

Association between Married Couples' Knowledge of Anemia Prevention and the Incidence of Anemia Among Pregnant Women

Maesaroh^{1*}, Qurat Ul Ain², Yania Febsi¹, Nisri Ina Zahrah¹, Nana Fitriana³

¹Faculty of Health Science, Bina Bangsa University, Banten, Postal Code 42121, Indonesia.

²Faculty of Pharmacy, The University of Faisalabad, Faisalabad City, Postal Code 38000, Pakistan.

³Faculty of Health Science, Poltekkes Bhakti Pertiwi Husada, Cirebon City, West Java, Postal Code 45122, Indonesia

Abstract

Background: Anemia during pregnancy remains a major public health issue in Indonesia, especially in rural areas such as Tasikmalaya Regency. Limited knowledge and inadequate partner involvement are key factors contributing to poor anemia prevention practices. This study aimed to assess the association between couples' knowledge of anemia prevention and maternal hemoglobin status.

Method: A cross-sectional study was conducted among 150 pregnant women and their partners in Tasikmalaya Regency, West Java. Data on sociodemographic characteristics, knowledge, and preventive practices were collected using a structured questionnaire, and hemoglobin (Hb) levels were classified according to WHO (2023) standards. Associations were analyzed using the chi-square test and multivariate logistic regression.

Results: Most respondents were aged 21–35 years (78.7%), and 43.3% had completed secondary education. Although 82% attended ≥ 4 antenatal care visits and 84.7% reported taking iron (Fe) tablets, the prevalence of anemia remained high at 58.7%, with 26.7% classified as having moderate-to-severe anemia. A significant association was found between couples' knowledge and maternal hemoglobin status ($\chi^2 = 18.43$; $df = 6$; $p = 0.005$), with a moderate effect size (Cramér's $V = 0.25$). Higher knowledge levels were associated with a greater proportion of non-anemic women, whereas lower knowledge levels were more frequently observed among women with moderate to severe anemia.

Conclusion: In Tasikmalaya Regency, higher couples' knowledge of anemia prevention was significantly associated with better maternal hemoglobin status. These findings support the importance of strengthening couple-based educational approaches and improving the quality of anemia prevention strategies within maternal health programs.

Keywords: Anemia prevention, Couples' knowledge, Hemoglobin, Pregnant women

INTRODUCTION

Anemia during pregnancy remains one of the most pressing global public health problems, particularly in low- and middle-income countries. The World Health Organization (WHO) estimates that approximately 35.5% of pregnant women worldwide experience anemia, with the majority of cases attributed to iron deficiency.¹ This condition is associated with serious maternal and fetal complications such as preterm delivery, low birth weight, impaired cognitive development, and increased maternal mortality.² Despite global health efforts, anemia in pregnancy continues to pose a significant barrier to achieving the Sustainable Development Goals (SDGs) related to maternal health and nutrition.³

In Indonesia, the prevalence of anemia among pregnant women remains alarmingly high. Data from the Indonesian Basic Health Research (*Riskesmas*) reported that 37.1% of pregnant women were anemic in 2013, rising sharply to 48.9% in 2018.⁴ Although more recent survey findings in 2023 indicated a lower prevalence of around 27.7%, this figure still represents a serious public health concern considering Indonesia's large and diverse population.⁵ In Indonesia, anemia in pregnancy is primarily caused by iron deficiency, inadequate dietary intake, parasitic infections, and limited adherence to iron

Correspondence*: Maesaroh
E-mail: Maesarohnayla77@gmail.com

Received: November 11th, 2025
Accepted: December 19th, 2025
Published: May 26th, 2026

folic acid supplementation programs.⁶ The persistently high prevalence highlights the need for interventions that go beyond supplementation and include behavioral and educational strategies targeting both women and their families.

One key but often overlooked factor in anemia prevention is the level of knowledge and awareness among married couples. Maternal health behaviors including nutritional practices, supplement adherence, and healthcare utilization are influenced by joint decision-making within households.⁷ Studies have demonstrated that husbands play a crucial role in supporting maternal health by encouraging antenatal visits, ensuring iron tablet consumption, and providing nutritional support.⁸ Therefore, improving the knowledge of both partners regarding anemia prevention could significantly reduce its incidence during pregnancy. Despite this, most previous studies in Indonesia have focused solely on the knowledge of pregnant women, overlooking the couple's shared understanding and collaboration in preventing anemia.⁹

The situation in Tasikmalaya Regency, West Java, Indonesia, reflects the urgency of family-centered approaches. Local data indicate that anemia remains prevalent among pregnant women in this area. A study conducted at the Singaparna Medical Centre Hospital reported an anemia prevalence of 50.9%, while another at the Karanganyar Primary Health Center found an even higher prevalence of 54.8%.¹⁰ More recent data from the Tasikmalaya Health Office in 2022 indicated that among 13,125 pregnant women, 11.8% were diagnosed with anemia. However, this may underestimate the true prevalence due to variations in reporting and data collection. Collectively, these findings suggest that the prevalence of anemia in Tasikmalaya remains higher than both global and national averages, underscoring persistent gaps in public health education and maternal care.¹¹

