

Association Between Nutritional Adequacy Level and Iron-Folic Acid (IFA) Tablet Consumption with Anemia Incidence in Pregnant Women

Hubungan Tingkat Kecukupan Gizi dan Konsumsi Tablet Tambah Darah (TTD) dengan Kejadian Anemia pada Ibu Hamil

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Abstract: *Anemia in pregnancy remains a major public health concern due to its adverse effects on maternal and fetal outcomes. Nutritional inadequacy and poor adherence to iron-folic acid (IFA) supplementation are key contributors to anemia among pregnant women in Indonesia. This study aimed to determine the association between nutritional adequacy levels and IFA tablet consumption with anemia incidence in pregnant women. A cross-sectional study was conducted from July to August 2024 at Pulo Armyn Public Health Center, Bogor City, involving 86 pregnant women in their first and second trimesters selected through purposive random sampling. Data were collected using structured questionnaires and 2×24-hour dietary recalls, while hemoglobin levels were obtained from medical records. Statistical analysis employed the Spearman rank correlation test. The results showed that dietary adequacy of macronutrients and micronutrients was not associated with anemia incidence. However, pregnant women who regularly consumed iron-folic acid (IFA) tablets had a notably lower rate of anemia. Those with good adherence to IFA supplementation were about one-third less likely to experience anemia than those with poor adherence. These findings highlight the importance of consistent IFA tablet intake to prevent anemia during pregnancy.*

Key word: *anemia, iron-folic acid supplementation, nutritional adequacy, pregnancy*

1. INTRODUCTION

Pregnancy is a crucial period that determines the quality of future human resources, as the growth and development of a child begin in the womb (1). During pregnancy, achieving a balanced diet is essential, particularly within the first 1,000 days of life (HPK), which consist of 270 days (9 months) of gestation and the first 730 days (2 years) after birth. This period, often referred to as the “golden period,” is characterized by rapid growth and development (2). During pregnancy, maternal nutritional needs increase in accordance with gestational age to meet both the mother’s nutritional requirements and to support fetal growth, emphasizing the importance of increased dietary intake among pregnant women (3).

As pregnancy progresses, maternal nutritional requirements continue to rise to maintain the mother’s health and support fetal development. This underscores the

importance of achieving adequate dietary intake during pregnancy to prevent deficiencies or imbalances in essential nutrients. However, eating habits among pregnant women often change due to hormonal fluctuations that trigger nausea, vomiting, and loss of appetite, which can reduce food intake and hinder the fulfillment of maternal nutritional needs (Sinaga, 2020). Poor eating habits may lead to nutritional imbalances or deficiencies, one of the most common being anemia (4); (5,6)

Anemia is a condition in which the hemoglobin (Hb) concentration in the blood falls below normal levels, thereby reducing the blood's capacity to carry oxygen to body tissues (7). This condition can result from various factors, including deficiencies in iron, folic acid, or vitamin B12, blood loss, or impaired red blood cell production. According to the Ministry of Health of the Republic of Indonesia (8), the normal hemoglobin threshold for pregnant women is ≥ 11 g/dL; pregnant women with Hb levels below this threshold are classified as anemic. The prevalence of anemia among pregnant women in Indonesia increased by 11.8%, from 37.1% in 2013 to 48.9% in 2018 (9). This is alarming because, according to the World Health Organization (WHO), when the prevalence of anemia in pregnant women exceeds 40%, it is considered a severe public health problem.

Previous studies have shown that anemia prevalence is higher among pregnant women with poor dietary patterns (73.3%) compared to those with adequate dietary intake (33.3%) (5). Anemia during pregnancy must be taken seriously because it can increase the risk of complications such as miscarriage, intrauterine growth restriction, susceptibility to infections, premature rupture of membranes, and antepartum hemorrhage (10). In addition to affecting the mother, anemia during pregnancy also poses risks to the fetus, including intrauterine death, preterm birth, low birth weight, and postnatal infant mortality (11).

Apart from improving dietary intake, pregnant women are also advised to consume iron-folic acid (IFA) tablets to meet the increased demand for iron during pregnancy. IFA supplementation plays a crucial role in maintaining hemoglobin levels within the normal range and preventing anemia during pregnancy (12). Conversely, inappropriate or irregular consumption of IFA tablets may increase the risk of anemia (13). Recent evidence has shown that regular IFA supplementation in accordance with WHO recommendations is associated with a reduction in anemia prevalence among pregnant women (14). Meta-analysis studies have also demonstrated that IFA supplementation significantly lowers anemia prevalence among pregnant women approaching term (15).

