

Original Research

Association Between Iron Tablet Consumption Practices and Anemia Status Among Second-Trimester Pregnant Women in South Kuta, Bali, Indonesia: A Cross-Sectional Study

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ABSTRACT

Background: Anemia in pregnancy remains a major maternal health problem despite high coverage of iron supplementation. Its effectiveness may depend not only on tablet availability and adherence but also on the method of consumption. This study aimed to determine the relationship between iron tablet consumption method and anemia status among second-trimester pregnant women in the South Kuta Community Health Center working area. **Methods:** A quantitative correlational analytical study with a cross-sectional design was conducted in the South Kuta Community Health Center working area, Benoa District, Badung, Indonesia, in May 2026. A total of 46 second-trimester pregnant women were selected using purposive sampling. Data on iron tablet consumption methods were collected using a structured questionnaire, while anemia status was obtained from hemoglobin records in maternal health documentation. Data were analyzed using descriptive statistics and the Spearman rank correlation test, with statistical significance set at $p < 0.05$. **Results:** Most respondents reported a good iron tablet consumption method (26/46; 56.5%), followed by a sufficient method (19/46; 41.3%) and poor method (1/46; 2.2%). Most respondents were not anemic (30/46; 65.2%), while 11 (23.9%) had mild anemia and 5 (10.9%) had moderate anemia. Spearman rank analysis demonstrated a statistically significant moderate association between iron tablet consumption method and anemia status ($r_s = 0.437$; $p = 0.002$). **Conclusions:** Iron tablet consumption method was significantly associated with anemia status among second-trimester pregnant women. Practical education on correct iron tablet consumption during antenatal care should be strengthened to support anemia prevention. Further studies with larger samples and direct monitoring are recommended.

Keywords: Anemia; iron preparations; pregnant women; pregnancy

1. INTRODUCTION

Anemia during pregnancy remains an important maternal health problem because inadequate hemoglobin levels can adversely affect maternal health and pregnancy outcomes, particularly in developing countries.⁽¹⁾ Anemia in pregnancy is generally defined as a hemoglobin concentration below 11 g/dL and may result from insufficient erythrocytes or inadequate hemoglobin levels.⁽²⁾ The burden of anemia remains substantial globally. According to the World Health Organization, the prevalence of anemia among pregnant women was 35.5% in 2023, with a considerably

higher prevalence reported in developing countries (45%) than in developed countries (13%).⁽³⁾ In Indonesia, the 2023 Indonesian Health Survey reported that 27.7% of pregnant women experienced anemia.⁽⁴⁾ This condition is also of concern in Bali Province, where the prevalence of anemia among pregnant women increased from 23.0% in 2022 to 23.2% in 2023 and further to 28.5% in 2024.⁽⁵⁻⁷⁾

Iron deficiency is an important modifiable factor in the prevention and management of anemia during pregnancy. The Indonesian government has therefore implemented iron supplementation for pregnant women, with a recommended minimum of 90 iron supplementation tablets during pregnancy.⁽²⁾ National coverage of iron supplementation reached 87.23% in 2023 and 87.27% in 2024. In Bali Province, coverage was also relatively high, reaching 91.7% in 2022, 91.8% in 2023, and 90.22% in 2024, exceeding the 80% target of the provincial strategic plan.⁽⁵⁻⁷⁾ These data indicate that the availability and distribution of iron supplementation have achieved relatively high program coverage. However, the continued increase in anemia prevalence in Bali despite high supplementation coverage suggests that program coverage alone may not be sufficient to prevent anemia.⁽⁸⁾

The effectiveness of iron supplementation is influenced not only by whether pregnant women receive the tablets but also by how the tablets are consumed. Proper consumption includes attention to the timing of intake and the accompanying foods or beverages. Iron tablets are recommended to be taken with foods or beverages containing vitamin C because vitamin C can facilitate iron absorption. In contrast, tea, coffee, milk, antacids, and calcium-containing tablets may interfere with iron absorption. The timing of consumption may also be considered, with nighttime intake recommended in some guidance to reduce gastrointestinal discomfort such as nausea.⁽⁹⁾ Thus, inappropriate consumption practices may reduce the effectiveness of iron supplementation even when pregnant women receive the recommended number of tablets.

