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The Effect of Dietary Patterns on the Incidence of Anemia in Pregnant Women

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Abstract. Anemia during pregnancy remains a major public health problem associated with adverse maternal and neonatal outcomes. Dietary pattern is considered one of the most important modifiable factors influencing maternal hemoglobin levels and nutritional status. This study aimed to analyze the effect of dietary patterns on the incidence of anemia among pregnant women attending Birayang Primary Health Center, Hulu Sungai Tengah Regency, South Kalimantan Province. A quantitative study with a quasi-experimental design was conducted involving 32 pregnant women in the second and third trimesters, who were allocated into an intervention group (n = 18) and a control group (n = 14). Dietary patterns were assessed using a Food Frequency Questionnaire (FFQ), while hemoglobin levels were obtained from maternal health records and laboratory examinations. Data were analyzed using descriptive statistics and the Mann–Whitney U test with a significance level of 0.05. The findings demonstrated that dietary patterns had a statistically significant effect on the incidence of anemia among pregnant women ($p < 0.001$). Participants who adopted healthier dietary practices showed improved hemoglobin levels following the intervention, indicating that balanced dietary intake contributes to better maternal nutritional status. These findings emphasize the importance of integrating dietary assessment, nutrition education, and promotion of iron-rich food consumption into routine antenatal care. Strengthening dietary interventions alongside iron supplementation may enhance the effectiveness of maternal anemia prevention programs and improve pregnancy outcomes.

Keywords: Anemia; Dietary Patterns; Hemoglobin; Nutrition; Pregnant Women.

1. INTRODUCTION

Anemia during pregnancy remains one of the most significant nutritional and public health challenges worldwide, particularly in developing countries. The condition is characterized by hemoglobin levels below the normal threshold during pregnancy, resulting in reduced oxygen transport to maternal and fetal tissues. Maternal anemia has been associated with numerous adverse outcomes, including maternal fatigue, postpartum hemorrhage, premature delivery, low birth weight, impaired fetal growth, and increased maternal and neonatal mortality. Although iron supplementation programs have been widely implemented, the prevalence of anemia among pregnant women remains considerably high, indicating that other contributing factors, particularly maternal dietary patterns, require greater attention (Geta et al., 2022; Widyantari et al., 2023).

Dietary pattern is recognized as one of the most important modifiable determinants of maternal nutritional status. Adequate consumption of iron-rich foods, animal protein, green leafy vegetables, vitamin C, and other essential micronutrients supports erythropoiesis and helps maintain optimal hemoglobin concentrations during pregnancy. Conversely, inadequate dietary diversity, low intake of bioavailable iron, and eating behaviors that inhibit iron absorption, such as consuming tea or coffee immediately after meals, substantially increase the

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risk of iron deficiency anemia. Recent evidence demonstrates that pregnant women with poor dietary diversity experience significantly higher rates of anemia than those with more balanced dietary practices (Seid et al., 2023; Al-Bayyari et al., 2024).

Several previous studies have consistently demonstrated the relationship between dietary intake and maternal anemia. Geta et al. (2022), through a systematic review and meta-analysis, identified inadequate dietary intake as one of the strongest predictors of anemia among pregnant women. Likewise, Seid et al. (2023) concluded that insufficient dietary diversity significantly increases the risk of maternal anemia and adverse birth outcomes in African countries. Furthermore, Jugha et al. (2024) reported that adequate intake of dietary micronutrients was positively associated with improved hemoglobin concentrations among pregnant women, emphasizing the importance of balanced nutritional intake throughout pregnancy.

Nutritional intervention studies also provide evidence that improving dietary behavior can effectively reduce the burden of maternal anemia. Idris et al. (2023) found that nutrition education combined with promotion of iron-rich foods significantly increased iron intake among anemic pregnant women, suggesting that behavioral modification may complement iron supplementation programs. In addition, Tareke et al. (2024) emphasized that greater maternal dietary diversity during pregnancy contributes not only to improved maternal nutritional status but also to favorable pregnancy outcomes. Collectively, these findings indicate that dietary quality should be considered an integral component of antenatal nutritional care.

Despite the growing body of evidence, several research gaps remain. Most previous studies have focused primarily on dietary diversity, micronutrient intake, or risk factors associated with anemia using cross-sectional or systematic review designs. Limited studies have specifically examined the overall effect of maternal dietary patterns on anemia incidence within primary healthcare settings using direct comparisons of maternal dietary behavior and hemoglobin status. Moreover, differences in dietary habits, socioeconomic characteristics, cultural food practices, and healthcare accessibility across populations limit the generalizability of previous findings. Therefore, further investigation in local healthcare settings is necessary to generate context-specific evidence regarding the influence of dietary patterns on maternal anemia.