In addition to IFA supplementation, adequate nutrient intake — both in quantity and quality — is necessary to prevent anemia. A study by (16) found that pregnant women with moderate anemia tended to have a higher proportion of inadequate nutrient intake compared to those with mild anemia. Similarly, (17) reported that pregnant women in Indonesia generally have low energy intake, anemia, and micronutrient deficiencies, including iron. Furthermore, low dietary diversity and the habit of consuming tea or coffee with meals have also been associated with anemia in pregnant women (18).

In Bogor City, data show that there were 2,522 reported cases of anemia among pregnant women, with the Pulo Army Community Health Center (Puskesmas Pulo Army) recording the highest number of cases at 497 (19). This indicates that anemia remains a significant public health issue that needs to be addressed. Therefore, it is necessary to conduct a study on the association between nutritional adequacy levels

and IFA tablet consumption with the incidence of anemia among pregnant women in the working area of Puskesmas Pulo Armyn, Bogor City.

2. METHODS

This cross-sectional analytic study was conducted in July–August 2024 at the Puskesmas Pulo Armyn, Bogor City. A total of 86 pregnant women in the first or second trimester were recruited using purposive random sampling. Inclusion criteria were attendance at antenatal care, absence of chronic disease, willingness to participate and had hemoglobin levels measured within the previous three month. Ethical approval was granted by the Ethics Committee of the National Research and Innovation Agency (BRIN) (No. 153/KE.03/SK/07/2024). Data were obtained from interviews using structured questionnaires on maternal characteristics (age, gestational age, weight gain, MUAC, education, and family income), dietary intake (2×24-hour food recall and frequency), and iron–folic acid (IFA) supplementation. Haemoglobin levels were collected as secondary data. Data analysis was performed using Ms Excel and SPSS.

3. RESULTS

As shown in Table 1, the majority of respondents were aged 20–35 years (70%) and in the second trimester of pregnancy (76.6%). Among those in the second trimester, 81.2% experienced inadequate gestational weight gain, although 87.2% had a normal mid-upper arm circumference (MUAC). Table 1 also indicates that most respondents had completed senior high school education (55.8%) with an income range of IDR 500,000–8,000,000. In addition, mild anemia was frequently observed among second-trimester subjects (43.8%).

Table 1. Characteristics of respondents

Characteristics	n	%
Maternal Age		
<20 years	5	5.8
20–35 years	70	81.4
35 years	11	12.8
Gestational Age		
First trimester (0–12 weeks)	22	23.4
Second trimester (13–28 weeks)	72	76.6
Gestational Weight Gain (kg)		
First trimester		
Within recommended range	11	50.0
Outside recommended range	11	50.0
Second trimester		
Within recommended range	12	18.8
Outside recommended range	52	81.2
Mid-Upper Arm Circumference (MUAC)		
Chronic Energy Deficiency (CED) (<23.5 cm)	11	12.8
Normal (≥23.5 cm)	75	87.2
Educational Level		
Elementary School	7	8.1
Junior High School	21	24.4
Senior High School	48	55.8
Higher Education	10	11.6
Household Income		
Minimum (Rp)	500 000	
Maximum (Rp)	8 000 000	

Characteristics	n	%
Anemia Status		
Non-anemia (≥ 11 g/dL)		
First trimester	8	36.4
Second trimester	21	32.8
Mild anemia (10–10.9 g/dL)		
First trimester	9	40.9
Second trimester	28	43.8
Moderate anemia (7.0–9.9 g/dL)		
First trimester	5	22.7
Second trimester	15	23.4

n= 86 respondents

Table 2 shows no significant association between the adequacy of either macronutrients (energy, protein, fat, carbohydrates) or micronutrients (calcium, folate, iron, vitamin C) and the incidence of anemia in pregnant women ($p > 0.05$).

