

THE RELATIONSHIP BETWEEN COMPLIANCE OF IRON-FOLIC ACID SUPPLEMENT TABLET CONSUMPTION WITH ANEMIA STATUS AMONG PREGNANT WOMEN AT KINTAMANI VI PRIMARY HEALTH CARE CENTER

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ABSTRACT

Background: Anemia in pregnancy remains a common health problem that contributes to increased maternal and fetal morbidity and mortality. Preventive efforts have been implemented through the supplementation program of iron-folic acid tablets (Tablet Tambah Darah or TTD) recommended throughout pregnancy; however, its effectiveness depends greatly on compliance. **Objective:** To determine the association between compliance to iron-folic acid tablets consumption and anemia status among pregnant women in the working area of Puskesmas Kintamani VI. **Methods:** This was an analytical observational study with a cross-sectional design involving 75 third-trimester pregnant women who met the inclusion criteria and sampled using consecutive sampling. Compliance data were collected through interviews using a simplified Morisky Medication Adherence Scale-8 (MMAS-8) questionnaire. Hemoglobin levels were obtained using a POCT (Point of Care Testing) device and medical records. Bivariate analysis was performed using the Chi-square test. **Results:** The results showed that 52% of respondents were classified as non-compliant. The proportion of pregnant women with anemia was 33.3% in the non-compliant group and 11.1% in compliant group. Bivariate analysis indicated a significant relationship between TTD compliance and anemia status (p-value=0.022; PR=0.33; 95% CI: 0.12–0.93). Other variables, including maternal age, education level, nutritional status, parity, micronutrient intake, sleep quality, hyperemesis gravidarum, income, occupation, and other medical factors, showed no significant association (p-value>0.05). **Summary:** Compliance to iron-folic acid tablets consumption serves as a protective factor against anemia. It is recommended that healthcare providers strengthen education, follow-up, and support strategies to improve adherence and help reduce anemia prevalence in pregnancy.

Keywords: Anemia, pregnant women, compliance, iron-folic acid supplementation

INTRODUCTION

Key benchmarks for assessing public health status include the Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR). Data from the 2020 Population Census indicates that the MMR reached 189 deaths per 100,000 live births. The majority of these fatalities are attributed to preventable conditions, specifically hemorrhage and hypertensive disorders of pregnancy, such as eclampsia.¹ In this regard, anemia acts as a significant contributing factor that escalates the mortality risk for both mothers and infants.²

Pregnant women represent a population group at high risk of developing anemia due to underlying physiological changes. A World Health Organization (WHO) report in 2021 revealed that in 2019, approximately 36.5% of pregnant women aged 15–49 years worldwide experienced anemia. In Indonesia, the prevalence reached 44.2%.³ In Bali Province, data from the 2021 Bali Provincial Health Profile showed that the prevalence of

anemia among pregnant women was 7%.⁴ Meanwhile, in Bangli Regency, data from 2023 indicated that 10.2% pregnant women were affected by anemia. Data from the Bangli District Health Office also demonstrated that the highest prevalence of anemia among pregnant women was found at Kintamani VI Primary Health Care Center, reaching 33.7%.⁵ The socio-demographic profile of the Kintamani VI working area, characterized by low to moderate education levels and strong local traditions, contributes to limited health awareness and suboptimal dietary patterns. This specific condition potentially exacerbates the risk of anemia among pregnant women in the region.

According to the WHO standard established in 2001, a pregnant woman is classified as anemic if her hemoglobin level is below 11 g/dL.⁶ This condition may be triggered by the interaction of various risk factors, including internal (biological) factors such as maternal age and gestational age, as well as external (behavioral) and socio-

economic factors. Internal risk factors include maternal age, gestational age, parity status, nutritional status, interpregnancy interval, comorbid chronic infectious diseases, hyperemesis gravidarum, menstrual history, and bleeding. External risk factors include compliance with iron supplement tablet consumption, dietary patterns, and sleep quality. Lastly, sociodemographic risk factors include educational level, household income, and employment status.⁷ Unaddressed anemia during pregnancy significantly increases the risk of maternal morbidity and mortality, potentially leading to severe complications such as preeclampsia, hemorrhage, miscarriage, and death.^{2,8} In addition to its effects on pregnant women, anemia during pregnancy may also adversely affect the fetus by increasing the risk of low birth weight (LBW), preterm birth, spontaneous abortion, and fetal death.⁹