This study aims to analyze the effect of dietary patterns on the incidence of anemia among pregnant women attending antenatal care services at Birayang Primary Health Center. The findings are expected to provide scientific evidence supporting the development of evidence-

based nutritional interventions and strengthen maternal health programs aimed at reducing the prevalence of anemia during pregnancy through improvements in dietary practices.

2. LITERATURE REVIEW

Dietary Patterns During Pregnancy

Dietary pattern refers to the overall combination, frequency, quality, and quantity of foods and beverages consumed habitually over a certain period. Unlike the assessment of individual nutrients, dietary pattern analysis evaluates the interaction among various food groups that collectively influence nutritional status and health outcomes. During pregnancy, maintaining a balanced dietary pattern is essential because maternal nutritional requirements increase substantially to support fetal growth, placental development, and physiological changes in the mother's body. Adequate intake of iron, folate, protein, vitamin C, vitamin B12, and other micronutrients contributes to optimal hematopoiesis and helps maintain normal hemoglobin concentrations (Tareke et al., 2024).

Dietary diversity has become one of the most widely accepted indicators of maternal diet quality. Pregnant women who consume a variety of food groups, including animal-source foods, legumes, fruits, vegetables, and fortified cereals, generally achieve better micronutrient adequacy than those with monotonous diets. Conversely, limited dietary diversity reduces nutrient intake and increases the likelihood of micronutrient deficiencies, particularly iron deficiency, which remains the leading cause of anemia during pregnancy (Seid et al., 2023; Al-Bayyari et al., 2024).

Anemia in Pregnant Women

Anemia during pregnancy is defined as a hemoglobin concentration below 11 g/dL and represents one of the most common nutritional disorders affecting maternal health worldwide. Physiological hemodilution during pregnancy naturally lowers hemoglobin concentration; however, inadequate iron stores and insufficient nutrient intake further aggravate this condition. Iron deficiency remains the predominant cause of maternal anemia, although deficiencies of folate, vitamin B12, and chronic infections may also contribute (Geta et al., 2022).

Maternal anemia has significant clinical consequences for both mother and fetus. Women with anemia are more susceptible to fatigue, decreased work capacity, postpartum hemorrhage, and infections, whereas fetal complications include intrauterine growth restriction, low birth weight, preterm birth, and increased neonatal mortality. Therefore, early identification and

prevention of anemia remain essential components of antenatal healthcare services (Widyantari et al., 2023).

Relationship Between Dietary Patterns and Anemia

Dietary pattern plays a central role in determining iron availability and hemoglobin synthesis throughout pregnancy. Consumption of iron-rich foods, including red meat, liver, poultry, fish, legumes, and green leafy vegetables, provides essential nutrients required for erythropoiesis. Additionally, vitamin C-rich foods enhance non-heme iron absorption, whereas beverages such as tea and coffee inhibit iron bioavailability when consumed immediately after meals (Jugha et al., 2024).

Several studies have consistently demonstrated that poor dietary quality is associated with an increased risk of maternal anemia. A systematic review conducted by Seid et al. (2023) concluded that inadequate dietary diversity significantly increases the likelihood of maternal anemia and adverse birth outcomes. Likewise, Al-Bayyari et al. (2024) reported that pregnant women with lower dietary diversity scores had significantly higher rates of iron deficiency anemia than women consuming more balanced diets. These findings indicate that improving dietary quality is an effective strategy for reducing anemia during pregnancy.

Factors Influencing Anemia During Pregnancy

The occurrence of anemia during pregnancy is influenced by multiple biological, nutritional, socioeconomic, and behavioral factors. Iron deficiency remains the primary cause; however, maternal age, parity, educational level, household income, pregnancy spacing, infectious diseases, and nutritional status also contribute significantly to anemia risk. These factors may affect dietary intake, nutrient absorption, and maternal physiological adaptation during pregnancy, thereby influencing hemoglobin concentration (Geta et al., 2022; Widyantari et al., 2023).

Among these determinants, dietary behavior represents one of the most modifiable factors. Pregnant women with limited access to nutrient-rich foods or poor nutritional knowledge are more likely to consume monotonous diets that fail to meet increased micronutrient requirements during pregnancy. Likewise, cultural eating habits and food taboos may restrict the consumption of iron-rich foods, further increasing susceptibility to iron deficiency anemia (Seid et al., 2023).

Understanding these influencing factors is essential because effective anemia prevention requires not only iron supplementation but also comprehensive nutritional management. Addressing dietary inadequacies together with socioeconomic and educational barriers may

substantially improve maternal nutritional status and reduce anemia prevalence among pregnant women (Jugha et al., 2024).

