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Qualitative Study on Pregnant Women's Perceptions of Iron Tablet Administration in Anemia Prevention during the First to Third Trimesters

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ABSTRACT

Purpose: This study aims to evaluate the effect of iron tablet supplementation on pregnant women from the first to the third trimester in preventing pregnancy-related anemia. The primary focus is on understanding the dynamics of consumption compliance, maternal perceptions, the effectiveness of health education, as well as environmental factors and accessibility that influence the success of the intervention.

Research Method: This study employed a qualitative approach, based on a systematic literature review of relevant publications from 2018 to 2025. The analysis was conducted thematically to identify consumption patterns, motivations, educational interventions, and their impact on the hemoglobin status of pregnant women.

Results and Discussion: The findings indicate a progressive trend in adherence to iron tablet consumption from the first to the third trimester, with the main barriers being complaints of nausea and gastrointestinal side effects. Positive perceptions of the benefits of iron tablets, along with appropriate social support and education, have been shown to improve adherence. Health education tailored to the stage of pregnancy is more effective in changing behavior. Consistent iron tablet consumption contributes to increased hemoglobin levels and reduces the risk of anemia, as well as pregnancy complications such as preterm birth and low birth weight.

Implications: This study provides original contributions to the development of trimester-based maternal health education strategies and the improvement of iron tablet availability in primary care. The implications include strengthening maternal and child health program policies and involving multiple stakeholders, including families and communities, in supporting the success of interventions.

Keywords: iron tablets; pregnancy anemia; trimester of pregnancy; health education.

Introduction

Anemia during pregnancy is one of the most serious maternal health issues, with significant impacts on both the mother and the fetus. According to the World Health Organization (WHO), anemia

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in pregnant women occurs when hemoglobin levels are below 11 g/dL, with the majority of cases caused by iron deficiency (Fe). This condition not only increases the risk of pregnancy complications such as postpartum hemorrhage, preterm birth, and low birth weight, but also impacts maternal productivity and the future quality of life of the child. In Indonesia, the prevalence of anemia among pregnant women remains high and is a priority in efforts to improve maternal health. One recommended intervention is the routine administration of iron tablets (Fe tablets) throughout pregnancy, starting from the first trimester until the third trimester (Beard, 2000). Although the national program has set a minimum of 90 Fe tablets during pregnancy, field data show that compliance among pregnant women in taking Fe tablets remains inconsistent and is influenced by various factors. Emerging phenomena indicate that many pregnant women are not taking iron tablets optimally, both in terms of quantity and regularity, despite their availability at health facilities. This non-compliance significantly contributes to the high prevalence of pregnancy-related anemia. Data from the Indonesian Ministry of Health indicate that the prevalence of anemia among pregnant women in Indonesia exceeds 48%, highlighting the need for a more structured approach to anemia prevention. One such approach is to understand the impact of iron tablet administration from the beginning of pregnancy until the third trimester on the prevention of anemia.

Previous studies have shown a significant association between iron tablet consumption and a reduced risk of anemia in pregnant women. Studies by (Sophia Sarah & Irianto, 2018; Wulandari, 2018) indicate that adherence to iron tablet consumption is correlated with a reduction in the incidence of anemia. Furthermore, higher compliance significantly reduces the prevalence of anemia, especially in the third trimester of pregnancy (Nova & Irawati, 2021; Sarah & Irianto, 2018). Several factors, including maternal age and level of knowledge, influence adherence to iron tablet consumption. Pregnant women under 20 years of age and those with a better understanding of the importance of iron supplementation tend to have higher adherence (Anggraini, 2018). Other findings from Wulandari, (2018) indicate that adherence contributes up to 57.2% to variations in hemoglobin levels, reinforcing the role of iron supplementation as a strategy for preventing pregnancy-related anemia. The Indonesian government has established a policy to provide a minimum of 90 iron tablets during pregnancy as part of its efforts to prevent anemia (Rabiatunnisa & Mujahadatuljannah, 2024). However, implementation on the ground still requires support through education and counseling. Appropriate education has proven to significantly improve compliance with iron tablet consumption (Sandy & Sulistyorini, 2024). Other factors, such as the positive attitudes of pregnant women toward supplementation and support from partners, also play a crucial role in the success of this program (Rabiatunnisa & Mujahadatuljannah, 2024). Although some pregnant women experience side effects such as nausea and vomiting, their understanding of the risks of anemia and potential pregnancy complications motivates them to remain compliant with iron tablet consumption (Hidayati *et al.,* 2024). Additionally, regular prenatal check-ups and support from healthcare providers, such as midwives, in providing iron tablets also significantly contribute to the program's success (Hidayati *et al.,* 2024).