Given this context, the present study aims to examine the association between married couples' knowledge of anemia prevention and the incidence of anemia among pregnant women in Tasikmalaya Regency, Indonesia. Using a cross-sectional design, this research sought to determine whether higher levels of shared knowledge among couples are associated with lower rates of anemia during pregnancy. The findings are expected to provide valuable insights for policymakers, healthcare professionals, and public health practitioners in developing family-based education and intervention programs. Enhancing couples' knowledge and participation in maternal health could play a pivotal role in reducing anemia and improving pregnancy outcomes in Indonesia and comparable settings.

METHOD

Participants and Study Design

This study employed an analytic cross-sectional design to investigate the association between married couples' knowledge of anemia prevention and the incidence of anemia among pregnant women. The research was conducted in Tasikmalaya Regency, West Java, Indonesia, from July 2024 to July 2025. Tasikmalaya is a semi-urban region with diverse socioeconomic conditions, making it a suitable setting for examining maternal health behaviors and knowledge related to anemia prevention.

The study population consisted of pregnant women attending antenatal care (ANC) at selected community health centers in Tasikmalaya, along with their husbands. Eligible participants included pregnant women of any gestational age who had lived in the study area for at least six months and were willing to participate with their husbands. Husbands were included if they were aged 18 years or older and could communicate in Bahasa Indonesia, the official language of Indonesia. Women with chronic hematologic diseases or serious illnesses were excluded.

A multistage sampling technique was used to ensure representativeness. Several subdistricts were purposively selected based on population density and accessibility, followed by the random selection of health centers. Systematic sampling of pregnant women was then conducted from the ANC registers. Their husbands were recruited through the same process. Sample size was calculated using a single-proportion formula based on an estimated anemia prevalence of 30%, a 95% confidence level, and a 5% margin of error.

Measurements and Procedure

Data were collected through structured face-to-face interviews using a pretested and validated questionnaire, along with hemoglobin (Hb) assessment conducted during the same visit. The questionnaire comprised three domains: sociodemographic characteristics, reproductive history, and knowledge of anemia prevention. The knowledge section included 20 closed-ended items covering

causes, symptoms, dietary sources of iron, iron–folic acid supplementation, and preventive health practices. Content validity was established through review by three maternal and public health experts. A pilot study ($n = 30$) was conducted to assess clarity and reliability. Internal consistency demonstrated good reliability (Cronbach's $\alpha = 0.82$). Each correct response was scored as 1, and incorrect / “don't know” responses as 0 (total score range: 0–20). Knowledge levels were categorized using modified Bloom's cut-off criteria: good ($\geq 80\%$, 16–20), moderate (60–79%, 12–15), and poor ($< 60\%$, < 12). This classification was applied consistently throughout the analysis.

Hemoglobin concentration was measured using capillary blood obtained via finger prick under standardized aseptic procedures. The samples were analyzed immediately using a point-of-care testing (POCT) device according to the manufacturer's instructions. Two measurements were obtained for each participant, and the mean value was recorded for analysis. Daily quality control and device calibration were performed in accordance with the manufacturer's guidelines to ensure accuracy and reliability. Anemia was defined according to World Health Organization criteria for pregnant women ($Hb < 11.0$ g/dL) and classified as mild (10.0–10.9 g/dL), moderate (7.0–9.9 g/dL), or severe (< 7.0 g/dL).

Enumerators received training on data collection techniques, research ethics, and hemoglobin measurement. The questionnaire was pretested among 30 couples outside the study area to ensure clarity and reliability. Supervisors reviewed the collected data daily, and hemoglobin measurement equipment was calibrated regularly to maintain accuracy.

Statistical Analysis

Descriptive statistics were used to summarize the demographic characteristics and knowledge levels of participants. Data were entered and analyzed using a statistical software. Descriptive statistics were used to summarize the demographic characteristics and knowledge levels of participants. Bivariate analysis using chi-square tests was conducted to examine the association between couples' knowledge of anemia prevention and hemoglobin status among pregnant women. To control potential confounding variables (such as maternal age, education level, parity, and socioeconomic status), a multivariate logistic regression analysis was performed. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to estimate the independent effect of knowledge level on hemoglobin status. Statistical significance was set at $p < 0.05$.

RESULT

This research analyzed the association between married couples' knowledge and the prevention of anemia during pregnancy. The study emphasizes that both the pregnant woman and her husband play vital roles in ensuring appropriate preventive behaviors, such as attending antenatal care, taking iron-folic acid supplements, and undergoing routine hemoglobin level checks. Most pregnant women were aged 21–35 years (78.7%) and had completed senior high school (43.3%). Although ANC attendance (≥ 4 visits, 82.0%) and iron tablet consumption (84.7%) were high, anemia prevalence remained 58.7%, with moderate to severe cases in 26.7% of participants.