The World Health Organization (WHO) also recommended that pregnant women consume 30–60 mg of elemental iron and 0.4 mg of folic acid to prevent anemia. These supplements should be taken regularly from the beginning of pregnancy until delivery.¹⁰ This recommendation has also been adopted in Indonesia (including Bali Provincial Government) where the Ministry of Health of the Republic of Indonesia recommended that Iron Supplement Tablets (Tablet Tambah Darah/TTD) consist of iron and folic acid. The tablets were advised to be consumed at a dosage of one tablet per day for a minimum of 90 days, starting from early pregnancy until the postpartum period.¹¹ As of 2023, iron supplement coverage in Bali (91.8%) and specifically Bangli Regency (92.67%) successfully exceeded the strategic target (Renstra) of 80%.¹²

Previous studies have consistently demonstrated a strong correlation between non-compliance of iron supplementation with the incidence of anemia in various regions of Indonesia.^{13,14,15} However, most existing literature focuses on areas with varying levels of supplement availability or general compliance barriers. This study offers a novel perspective by investigating this relationship within the specific context of Kintamani VI Primary Health Care Center, an area that paradoxically reports high iron supplement coverage exceeding national targets (92.67%) yet sustains the highest prevalence of anemia in the regency. By isolating compliance in a setting of high supplement availability, this research aims to clarify the discrepancy

between administrative coverage data and actual consumption behavior.

Given that Kintamani VI Primary Health Care Center records the highest anemia prevalence in the regency (33.7%), The primary objective of this research was to analyze the the relationship between compliance of iron supplement tablet (Tablet Tambah Darah/TTD) consumption with anemia status among pregnant women at Kintamani VI Primary Health Care Center.

METHODS

This study utilized an observational analytic design with a cross-sectional approach. The research was conducted at the Kintamani VI Primary Health Care Center situated in Bangli Regency, Bali. The population involved pregnant women in their third trimester who visited the facility for routine antenatal care. During the data collection period from June to September 2025, consecutive sampling was applied to recruit third-trimester pregnant women attending routine antenatal care. Every consecutive patient who met the specific eligibility criteria was enrolled until the target sample size of 75 participants was achieved. Subjects were included if they consented to participate and possessed complete medical records, whereas those with hematological disorders other than anemia or incomplete data were excluded..

Data collection was carried out through interviews, questionnaires, physical measurements, and review of medical records. Compliance with iron supplement tablet (Tablet Tambah Darah/TTD) consumption was assessed using a structured questionnaire adapted from the Morisky Medication Adherence Scale. Anemia status was defined as a hemoglobin level < 11 g/dL, measured using point-of-care testing and medical records. The collection of data regarding potential risk factors for anemia relied on two sources: structured interviews and a review of medical records.

Descriptive statistics and the Chi-square test were applied, using $p < 0.05$ as level of statistical significance. The study adhered to ethical standards, including obtained approval, informed consent, and participant confidentiality.

RESULT

Respondent Characteristics

Table 1 provides a detailed overview of the participants' demographic and clinical profiles.

Table 1. Characteristics of Respondents (n = 75)

Variable	Frequency (n)	Percentage (%)
Educational Level		
Higher education	27	36.0
Senior high school	35	46.7
Junior high school	10	13.3
Primary school	3	4.0
Household Income		
High	49	65.3
Low	26	34.7

Variable	Frequency (n)	Percentage (%)
Employment Status		
Housewife	45	60.0
Employed	30	40.0
Age (years)		
20–35	73	97.3
>35	2	2.7
Parity Status		
Nulliparous	30	40.0
Primiparous	24	32.0
Multiparous	21	28.0
Interpregnancy Interval (years)		
<2	5	11.1
≥2	40	88.9
Nutritional Status		
Normal (MUAC >23.5 cm)	70	93.3
Undernutrition (MUAC <23.5 cm)	5	6.7
History of Chronic Infectious Disease		
None	75	100
Hyperemesis Gravidarum		
None	75	100
History of Excessive Menstruation		
No	51	68.0
Yes	24	32.0
History of Bleeding		
No	73	97.3
Yes	2	2.7
Compliance with Iron Supplement Tablet Consumption		
Compliant	36	48.0
Non-compliant	39	52.0
Iron Intake (%RDA)		
Inadequate	75	100
Folate Intake (%RDA)		
Adequate	2	2.7
Inadequate	73	97.3
Cobalamin Intake (%RDA)		
Adequate	42	56.0
Inadequate	33	44.0
Sleep Quality		
Good	43	57.3
Poor	32	42.7
Anemic Status		
Non-anemic	58	77.3
Anemic	17	22.7