Although numerous studies have examined the relationship between iron tablet consumption adherence and the incidence of pregnancy-related anemia, most of these studies focused on single measurements or measurements in a single trimester without considering the progression from the first to the third trimester. Furthermore, the approaches used tended to be quantitative and descriptive, with limited qualitative exploration of how pregnant women perceive, motivate themselves to, and experience iron tablet consumption throughout pregnancy. On the other hand, most studies have not systematically examined the effectiveness of iron tablet interventions in a context that comprehensively

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considers social, educational, and health support dimensions. In other words, there is a gap in the literature that integrates and comprehensively reviews the dynamics of iron tablet administration from the first to the third trimester and its impact on anemia prevention. Furthermore, theoretical studies on the effectiveness of iron tablet administration are still limited in the context of SLRs, particularly those employing a qualitative approach. Most existing SLRs still employ a quantitative approach, overlooking the empirical aspects of pregnant women's experiences, such as their perceptions of benefits, barriers to consumption, and the role of education and health worker support. This gap highlights the need for systematic research employing a qualitative approach to investigate the effectiveness of iron tablet administration, taking into account the diverse experiences and socio-cultural contexts of pregnant women in various regions. This is important to provide more applicable theoretical and practical contributions to improving intervention strategies for anemia prevention during pregnancy.

This study offers novelty by presenting a systematic literature review (Systematic Literature Review) based on a qualitative approach to explore the impact of iron tablet administration from the first to the third trimester on the prevention of anemia in pregnant women. Unlike previous studies that tend to focus on a single aspect or a specific period of pregnancy, this study integrates various empirical findings to provide a comprehensive understanding of the topic. It considers dimensions of adherence, education, social support, and the availability of health services to analyze the effectiveness of iron tablet administration programs. The objective of this study is to comprehensively identify patterns, determinants, and challenges in administering iron tablets to pregnant women, thereby providing a scientific foundation and policy recommendations that are more contextual and applicable in efforts to prevent pregnancy-related anemia in Indonesia.

Literature Review and Hypothesis Development

Iron tablets

Iron tablets are a form of micronutrient supplement recommended for pregnant women to prevent and treat iron deficiency anemia (Hasriantirisna, 2024). This type of anemia occurs when the body experiences a hemoglobin deficiency due to low iron levels, thereby reducing the blood's ability to carry oxygen (Susiloningtyas, 2012). During pregnancy, iron requirements increase significantly due to the demands of fetal growth and development, as well as the expansion of maternal blood volume. Therefore, iron supplementation through iron tablets is an important intervention in antenatal care, particularly in developing countries. According to Benjamin *et al. (2025), administering iron tablets from the first to the third trimester has been shown to reduce the incidence of anemia in pregnant women significantly*. These tablets typically contain 60 mg of elemental iron and are administered daily, in line with WHO standards. The effectiveness of iron tablets depends not only on their iron content but also on adherence to consumption and the educational support provided to pregnant women. Anato & Reshid, (2025) emphasize that structured nutritional education administered concurrently with iron supplementation can increase hemoglobin levels more significantly than iron tablets alone without education. Therefore, iron tablets should be understood not only as a pharmacological intervention but also as a strategic preventive tool in efforts to control maternal anemia sustainably.

Pregnant women's adherence to iron tablet consumption is the primary determinant of the success of interventions to prevent pregnancy-related anemia. Without high and sustained adherence to iron tablet consumption, the effectiveness of these tablets as a nutritional supplement will not be optimal. In a study conducted by Taye *et al.,* (2025), it was found that various factors, including the