Behavioral factors may contribute to differences in the way pregnant women consume iron tablets. The preliminary assessment conducted in the South Kuta Community Health Center working area identified pregnant women who had insufficient knowledge regarding the appropriate timing of iron tablet consumption, recommended foods or beverages to accompany supplementation, and foods or beverages that should be avoided. These findings indicate a potential gap between the provision of iron

supplementation and the correct implementation of iron tablet consumption practices. From a behavioral perspective, knowledge is a predisposing factor that can influence health behavior, while support from health workers can reinforce appropriate health practices. Consequently, improving knowledge and reinforcing correct consumption practices may be important components of efforts to maximize the effectiveness of iron supplementation.

Previous studies have reported associations between iron supplementation practices and indicators of maternal iron status. Studies cited in the present research have demonstrated relationships between iron supplementation and hemoglobin levels among pregnant women, including moderate correlations. However, evidence specifically examining the relationship between the method of consuming iron tablets and anemia status among second-trimester pregnant women remains limited, particularly in the local context of the South Kuta Community Health Center working area. This distinction is important because receiving or consuming iron tablets does not necessarily indicate that the tablets are being consumed in a manner that optimizes iron absorption and effectiveness.

Therefore, this study aimed to determine the relationship between the method of iron tablet consumption and anemia status among second-trimester pregnant women in the South Kuta Community Health Center working area. The findings are expected to provide evidence for strengthening maternal health education, particularly regarding the correct method of consuming iron tablets, and to support nurses, midwives, and other health professionals in optimizing iron supplementation programs for the prevention of anemia during pregnancy.

2. METHODS

2.1 Study Design

This study employed a quantitative correlational analytical design with a cross-sectional approach. The study was conducted to determine the relationship between the method of iron tablet consumption and anemia status among pregnant women in the second trimester. The independent variable was the method of iron tablet consumption, while the dependent variable was anemia status.

2.2 Study Setting and Period

The study was conducted in the working area of the South Kuta Community Health Center (Puskesmas), Benoa District, Badung, Indonesia. Data collection was conducted during a two-week period, from the first to the second week of May 2026.

2.3 Population and Sample

The target population comprised pregnant women receiving iron supplementation in the South Kuta Community Health Center working area. Based on local health records, the population consisted of 974 pregnant women. The sample size was determined using the Slovin formula:

$$n = \frac{N}{1 + Ne^2}$$

where n is the required sample size, N is the population size (974), and e is the margin of error. Using a margin of error of approximately 14.4%, the calculation was:

$$n = \frac{974}{1 + 974(0.144)^2}$$

$$n = \frac{974}{1 + 20.20}$$

$$n \approx 45.8$$

Thus, the minimum required sample was approximately 46 respondents. A total of 46 second-trimester pregnant women who met the predetermined inclusion and exclusion criteria were subsequently recruited using purposive sampling.

Respondents were selected using purposive sampling based on predetermined inclusion and exclusion criteria. The inclusion criteria were: willingness to participate in the study; gestational age of 13–27 weeks; good nutritional status indicated by a mid-upper arm circumference (MUAC) of ≥ 23.5 cm; fewer than three previous live births; availability of the most recent hemoglobin test result obtained at 13–27 weeks of gestation; and the ability to read and write. Respondents were excluded if they had cognitive impairment, dementia, or congenital diseases and other conditions specified in the study criteria, including thalassemia, chronic kidney failure, chronic infections, and autoimmune diseases.

2.4 Study Variables and Measurement

The independent variable was the method of iron tablet consumption among pregnant women. Data were obtained using a structured questionnaire and

categorized into three levels based on the total assessment score: good, sufficient, and poor.

The dependent variable was anemia status among second-trimester pregnant women. Anemia status was determined based on the hemoglobin level recorded in the pregnant woman's registration book or maternal and child health (Buku Kesehatan Ibu dan Anak). The status was categorized as no anemia, mild anemia, moderate anemia, or severe anemia.

