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The relationship between diet and the incidence of anemia in pregnant women in the third trimester

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Abstract

Background: Anemia in pregnant women is a serious health problem because it increases the risk of maternal morbidity and mortality, preterm delivery, and low birth weight infants, especially during the third trimester when iron requirements significantly increase. Dietary patterns play an important role in the incidence of anemia, as inadequate intake of iron-rich foods and supporting nutrients can lead to decreased hemoglobin levels. Therefore, dietary patterns are an important factor associated with anemia among third-trimester pregnant women.

Purpose: To determine the relationship between dietary patterns and the incidence of anemia among third-trimester pregnant women.

Method: This study employed a quantitative research method with a cross-sectional design. The sampling technique used was purposive random sampling, involving a population of 80 pregnant women and a sample of 48 respondents. Data collection consisted of primary data for the dietary pattern variable, which were obtained using a dietary pattern questionnaire, and secondary data for the anemia variable, which were collected from the Maternal and Child Health (MCH) handbook records. Data were analyzed using the Kendall's tau statistical test.

Results: The results of the statistical analysis using Kendall's tau test showed a p-value of 0.000, which was less than $\alpha = 0.05$, indicating a statistically significant relationship between dietary patterns and the incidence of anemia. The correlation coefficient obtained was 0.859, indicating a strong category of relationship.

Conclusion: It can be concluded that there is a significant relationship between dietary patterns and the incidence of anemia among third-trimester pregnant women.

Keywords: Anemia; Dietary Patterns; Third Trimester Pregnant Women.

INTRODUCTION

Pregnancy is a complex physiological period that requires special attention to maternal health, as it plays a crucial role in determining the quality of fetal growth and development. During this period, nutritional needs increase to support maternal and fetal tissue formation and maintain a stable body metabolism. However, not all pregnant women are able to optimally meet these nutritional needs, either due to limited access, knowledge, or unbalanced dietary patterns. An imbalance between nutritional needs and nutrient intake can lead to various health problems, one of which is anemia (Ballestín, Campos, Ballestín, & Bartolomé, 2021).

Anemia in pregnant women is a condition characterized by reduced hemoglobin levels in the blood (<11 g/dL), which results in suboptimal oxygen distribution to body tissues (World Health Organization, 2021). Common early symptoms include excessive fatigue, weakness, dizziness, and a pale complexion. Pregnant women often dismiss these symptoms as normal, but they actually indicate a disruption in oxygen circulation (Sun, Shen, Huang, Jiang, Wang, Zhang, & Ma, 2021). If left untreated, anemia can cause systemic effects, such as increased heart rate (tachycardia), mild shortness of breath during activity, and reduced concentration and

productivity (Pebrina, Fernando, & Fransiska, 2021). Furthermore, anemia also compromises the immune system, making pregnant women more susceptible to infection (Sari, Fitri, & Dewi, 2021). More seriously, anemia can increase the risk of obstetric complications, such as preeclampsia, placenta previa, and premature rupture of membranes (decompensated premature rupture of membranes) (Kaushal, Priya, Thakur, Marwaha, & Kaur, 2022). Not only that, anemia increases the likelihood of antepartum hemorrhage (antepartum hemorrhage) and postpartum hemorrhage, one of the main causes of maternal death in developing countries (World Health Organization, 2021).

The impact on the fetus is also significant. Severe anemia contributes to an increased risk of low birth weight (LBW), premature birth, and impaired organ development (Sun et al., 2021). Recent research also shows that anemia during pregnancy is correlated with an increased risk of stunting and impaired cognitive development in early childhood. In extreme cases, untreated anemia can lead to maternal and fetal death (Wang, Xu, Hao, Jin, Pan, Xia, & Wang, 2025).

According to a 2023 World Health Organization (WHO) report, the global prevalence of anemia among pregnant women reached 35.5%. In Indonesia, the 2023 Indonesian Health Survey (SKI) showed that 27.7% of pregnant women experienced anemia, indicating that more than a quarter of the country's pregnant population is exposed to this condition. At the regional level, the prevalence of anemia among pregnant women in the Special Region of Yogyakarta (DIY) Province was reported at 37.8% (Yogyakarta City Health Service, 2022). Meanwhile, at the district level, data from community health centers and the Sleman Regency Health Office in 2023 recorded a prevalence rate of 34.6%.