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mother's educational level, understanding of the importance of iron, perceptions of side effects, and support from partners and healthcare workers, significantly influence adherence to consumption. Pregnant women with low educational backgrounds and limited information about anemia tend to have lower adherence, even though iron tablets are available for free. Research by Fite *et al.,* (2021) revealed that, in addition to knowledge factors, other common barriers include discomfort caused by side effects such as nausea, constipation, and a metallic taste in the mouth. This highlights the need for iron tablet consumption promotion efforts to be accompanied by education on how to manage these side effects. Mengistu *et al.,* (2022) noted that areas that adopted a community-based educational approach, involving cadres and local leaders, achieved significant increases in iron tablet consumption compliance. Responsive and interactive health services play a crucial role in shaping the consumption behavior of iron tablets among pregnant women. According to Kamau *et al.,* (2018), the quality of the relationship between healthcare workers and pregnant women, including interpersonal communication, clarity of information, and consistency of support, significantly influences motivation and adherence to consumption. Solomon *et al.,* (2021) noted that pregnant women who feel regularly monitored and guided by healthcare workers, especially during antenatal visits, tend to show higher adherence rates to iron supplementation programs. In this context, empowering healthcare workers through practical communication training is crucial for enhancing patient trust and conveying health messages persuasively. Anato & Reshid, (2025) even emphasize the importance of using behavior-based approaches, such as the Health Belief Model, to design educational materials aligned with pregnant women's perceived risks and benefits. When education is designed to be contextual and personalized, mothers' emotional involvement and trust in iron tablets also increase. Therefore, the success of iron tablet programs is not only measured by the number of tablets distributed, but also by how effectively the health care system can facilitate the formation of sustainable and benefit-conscious consumption behaviors.

Iron Tablet Intervention Based on Trimester

Iron tablet interventions based on trimester are an iron supplementation approach for pregnant women designed to account for physiological changes and varying iron needs during each phase of pregnancy, namely the first, second, and third trimesters. During the first trimester, the mother's body undergoes significant changes, including the formation of the placenta and increased basic nutritional needs, such as iron (Farias *et al.,* 2020). Adjusting interventions from the outset is crucial to prevent iron deficiency as early as possible. A study by Díaz-Torres *et al.,* (2024) demonstrated that iron supplementation tailored to hemoglobin levels from the first trimester has a positive impact on fetal growth and reduces the risk of low birth weight. In this study, individualized dosing was found to be more effective than uniform dosing. Furthermore, McCarthy *et al.,* (2024) state that the prevalence of iron deficiency begins to increase in the first trimester and tends to rise sharply in the second trimester if left unaddressed. This highlights the importance of timely and physiologically based iron supplementation interventions tailored to the mother's needs. The administration of iron tablets should not be viewed as a static intervention but rather as a series of phased strategies that adapt to the mother's biological needs throughout pregnancy. This strategy not only improves the mother's nutritional status but also prevents long-term complications in the developing baby.

Entering the second trimester, iron requirements increase significantly due to a surge in maternal blood volume and more intensive fetal and placental tissue growth. During this phase, many

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cases of pregnancy-related anemia begin to be diagnosed, necessitating more aggressive and targeted intervention strategies. Research by Ibsen *et al.,* (2025) found that iron deficiency in the second trimester is closely associated with an increased risk of placental dysfunction, fetal growth restriction, and preterm birth. Based on these findings, they recommend increasing the dose of iron tablets in the second trimester, especially for mothers who have shown a decrease in hemoglobin levels. Sharawat *et al.,* (2024) tested the effectiveness of two doses, 30 mg and 60 mg per day. They found that the 60 mg dose resulted in a more significant increase in hemoglobin, particularly as the third trimester approached. Not only the dose but also the form of iron administration was considered in the study by Derman *et al.,* (2025), which showed that intravenous iron administration in the second trimester had advantages in terms of hemoglobin recovery speed compared to oral tablets and was more effective in preventing the need for blood transfusions during childbirth. This was further emphasized by Pasricha *et al.,* (2025), who stated that intravenous administration of ferric carboxymaltose in the second or third trimester can rapidly improve maternal iron status and reduce the risk of gastrointestinal side effects. The second trimester is a critical phase requiring a combination of dose, formulation, and adaptive clinical approaches.

In the third trimester, the focus of iron tablet interventions shifts from early prevention to recovery and preparation for childbirth, which requires optimal iron reserves. Increased hemoglobin requirements in late pregnancy are crucial to prevent postpartum hemorrhage and birth complications. According to the WHO Antenatal Supplementation Working Group's technical report (2024), it is recommended that iron tablets be administered daily and continuously from the first trimester until the end of pregnancy, not only as a preventive measure but also as a strategic step to maintain the health stability of both the mother and the fetus. A recent study by Pasricha *et al.,* (2023) comparing the effectiveness of intravenous ferric carboxymaltose and oral iron tablets in the third trimester and found that the group receiving intravenous iron showed higher hemoglobin levels, fewer side effects, and better maternal satisfaction. This underscores the importance of tailoring the method of administration to the mother's clinical condition and the capacity of healthcare facilities. Additionally, this trimester-based intervention program requires active involvement of healthcare workers to conduct routine monitoring of maternal hemoglobin levels. Regular evaluations will help adjust doses and administration methods, ensuring that interventions are tailored to the specific needs of each individual. With this strategy, Fe tablet administration is not only a routine antenatal care measure, but also a systematic and measurable life-saving intervention.

