variables and preeclampsia (Yang et al., 2021). In addition, most pregnant women with preeclampsia reported having unbalanced dietary patterns (Abbasi et al., 2021). The univariate analysis further confirmed that a large proportion of respondents had inadequate nutrient intake, indicating that dietary imbalance remains a common issue.

The results showed no significant association between protein intake and preeclampsia ($p = 0.135$), although most respondents had inadequate protein intake. Interviews revealed that animal protein consumption was relatively low, with a preference for plant-based protein sources and high-calorie, low-protein snacks. This finding is consistent with previous studies reporting no association between protein intake and hypertension (He et al., 2022). Protein plays an essential role during pregnancy, particularly in tissue formation, cell regeneration, and placental development (Burton & Jauniaux, 2023). While excessive intake of animal protein may increase blood pressure due to higher saturated fat and cholesterol content, plant-based protein may have protective effects against hypertension. Therefore, both the quantity and quality of protein intake are important considerations during pregnancy. In contrast, fat intake was significantly associated with preeclampsia.

Most women with preeclampsia had excessive fat intake, largely due to frequent consumption of high-fat foods such as fried snacks, processed foods, and fast food. Additionally, most respondents were housewives with relatively low physical activity levels, which may contribute to fat accumulation. Cooking methods, particularly frying, also played a role in increasing fat intake. This finding aligns with previous studies showing a significant relationship between fat intake and preeclampsia (S. Li et al., 2021). High-fat consumption can increase oxidative stress through lipid peroxidation, leading to endothelial dysfunction—a key mechanism in the development of preeclampsia. Furthermore, excessive fat intake may contribute to atherosclerosis, increasing vascular resistance and blood pressure. No significant association was found between carbohydrate intake and preeclampsia. This may be explained by reduced appetite among some pregnant women due to nausea, leading to lower carbohydrate intake or substitution with alternative foods. This finding is consistent with previous studies reporting no association between carbohydrate intake and hypertension (Q. Li et al., 2021). Carbohydrates serve as the primary energy source during pregnancy, contributing approximately 50–60% of total energy intake. However, excessive carbohydrate intake may lead to increased triglyceride levels and fat accumulation, potentially contributing to cardiovascular risk factors, including hypertension.

Fiber intake, on the other hand, showed a significant association with preeclampsia. Most pregnant women with preeclampsia had low fiber intake, primarily due to low consumption of fruits and vegetables. Some respondents reported disliking vegetables or consuming them infrequently. Adequate fiber intake during pregnancy plays a protective role by reducing cholesterol levels and improving vascular health. Fiber helps inhibit bile acid reabsorption and reduces plasma lipid levels, thereby lowering the risk of hypertension. Insufficient fiber intake may lead to increased cholesterol circulation and vascular resistance, contributing to elevated blood pressure (Jama et al., 2024).

This study found a significant association between sodium intake and preeclampsia. Many respondents reported frequent consumption of high-sodium foods such as instant noodles, processed

foods, soy sauce, and sausages. Additionally, most respondents reported using approximately one teaspoon of salt in daily cooking. Excessive sodium intake increases extracellular fluid volume and promotes water retention, leading to increased blood volume and elevated blood pressure. This mechanism is mediated through the renin–angiotensin–aldosterone system, which plays a crucial role in blood pressure regulation. In contrast, no significant association was found between potassium intake and preeclampsia (Uddin et al., 2023). Despite this, most respondents had inadequate potassium intake due to low consumption of fruits and vegetables. This finding is consistent with previous studies reporting no significant relationship between potassium intake and preeclampsia. Potassium plays an important role in maintaining electrolyte balance and counteracting the effects of sodium. It promotes natriuresis, reduces renin secretion, and helps regulate blood pressure. Therefore, maintaining a balance between sodium and potassium intake is essential during pregnancy.

Maternal age was significantly associated with preeclampsia. The findings suggest that pregnancies occurring at high-risk ages (<20 years or >35 years) are more likely to develop preeclampsia. Interviews indicated that some women delayed marriage and pregnancy due to educational or occupational reasons, leading to pregnancies at older ages. Women under 20 years may have immature reproductive systems, while women over 35 years may experience degenerative vascular changes, both of which increase the risk of hypertension and preeclampsia (Farkas et al., 2024). Parity was also significantly associated with preeclampsia. A higher proportion of preeclampsia cases occurred among women with high-risk parity . Some respondents had a history of preeclampsia in previous pregnancies, which increases the likelihood of recurrence. High parity (more than three pregnancies) may weaken uterine and vascular function, increasing the risk of pregnancy complications, including endothelial dysfunction and hypertension.

Nutritional status showed a significant association with preeclampsia. Many women with preeclampsia were classified as having poor nutritional status, particularly overweight or obesity. This was associated with high consumption of energy-dense, high-fat foods and low physical activity levels. Obesity contributes to increased levels of free fatty acids, insulin resistance, and systemic inflammation, all of which can impair placental function and blood flow (Eastman et al., 2021). These conditions may lead to placental ischemia and endothelial dysfunction, which are central mechanisms in the development of preeclampsia.

Conclusion

This study concludes that both nutritional intake and maternal characteristics are important factors associated with the occurrence of preeclampsia among pregnant women at Umbulharjo 1 Public Health Center, Yogyakarta. The findings indicate that imbalanced dietary patterns, particularly high fat and sodium intake and low fiber intake, are significantly associated with an increased risk of preeclampsia, while protein, carbohydrate, and potassium intake show no significant relationship with its incidence. In addition, maternal age, parity, and nutritional status were also significantly associated with preeclampsia, suggesting that both biological and lifestyle-related factors contribute to its development. These results highlight that preeclampsia is a multifactorial condition influenced by the interaction of maternal health status and dietary behavior, where poor nutritional quality and high-risk maternal conditions may increase susceptibility to the disease. Therefore, maintaining a balanced diet and optimal nutritional status during pregnancy is essential in preventing complications. Early screening and identification of high-risk pregnant women, along with continuous nutritional education and counseling during antenatal care services, are recommended to reduce the risk of preeclampsia and improve maternal and fetal health outcomes.

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