The Indonesian government, through Minister of Health Regulation No. 88 of 2014 concerning Iron Tablet Standards for Adolescent Girls and Pregnant Women, stipulates that every pregnant woman is required to receive 90 iron tablets during pregnancy. Furthermore, the national strategy for anemia management is also outlined in Presidential Regulation No. Law No. 72 of 2021 concerning the Acceleration of Stunting Reduction supports improving the nutritional status of pregnant women as

a preventative measure. However, the implementation of this policy still faces challenges in terms of public compliance and understanding of the importance of consuming iron supplements and maintaining a healthy diet.

Various efforts have been made by the community through integrated health posts, nutrition counseling, and distribution of iron tablets (Amin, Salsabilah, Pratama, Salsabila, Satria, & Az-Zahra, 2024). However, the incidence of anemia remains high, indicating that this problem remains unresolved due to low compliance with iron tablet intake (Nimwesiga, Murezi, & Taremwa, 2021). Many pregnant women still have limited knowledge about nutritious diets and are inconsistent in consuming iron-rich foods. This reflects real public concern about the health status of pregnant women.

Several factors contribute to anemia in pregnant women, including maternal age, socioeconomic status, education level, nutritional status, iron tablet consumption, parity, bleeding, and an unbalanced diet (Astuti & Ertiana, 2018; Dewi, & Mardiana, 2021). Diet plays a crucial role because it is directly related to nutritional intake, especially iron, and the availability of other micronutrients needed for hemoglobin formation (Liana, Wulandari, & Darmi, 2023). Lack of dietary diversity can increase the risk of anemia in pregnant women. Pregnant women who consume fewer than five food groups are at risk. dalam sehari cenderung mempunyai kadar hemoglobin yang rendah dibanding dengan ibu hamil yang memiliki variasi makanan yang variasinya lebih dari atau sama dengan lima (Al-Bayyari, Al Sabbah, Hailat, AlDahoun, & Abu-Samra, 2024).

Low-frequency eating (<3 times a day) can also be a significant risk factor, as it can lead to low total daily energy and iron intake (Gibore, Ngowi, Munyogwa, & Ali, 2021). Low consumption of animal iron sources, such as liver, red meat, and fish, as well as a predominance of plant-based foods with non-animal iron sources that are less absorbable, contribute to iron deficiency. The study also showed that pregnant women who consumed meat less than once a week or less frequently had a three-fold higher risk of anemia compared to those who consumed more meat (Zhang, Li, Song, Fang, Huang, & Sun, 2022).

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The habit of drinking tea and coffee after meals has also been shown to increase the risk of anemia because the tannins and polyphenols in these beverages can inhibit iron absorption in the intestine

(Gibore et al., 2021). Therefore, a balanced diet, adequate dietary diversity, optimal meal frequency, and avoiding tea or coffee after meals may be key to preventing anemia during pregnancy.

RESEARCH METHOD

This study used quantitative data and a cross-sectional design. The sampling technique used was purposive random sampling, with a population of 80 pregnant women and a sample of 48 respondents. Primary data for dietary patterns was collected using a dietary pattern questionnaire, while secondary data for anemia incidence was obtained from the maternal and child health (KIA) handbook. These data were then analyzed using the Kendall's tau test. The research process was carried out in three main stages: preparation, implementation, and finalization.

In the preparation stage, the researcher began by proposing the research title and conducting consultations with the academic supervisor. Subsequently, a preliminary study permit was arranged from the university to the Yogyakarta City Health Office and continued to the Tegalrejo Public Health Center. The researcher then developed the research proposal, followed by consultations and a proposal seminar. After revising the proposal based on feedback, ethical clearance was obtained from the Ethics Committee of Universitas 'Aisyiyah Yogyakarta. In addition, a research permit was issued by the Faculty of Health Sciences and submitted to the Tegalrejo Public Health Center to proceed with data collection.

The implementation stage involved direct data collection at the Tegalrejo Public Health Center. The researcher first ensured that all respondents met the inclusion and exclusion criteria. The inclusion criteria included third-trimester pregnant women (≥ 28 weeks of gestation) who attended antenatal care at the health center, had undergone hemoglobin (Hb) examination, were in good health without chronic diseases, and had complete medical records related to hemoglobin status. Prior to data collection, respondents were given a clear explanation regarding the objectives, benefits, and procedures of the study. Informed consent was obtained from all participants. Data collection was conducted by distributing structured questionnaires to respondents and assisting them during completion when necessary. Afterward, all completed questionnaires were checked for completeness and accuracy before proceeding to the data processing stage.

The final stage consisted of data processing, analysis, and interpretation. The researcher then compiled the research report, followed by consultation with the supervisor. The results were presented in a final seminar, revised based on feedback, and subsequently prepared for publication.