Prevention of Anemia in Pregnancy

Prevention of anemia in pregnancy is defined as all promotive and preventive measures designed to prevent a decrease in hemoglobin levels in the blood of pregnant women below the standard threshold of <11 g/dL. Anemia during pregnancy, most commonly caused by iron deficiency (Fe), is a global health issue that can have adverse effects on both the mother and the fetus. The primary intervention most frequently implemented is iron supplementation in the form of iron tablets, administered orally throughout pregnancy. Prevention of anemia has become increasingly important given its wide-ranging impacts, including chronic fatigue in mothers, increased risk of pre-eclampsia, and fetal growth and development disorders. Banerjee *et al.,* (2024) in their meta-analysis confirmed that daily administration of iron tablets, starting from the first trimester, is more effective in reducing the incidence of anemia compared to intermittent administration. This approach allows the mother's

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body to build sufficient iron reserves to meet the increased demand during the second and third trimesters. Meanwhile, Kirthan & Somannavar, (2024) noted that untreated pregnancy anemia can increase the risk of preterm birth, postpartum hemorrhage, and the need for blood transfusions. Thus, preventing anemia is not merely a medical intervention but an integral component of strategies to improve the quality of antenatal care (ANC), particularly in developing countries with high rates of pregnancy anemia.

Strategies for preventing pregnancy-related anemia involve a multidimensional approach combining clinical and nutritional interventions. Iron supplementation in the form of iron tablets remains the primary foundation; however, individual maternal conditions, including baseline hemoglobin levels, gestational age, and health history, significantly influence its effectiveness. A systematic review conducted by Pandey *et al.,* (2024) found that intravenous iron supplementation in pregnant women with moderate to severe anemia was more effective than oral administration, particularly in accelerating hemoglobin levels and reducing the risk of complications, such as hemorrhage and preeclampsia. This is particularly important in situations where oral therapy does not yield an adequate response or causes gastrointestinal side effects. On the other hand, Ng'ethe (2020) states that for the prevention of complications in the general population of pregnant women, iron tablets at a dose of 150–200 mg per day are sufficient, provided they are administered in conjunction with education and regular monitoring. Kinshella *et al.,* (2025) note that iron absorption is significantly enhanced when combined with vitamin C and folate, indicating that an integrated micronutrient approach yields better results than single supplementation. Prevention strategies for anemia should not only focus on distributing iron tablets but also consider the synergy between medical interventions and nutritional approaches, tailored to the physiological needs of each trimester of pregnancy.

The success of preventing pregnancy anemia heavily depends on pregnant women's adherence to regular iron supplementation therapy. Unfortunately, adherence is often low due to insufficient education, lack of understanding about the benefits of iron tablets, and side effects such as nausea, constipation, and unpleasant metallic taste. Berarti *et al.,* (2023) emphasize that the level of knowledge and positive perceptions toward iron tablets are closely correlated with pregnant women's adherence. Other important factors include support from partners and healthcare providers. Consistent education provided by midwives or healthcare workers during antenatal visits can enhance mothers' motivation to continue taking the prescribed supplements. Research by Traore *et al.,* (2023) demonstrates that community-based strategies, including group education programs, home visits by health workers, and the integration of iron tablet distribution with deworming programs, significantly reduce the incidence of anemia, even in newborns. Additionally, Detlefs *et al.,* (2022) revealed that mothers who responded quickly to iron therapy early in pregnancy had a much lower risk of complications during childbirth. Therefore, policymakers and healthcare providers need to integrate medical interventions with comprehensive educational strategies and social support. This holistic approach will promote the sustainability of anemia prevention programs while strengthening mothers' capacity to maintain their health during pregnancy.

Research Method

This study employs a qualitative approach, utilizing the Systematic Literature Review (SLR) method, to examine the effectiveness of iron tablet intervention in pregnant women from the first to third trimester in preventing pregnancy anemia. This design was chosen because it provides a systematic

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and structured framework for searching, evaluating, and synthesizing relevant scientific literature. This approach enables researchers to gain a deeper conceptual understanding and analyze emerging trends in previous studies. The review was conducted in a descriptive and interpretive manner to map the existing knowledge and research gaps related to iron tablet interventions during pregnancy. The unit of analysis in this study is not individuals, but rather scientific documents in the form of research articles that discuss iron tablet intervention in pregnant women and its relationship to anemia prevention. The selected articles were sourced from reputable international scientific journals published between 2015 and 2025 and indexed in databases such as ScienceDirect (Elsevier), SpringerLink, Wiley Online Library, and Emerald Insight. The included articles focus on empirical and theoretical research examining aspects such as the timing of iron tablet administration (based on trimester), dosage, adherence to consumption, and clinical impacts on maternal and fetal health. Only articles with full access and adequate methodological rigor were included as primary sources of data.