2.5 Data Collection

Data collection involved both primary and secondary data. Primary data were obtained using a structured questionnaire to assess the respondents' method of consuming iron tablets. Secondary data were obtained from the pregnant women's registration book or KIA book, particularly the most recent hemoglobin test results.

Initially, potential respondents were screened according to the inclusion criteria, including second-trimester gestational age, good nutritional status (MUAC ≥ 23.5 cm), and parity of fewer than three previous live births. Eligible pregnant women were then approached by the researcher and provided with an explanation of the study objectives and procedures. Respondents who agreed to participate provided their willingness through the Google Form. The researcher then administered the questionnaire by reading each question to the respondent and recording the response according to the available answer options. Subsequently, the researcher collected the respondents' hemoglobin data from the registration book or KIA book.

2.6 Data Analysis

Data were processed through checking for completeness, coding, data entry, and statistical analysis using IBM SPSS Statistics version 25.0. Univariate analysis was conducted to describe respondent characteristics, including age, highest educational level, and employment status, as well as the method of iron tablet consumption and anemia status. The results were presented as frequencies and percentages.

Bivariate analysis was performed to examine the relationship between the method of iron tablet consumption and anemia status. The Spearman rank correlation test was used because the study variables were analyzed as ordinal categories. Statistical significance was determined at a p -value of <0.05 with a 95% confidence level.

2.7 Ethical Considerations

This study was conducted in accordance with ethical principles for research involving human participants. Before data collection, eligible respondents were informed about the purpose and procedures of the study and their voluntary participation was obtained. Confidentiality of respondents' information was maintained throughout the research process.

Ethical approval was obtained from the Health Research Ethics Commission of Denpasar Health Polytechnic under approval number DP.04.02/F.XXIV.26/516/2026.

3. RESULTS

3.1 Respondent Characteristics

A total of 46 pregnant women in the second trimester who met the inclusion and exclusion criteria participated in this study. The characteristics of the respondents are presented in Table 1. Most respondents were classified as being in the non-risk age group (45 respondents, 97.8%), had secondary education (35 respondents, 76.1%), and were not employed (26 respondents, 56.5%).

Table 1. Sociodemographic characteristics of second-trimester pregnant women in the South Kuta Community Health Center working area, May 2026 (n=46)

Characteristics	N	%
Age group		
Non-risk age	45	97.8
Risk age	1	2.2
Highest educational level		
Basic education	2	4.3
Secondary education	35	76.1
Higher education	9	19.6
Employment status		
Employed	20	43.5
Not employed	26	56.5
Total	46	100.0

3.2 Method of Iron Tablet Consumption

The distribution of respondents according to their method of iron tablet consumption is presented in Table 2. Of the 46 respondents, more than half demonstrated a good method of iron tablet consumption (26 respondents, 56.5%). A further 19 respondents (41.3%) demonstrated a

sufficient method, while only 1 respondent (2.2%) demonstrated a poor method of iron tablet consumption.

Table 2. Distribution of iron tablet consumption method among second-trimester pregnant women in the South Kuta Community Health Center working area, May 2026 (n=46)

Method of iron tablet consumption	n	%
Good	26	56.5
Sufficient	19	41.3
Poor	1	2.2
Total	46	100.0

3.3 Anemia Status

The distribution of anemia status among the respondents is shown in Table 3. Most respondents did not experience anemia, accounting for 30 respondents (65.2%). Mild anemia was identified in 11 respondents (23.9%), while 5 respondents (10.9%) experienced moderate anemia. No respondent was reported as having severe anemia.

Table 3. Anemia Status among Second-Trimester Pregnant Women in the South Kuta Community Health Center Working Area, May 2026 (n=46)

Anemia status	n	%
No anemia	30	65.2
Mild anemia	11	23.9
Moderate anemia	5	10.9
Severe anemia	0	0.0
Total	46	100.0

3.4 Relationship between Iron Tablet Consumption Method and Anemia Status

The relationship between the method of iron tablet consumption and anemia status is presented in Table 4. Among respondents with a good method of iron tablet consumption, 21 (45.7% of the total sample) had no anemia and 5 (10.9%) had mild anemia; none had moderate anemia. Among respondents with a sufficient method of consumption, 9 (19.6%) had no anemia, 6 (13.0%) had mild anemia, and 4 (8.7%) had moderate anemia. The single respondent with a poor method of iron tablet consumption experienced moderate anemia.