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RESEARCH RESULT

Table Frequency Distribution of Respondent (N=48)

Variable	Results	P-value	Correlation Coefficient
Age (Mean±SD) (Years)	(28.95 ± 3.87) (20-35)		
20-25	9/19.0		
26-30	20/42.0		
31-35	19/39.0		
Education (n/%)			
Junior High School	0/0		
Senior High School	24/50.0		
Bachelor	24/50.0		
Parity (n/%)			
0	19/39.6		
1	13/27.1		
2	13/27.1		
3	3/6.3		
Occupation (n/%)			
Employee	14/29.0		
Entrepreneur	20/42.0		
Civil Servants	14/29.0		
Dietary Habit (n/%)		0.00	0.859
Good	27/56.3		
Enough	5/10.4		
Poor	16/33.3		
Anemia in Pregnant Women (n/%)			
Yes	29/60.4		
No	19/39.6		

The results of the study based on table respondent characteristics show that based on education, pregnant women with high school and college education (PT) have the same prevalence, each as many as 24 people (50%), while pregnant women with junior high school education were not found or as many as 0 people (0%). Based on age, most pregnant women are in the age range of 26-30 years, namely as many as 20 people (41.7%), followed by pregnant women aged 31-35 years as many as 19 people (39.6%), while pregnant women aged 20-25 years as many as 9 people (18.8%). Based on parity, pregnant women with parity 0 are the largest group, namely as many as 19 people (39.6%), followed by parity 1 and parity 2, each amounting to 13 people (27.1%), and parity 3 as many as 3 people (6.3%). Based on occupation, pregnant women who work as civil servants are the largest group, namely 20 people (41.7%), while pregnant women who work as employees and entrepreneurs/self-employed are 14 people each (29.2%). Based on the data analysis, the distribution of respondents by dietary patterns showed that the majority of pregnant women had a good diet, namely 27 people (56.3%). Respondents

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with an inadequate diet numbered 16 people (33.3%), while those with an adequate diet made up the smallest proportion, namely 5 people (10.4%). Based on the analysis of the distribution of respondents based on the incidence of anemia in pregnant women, it was shown that the majority of respondents, 29 (60.4%), did not experience anemia. Meanwhile, 18 (39.6%) respondents experienced anemia.

The statistical test used in this analysis, as the dietary pattern variable is ordinal and the anemia incidence variable is ordinal. The Kendall's Tau test showed a p-value of 0.00 ($p < 0.05$), and the correlation coefficient was 0.859, indicating a statistically significant, strong, and positive correlation between the dietary patterns of pregnant women and the incidence of anemia.

DISCUSSION

Diet plays a crucial role in meeting iron requirements during pregnancy, especially in the third trimester. Iron requirements increase significantly to support fetal growth and maternal blood volume. Inadequate dietary intake of iron and vitamin C will affect hemoglobin, resulting in low hemoglobin levels. Other research showed that dietary protein and vitamin C intake were significantly correlated with the incidence of anemia in pregnant women in the third trimester, underscoring the importance of a quality diet in preventing anemia (Masrikhiyah & Rahmawati, 2024).

Other research also demonstrated a significant relationship between diet and maternal nutrition, including the incidence of anemia due to micronutrient deficiencies such as iron and folate. A less varied diet and low iron content can increase the risk of anemia, aligning with findings from a dietary study at the Cilacap Utara 2 Community Health Center, which found that pregnant women with poor diets had a higher risk of anemia compared to those with healthy diets (Prasetyani, Apriani, & Halimatusyadiyah, 2020).

According to researchers, it is crucial for pregnant women to maintain a healthy diet because they require adequate nutrition for both the mother and the fetus. Maintaining a healthy diet can help prevent anemia. Iron deficiency can disrupt or hinder fetal growth, both in body cells and the brain. Pregnant women with severe anemia can increase the risk of maternal and fetal morbidity, and the likelihood of delivering a low birth weight (LBW) or premature baby.

Anemia in pregnant women is a serious problem in the community, with a high prevalence, even though some respondents attend regular antenatal care visits. In this study, the percentage of pregnant women with anemia was recorded at 18 (39.6%).

Pregnant women are considered anemic if their hemoglobin level is <11 g/dL, and this condition can negatively impact the health of both mother and fetus, such as increasing the risk of bleeding during delivery, premature birth, and low birth weight.

According to pregnancy physiology theory, during the third trimester, plasma volume increases more rapidly than red blood cells, resulting in hemodilution, which triggers a decrease in hemoglobin levels if iron requirements from food and supplements are not met (Situmorang, Hilinti, Yulianti, Iswari, & Sari, 2021). This theory is supported other research who showed that anemia in pregnancy is significantly influenced by iron deficiency due to the consumption of foods low in iron and vitamins that support absorption (Gozali, 2022).