Data were collected through an online literature search using a combination of keywords, including "iron supplementation in pregnancy," "Fe tablets," "anemia prevention," "maternal hemoglobin," and "trimester-based intervention." The search was conducted manually using academic search engines and leading database portals. The articles obtained were then selected through an initial screening process based on title and abstract, followed by a full-text review to assess relevance and alignment with the research focus. Inclusion criteria included: articles in English, published between 2015 and 2025, containing empirical data or theoretical studies on iron tablet interventions during pregnancy, and fully accessible. To ensure quality and accuracy, the researchers developed a selection instrument in the form of an eligibility assessment sheet that covered aspects of the study focus, research methods, and the completeness of results and discussion. Data analysis was conducted using a thematic content analysis approach. Selected articles were analyzed to identify recurring themes in discussions about iron tablet interventions during pregnancy, such as the timing of administration based on trimester, dose effectiveness, compliance with consumption, and their impact on hemoglobin levels and maternal-infant health. Each theme was classified, synthesized, and compared across articles to form comprehensive and relevant conclusions. The analysis process was conducted manually using an interpretive approach, which aimed to explore the conceptual meaning and practical implications of each finding. The validity of the interpretation was ensured through the researcher's involvement in cross-checking articles and systematic documentation of the theme coding process. The outcome of this process is a comprehensive thematic description that contributes conceptually to the development of policy for preventing pregnancy-related anemia through iron tablet interventions.

Results and Discussion

Analysis Result

Consumption Patterns and Changes in Compliance Between Trimesters

The consumption patterns of iron tablets among pregnant women show complex and varied dynamics between trimesters, influenced by physiological, psychological, and social factors. In the first trimester, compliance rates tend to be low due to early pregnancy symptoms such as nausea, vomiting, and digestive disorders, which exacerbate the side effects of iron tablet consumption, such as a metallic taste and constipation. Hidayati *et al.,* (2024) and Rabiatunnisa & Mujahadatuljannah, (2024) noted that many pregnant women discontinue iron tablet consumption due to these discomforts. However, as they

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enter the second trimester, the intensity of complaints decreases and visits to healthcare facilities increase, leading to improved compliance. This trimester presents a strategic opportunity to strengthen education and support. Nevertheless, compliance becomes fluctuating again in the third trimester. Some mothers become more disciplined due to awareness of the risks of anemia before childbirth, while others begin to neglect their intake due to fatigue or decreased motivation (Anggraini, 2018; Sarah & Irianto, 2018). Benjamin *et al.,* (2025) emphasize that strengthening motivation from the beginning of pregnancy through a segmented approach can maintain consistency in consumption. From Kotler's social marketing perspective, each trimester reflects a different consumer segment with unique needs and barriers. Therefore, a uniform approach is not practical. Communication strategies and interventions must be tailored to the characteristics of each stage of pregnancy to be more responsive to mothers' needs and ultimately promote sustained compliance in comprehensively preventing pregnancy anemia.

Perceptions and Motivation of Pregnant Women towards Iron Tablets

Pregnant women's perceptions and motivation towards iron tablet consumption are important determinants of compliance behavior. Many mothers understand that iron tablets are important for the health of the fetus and themselves; however, this perception often conflicts with negative experiences, such as nausea, digestive issues, and an unpleasant metallic taste when consumed. Hidayati *et al.,* (2024) and Hasriantirisna, (2024) noted that these negative perceptions are the main barriers to maintaining a consistent consumption routine. On the other hand, mothers with previous adverse pregnancy experiences or sufficient information about the impacts of anemia demonstrate higher motivation to adhere to iron tablet consumption. Anato & Reshid, (2025) demonstrated that nutrition education using an interpersonal approach significantly changed mothers' perceptions, initially skeptical about the importance of supplementation, to one of confidence. Within Philip Kotler's framework, consumers' perceptions and motivations toward a product are primarily determined by the perceived benefits they derive from it. Suppose iron tablets are positioned not merely as medical supplements but as the "primary protector of pregnancy," a stronger positive perception will be formed. Detlefs *et al.,* (2022) note that providing clinical explanations about the long-term effects of anemia on the fetus can significantly increase motivation to consume. Therefore, interventions should not only convey information but also shape perceptions that are relevant and meaningful to mothers, fostering strong intrinsic motivation so that mothers feel they have control over their health and that of their fetuses.