The presentation of results begins with a description of respondents' sociodemographic characteristics, including age, educational attainment, and occupational status, which serve as contextual factors influencing knowledge levels. Subsequently, the distribution of married couples' knowledge regarding anemia prevention is outlined, encompassing aspects such as dietary practices, iron supplementation, and routine antenatal care. This section also reports the prevalence of anemia among pregnant women in the study area. Statistical analyses were conducted to examine the association between couples' knowledge and anemia incidence, enabling the identification of significant patterns and correlations. This approach provides comprehensive insight into how shared knowledge between husband and wife contributes to effective anemia prevention during pregnancy, emphasizing the importance of involving both partners in maternal health promotion strategies.

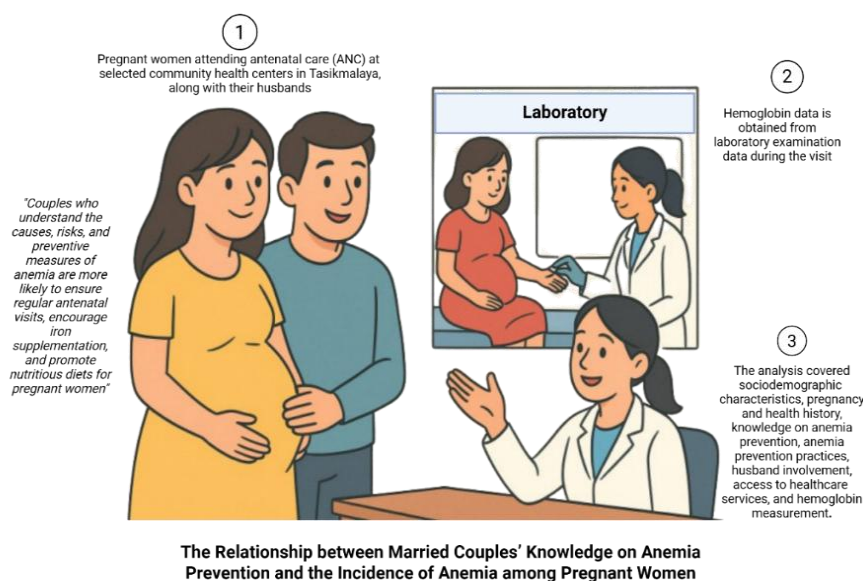


Figure 1. This illustration shows a married couple participating in a community-based observation conducted by a healthcare researcher.

Distribution of Respondents

This study involved 150 married couples (pregnant women and their husbands) residing in Tasikmalaya Regency, Indonesia. All participants completed the interview and signed the informed consent form. No respondents withdrew during data collection. The analysis covered sociodemographic characteristics, pregnancy and health history, knowledge of anemia prevention, anemia prevention practices, husband involvement, access to healthcare services, and hemoglobin measurement.

Correlation between Couples' Knowledge on Anemia Prevention and Hemoglobin Status

A chi-square test was conducted to examine the association between married couples' knowledge of anemia prevention and the hemoglobin status of pregnant women. The contingency table (Table 2) is reproduced below. Table 1 shows most pregnant women were aged 21–35 years (78.7%) and had completed senior high school (43.3%). Although ANC attendance (≥ 4 visits, 82.0%) and iron tablet consumption (84.7%) were high, anemia prevalence remained 58.7%, with moderate to severe cases in 26.7% of participants.

Based on Table 2, there was a significant association between couples' knowledge of anemia prevention and pregnant women's hemoglobin status ($\chi^2 = 18.43$; $df = 6$; $p = 0.005$). These findings indicate that higher couples' knowledge is associated with better maternal hemoglobin levels, whereas lower knowledge is associated with an increased risk of moderate-to-severe anemia, emphasizing the importance of couple-based education in anemia prevention.

To determine the simultaneous and partial effects of maternal sociodemographic characteristics, clinical factors, nutritional compliance, and paternal support dimensions on the incidence of anemia, a binary logistic regression analysis was conducted in Table 3. Prior to individual parameter evaluation, the goodness-of-fit of the empirical model was assessed. The Omnibus Tests of Model Coefficients yielded a chi-square value of 17.054 ($p = 0.253$), indicating that the collective predictors did not establish a statistically significant simultaneous variation. However, the Hosmer and Lemeshow test demonstrated an excellent model fit, with a chi-square value of 1.875 and a p-value of 0.985 ($p > 0.05$), confirming that the model's predicted probabilities aligned strongly with the actual observed data. The Nagelkerke R-squared value indicated that the entered independent variables accounted for 14.5% of the variance in maternal anemia status, while the remaining 85.5% was attributable to extraneous factors outside this study's scope. Furthermore, the final model demonstrated an overall classification accuracy of 66.7% in predicting maternal anemia outcomes.