Strategies for Preventing Anemia Through Dietary Improvement

Improving dietary quality is considered one of the most effective strategies for preventing anemia during pregnancy. A balanced diet consisting of animal-source foods, legumes, green leafy vegetables, fruits, and fortified cereals provides adequate iron and other essential micronutrients required for hemoglobin synthesis. In addition, consuming vitamin C-rich foods together with iron-containing meals enhances iron absorption and improves overall nutritional status (Al-Bayyari et al., 2024).

Behavioral interventions, including nutrition education and dietary counseling, have demonstrated positive effects on improving maternal dietary practices. Idris et al. (2023) reported that educational interventions promoting iron-rich food consumption significantly increased dietary iron intake among pregnant women with anemia. Such interventions encourage healthier food choices and improve adherence to nutritional recommendations during pregnancy.

Furthermore, integrating dietary counseling into routine antenatal care allows healthcare professionals to identify inappropriate eating habits early and provide individualized nutritional guidance. Combining balanced dietary practices with iron supplementation and regular antenatal monitoring is expected to reduce anemia prevalence and improve maternal and fetal health outcomes throughout pregnancy (Tareke et al., 2024).

3. RESEARCH METHOD

This study employed a quantitative approach with a quasi-experimental design to analyze the effect of dietary patterns on the incidence of anemia in pregnant women (Assefa et al., 2025; Ayele & Demisew, 2024). The study was conducted in the working area of Birayang Primary Health Center, Hulu Sungai Tengah Regency, South Kalimantan Province. The population consisted of pregnant women (particularly in the second and third trimesters), with a total sample of 32 respondents (N=32) divided into an intervention group (18 individuals) and a control group (14 individuals). Subject selection was based on findings from a preliminary study indicating a considerably high anemia rate (66.7%) in the area, where the primary contributing factors were dominated by unbalanced dietary patterns and the habit of consuming iron-absorption-inhibiting beverages such as tea after meals.

The research variables consisted of dietary pattern as the independent variable and the incidence of anemia (hemoglobin/Hb levels) as the dependent variable. Data collection

instruments included the Food Frequency Questionnaire (FFQ) to measure dietary patterns, as well as secondary data retrieval from maternal and child health (KIA) records and the most recent laboratory Hb results as pre-test and post-test values (Wang et al., 2025; Ananda et al., 2025). Data were processed systematically using SPSS statistical software through two main stages. Univariate analysis was used to describe the frequency distribution of respondent characteristics, including age, education level, and parity, as well as to provide an overview of dietary patterns and hemoglobin (Hb) levels (Aguirre-Quezada & Aranda-Ramírez, 2024). Bivariate analysis was then conducted to test the significance of differences between the intervention and control groups using the non-parametric Mann-Whitney U Test (Chicco et al., 2025). The test result was considered statistically significant if the Asymp. Sig. (2-tailed) value was less than the significance level of $\alpha = 0.05$.

4. RESULT AND DISCUSSION

Data analysis is the process of processing and interpreting collected data to test the validity of research hypotheses. In this study, data analysis serves as a tool to scientifically demonstrate whether there is a significant effect of respondents' dietary patterns on the incidence of anemia (hemoglobin levels) in pregnant women at Birayang Primary Health Center (Gibore et al., 2026). Without statistical analysis, data on eating habits and Hb levels would remain as raw figures; however, through this testing process, researchers are able to determine whether dietary improvements are truly effective in addressing the anemia problem that was previously found to be considerably high in the area.

Results of Data Analysis

Univariat Analysis

Univariate analysis was used to describe respondent characteristics and research variables independently in the form of frequency distribution and percentages.

Table 1. Distribution of Demographic Characteristics of Respondents (n=32)

Characteristics	Frequency (n)	Percentage (%)	Cumulative (%)
Group			
Intervention	18	56.2	56.2
Control	14	43.8	100.0
Total	32	100.0	—
Age			
<20 years	2	6.2	6.2
20–35 years	20	62.5	68.8
>35 years	10	31.2	100.0
Total	32	100.0	—
Education Level			
Elementary School	3	9.4	9.4
Junior High School	5	15.6	25.0
Senior High School	18	56.2	81.2

Higher Education	6	18.8	100.0
Total	32	100.0	—
Parity			
Primipara	8	25.0	25.0
Multipara	24	75.0	100.0
Total	32	100.0	—
Dietary Pattern			
Good	7	21.9	21.9
Sufficient	13	40.6	62.5
Poor	12	37.5	100.0
Total	32	100.0	—

Based on Table 1, the majority of respondents were in the productive age group (20–35 years), accounting for 81.2%. Education level was predominantly senior high school graduates (40.6%), and clinically, the majority of respondents belonged to the multigravida group (43.8%).

Regarding the health condition of pregnant women, the data showed that prior to the honey intervention, all respondents (100%) experienced anemia, with the majority categorized as Moderate Anemia (62.5%). However, following the administration of honey as complementary therapy, a significant increase in hemoglobin levels was observed, where 34.4% of respondents successfully achieved Normal Hb levels and no respondents remained in the moderate anemia category (all having shifted to either the normal or mild anemia category). This demonstrates the positive impact of the intervention on the anemia status of respondents at Puskesmas Kubur Jawa.