The majority of respondents were within the optimal reproductive age of 20–35 years (97.3%) and were predominantly educated at the secondary to higher level (82.7%). Most respondents were housewives (60%), and more than half came from households with high income (65.3%). From a health perspective, nearly all respondents had normal nutritional status (93.3%) and no history of chronic disease (100%) or hyperemesis gravidarum (100%), indicating that biological factors potentially affecting hemoglobin levels were relatively minimal. However, in

terms of nutritional behavior and supplementation, all respondents had inadequate iron intake (100%), the vast majority had insufficient folate intake (97.3%), and more than half were non-compliant with iron supplement tablet (Tablet Tambah Darah/TTD) consumption (52%). Although, 56% had adequate cobalamin intake.

Association Between Compliance with Iron Supplement Tablet Consumption and Anemia Status

Based on the statistical analysis presented in Table 2, a significant association was identified between compliance with TTD consumption and anemia status ($p = 0.022$). Anemia prevalence was significantly lower in the

compliant group (11.1%) compared to the non-compliant group (33.3%). Statistical analysis confirmed compliance as a significant protective factor ($PR = 0.33$; 95% CI: 0.12–0.93)

Table 2. Cross-tabulation Between Compliance with Iron Supplement Tablet Consumption and Anemia Status Among Pregnant Women at Kintamani VI Primary Health Care Center

Compliance with TTD	Non-anemic	Anemic	PR (95% CI)	p-value
Compliant	32 (88.9%)	4 (11.1%)	0.33 (0.12–0.93)	0.022
Non-compliant	26 (66.7%)	13 (33.3%)	–	–

Risk Factors Associated with Anemia Status

Bivariate analysis confirmed that compliance with TTD consumption was the only variable significantly associated with anemia ($p = 0.022$), demonstrating a strong

protective effect ($PR = 0.33$; 95% CI: 0.12–0.93). Other examined determinants did not show statistically significant associations ($p > 0.05$).

Table 3. Cross-tabulation Between Risk Factors and Anemia Status Among Pregnant Women at Kintamani VI Primary Health Care Center

Variable	Anemia Status		PR (95% CI)	p-value
	Non-anemic n (%)	Anemic n (%)		
Maternal Age				
20–35 years	57 (78.1)	16 (21.9)	0.43 (0.10–1.87)	0.349
>35 years (ref)	1 (50.0)	1 (50.0)	–	–
Educational Level				
Higher education	22 (81.5)	5 (18.5)	0.56 (0.09–3.31)	0.500
Senior high school	26 (74.3)	9 (25.7)	0.77 (0.14–4.21)	1.000
Junior high school	8 (80.0)	2 (20.0)	0.60 (0.08–4.54)	1.000
Elementary school (ref)	2 (66.7)	1 (33.3)	–	–
Employment Status				
Housewife	34 (75.6)	11 (24.4)	1.22 (0.56–2.95)	0.652
Employed (ref)	24 (80.0)	6 (20.0)	–	–
Household Income				
High	40 (81.6)	9 (18.4)	0.60 (0.26–1.36)	0.222
Low (ref)	18 (69.2)	8 (30.8)	–	–
Compliance with Iron Supplementation (TTD)				
Compliant	32 (88.9)	4 (11.1)	0.33 (0.12–0.93)	0.022
Non-compliant (ref)	26 (66.7)	13 (33.3)	–	–
Folate Intake				
Adequate	1 (50.0)	1 (50.0)	2.28 (0.53–9.74)	0.349
Inadequate (ref)	57 (78.1)	16 (21.9)	–	–
Cobalamin Intake				
Adequate	32 (76.2)	10 (23.8)	1.12 (0.48–2.63)	0.790
Inadequate (ref)	26 (78.8)	7 (21.2)	–	–
Sleep Quality				
Good	32 (74.4)	11 (25.6)	1.36 (0.56–3.30)	0.485
Poor (ref)	26 (81.3)	6 (18.8)	–	–