Table 1. Distribution of respondents of married couples (n = 150)

Variable	n	%
Sociodemographic Characteristics		
Age of pregnant women		
<20	12	8.0
21–35	118	78.7
>35	20	13.3
Education level of wife		
No School–Junior high School	48	32.0
Senior high School	65	43.3
Diploma/Bachelor	37	24.7
Occupation		
Housewife	105	70
Laborer/Farmer	27	18.0
Entrepreneur	18	12.0
Monthly income		
< RMW	75	50.0
≥ RMW	75	50.0
Pregnancy and Health History		
Gestational age		
1st trimester	22	14.7
2nd trimester	85	56.7
3rd trimester	43	28.6
ANC visits		
<4	27	18.0
≥4	123	82.0
Consumed Fe tablets		
Yes	127	84.7
No	23	15.3
Knowledge Level on Anemia Prevention		
High (≥80%)	72	48.0
Moderate (60–79%)	57	38.0
Low (<60%)	21	14.0
Practices of Anemia Prevention among Pregnant Women		
Fe tablet intake (past 7 days)		
7 times	64	42.7
4–6 times	48	32.0
1–3 times	25	16.7
None	13	8.6
Frequency of eating iron-rich foods		
5–7 times/week	45	30.0
2–4 times/week	67	44.7
<2 times/week	30	20.0
Never	8	5.3
Husband Involvement in Anemia Prevention		
Accompanied wife during ANC		
Yes	78	52.0
No	72	48.0
Reminded wife to take Fe tablets		
Always	72	48.0
Sometimes	47	31.3
Never	31	20.7
Discussed nutrition during pregnancy		
Always	66	44.0
Sometimes	58	38.7
Never	26	17.3

Variable	n	%
Willing to support prevention		
Very Willing	95	63.3
Sometimes	45	30.0
No	10	6.7
Accompanied wife during ANC		
Yes	78	52.0
No	72	48.0
Reminded wife to take Fe tablets		
Always	72	48.0
Sometimes	47	31.3
Never	31	20.7
Discussed nutrition during pregnancy		
Always	66	44.0
Sometimes	58	38.7
Never	26	17.3
Willing to support prevention		
Very Willing	95	63.4
Sometimes	47	31.3
Never	8	5.3
Anemia Category		
Category (WHO, 2023)		
Non-anemia (≥ 11.0 g/dL)	62	41.3
Mild (10.0–10.9 g/dL)	48	32.0
Moderate (7.0–9.9 g/dL)	35	23.3
Severe (< 7.0 g/dL)	5	3.4

Table 2. Association Between Couples' Knowledge on Anemia Prevention and Hemoglobin Status Among Pregnant Women (N = 150)

Couples' Knowledge Level	Non-anemia (≥ 11.0 g/dL) n (%)	Mild anemia (10.0–10.9 g/dL) n (%)	Moderate anemia (7.0–9.9 g/dL) n (%)	Severe anemia (< 7.0 g/dL) n (%)	Total n (%)
Good (n=72)	40 (55.6%)	20 (27.8%)	10 (13.9%)	2 (2.8%)	72 (100%)
Moderate (n=57)	17 (29.8%)	20 (35.1%)	18 (31.6%)	2 (3.5%)	57 (100%)
Poor (n=21)	5 (23.8%)	8 (38.1%)	7 (33.3%)	1 (4.8%)	21 (100%)
Statistical test	χ^2	df	Cramér's V	p-value	
Result	18.43	6	0.25	0.005	

As summarized in Table 3, the multivariate assessment revealed that, among the fourteen predictors controlled for in the model, only one factor emerged as a statistically significant predictor of maternal anemia: husband's willingness ($p = 0.023$). Husband willingness displayed a negative regression coefficient ($B = -0.737$), suggesting a protective effect against the development of anemia. Specifically, the calculated Odds Ratio (0.479) indicated that mothers who perceived their husbands as highly willing to support their reproductive health care had 0.479 times lower odds of experiencing anemia (a 52.1% reduction in risk) compared to those who lacked such explicit paternal willingness. Conversely, other conventional predictors, including maternal age ($p = 0.259$), education level ($p = 0.186$), household income ($p = 0.582$), gestational age ($p = 0.273$), antenatal care (ANC) visits ($p = 0.271$), iron supplementation compliance ($p = 0.792$), and other peer-led communication attributes of paternal support did not demonstrate statistically significant independent associations with maternal anemia within this multivariate framework ($p > 0.05$).