The Spearman rank correlation analysis demonstrated a statistically significant relationship between the method of iron tablet consumption and

anemia status ($p = 0.002$), with a correlation coefficient of $r = 0.437$, indicating a moderate correlation. Thus, the statistical analysis showed a significant relationship between the two study variables.

The descriptive findings indicate that respondents with a good method of iron tablet consumption

predominantly had no anemia, whereas the only respondent classified as having a poor consumption method experienced moderate anemia. The inferential analysis confirmed a statistically significant relationship between the method of iron tablet consumption and anemia status.

Table 4. Relationship between Iron tablet consumption method and anemia status among second-trimester pregnant women in the South Kuta Community Health Center working area, May 2026 (n=46)

Method of iron tablet consumption	No anemia, n (%)	Mild anemia, n (%)	Moderate anemia, n (%)	Total, n (%)
Good	21 (45.7)	5 (10.9)	0 (0.0)	26 (56.5)
Sufficient	9 (19.6)	6 (13.0)	4 (8.7)	19 (41.3)
Poor	0 (0.0)	0 (0.0)	1 (2.2)	1 (2.2)
Total	30 (65.2)	11 (23.9)	5 (10.9)	46 (100.0)

The Spearman rank correlation analysis demonstrated a statistically significant relationship between the method of iron tablet consumption and

anemia status among second-trimester pregnant women ($r_s = 0.437$; $p = 0.002$). The correlation coefficient indicated a moderate association between the two ordinal variables.

Table 5. Spearman rank correlation between iron tablet consumption method and anemia status among second-trimester pregnant women in the South Kuta Community Health Center working area, May 2026 (n = 46)

Variables	Spearman's rho (r_s)	p-value	Correlation strength	Interpretation
Iron tablet consumption method – Anemia status	0.437	0.002	Moderate	Statistically significant

Note: Spearman's rank correlation test; statistically significant at $p < 0.05$, Spearman rank correlation: $p = 0.002$; $r = 0.437$.

4. DISCUSSION

4.1 Method of Iron Tablet Consumption among Pregnant Women

This study found that more than half of the respondents (56.5%) demonstrated a good method of iron tablet consumption, while 41.3% demonstrated a sufficient method and 2.2% demonstrated a poor method. This finding suggests that most respondents had adopted relatively appropriate practices in consuming iron tablets during pregnancy. However, the proportion of respondents with only sufficient or poor consumption practices indicates that receiving iron supplementation does not necessarily ensure that pregnant women consume the tablets appropriately.

The relatively good consumption practices observed in this study may be related to health education provided by health workers during antenatal care and iron tablet distribution. Health workers have an important role in reinforcing appropriate maternal health behaviors by providing information about the timing of consumption, appropriate accompanying foods or

beverages, and substances that should be avoided when taking iron tablets. This interpretation is consistent with the behavioral framework used in the original study, in which health-worker support functions as a reinforcing factor in health behavior.

Educational attainment may also contribute to the ability of pregnant women to understand and apply information concerning iron supplementation. In this study, most respondents had secondary education (76.1%). Previous research by Rumayomi et al. reported a significant relationship between educational level and compliance with iron supplementation among pregnant women ($p = 0.002$).⁽¹⁰⁾ Education may influence the ability to receive health information, understand recommendations, and make decisions regarding health practices. Amir et al. similarly reported that maternal educational characteristics were associated with factors related to hemoglobin levels during pregnancy.⁽¹¹⁾ Nevertheless, because educational level was not analyzed as an independent predictor in the present study, its contribution should be interpreted as a possible contextual factor rather than a causal determinant.

The findings also indicate the importance of continuing individualized education rather than relying solely on the distribution of iron tablets. Although iron supplementation coverage in Bali has exceeded the strategic target, the continued occurrence of anemia suggests that program effectiveness depends not only on access to tablets but also on appropriate utilization.^(11,12) Therefore, counseling on how to consume iron tablets should be integrated into routine antenatal services.