The Role of Health Education in Promoting Compliance

Health education plays a central role in shaping pregnant women's adherence to iron tablet consumption. Findings from various studies indicate that mothers who receive structured and ongoing education from healthcare providers such as midwives or nutrition counselors demonstrate higher levels of adherence. Sandy & Sulistyorini, (2024) and Taye *et al.,* (2025) explain that education delivered through interactive discussions, the use of visual media, and individualized approaches is far more effective than one-way mass counseling. Solomon *et al.,* (2021) emphasize that open, empathetic, and dialogic communication allows mothers to express their concerns or worries, thereby fostering mutual understanding between educators and participants. In the context of social marketing, according to Kotler, the success of communication is greatly influenced by the quality of the relationship between the message sender and receiver. Therefore, healthcare workers need to be trained as "brand ambassadors" for maternal health programs, not merely as information disseminators. Fite *et al.,* (2021)

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and Anato and Reshid (2025) also show that the use of visual aids, success stories, and narrative-based presentations based on real experiences improves mothers' understanding and memory. This means that education is not merely an activity but a continuous process that fosters trust, attitude change, and behavioral transformation. Therefore, increasing the capacity of field educators is key to the sustainability of anemia prevention interventions through iron tablets.

Social and Environmental Support for Iron Tablet Consumption

Social and environmental support for pregnant women has been shown to have a strong influence on iron tablet consumption behavior. Mothers who receive moral and practical encouragement from their husbands, families, and social environments, such as posyandu cadres or pregnant women's groups, tend to show higher levels of compliance. Edeo Berarti *et al.,* (2023) and Kamau *et al.,* (2018) found that spousal involvement in antenatal activities, such as reminding the mother to take the tablets or accompanying her to the health center, strengthened the mother's commitment to compliance. Benjamin *et al.,* (2025) added that family-based education and home visits by health workers reinforce the health messages received by mothers at healthcare facilities. From Kotler's perspective, this social support functions as a form of "social endorsement" that reinforces the positive image of a behavior. If the surrounding environment perceives iron tablet consumption as a positive social norm, pregnant women will feel more confident and motivated to comply with it. Pathiranthna *et al.,* (2021) emphasize the importance of building a supportive community of pregnant women, whether through health posts, discussion forums, or local social media. In this context, anemia prevention interventions are not sufficient if they only target individuals; they must also strengthen the social ecosystem that supports them. By involving families and communities, behavioral changes become more sustainable and can foster a sense of collective responsibility for the health of mothers and babies.

Effectiveness of Iron Tablet Administration in Preventing Anemia

The effectiveness of iron tablet administration in preventing pregnancy anemia has been consistently proven in various studies. When taken regularly and in the correct dosage, iron tablets have been shown to increase hemoglobin levels in pregnant women, reduce maternal fatigue, and lower the risk of premature birth and low birth weight babies. Derman *et al.,* (2025) and Pandey *et al.,* (2024) demonstrated that iron interventions, whether administered orally or intravenously, can significantly improve the iron status of pregnant women, particularly when initiated early in pregnancy. Díaz-Torres *et al.,* (2024) added that iron tablets tailored to initial hemoglobin levels are more effective in supporting healthy fetal growth. However, the availability and accessibility of iron tablets in healthcare facilities continue to be a challenge. Ibsen *et al.,* (2025) revealed that areas experiencing stockouts or weak monitoring systems tend to have higher rates of anemia. From Kotler's perspective, this reflects issues with the "place" and "availability" elements of the marketing mix for health. Even an effective health product will not yield impact if its distribution is suboptimal. Sharawat *et al.,* (2024) suggest that dosage and administration methods should be tailored to each mother's clinical condition and tolerance to enhance acceptability. Therefore, the effectiveness of iron tablet programs heavily depends on the synergy between clinical, behavioral, and healthcare system aspects. Integration between availability, education, and responsive support is key to transforming iron tablet interventions into a real solution for preventing pregnancy-related anemia.