Table 3. Model of Factors Associated with Anemia (N = 150)

Variable	B	Standard Error	Wald	P-value	Odds Ratio (95% CI)
Age	0.451	0.400	1.272	0.259	1.570 (0.72–3.44)
Education	-0.331	0.250	1.751	0.186	0.718 (0.44–1.17)
Occupation	-0.002	0.261	0.000	0.994	0.998 (0.60–1.67)
Monthly Income	0.199	0.362	0.303	0.582	1.220 (0.60–2.48)
Gestational Age	-0.325	0.297	1.203	0.273	0.722 (0.40–1.29)
ANC Visit	-0.492	0.447	1.210	0.271	0.611 (0.25–1.47)
Fe Tablet Compliance	0.137	0.519	0.070	0.792	1.147 (0.42–3.17)
Knowledge Level	0.289	0.248	1.355	0.244	1.335 (0.82–2.17)
Fe Consumption (7 Days)	-0.067	0.192	0.120	0.729	0.936 (0.64–1.36)
Iron-Rich Food Intake	-0.102	0.227	0.203	0.652	0.903 (0.58–1.41)
Husband Accompanied	0.310	0.369	0.705	0.401	1.364 (0.66–2.81)
Husband Reminded	-0.245	0.236	1.076	0.300	0.783 (0.49–1.24)
Husband Discussed	-0.381	0.269	1.996	0.158	0.683 (0.40–1.16)
Husband Willingness	-0.737	0.323	5.193	0.023	0.479 (0.25–0.90)
Constant	1.728	1.646	1.102	0.294	5.631 (0.22–142.08)
Model Diagnostics:					
Omnibus Test (χ^2)	17.054				
	($p=0.253$)				
Nagelkerke R Square	0.145				
Hosmer and Lemeshow Test (χ^2)	1.875				
	($p=0.985$)				
Overall Classification	66.7%				

DISCUSSION

The findings of this study describe the sociodemographic characteristics and behavioral patterns related to anemia prevention among pregnant women and their spouses. Most respondents were aged 21–35 years, considered the optimal reproductive age group. Although maternal age outside this range (<20 or >35 years) has been associated with higher nutritional risk in previous studies, the present study was not designed to establish age as a causal factor but rather to describe its distribution within the sample.^{1,12} Higher couples' knowledge of anemia prevention was associated with better maternal hemoglobin levels, while preventive practices and male involvement were inconsistent. These findings indicate that enhancing couple-based education and male participation is essential to reducing anemia among pregnant women in Tasikmalaya Regency.¹³ Pregnant women with non-anemia status were more frequently found in the group with good knowledge (40 respondents). At the same time, mild and moderate anemia were more common among those with moderate and poor knowledge. These findings indicate that better couples' knowledge regarding anemia prevention is associated with better hemoglobin status among pregnant women.¹⁴

In terms of education, the majority of respondents had completed at least senior high school. Higher educational attainment has been associated in previous literature with improved health literacy and maternal nutrition awareness.¹⁴ However, given the cross-sectional nature of this study, the findings only indicate a pattern of distribution rather than a direct causal relationship between education level and anemia status.¹⁵

Half of the households reported income below the regional minimum wage (RMW). Economic constraints are widely documented as barriers to accessing diverse and iron-rich foods. While this study did not directly measure dietary intake adequacy, the observed income distribution may partially explain the persistence of anemia in the study population. These findings are consistent with broader evidence from low- and middle-income countries where socioeconomic vulnerability is associated with a higher burden of maternal anemia.¹⁶

Most pregnant women (82%) attended at least four antenatal care (ANC) visits, aligning with WHO recommendations for focused maternal care. Additionally, 84.7% reported consuming Fe tablets. This coverage appears relatively high; however, national reports in Indonesia indicate that although Fe tablet distribution coverage is substantial, adherence and correct consumption remain ongoing challenges. Therefore, self-reported intake in this study should be interpreted cautiously, as it may not

fully reflect adherence quality, duration of supplementation, or correct dosage.⁸ Knowledge levels regarding anemia prevention were categorized as good in 48% of respondents. The bivariate analysis showed a statistically significant association between couples' knowledge and hemoglobin status. However, because the study design is cross-sectional, the direction of this relationship cannot be determined. It is not possible to conclude whether higher knowledge improves hemoglobin status or whether women with better health status are more exposed to health information. The findings indicate an association rather than causation.^{17,18}

Husband involvement was frequently reported, particularly in accompanying ANC visits and reminding wives to take Fe tablets. Previous research suggests that male engagement may support maternal health. Nevertheless, in this study, husband involvement was measured through self-report and was not evaluated longitudinally; therefore, its direct impact on anemia reduction cannot be established.¹⁵ The observed pattern suggests potential supportive dynamics within households, but further analytical studies would be required to confirm its independent effect.

Despite relatively favorable indicators in ANC attendance, reported Fe tablet intake, and knowledge levels, anemia prevalence remained high at 58.7%. This proportion is comparable to national data in Indonesia, where maternal anemia prevalence ranges approximately from 48% to 60%. The persistence of anemia despite reported preventive behaviors suggests that structural factors such as dietary quality, infection burden, absorption issues, supplementation adherence quality, and broader socioeconomic conditions may contribute to the observed outcomes.⁴ However, these mechanisms were not directly measured in the present study and, therefore, cannot be confirmed.