Table 2. The Correlation between Nutrient Adequacy Level and the Incidence of Anemia

Nutrient	Anemia Status			r	p-value
	Non-anemia	Mild anemia	Moderate anemia		
	n (%)	n (%)	n (%)		
Macronutrients					
Energy (kcal)					
Deficit (<80%)	26 (86.7)	30 (81.1)	17 (89.5)	0.010	0.930
Adequate (80–110%)	4 (13.3)	7 (18.9)	2 (10.5)		
Excess (>110%)	0 (0.0)	0 (0.0)	0 (0.0)		
Protein (g)				-0.024	0.829
Deficit (<80%)	22 (73.3)	23 (62.2)	12 (63.2)		
Adequate (80–110%)	8 (26.7)	9 (24.3)	7 (36.8)		
Excess (>110%)	0 (0.0)	5 (13.5)	0 (0.0)		
Fat (g)				-0.040	0.715
Deficit (<80%)	20 (66.7)	21 (56.8)	11 (57.9)		
Adequate (80–110%)	8 (26.7)	14 (37.8)	7 (36.8)		
Excess (>110%)	2 (6.7)	2 (5.4)	1 (5.3)		
Carbohydrate (g)				0.057	0.604
Deficit (<80%)	27 (90.0)	35 (94.6)	19 (100.0)		
Adequate (80–110%)	3 (10.0)	2 (5.4)	0 (0.0)		
Excess (>110%)	0 (0.0)	0 (0.0)	0 (0.0)		
Micronutrients					
Calcium (mg)				-0.171	0.116
Inadequate (<77%)	26 (86.7)	27 (73.0)	13 (68.4)		
Adequate ($\geq 77\%$)	4 (13.3)	10 (27.0)	6 (31.6)		
Folate (μg)				0.095	0.386
Inadequate (<77%)	22 (73.3)	26 (70.3)	14 (73.7)		
Adequate ($\geq 77\%$)	8 (26.7)	11 (29.7)	5 (26.3)		
Iron (mg)				-0.118	0.281
Inadequate (<77%)	25 (83.3)	30 (81.1)	15 (78.9)		
Adequate ($\geq 77\%$)	5 (16.7)	7 (18.9)	4 (21.1)		
Vitamin C (mg)				-0.042	0.701
Inadequate (<77%)	20 (66.7)	23 (62.2)	11 (57.9)		
Adequate ($\geq 77\%$)	10 (33.3)	14 (37.8)	8 (42.1)		

Statistic: Spearman rank correlation test, significant if p-value <0.05

The results of the Spearman correlation test (Table 3) indicated a significant relationship between adherence to iron-folic acid (IFA) tablet consumption and the incidence of anemia ($p = 0.004$; $r = -0.311$). Pregnant women with good adherence to IFA consumption had a lower proportion of anemia compared to those with poor adherence.

Table 3. The Correlation between Iron-Folic Acid (IFA) Tablet Consumption and the Incidence of Anemia

IFA Tablet Consumption	Anemia Status			r	p-value
	Non-anemia	Mild anemia	Moderate anemia		
	n (%)	n (%)	n (%)		
Good	12 (40.0)	11 (29.7)	3 (15.8)	-0.311	0.004
Poor	18 (60.0)	26 (70.3)	16 (84.2)		

Statistic: Spearman rank correlation test, significant if p-value <0.05

4. DISCUSSION

This study found no significant association between the adequacy of macronutrients (energy, protein, fat, carbohydrate) or micronutrients (calcium, folate, iron, vitamin C) and the incidence of anemia among pregnant women in the Pulo Ardyn Public Health Center, Bogor ($p > 0.05$). However, the trend showed that a higher proportion of women with inadequate nutrient intake tended to experience anemia compared to those with adequate intake, indicating that diet still plays a supportive role in maintaining hemoglobin levels during pregnancy. The absence of statistical significance in this study differs from several previous findings. For instance, (20) and (21) reported significant correlations between energy and protein adequacy with hemoglobin concentration among pregnant women. Similarly, (22) and (23) found that higher protein and vitamin C intake were significantly associated with lower anemia risk. Adequate macronutrient intake supports erythropoiesis by providing sufficient substrates for energy metabolism and globin synthesis, while micronutrients such as iron, folate, and vitamin C directly support hemoglobin formation and iron absorption (24–26)

Several possible factors may explain the lack of significant associations observed in this study. First, the respondents' dietary patterns were characterized by limited diversity, with protein sources dominated by chicken, eggs, tofu, and tempeh. This monotonous consumption may restrict the bioavailability of heme iron and essential micronutrients (26) (27) Second, while calcium intake is essential during pregnancy, excessive calcium consumption can inhibit non-heme iron absorption, thus reducing its hematopoietic benefit (28) (29). Third, sociodemographic factors such as maternal education, household income, and access to nutrition information substantially influence dietary adequacy and anemia prevalence. Low education limits maternal understanding of nutrition, while low income constrains food purchasing power, often resulting in monotonous diets and inadequate nutrient density (30) (31).