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Discussion

The study's results indicate a trend toward increased adherence to iron tablet consumption from the first to the third trimester. At the beginning of pregnancy, most pregnant women showed low levels of adherence, influenced by complaints of nausea and vomiting as part of the initial physiological changes of pregnancy. However, as pregnancy progressed and the frequency of interactions with healthcare providers increased, adherence to iron tablet consumption tended to improve. This trend directly contributes to a significant increase in hemoglobin (Hb) levels, particularly in the second and third trimesters, as also found by Derman *et al.,* (2025), who stated that increased oral or parenteral iron intake is closely associated with improved anemia status. Physiologically, iron requirements in pregnant women increase with fetal development and the growing plasma volume. Therefore, supplementation from the onset of pregnancy is crucial to maintain adequate iron stores. Consistent iron tablet consumption from the first trimester is more effective in preventing declines in Hb levels compared to interventions implemented only in the late stages of pregnancy. These findings underscore the importance of a continuous, promotive, and preventive approach in antenatal care. Consistent iron tablet consumption from the first to the last trimester not only impacts Hb status but also reduces the risk of obstetric complications due to anemia, such as preterm labor and low birth weight.

The results of this study align with those of Anato & Reshid (2025), who found that nutrition education and regular iron tablet supplementation significantly reduced the prevalence of anemia among pregnant women in Ethiopia. This study demonstrated that interventions initiated earlier, accompanied by consistent education, yield more optimal results in improving hemoglobin levels. Similar findings were reported by Benjamin *et al.,* (2025) in Tanzania, who found that high compliance with iron supplementation correlates with an improved overall health status among pregnant women. However, differences in outcomes are also evident when considering geographical and socio-cultural contexts. For example, a study by Kamau *et al.,* (2018) in Kenya found that community trust in supplements and traditional consumption patterns influenced the effectiveness of iron tablet administration. Meanwhile, in Indonesia, access to healthcare services and the distribution of iron tablets in some areas remain challenges. These differences underscore that, although the main findings exhibit global similarities, intervention approaches must still be tailored to local contexts. Therefore, strategies used in the implementation of iron supplementation programs must consider cultural diversity, service policies, and other structural factors. This study makes additional contributions to the Indonesian context, where the literature discussing the effectiveness of cross-trimester interventions remains limited.

Factors Affecting Compliance

The availability of supplements does not solely influence adherence to iron tablet consumption but is also determined by various individual, social, and institutional factors. Individually, pregnant women often experience nausea and vomiting in the first trimester, leading to reluctance to consume iron tablets, mainly due to side effects such as constipation or digestive disorders. As stated by Hidayati *et al.,* (2024), negative experiences with side effects are a primary cause of non-compliance. On the other hand, social factors such as support from husbands and families have been shown to influence mothers' decisions to take iron tablets regularly. A study by Edeo Berarti *et al.,* (2023) confirms that the active role of partners or family members in reminding and motivating women also increases compliance. Additionally, from an institutional perspective, the presence of a reliable distribution system and services

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provided by healthcare workers, such as midwives and posyandu cadres, plays a crucial role. The availability of iron tablets at healthcare facilities, ease of access, and pregnant women's trust in healthcare workers are significant determinants. This study found that differences in compliance between trimesters also reflect the effectiveness of services and the frequency of contact with health facilities. In other words, the second and third trimesters show higher compliance due to more intensive interventions from service providers. Therefore, strengthening the role of all parties involved, including individuals, families, and health institutions, is crucial in improving the effectiveness of iron tablet administration during pregnancy.

Effectiveness of Health Education and Trimester-Based Interventions

Health education plays a significant role in shaping the awareness and behavior change of pregnant women regarding iron tablet consumption. This study shows that pregnant women who receive regular education from health workers tend to have a better understanding of the importance of iron in pregnancy and the risks of anemia if left untreated. Sandy & Sulistyorini (2024) revealed that effective methods of information delivery, such as personal counseling, educational leaflets, and group discussions, can enhance the health literacy of pregnant women. Additionally, an educational approach tailored to the stage of pregnancy is more effective than a general approach. Education in the first trimester should focus on fundamental understanding and initial motivation. In the second and third trimesters, education can focus on preventing complications and strengthening compliance. This trimester-based education segmentation aligns with the recommendations of Kinshella *et al.,* (2025), who emphasize the importance of adaptive communication strategies that respond to changes in the needs and physiological conditions of pregnant women. This study also found that mothers who received repeated education were more open to consultation and more likely to report side effects or other issues they experienced. Thus, trimester-based interventions not only improve understanding but also encourage pregnant women to actively participate in maintaining their health. This reinforces the idea that education should be an integral part of iron supplementation programs and not just a one-time intervention, but rather a continuous and contextual effort.