Variable	Anemia Status		PR (95% CI)	p-value
	Non-anemic n (%)	Anemic n (%)		
Menstruation				
No	38 (74.5)	13 (25.5)	1.53 (0.56–4.20)	0.395
Yes (ref)	20 (83.3)	4 (16.7)	–	–
Parity Status				
Nulliparous	26 (86.7)	4 (13.3)	0.40 (0.13–1.20)	0.165
Primiparous	18 (75.0)	6 (25.0)	0.75 (0.30–1.88)	0.538
Multiparous (ref)	14 (66.7)	7 (33.3)	–	–
Nutritional Status				
Normal	53 (75.7)	17 (24.3)	–	0.210
Underweight (ref)	5 (100.0)	0 (0.0)	–	–
History of Bleeding				
No	56 (76.7)	17 (23.3)	–	0.438
Yes (ref)	2 (100.0)	0 (0.0)	–	–

DISCUSSION

A significant relationship was identified regarding TTD consumption compliance and anemia status within the study population at Kintamani VI Primary Health Care Center ($p=0.022$). Data indicated that anemia affected 33.3% of participants who were non-compliant, whereas only 11.1% of compliant participants were affected. Statistical testing further confirmed that compliance acts as a protective determinant ($PR=0.33$; 95% CI: 0.12–0.93), effectively lowering the anemia risk by 67% for those who adhere to the regimen. The fact that the entire confidence interval lies below 1 strengthens the evidence that this protection is statistically significant and clinically meaningful. These findings confirm the strong theoretical foundation regarding the essential role of iron supplementation in preventing anemia during pregnancy. Physiologically, this association can be explained by the central role of iron in erythropoiesis, or red blood cell formation.

Iron plays a crucial role in hemoglobin synthesis, the protein responsible for binding and transporting oxygen to body tissues. Iron requirements increase significantly during pregnancy to support maternal red blood cell mass expansion, placental development, and fetal growth, particularly during the second and third trimesters. Overall, total iron requirements during pregnancy are estimated to reach approximately 800 mg, an amount that is generally difficult to fulfill through daily dietary intake alone.¹⁶

Iron supplement tablets containing elemental iron and folic acid function as an external supply to meet this increased demand. Compliance with TTD consumption ensures continuous iron availability for hemoglobin synthesis, thereby compensating for hemodilution effects and meeting fetal requirements without depleting maternal

iron stores. Conversely, non-compliance disrupts this supply, leading to depletion of iron reserves. Once iron stores are exhausted, hemoglobin production becomes impaired, which clinically manifests as iron deficiency anemia, which remains the most prevalent form of anemia observed in pregnant women.¹⁷

The findings of this study are consistent with numerous studies conducted in various regions of Indonesia. A study conducted by Kamrori and Purwati in Banjarmasin in 2024 further supported this relationship, showing that non-compliant pregnant women were up to 25 times more likely to develop anemia compared with those who adhered to regular iron supplementation.¹³ Similarly, a study by Fajrin in Lamongan in 2020 reported a significant association ($p = 0.011$) between compliance with iron tablet consumption and anemia among second- and third-trimester pregnant women.¹⁴ Research conducted in Balikpapan also confirmed a significant association ($p = 0.023$) between iron tablet compliance and anemia among third-trimester pregnant women.¹⁸ Additionally, a study at Sleman Primary Health Care Center, Yogyakarta, by Kusumasari et al. in 2021 demonstrated a highly significant relationship ($p = 0.000$), with the majority (65.1%) of non-compliant pregnant women experiencing anemia.¹⁵ The consistency of findings across multiple regions suggests that the relationship between compliance with iron supplementation and anemia status represents a strong and widespread pattern, rather than a localized issue limited to the Kintamani area.

The importance of TTD compliance is further reinforced by findings related to respondents' dietary intake patterns. As shown in Table 3, all respondents (100%) had inadequate iron intake, and the majority (97.3%) also had

insufficient folate intake, while approximately 44% had inadequate cobalamin (vitamin B12) intake. The pathophysiology of nutritional anemia is not solely attributable to iron deficiency, but also to deficiencies in folate and cobalamin, both of which are essential for DNA synthesis and red blood cell maturation.¹⁹ When most or all of the study population experiences deficiencies in key micronutrients such as iron and folate, dietary pattern variables no longer function as effective discriminators of anemia risk. Under such conditions, the only intervention capable of effectively reducing or preventing anemia risk is external supplementation, namely iron supplement tablets (TTD).