A study at the Sitanggal Community Health Center reported a very high prevalence of anemia in pregnant women, with nearly every respondent experiencing anemia. This is influenced by a combination of low knowledge, non-adherence to iron tablet consumption, and inadequate dietary intake. This suggests that nutritional interventions and education are crucial for reducing anemia rates, especially in areas with limited access to health information (Masrikhiyah & Rahmawati, 2024).

Anemia during pregnancy can be prevented by improving nutritional intake through a balanced diet, increasing iron intake by taking iron supplements, and treating diseases that can cause or worsen anemia, such as worm infestation, malaria, and tuberculosis. Iron deficiency anemia can also be prevented by maintaining a balance between the amount of iron consumed and the body's needs and the iron losses that occur (Sattu, 2023).

Based on research conducted at the Tegalrejo Community Health Center, a significant association was found between dietary patterns and the incidence

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of anemia in pregnant women in the third trimester. Statistical tests showed a p-value of 0.00 ($p < 0.05$), indicating a statistical association between dietary patterns and the incidence of anemia in pregnant women in the third trimester. These results are in line with the other research which examined the relationship between dietary patterns and the incidence of anemia in pregnant women in the third trimester in the Nanggaleng Sukabumi Community Health Center working area. The test results showed a significant relationship between dietary patterns and the incidence of anemia with a p-value = 0.000 ($p < 0.05$) (Nuraeni, Novryanthi, & Mustopa, 2024).

The crosstab analysis showed that of the 27 pregnant women with good diets, almost all (26) did not experience anemia, with only one (3.7%) experiencing anemia. This finding suggests that a good diet plays a role in maintaining hemoglobin levels within normal limits during the third trimester of pregnancy. A good diet ensures that nutritional needs are met, particularly iron, protein, and supporting vitamins, which play a role in hemoglobin formation.

The study found that one pregnant woman in her third trimester with a good diet experienced anemia. This finding indicates a data gap that does not fully align with the general theory that a good diet can reduce the risk of anemia in pregnant women. Anemia in pregnant women is not only influenced by diet but also by other factors such as parity, maternal age, pre-pregnancy iron reserves, pregnancy spacing, iron nutrient absorption, and blood loss during pregnancy. Pregnant women who enter pregnancy with already low iron levels remain at risk of anemia even if they maintain a good diet throughout their pregnancy (Astuti & Ertiana, 2018). This can also be seen from the parity level of the pregnant woman, that the pregnant woman has a parity of 3, high parity can affect the condition of the pregnant woman in absorbing and storing micronutrients such as iron (Manuaba, 1998).

Parity indicates the number of pregnancies and deliveries a mother has experienced. The more pregnancies and deliveries a mother has, the greater the risk of reduced iron stores due to repeated iron needs and losses. Research on pregnant women in the third trimester shows that mothers with a high parity (≥ 3) have a greater risk of anemia than mothers with a low parity, because the body's iron reserves

have not yet recovered optimally from previous pregnancies. This is in line with the results of this study, where the majority of respondents with low parity did not experience anemia, while respondents with higher parity were more likely to experience anemia. Therefore, parity can be considered an important risk factor for anemia in late pregnancy (Herliani, Efriani, Sujianti, & Khodijah, 2024).

Data from other research study also supports these findings, where the majority of respondents with low parity were less likely to experience anemia, while some with higher parity showed a greater tendency to develop anemia. This finding is in line with the results of research showing a significant relationship between high parity and the incidence of anemia in pregnant women in the third trimester, where mothers with parity ≥ 3 have a higher prevalence of anemia ($p < 0.05$) compared to low parity, making parity an important risk factor for anemia in late pregnancy (Damanik, Tunggal, Yuliasuti, & Kristiana, 2025).

When compared to age, the characteristics of the pregnant woman, who is 30 years old, suggest that pregnant women approaching the upper limit of reproductive age (≥ 30 years) tend to experience decreased metabolic efficiency and iron absorption (Kaushal, Priya, Thakur, Marwaha, & Kaur, 2022). Another theory that may explain this condition is impaired iron absorption (bioavailability). States that iron absorption is significantly affected by inhibitory factors such as the consumption of tea, coffee, or foods high in phytate and polyphenols, often consumed with main meals. Pregnant women who have a healthy diet in terms of type and frequency, but still consume tea or coffee after meals, remain at risk of anemia because the iron consumed is not optimally absorbed (Zhang, Li, Song, Fang, Huang, & Sun, 2022).