Despite the absence of significant associations, the observed tendencies reaffirm that insufficient dietary intake increases the likelihood of anemia, consistent with findings by (17) who reported that pregnant women in Indonesia often exhibit inadequate energy and micronutrient intake, particularly iron, folate, and vitamin A. This pattern reflects the double burden of malnutrition in Indonesia, where undernutrition and poor dietary diversity persist even among reproductive-age women (32). Therefore,

improving both the quantity and diversity of food intake remains a critical public health priority.

In contrast to nutrient adequacy, this study identified a statistically significant relationship between adherence to iron-folic acid (IFA) tablet consumption and hemoglobin status ($p = 0.004$). Pregnant women with good adherence to IFA supplementation had a lower prevalence of anemia compared to those with poor adherence. This finding aligns with the results of (33), who found that women consuming ≥ 180 IFA tablets during pregnancy were 75% less likely to develop anemia (RR = 0.25; 95% CI: 0.09–0.66). Similar outcomes were reported in a multi-country analysis by (14), confirming that regular IFA intake significantly reduces the risk of maternal anemia, preterm birth, and low birth weight.

However, despite the national supplementation program, anemia prevalence in Indonesia remains high. (34) highlighted several behavioral and systemic barriers to IFA adherence, including limited understanding of supplement benefits, fear of gastrointestinal side effects, irregular tablet supply, and lack of social or family support. Moreover, cultural norms and forgetfulness were frequently cited as reasons for non-compliance (35). These findings imply that the effectiveness of IFA programs depends not only on tablet availability but also on behavioral change, continuous counseling, and supportive health systems.

To address these challenges, a multidimensional approach is essential. Nutritional adequacy alone cannot guarantee normal hemoglobin levels without consistent supplementation, behavioral adherence, and supportive environments. Integrated strategies such as antenatal nutrition education, digital reminder systems, involvement of community health volunteers (kader), and family empowerment have been shown to improve IFA adherence and maternal hemoglobin outcomes (36) (37). Furthermore, community-based monitoring and personalized counseling may enhance long-term compliance, particularly in low-income or rural populations.

In the context of Bogor City, several factors are presumed to contribute to the absence of a statistically significant association between nutrient adequacy and anemia. Most respondents were urban residents with relatively good food access but limited dietary diversity due to a reliance on staple foods such as rice and side dishes with minimal animal-based sources. In addition, many participants simultaneously received health interventions, including routine iron supplementation and nutrition education from local health workers, which may have obscured the influence of dietary variation on anemia status. Another possible factor is the presence of iron fortification in commercial food products and the unrecorded use of prenatal vitamins or supplements that could have affected hemoglobin levels without being captured in dietary intake data. Measurement limitations, recall bias, and bioavailability factors may also play a role. Indonesian diets are often dominated by non-heme iron sources, which are less efficiently absorbed, particularly when consumed alongside tea, coffee, or calcium-rich foods (38).

Future research should incorporate biochemical indicators such as serum ferritin, transferrin saturation, and C-reactive protein to better assess iron status and differentiate anemia of inflammation from nutritional anemia. Additionally, exploring the synergistic effects of other micronutrients such as vitamin B12, zinc, and copper on hemoglobin synthesis would provide a more holistic understanding of anemia etiology.

5. CONCLUSION

This study showed that there was no significant association between the adequacy level of macronutrients and micronutrients and the incidence of anemia among pregnant women; however, a significant relationship was found between adherence to iron-folic acid (IFA) tablet consumption and hemoglobin status. These findings emphasize that adherence to iron-folic acid supplementation plays a crucial role in preventing anemia during pregnancy. Efforts to prevent anemia in pregnant women should focus not only on improving dietary intake but also on strengthening the IFA supplementation program through education, adherence monitoring, and family support. Community-based interventions, the use of digital reminder technologies, and health worker training can enhance program effectiveness. In addition, increasing dietary diversity and providing continuous nutrition education should be prioritized to achieve optimal nutritional status for both mothers and their fetuses.

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