4.2 Anemia Status among Pregnant Women

The majority of respondents in this study did not experience anemia (65.2%), whereas 23.9% had mild anemia and 10.9% had moderate anemia. The relatively high proportion of respondents without anemia may reflect the generally favorable iron tablet consumption practices observed in this study. However, the presence of mild and moderate anemia among respondents indicates that anemia remains an important concern even among pregnant women who have access to iron supplementation.

The findings should be considered in the context of the broader anemia situation in Bali. The prevalence of anemia among pregnant women in Bali increased from 23.0% in 2022 to 23.2% in 2023 and 28.5% in 2024.⁽⁵⁻⁷⁾ At the national level, the 2023 Indonesian Health Survey reported an anemia prevalence of 27.7% among pregnant women.⁽¹³⁾ These figures indicate that anemia remains a substantial maternal health problem despite relatively high coverage of iron supplementation.

Age and educational characteristics may also provide contextual explanations for the anemia distribution observed in this study. Almost all respondents (97.8%) were classified within the non-risk age group. Previous research has reported an association between maternal age and hemoglobin levels, with women within the reproductive age range generally having lower pregnancy-related health risks than women at more extreme reproductive ages.⁽¹⁴⁾ However, because the present study included only one respondent in the risk-age category, the role of age could not be meaningfully evaluated statistically.

Similarly, the predominance of respondents with secondary education may have supported better understanding of information related to pregnancy nutrition and iron supplementation. Laia et al. reported a significant relationship between educational level and hemoglobin levels among pregnant women ($p = 0.012$).⁽¹⁵⁾ Nevertheless, the present study was not designed to

determine whether age or education independently influenced anemia status. These variables should therefore be regarded as potential background factors rather than explanatory variables established by this study.

4.3 Relationship between Iron Tablet Consumption Method and Anemia Status

The main finding of this study was a statistically significant relationship between the method of iron tablet consumption and anemia status among second-trimester pregnant women. The Spearman rank test produced $p = 0.002$, with a correlation coefficient of $r = 0.437$, indicating a moderate association. Respondents with a good method of iron tablet consumption predominantly had no anemia, whereas the respondent with a poor consumption method experienced moderate anemia.

This finding supports the importance of correct iron tablet consumption practices in addition to the provision of iron supplementation itself. Iron supplementation is intended to increase iron availability and prevent iron deficiency during pregnancy, but its effectiveness may be influenced by how the tablets are consumed. The Indonesian Ministry of Health recommends attention to the timing and manner of iron tablet consumption, including consideration of foods and beverages that may enhance or inhibit iron absorption.^(9,16) The appropriate consumption of iron tablets may therefore contribute to maximizing the physiological benefit of supplementation.

The finding is consistent with previous research. Istikhomah et al. reported a significant relationship between iron supplementation and hemoglobin levels among pregnant women, with a moderate correlation ($r = 0.516$; $p < 0.001$).⁽¹⁴⁾ Hafizah and Yuliawati also reported a significant relationship between iron supplementation and hemoglobin levels among pregnant women ($p = 0.007$).⁽¹⁵⁾ Although these studies examined iron supplementation or its relationship with hemoglobin levels rather than precisely the method of tablet consumption assessed in the present study, their findings provide supporting evidence that iron supplementation practices are relevant to maternal hemoglobin status.^(17,18)

The present study extends this evidence by emphasizing the behavioral dimension of supplementation. The availability of iron tablets and high program coverage do not automatically guarantee optimal physiological effectiveness. In Bali, iron supplementation coverage reached 91.7% in 2022, 91.8%

in 2023, and 90.22% in 2024, while anemia prevalence continued to increase.⁽⁵⁻⁷⁾ This discrepancy suggests that future program evaluation should consider not only coverage indicators but also adherence, correct consumption practices, dietary factors, and other determinants of anemia.⁽¹⁹⁾

The moderate magnitude of the correlation also indicates that the method of iron tablet consumption is unlikely to be the sole determinant of anemia status. Maternal anemia is multifactorial and may be influenced by nutritional status, dietary iron intake, infection, parity, socioeconomic conditions, health knowledge, and other maternal characteristics.⁽²⁰⁾ The present study controlled some potential sources of heterogeneity through its inclusion and exclusion criteria, including nutritional status and parity, but it did not statistically examine all potential determinants of anemia.⁽²¹⁾ Therefore, the observed association should not be interpreted as evidence that inappropriate iron tablet consumption alone causes anemia.

