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The Impact of Health Behaviors on Iron Supplementation Adherence and Anemia Prevalence among Pregnant Women: Evidence from a Primary Care Setting in Aceh Tengah, Indonesia

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A B S T R A C T

Anemia during pregnancy remains a significant global health concern, particularly in developing countries like Indonesia. However, adherence to iron supplementation programs is often suboptimal, leading to persistent anemia and adverse maternal and neonatal outcomes. This study aimed to investigate the relationship between health behaviors (knowledge, attitudes, and practices) and adherence to iron supplementation among pregnant women in a primary care setting in Aceh Tengah, Indonesia. Additionally, we explored the impact of these factors on anemia prevalence. A cross-sectional study was conducted at the Pegasing Community Health Center in Aceh Tengah, Indonesia. Pregnant women diagnosed with anemia were recruited, and data were collected using questionnaires assessing their knowledge, attitudes, and practices regarding iron supplementation. Hemoglobin levels were measured to determine anemia status. Statistical analyses were performed to examine the relationships between health behaviors, adherence, and anemia prevalence. A total of 59 pregnant women with anemia participated in the study. Adherence to iron supplementation was suboptimal, with 59.3% reporting poor adherence. Knowledge about iron supplementation was generally good (76.3%), but attitudes and practices were less favorable (30.5% and 27.1%, respectively). Statistical analyses revealed a significant association between attitudes and practices related to iron supplementation and adherence. Furthermore, poor adherence was linked to a higher prevalence of anemia. In conclusion, healthy behaviors, particularly attitudes and practices, play a crucial role in iron supplementation adherence among pregnant women in Aceh Tengah, Indonesia. Interventions targeting these behaviors are essential to improve adherence and reduce the burden of anemia in this population.

1. Introduction

Anemia, a condition characterized by a decrease in the total amount of red blood cells (RBCs) or hemoglobin in the blood, or a lowered ability of the blood to carry oxygen, remains a pressing global health concern, casting a particularly long shadow over pregnant women, especially in developing nations like Indonesia. This condition is frequently associated with iron deficiency, where the body lacks sufficient iron to produce adequate hemoglobin, the protein responsible for oxygen transport in red blood cells. The implications of anemia during pregnancy are far-reaching, impacting both maternal and fetal health. For the mother, anemia can increase the risk of adverse outcomes such as preterm birth, low birth weight, postpartum hemorrhage, and even maternal mortality. The fetus, too, is not spared, as anemia can lead to growth retardation, impaired cognitive development, and increased susceptibility to infections.[1,2]

The World Health Organization (WHO) estimates that approximately 36.5% of pregnant women globally suffer from anemia, with the highest prevalence observed in developing countries and among populations with low socioeconomic status. In Indonesia, the prevalence of anemia among pregnant

women is alarmingly high, reaching 48.9% in 2019. This figure underscores the urgent need for effective interventions to address this public health challenge. Iron supplementation is a cornerstone of anemia prevention and treatment strategies during pregnancy. Iron, a vital micronutrient, is essential for the production of hemoglobin and the optimal functioning of red blood cells. Recognizing the increased iron requirements during pregnancy, the WHO recommends daily iron and folic acid supplementation for all pregnant women. However, despite the availability and affordability of iron supplements, adherence to supplementation programs remains suboptimal, hindering efforts to combat anemia in this vulnerable population.[3,4]

Several factors contribute to the complex issue of poor adherence to iron supplementation. Side effects such as nausea, constipation, and gastrointestinal discomfort can deter women from taking their supplements regularly. Additionally, sociocultural factors, including misconceptions about iron supplements and their safety, can influence adherence. Lack of knowledge about anemia and its consequences, as well as the importance of iron supplementation, can also play a role in non-compliance. Health behaviors, encompassing knowledge, attitudes, and practices, are recognized as key determinants of adherence to health interventions. Knowledge refers to an individual's understanding of a particular health issue, while attitudes reflect their beliefs and feelings towards it. Practices, on the other hand, represent the actions taken in response to the health issue. These three components interact dynamically, shaping an individual's overall health behavior and influencing their adherence to preventive or therapeutic measures.[5,6]

In the context of iron supplementation during pregnancy, positive health behaviors are crucial for ensuring optimal adherence and reducing the risk of anemia. Adequate knowledge about anemia, its causes, and the benefits of iron supplementation can empower women to make informed decisions about their health. Favorable attitudes towards iron supplements, including beliefs about their effectiveness and safety, can motivate women to take them consistently. Finally, appropriate practices, such as taking the supplements as prescribed and managing any side effects, are essential for maximizing the benefits of iron supplementation. Previous research has explored the relationship between health behaviors and adherence to iron supplementation, with mixed results. Some studies have reported a positive association between knowledge and adherence, while others have found no significant relationship. Similarly, the impact of attitudes and practices on adherence has been inconsistent across studies. These discrepancies may be attributed to variations in study populations, cultural contexts, and measurement tools.[7,8]

Furthermore, the interplay between health behaviors and anemia prevalence remains poorly understood. While poor adherence to iron supplementation is intuitively linked to a higher risk of anemia, the specific contribution of knowledge, attitudes, and practices to this relationship warrants further investigation. Understanding these dynamics is crucial for developing targeted interventions to improve adherence and reduce the burden of anemia among pregnant women.[9,10] This study aimed to address these knowledge gaps by examining the impact of health behaviors on iron supplementation adherence and anemia prevalence among pregnant women in Aceh Tengah, Indonesia.