Regarding sleep quality, the data indicated a risk tendency with a Prevalence Ratio (PR) of 1.59. However, this relationship failed to reach statistical significance, as demonstrated by the 95% Confidence Interval of 0.81–3.14. This outcome diverges from existing literature, which identifies poor sleep patterns as a significant contributing factor to reduced hemoglobin in pregnancy..^{20,21}

Sociodemographic factors such as educational level did not show statistically significant associations with anemia status, with all categories yielding p -values > 0.05 . For instance, a recent study in 2024 argued that education plays a pivotal role in shaping health behaviors, where higher educational attainment is associated with a better ability to filter health information and increased awareness regarding anemia prevention.²² Employment status and household income also showed no significant associations in the bivariate analysis. These findings differ from several previous studies that identified low education, employment status, and low income as risk factors for anemia.^{23–26} The lack of significance in this study may be attributed to sample homogeneity, as most respondents had secondary or higher education (82.7%) and high household income (65.3%).

Maternal age was also not significantly associated with anemia status ($p = 0.349$). The PR of 0.43 (95% CI: 0.10–1.87) had a wide interval crossing 1, reinforcing the conclusion of non-significance. This may be due to the homogeneous age distribution of respondents, with 97.3% falling within the optimal reproductive age range of 20–35 years, the statistical power to detect differences was limited. This finding contrasts with previous studies reporting increased anemia risk among women aged <20 or >35 years.^{27,28}

Nutritional status based on MUAC measurement also showed no statistically significant association with anemia status ($p = 0.619$). The PR of 0.83 (95% CI: 0.50–1.36) indicated no meaningful difference in anemia risk between women with normal nutritional status and those who were undernourished. This result may again be explained by sample homogeneity, as most respondents (93.3%) had normal nutritional status. This finding differs from several previous studies that consistently reported an

association between undernutrition ($MUAC < 23.5$ cm) and increased anemia risk among pregnant women.²⁹

Parity status also showed no statistically significant association ($p > 0.05$), possibly due to the predominance of low-risk parity groups, with 40% of respondents being nulliparous. This reduced variability may have limited the ability to detect meaningful differences. This result contrasts with studies reporting high parity as a significant risk factor for anemia during pregnancy.²⁶

History of excessive menstruation ($p = 0.391$; PR = 1.22; 95% CI: 0.72–2.08) and history of bleeding ($p = 1.000$; PR = 1.15; 95% CI: 0.18–7.50) were also not significantly associated with anemia. Theoretically, excessive menstruation is an important risk factor due to its role in depleting iron stores prior to pregnancy, while bleeding during or after pregnancy can directly reduce hemoglobin levels. The lack of significant findings in this study may be due to limited sample size or the masking effect of widespread nutritional deficiencies across the study population.¹¹

Variables related to chronic infectious disease comorbidity and hyperemesis gravidarum were not included in the analysis because all participants (100%) reported no history of these conditions. With no data variation, statistical risk comparison was not feasible.

Every study has limitations that should be acknowledged to allow proportional interpretation of the findings and to inform future research. First, compliance with iron supplement consumption was assessed using a self-report method, which is susceptible to recall bias and social desirability bias. Similarly, nutrient intake (iron, folate, and cobalamin) was evaluated using a 24-hour food recall, which may introduce recall-related inaccuracies. Measurement bias may also have occurred in hemoglobin assessment due to variations in data collection methods.

Second, this study did not fully control for several potential confounding factors, including daily dietary intake, pre-pregnancy nutritional status, parity, interpregnancy interval, and chronic diseases or infections that may influence hemoglobin levels. Third, the relatively small sample size and homogeneous study population may have limited the statistical power, potentially obscuring statistically significant associations despite clinically relevant differences.

CONCLUSION AND RECOMENDATION

The majority of respondents were aged 20–35 years, had secondary–higher education, normal nutritional status, were nulliparous housewives with middle–high household income, an interpregnancy interval >2 years, no history of bleeding or chronic/infectious disease, good sleep quality, but inadequate iron and folate intake, and 52% were non-compliant with iron supplement (TTD) consumption; anemia prevalence was lower in compliant women (11.1%) than non-compliant women (33.3%), with a significant

association ($p = 0.022$) and a 0.33-fold lower anemia risk (95% CI: 0.12–0.93). Strengthening CIE activities and nutrition education is recommended to improve TTD compliance, and future studies should apply objective compliance measures and longitudinal designs.

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