4.4 Implications for Maternal Health Services

The findings have practical implications for antenatal care, particularly for midwives, nurses, and other health professionals responsible for maternal health promotion. Iron supplementation counseling should go beyond informing pregnant women about the need to consume iron tablets and should provide practical instructions on how to consume them correctly. Counseling should address the timing of intake, appropriate accompanying foods or beverages, and substances that may interfere with iron absorption.

The results also suggest that the effectiveness of iron supplementation programs should be assessed using both coverage and behavioral indicators. A high proportion of pregnant women receiving iron tablets is an important program achievement, but it should be accompanied by monitoring of appropriate consumption practices and maternal anemia outcomes. Integrating brief counseling and reinforcement into every contact for antenatal care may provide an opportunity to address incorrect consumption practices before they compromise the effectiveness of supplementation.

From a behavioral perspective, the preliminary findings from the study area showed that some pregnant women still had insufficient knowledge regarding the appropriate timing of iron tablet consumption and the foods or beverages that should or should not accompany supplementation. This supports the need for health

education strategies that are specific, practical, and repeated during pregnancy rather than relying on one-time information delivery.

4.5 Strengths and Limitations

A strength of this study is its focus on the method of iron tablet consumption rather than merely measuring whether pregnant women received iron supplementation. The study also restricted the participants to second-trimester pregnant women who met predefined nutritional, parity, gestational-age, and clinical criteria, thereby providing a relatively specific study population.

However, several limitations should be considered. First, the sample consisted of only 46 respondents and was selected using purposive sampling from the South Kuta Community Health Center working area. Therefore, the findings may not be generalizable to all pregnant women or to other geographical and health-service settings. Second, the method of iron tablet consumption was assessed using a questionnaire rather than direct observation. Self-reported behavior may be affected by recall or social desirability bias. Third, anemia status was determined from recorded hemoglobin results rather than repeated hemoglobin measurements performed specifically for this study. Finally, the cross-sectional design identifies an association between the variables but cannot establish a temporal or causal relationship.

Future studies should involve larger samples and, where feasible, longitudinal designs to examine whether changes in iron tablet consumption practices precede changes in hemoglobin or anemia status. Direct observation or repeated monitoring of iron tablet consumption could also provide a more objective assessment of adherence and consumption practices. Further research should additionally consider dietary iron intake, infection, parity, socioeconomic characteristics, and other potential determinants to develop a more comprehensive model of anemia prevention during pregnancy.

5. CONCLUSION

This study concludes that there is a statistically significant relationship between the method of iron tablet consumption and anemia status among second-trimester pregnant women in the South Kuta Community Health Center working area. The Spearman rank analysis

demonstrated a significant association ($p = 0.002$) with a moderate correlation coefficient ($r = 0.437$). Most respondents who demonstrated a good method of iron tablet consumption did not experience anemia, whereas the respondent with a poor consumption method experienced moderate anemia. These findings indicate that appropriate iron tablet consumption practices are an important component of maternal anemia prevention and should be strengthened alongside the provision of iron supplementation. Maternal health services, particularly antenatal care, should integrate practical education and reinforcement regarding the correct method of consuming iron tablets. Further studies involving larger samples, direct monitoring of consumption practices, and longitudinal designs are recommended to clarify the temporal relationship between iron tablet consumption practices and anemia status and to improve the generalizability of the findings.

Ethical Approval

Ethical approval for this study was obtained from the Health Research Ethics Commission of Denpasar Health Polytechnic, Indonesia, under approval number DP.04.02/F.XXIV.26/516/2026.

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Competing Interests

All the authors declare that there are no conflicts of interest.

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Underlying Data

Derived data supporting the findings of this study are available from the corresponding author on request.

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