From a public health perspective, these findings highlight the need to adopt evidence-based best practices for maternal anemia prevention. Key strategies include routine antenatal hemoglobin screening, consistent iron-folic acid supplementation with adherence monitoring, targeted nutrition counseling on iron-rich diets, and active male involvement through couple-based education.¹⁹ Integrated, multilevel interventions combining screening, supplementation, behavior change communication, and partner engagement have been shown to effectively improve maternal hemoglobin status and reduce anemia prevalence.²⁰

Association between Couples' Knowledge on Anemia Prevention and Hemoglobin Status

The present study found a statistically significant association between the knowledge level of couples and the hemoglobin status of pregnant women. In other words, higher knowledge among couples was associated with a greater proportion of women in the non-anemic category, while lower knowledge corresponded to higher proportions of moderate and severe anemia.²¹

This finding supports existing literature that confirms the importance of knowledge and awareness in maternal nutrition and anemia prevention. For instance, a study by Mardiyanti et al. found that family empowerment, including educational support and knowledge dissemination, was shown to improve hemoglobin levels in pregnant women. Further, research in low-income settings indicates that male involvement in maternal and child nutrition (which presumes a degree of knowledge) plays a key role in improving maternal nutritional status and reducing anemia risk.^{22,23}

The multivariate logistic regression analysis revealed that most sociodemographic and health-related variables, including maternal age, education, occupation, income, gestational age, ANC visits, Fe tablet consumption, knowledge level, and dietary practices, were not statistically significant predictors of anemia.⁹ However, the husband's willingness to support anemia prevention was identified as a significant factor, with supportive husbands reducing the likelihood of anemia among pregnant women. This finding highlights the importance of family involvement, particularly spousal support, in maternal health outcomes.^{24,25} While individual knowledge and resources are essential, the presence of strong social support appears to play a decisive role in adherence to preventive practices.²⁶ These results suggest that interventions aimed at reducing anemia should incorporate strategies to engage husbands in antenatal care and nutrition counseling actively.³

The multivariate analysis demonstrates that when maternal, clinical, and behavioral variables are controlled concurrently, husband willingness emerges as the primary social determinant protecting against maternal anemia ($p = 0.023$; OR = 0.479). This indicates that passive or superficial partner involvement, such as merely accompanying the mother to clinics or reminding her to take medication, is insufficient if it lacks an intrinsic willingness to support maternal welfare actively. In many traditional communities, a husband's proactive willingness directly influences the household's micro-allocation of

resources, prioritizing iron-rich nutrition for the mother and reducing gestational psychological stress, which indirectly optimizes maternal hematological health.

Conversely, iron tablet compliance ($p = 0.792$) and maternal knowledge ($p = 0.244$) did not exhibit independent statistical significance in this model. This suggests that clinical compliance in this cohort does not act in isolation but is heavily mediated by broader domestic dynamics, particularly paternal encouragement. Furthermore, the low Nagelkerke R-squared value (14.5%) highlights that maternal anemia is a complex, multifactorial condition driven by unmeasured biological variables, such as dietary iron bioavailability, parasitic infections, or genetics. Consequently, public health strategies must shift from individual-centric supplement distribution toward dyadic, family-centered interventions that actively cultivate intrinsic paternal willingness and engagement throughout the gestational period.

The present results suggest several potential mechanisms. Couples with higher knowledge may be more likely to engage in preventive practices, such as taking iron (Fe) supplements consistently, consuming iron-rich foods, attending antenatal care (ANC) visits regularly, and encouraging husband involvement in nutrition discussions and reminders. These behaviors, in turn, reduce the risk of anemia. From a public health perspective, these findings highlight the critical role of couple-based educational interventions in anemia prevention during pregnancy.²⁷ Given that male partners often influence household decision-making around health behaviors, targeting both partners rather than only the pregnant women may yield better outcomes.^{28,29} This pattern is aligned with studies that show male partner accompaniment to ANC, reminders of tablets, and discussion of nutrition during pregnancy significantly contribute to improved maternal health outcomes.⁷

However, some limitations should be considered when interpreting these results. The cross-sectional nature of the data limits causal inference; while the statistical association is significant, we cannot definitively say that higher knowledge caused improved hemoglobin status. The knowledge level was self-reported and may be subject to reporting bias.^{12,30} Future research should collect individual-level cross-tabulated data for more precise modeling (e.g., via logistic regression).

In summary, the observed association between couples' knowledge about anemia prevention and maternal hemoglobin status suggests that integrated educational strategies involving both pregnant women and their partners may contribute to improving maternal anemia prevention. Such strategies could form part of broader maternal nutrition and antenatal care programs aiming to reduce the prevalence of anemia among pregnant women.