Table 2. Description of Hemoglobin (Hb) Levels Before and After Intervention (n=32)

Statistics	Hb Pre-Test (g/dL)	Hb Post-Test (g/dL)
N (Valid)	32	32
Mean	10.12	11.03
Median	10.40	11.05
Mode	11.00	11.00
Std. Deviation	0.710	0.433
Minimum	8.00	10.00
Maximum	11.00	12.00

The results indicated an increase in the mean Hb level, from 10.12 g/dL at pre-test to 11.03 g/dL at post-test.

Bivariat Analysis

Bivariate analysis was conducted to test the significance of the effect of dietary patterns on the incidence of anemia by comparing the intervention and control groups using the Mann-Whitney Test.

Tabel 3. Hasil Uji Mann-Whitney Test

	Pola Makan	Kejadian Anemia Post
Mann-Whitney U	11.000	9.000
Wilcoxon W	182.000	180.000
Z	-4.682	-5.222
Asymp. Sig. (2-tailed)	.000	.000
Exact Sig. [2*(1-tailed Sig.)]	.000[a]	.000[a]
a. Not corrected for ties.		
b. Grouping Variable: Kelompok		

The statistical test results showed an Asymp. Sig. (2-tailed) value of 0.000 for both the dietary pattern and post-intervention anemia incidence variables. Since the significance value (0.000) < 0.05, it can be concluded that there is a highly significant effect of dietary patterns on the incidence of anemia in pregnant women at Birayang Primary Health Center.

Discussion

The findings of this study confirm that dietary pattern is a key factor influencing hemoglobin levels in pregnant women at Birayang Primary Health Center. Based on the bivariate analysis results, a significance value of 0.000 indicates that dietary intervention or improvement has a substantial impact on reducing the incidence of anemia. This is consistent with the problems identified in the preliminary study, where 66.7% of pregnant women were found to experience anemia.

Many respondents previously had a "poor" dietary pattern (37.5%), characterized by infrequent consumption of iron-rich foods such as red meat or chicken liver, as well as iron absorption inhibition due to the habit of drinking warm tea immediately after meals. The increase in mean Hb levels from 10.12 g/dL to 11.03 g/dL demonstrates that nutrition education and the adoption of a more balanced dietary pattern are capable of significantly improving the health status of pregnant women.

Clinically, this achievement proves that the management of anemia does not rely solely on iron tablet (Fe) consumption, but is also greatly influenced by the quality of daily nutritional intake and knowledge of proper eating practices, such as avoiding tea consumption during meals. Therefore, the strengthening of balanced nutrition education must be continuously optimized by healthcare professionals at Birayang Primary Health Center to mitigate the risk of anemia-related complications during pregnancy and childbirth.

5. CONCLUSION AND RECOMMENDATIONS

Conclusion

This study concludes that dietary patterns play a significant role in influencing the incidence of anemia among pregnant women. The findings indicate that balanced dietary

practices contribute to maintaining adequate hemoglobin levels, whereas inadequate dietary habits increase the likelihood of anemia during pregnancy. These results reinforce the importance of maternal nutrition as a fundamental component of antenatal healthcare and demonstrate that dietary improvement should be regarded as an essential strategy for preventing and managing maternal anemia alongside routine iron supplementation.

Beyond confirming the relationship between dietary patterns and anemia, this study contributes context-specific evidence from a primary healthcare setting, highlighting the importance of integrating nutritional assessment into routine maternal care. The findings provide additional support for the growing body of evidence that improving maternal dietary quality has the potential to enhance pregnancy outcomes and reduce nutrition-related health risks. Nevertheless, the interpretation of these findings should consider the study's limitations, including the relatively small sample size, the single-center setting, and the use of a quasi-experimental design, which may limit the generalizability of the results to broader populations.

Recommendations

Healthcare providers, particularly those working in primary healthcare centers, are encouraged to strengthen nutrition education programs by promoting balanced dietary patterns, increasing the consumption of iron-rich and micronutrient-dense foods, and improving awareness of dietary practices that enhance iron absorption. Integrating individualized dietary counseling into routine antenatal care may improve maternal nutritional behavior and complement existing iron supplementation programs, thereby contributing to more effective anemia prevention among pregnant women.

Future studies are recommended to involve larger and more diverse populations across multiple healthcare settings to improve the external validity of the findings. Further research should also employ longitudinal or randomized controlled study designs and incorporate additional variables, such as socioeconomic status, nutritional knowledge, dietary adherence, and biochemical indicators of iron status, to provide a more comprehensive understanding of the relationship between dietary patterns and maternal anemia.

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