Dietary quality is determined not only by food diversity but also by food combination and timing of consumption. Consuming iron sources without supplementation with iron enhancers such as vitamin C can lead to low iron absorption, resulting in low hemoglobin levels (Al-Bayyari, Al Sabbah, Hailat, AlDahoun, & Abu-Samra, 2024).

In this study, although respondents met the criteria for a good diet based on the questionnaire, other factors such as low initial iron reserves, maternal age, impaired iron absorption, or

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inflammatory conditions may explain the occurrence of anemia in these respondents. The existence of this single data gap does not negate the main findings of the study but rather indicates that anemia in pregnant women is a multifactorial condition.

Conversely, anemia was still found in pregnant women with adequate diets. Of the five respondents with adequate diets, two (40.0%) experienced anemia, while three (60.0%) did not. This indicates that a diet considered adequate may not optimally meet the increased iron requirements in the third trimester. During this phase, iron requirements increase with fetal growth and maternal blood volume, so a suboptimal diet still carries the risk of anemia.

The study found that some pregnant women in their third trimester with adequate diets did not experience anemia. This finding suggests that even though the respondents' diets were not considered adequate, their nutritional intake was still sufficient to meet the iron and other nutrients needed to support hemoglobin formation during pregnancy.

One factor that may explain this condition is the mother's initial iron reserves before pregnancy. Pregnant women who enter pregnancy with good nutritional status and hemoglobin levels have sufficient iron reserves, so even if they only follow a moderate diet during pregnancy, their bodies are still able to maintain hemoglobin levels within normal limits. States that pre-pregnancy iron reserves play a significant role in determining anemia status during pregnancy, especially in the third trimester (World Health Organization, 2021).

Furthermore, pregnant women with an adequate diet are likely to have good adherence to taking iron tablets. Iron tablets are a source of iron with high bioavailability, which is very effective in preventing anemia. Research by Rangga (2024) shows that adherence to regular consumption of iron tablets can significantly reduce the risk of anemia, even in pregnant women with moderate dietary iron intake.

Another contributing factor is the efficiency of iron absorption. Pregnant women with an adequate diet but who habitually consume foods that support iron absorption, such as fruits rich in vitamin C, can maintain normal hemoglobin levels. Vitamin C can increase the absorption of non-heme iron by two to three times, so that iron intake that is not too high can still be utilized optimally by the body (Pipit, 2018).

In the group of pregnant women with a poor diet, all 16 respondents (100.0%) experienced anemia. No pregnant women with a poor diet were found to be without anemia. This finding indicates that a poor diet is strongly associated with a high incidence of anemia in pregnant women in the third trimester. A poor diet, both in terms of frequency and quality, results in insufficient intake of iron and other supporting nutrients, resulting in decreased iron reserves and suboptimal hemoglobin formation.

The results of this study align with the theory of pregnancy nutrition, which states that diet plays a crucial role in meeting iron requirements during pregnancy, particularly in the third trimester. Iron deficiency due to an inadequate diet can lead to decreased hemoglobin levels and increase the risk of anemia. Furthermore, insufficient vitamin C consumption can inhibit the absorption of non-heme iron from plant foods, thereby exacerbating anemia (Hardinsyah & Supariasa, 2017).

The results of this study also align with other study, which stated a relationship between dietary patterns and the incidence of anemia in pregnant women. The study showed that the majority of pregnant women (40.9%) had a good diet, but 50% still experienced anemia. Bivariate analysis using the Chi-Square test yielded a p-value of 0.001 ($p < 0.05$), indicating a significant relationship between dietary patterns and the incidence of anemia in third-trimester pregnant women at the Banguntapan III Community Health Center in Yogyakarta City. These studies indicate that pregnant women with poor dietary patterns have a higher risk of anemia than those with good dietary patterns. Therefore, these results strengthen the evidence that dietary patterns are an important modifiable factor in preventing anemia in pregnant women (Mardiana, Estri, & Ismarwati, 2020).

The researchers assume that pregnant women with good dietary patterns tend to have a higher awareness of the importance of food quality and variety during pregnancy, either due to education from health professionals, previous pregnancy experiences, or family support. On the other hand, pregnant women with poor diets are likely to still maintain their pre-pregnancy eating habits, pay less attention to food variety, or not fully understand the importance of iron intake in late pregnancy.

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CONCLUSION

This study confirms a significant and strong relationship between dietary patterns and the incidence of anemia in third-trimester pregnant women. Pregnant women with poor dietary patterns tend to have a higher risk of anemia.

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