CONCLUSION

This study identified a significant association between couples' knowledge of anemia prevention and hemoglobin status among pregnant women. Despite relatively high ANC attendance and reported Fe tablet consumption, anemia prevalence remained substantial. These findings indicate that knowledge and reported preventive behaviors may not be sufficient to address maternal anemia. Given the cross-sectional design, causal relationships cannot be inferred. Strengthening iron folic acid supplementation adherence quality, improving dietary diversity, and promoting couple-based educational approaches may enhance anemia prevention efforts. Further longitudinal and interventional studies are needed to clarify causal pathways and assess the effectiveness of these strategies in reducing maternal anemia in Tasikmalaya Regency.

ETHICS APPROVAL

The study protocol was approved by the Ethics Committee of Stikes Karya Husada under reference number 094/EC/LPPM/STIKES/KH/VI/2024. Written informed consent was obtained from all participants after an explanation of the study objectives and procedures. Confidentiality was maintained through anonymous coding and secure data storage. Participants found to be anemic were referred to local health services for appropriate treatment in accordance with national guidelines.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Faculty of Health Science, Universitas Bina Bangsa, Banten, Indonesia; Faculty of Pharmacy, The University of Faisalabad, Pakistan; and Faculty of Health Science, Poltekkes Bhakti Pertiwi Husada, Cirebon, Indonesia for providing academic and administrative support throughout this research. The authors also extend their appreciation to the Head of the Tasikmalaya Regency Health Office and the heads and staff of the

participating community health centers for their cooperation during data collection. Finally, the authors thank all pregnant women and their husbands who willingly participated in this study.

COMPETING INTEREST

The authors declare that there is no conflict of interest related to this study.

FUNDING

This research received no specific funding from any public, commercial, or not-for-profit funding agency.

UNDERLYING DATA

The dataset generated and analyzed for this study may be obtained from the corresponding author following a justified and reasonable request. Public access has not been provided in order to protect participant privacy and to comply with the confidentiality requirements specified in the ethical approval.

DECLARATION OF ARTIFICIAL INTELLIGENCE USE

Artificial intelligence (AI)-assisted tools were used only during manuscript preparation to improve English expression, grammar, sentence structure, and readability. These tools were not involved in the study design, participant recruitment, data collection, statistical processing, interpretation of findings, or research decision-making. Every AI-assisted revision was independently reviewed and verified by the authors, who retain full responsibility for the scientific accuracy, originality, and integrity of the manuscript.

REFERENCES

1. World Health Organization. *WHO Guideline 1: Use of Multiple Micronutrient Powders for Home Fortification of Foods Consumed by Infants and Children 6–23 Months of Age*. World Health Organization; 2023.
2. Ibrahim AA, Mohammed HS, Elsaid NMAB, Salim AA, Fathy EG, Hasaneen NM. Risk factors for polycystic ovary syndrome among women of reproductive age in Egypt: A case control study. *Afr J Reprod Health*. 2023;27(6):41-50. doi:10.29063/ajrh2023/v27i6.5
3. Susanti E, Novryanthi D, Andriani R. The correlation between knowledge of pregnant women and the incidence of anemia in pregnancy in the working area of Puskesmas Nagrak. 2025;11(3):488-494.
4. Kementerian Kesehatan Republik Indonesia, Badan Kebijakan Pembangunan Kesehatan. *Survei Kesehatan Indonesia 2023 (SKI)*. Kementerian Kesehatan Republik Indonesia; 2023.
5. Nuryanti, Muflihah IS. Hubungan tingkat pengetahuan ibu hamil tentang anemia dengan kejadian anemia pada ibu hamil di wilayah Puskesmas Cilacap Selatan I Kabupaten Cilacap tahun 2025. 2025;5(3):288-301.
6. Santosa B, Damayanti FN, Nurjanah S, Anggraini NN. The effect of iron giving on hemoglobin levels in anemia pregnant women. *J Kebidanan*. 2022;11(2):203-210. doi:10.26714/jk.11.2.2022.203-210
7. Galle A, Plaieser G, Van Steenstraeten T, et al. Systematic review of the concept 'male involvement in maternal health' by natural language processing and descriptive analysis. *BMJ Glob Heal*. 2021;6(4):e004909. doi:10.1136/bmjgh-2020-004909
8. Sugarsih U, Solihah E, Budiarti Y. The Effect of Soy Milk on Haemoglobin Levels in Pregnant Women with Anaemia. *J Gizi Indones (The Indones J Nutr*. 2024;12(2):70-79. doi:10.14710/jgi.12.2.70-79
9. Rohmah HNF. The Effect of Soy Milk on Increasing Hemoglobin (Hb) Levels in Pregnant Women. *J Midpro*. 2024;15(2):245-252. doi:10.30736/md.v15i2.666
10. Ilmiyati L, Indarto D, Wasita B. Anemia in female adolescents at Karanganyar Regency: A cross-sectional study associated with polymorphism of duodenal cytochrome B gene and daily consumptions of fruits and vegetables. *Nutr Health*. Published online 2023. doi:10.1177/02601060231201891
11. Sari M, Bloem MW, Semba RD. Relationship of maternal knowledge of anemia with maternal and child anemia and health-related behaviors targeted at anemia among families in Indonesia.