Contribution of Iron Tablet Administration to Anemia Prevention

Consistent administration of iron tablets from the first to the third trimester has been shown to have a positive impact on the health status of pregnant women, particularly in preventing anemia. Based on data from various studies, including (Detlefs *et al.,* 2022; Díaz-Torres *et al.,* 2024), iron supplementation interventions have been found to significantly increase hemoglobin levels and reduce anemia prevalence by 30–50% in compliant groups. These findings align with the study results, which show an average increase in hemoglobin levels among pregnant women who regularly consumed iron tablets. Other positive effects include a reduced risk of complications such as preterm birth, low birth weight (LBW), and the need for blood transfusions during childbirth. This is further supported by the study by Pasricha *et al.,* (2025), which states that iron supplementation during pregnancy is one of the most effective and cost-effective interventions in reducing maternal morbidity and mortality rates. In addition to physiological effects, the intervention group also experienced improved energy levels and quality of life. Thus, this study reinforces the strategic role of iron tablets as a primary intervention tool in preventing pregnancy anemia.

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This effectiveness is further enhanced when administration is planned, timely, and supported by education and continuous monitoring. Therefore, the integration of iron supplementation programs into routine antenatal care must be strengthened as a standardized national policy. This study has significant implications for healthcare practices and the formulation of public policy. First, the distribution system for iron tablets must be strengthened to ensure their availability in all health facilities, especially in remote areas. Second, health education must be an integral part of antenatal programs, conducted repeatedly and tailored to the stage of pregnancy. Third, family and community involvement in supporting iron tablet consumption must be integrated into community-based programs, such as posyandu and antenatal classes. Fourth, a monitoring and evaluation system for compliance rates and Hb status needs to be developed, such as through regular reporting of supplement consumption cards. These findings also indicate that data-driven and socio-cultural context-based approaches will yield more effective results in reducing the prevalence of pregnancy-related anemia. Therefore, policymakers need to design interventions that are not only clinical but also social and educational in nature. Finally, further research is needed to explore community-based and technology-based intervention models (such as tablet reminder apps) that can improve compliance and program effectiveness. With these steps, it is hoped that the incidence of pregnancy-related anemia can continue to be reduced, and the quality of life for pregnant women and their newborns will improve significantly in the long term.

Conclusion

This study aims to examine the effect of iron tablet supplementation on pregnant women from the first to third trimester on efforts to prevent pregnancy-related anemia. The study employed a qualitative approach, conducted through a systematic literature review, which identified and analyzed various empirical findings related to consumption patterns, perceptions, education, social support, and the effectiveness of iron tablet interventions in diverse contexts. By mapping the dynamics of iron tablet consumption longitudinally, this study answers important questions about how compliance and trimester-based interventions can play a key role in reducing the risk of anemia. Additionally, the study describes the interaction between individual, social, and institutional factors in influencing the success of iron supplementation programs during pregnancy. This research makes an original contribution to the field of maternal and child health, particularly through its systematic and qualitative approach that provides a holistic understanding of trimester-based iron tablet administration. The study's findings emphasize the importance of developing intervention strategies that are not only clinically based but also consider educational, social, and health service policy dimensions.

Practically, the study results can serve as a basis for developing more responsive public health policies, such as optimizing pregnancy-phase-based education, strengthening iron tablet distribution, and involving families and communities in improving the compliance of pregnant women. For health service managers, this study offers guidance on integrating antenatal programs with systematic and adaptive monitoring of supplement consumption, tailored to local field conditions. These implications are highly relevant to support national efforts to reduce anemia among pregnant women in Indonesia. Although this study presents a comprehensive review, several limitations need to be considered. First, a systematic literature-based approach has limitations in accessing the latest dynamics in the field, which are constantly changing, especially in the aftermath of the pandemic and health policy reforms.

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This study did not involve direct empirical testing in pregnant women's communities, so the findings rely entirely on available secondary data. Third, regionalism and cultural diversity in Indonesia have not been thoroughly explored. Therefore, for future research, it is recommended that researchers conduct participatory field studies that explore the direct experiences of pregnant women from various social and geographical backgrounds. Experimental research could also be conducted to measure the effectiveness of trimester-based educational interventions on hemoglobin levels. Additionally, digital technology approaches, such as supplement intake reminder apps, are worth exploring as innovations to enhance compliance. With these steps, future research findings will be more precise in formulating adaptive and sustainable strategies.

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