- 2020;16(9):1913-1925. doi:10.1007/s10995-011-0938-y
12. Addila AE, Azale T, Yitayal M. Effect of prenatal alcohol consumption on maternal anemia among pregnant women in Gondar town, Northwest Ethiopia: A retrospective cohort study. *Int Health*. Published online 2025. doi:10.1093/inthealth/ihaf010
13. Cahyati P, Mardiah SS. Policy analysis for anemia and pregnant women care elevation program through prospective bride's preparation. *J Drug Deliv Ther*. 2024;14(9):29-34.
14. Dissanayakage I, Chalindra J, Jayaratne K. Proportion of unplanned pregnancies, their determinants and health outcomes of women delivering at a teaching hospital in Sri Lanka. 2020;2:1-15.
15. Sentuf DR, Jumrah, Idrus HH, Stang, Darmawansyah. Empowering community health volunteers as a strategy to prevent anemia in pregnant women: A quasi-experimental study. *Natl J Community Med*. 2025;16(10):1008-1016. doi:10.55489/njcm.161020255672
16. Suhartatik, Fatmawati A, Kasim J. Hubungan pengetahuan dengan kejadian anemia pada ibu hamil di Puskesmas Tamalanrea. *J Ilm Kesehat Diagnosis*. 2019;14(2):187-191. doi:10.35892/jikd.v14i2.157
17. Simbolon JL, Sitompul ES. Tamarillo juice (*Solanum betaceum* Cav) as an alternative to increase hemoglobin levels for pregnant women with anemia. *Babali Nurs Res*. 2021;2(3):106-119. doi:10.37363/bnr.2021.2355
18. Mbowe F, Darboe KS, Sanyang AM, Barrow A. Prevalence and determinants of anemia among pregnant women attending maternal and child health clinics at Sukuta Health Center, The Gambia: An institutional-based cross-sectional study. *Women's Heal*. 2025;21. doi:10.1177/17455057251338380
19. Goretik M, Nazarius YR, Romina F. The relationship of pregnant woman's knowledge about anemia with compliance consuming iron (Fe) tablets. 2021;5(1):182-188.
20. Andriani N, Mariza A. The relationship of knowledge with the incidence of anemia in premarital women. 2022;13.
21. Sholihatin NA. *Hubungan Pengetahuan Ibu Dengan Kejadian Anemia Pada Ibu Hamil Di Puskesmas Umbulharjo 2 Tahun 2023*. Politeknik Kesehatan Kementerian Kesehatan Yogyakarta; 2023.
22. Chen S. Micronutrient supplementation during pregnancy and the risk of pregnancy-induced hypertension: A randomized clinical trial. *Clin Nutr*. 2019;38(1):146-151. doi:10.1016/j.clnu.2018.01.029
23. Abdilla, Wibowo Q. The relationship between knowledge of anemia and its incidence among pregnant women. 2025;10(2):92-99.
24. Ginting KB, Sarwani I, Silalahi B, Ratna E. The correlation of mother's knowledge and work with the incidence of anemia in pregnancy at the Modesta Clinic, Sinaman Village, Barusjahe District, Karo District, 2023. 2023;3(2).
25. Kumar P, Shah P, Awasthi V, Khera B, Agarwal M, Lakhtakia M. Anemia in pregnancy: A knowledge, attitude and practice survey amongst obstetricians and gynaecologists in India. *J Obstet Gynaecol India*. 2022;72(5):382-388. doi:10.1007/s13224-022-01618-x
26. Mulder FVM. Severe autoimmune hemolytic anemia: Epidemiology, clinical management, outcomes and knowledge gaps. *Front Immunol*. Published online 2023. doi:10.3389/fimmu.2023.1228142
27. Diniarti N, Maria R, Widiatrilupi V. The relationship between the level of knowledge of prospective brides and grooms about anemia and compliance. Published online 2025.
28. Akinyemi AO, Ibrahim EA. Prevalence and predictors of men's involvement in pregnancy care in Modakeke, Southwest Nigeria. *Front Glob Women's Heal*. 2024;5. doi:10.3389/fgwh.2024.1337094
29. Futhandayani A, Siagian I. Maternal knowledge and behavior as prevention of anemia in pregnancy: A primary health care cross-sectional study. *Obgynia*. 2022;8(1):42-50. doi:10.24198/obgynia.v8i1.800
30. Dewi OP, Adnyani S. Knowledge of pregnant women about anemia in pregnancy. 2023;4(1):7-10.