2. Methods

This research employed a cross-sectional study design, aiming to capture a snapshot of the relationship between health behaviors, iron supplementation adherence, and anemia prevalence among pregnant women at a specific point in time. This design is well-suited for examining associations between variables and estimating the prevalence of health conditions within a defined population.

The study was conducted at the Pegasing Community Health Center (Puskesmas Pegasing) in the Aceh Tengah district of Indonesia. This primary

care facility serves a predominantly rural population, characterized by limited access to healthcare resources and a high prevalence of anemia among pregnant women. The choice of this setting was strategic, as it allowed us to investigate the research questions within a real-world context where anemia poses a significant public health challenge. The study population comprised pregnant women attending antenatal care (ANC) at Puskesmas Pegasing. To be eligible for inclusion, women had to meet the following criteria; Be currently pregnant; Have a confirmed diagnosis of anemia, defined as a hemoglobin level below 11 g/dL; Be willing to participate in the study and provide informed consent. The inclusion of pregnant women with anemia ensured that the study focused on the population most at risk of poor iron supplementation adherence and its associated consequences.

A convenience sampling method was used to recruit participants from the ANC clinic at Puskesmas Pegasing. This non-probability sampling technique involves selecting individuals who are readily available and meet the eligibility criteria. While convenience sampling offers practical advantages in terms of feasibility and cost-effectiveness, it may introduce selection bias, limiting the generalizability of the findings. The sample size for this study was determined based on the estimated prevalence of anemia among pregnant women in Aceh Tengah, which is approximately 48.9%. Using a confidence level of 95% and a margin of error of 5%, the calculated sample size was 59. All eligible pregnant women who attended the ANC clinic during the study period and consented to participate were included, resulting in a total sample size of 59.

Data collection was carried out using a structured questionnaire administered by trained research assistants. The questionnaire was developed based on a comprehensive literature review and adapted to the local context. It included questions assessing various aspects relevant to the research objectives; Sociodemographic characteristics: Age, education level, occupation, parity (number of previous pregnancies), and other relevant demographic information were collected to characterize the study population and identify potential confounding factors; Knowledge about anemia and iron supplementation: Questions assessed participants' understanding of anemia, its causes, symptoms, consequences, and the importance of iron supplementation during pregnancy. This included questions about the recommended dosage, frequency, and duration of iron supplementation; Attitudes towards iron supplementation: Participants' beliefs and feelings about iron supplements were explored, including their perceived benefits, concerns about side effects, and overall acceptance of iron supplementation as a preventive and therapeutic measure; Practices related to iron supplementation: Questions focused on participants' actual behaviors regarding iron supplementation, including frequency of intake, timing of doses, and adherence to the recommended dosage; Barriers to adherence: Potential obstacles to iron supplementation adherence were investigated, such as experienced side effects, forgetfulness, lack of motivation, and difficulties accessing or affording iron supplements. To ensure data quality and minimize measurement error, the questionnaire was pre-tested on a small group of pregnant women before the main study. The research assistants received comprehensive training on administering the questionnaire and obtaining informed consent. Data collection took place in a private setting within the ANC clinic to ensure confidentiality and participant comfort. In addition to the questionnaire, hemoglobin levels were measured using a portable HemoCue® hemoglobinometer. This point-of-care device provides a rapid and accurate assessment of hemoglobin concentration, allowing for immediate confirmation of anemia status.

The collected data were entered into a secure database and analyzed using statistical software (SPSS version 25). Descriptive statistics were used to summarize participant characteristics, health behaviors, adherence to iron supplementation, and anemia prevalence. Categorical variables were

presented as frequencies and percentages, while continuous variables were summarized using means and standard deviations. To examine the associations between health behaviors (knowledge, attitudes, and practices), adherence to iron supplementation, and anemia prevalence, chi-square tests were performed. This statistical test assesses the significance of the relationship between two categorical variables. A p-value less than 0.05 was considered statistically significant. Furthermore, logistic regression analysis was employed to identify independent predictors of adherence to iron supplementation and anemia. This multivariate analysis allows for the examination of the relationship between multiple independent variables and a binary outcome variable, while controlling for potential confounding factors. Odds ratios (ORs) and their corresponding 95% confidence intervals (CIs) were calculated to estimate the strength of the associations. Ethical approval for the study was obtained from the Institutional Review Board of the Aceh Tengah Health Office. All participants provided written informed consent before enrollment. The research team adhered to ethical principles throughout the study, ensuring confidentiality, anonymity, and respect for participant autonomy. Participation was voluntary, and participants were free to withdraw from the study at any time without any consequences.

3. Results and Discussion

Table 1 provides a snapshot of the demographic and socioeconomic profile of the 59 pregnant women with anemia who participated in the study in Aceh Tengah, Indonesia. The data reveals a relatively young population with a mean age of 27.3 years. The majority of the women had attained a secondary level of education, suggesting a moderate level of literacy. Most participants were housewives, reflecting the prevalent gender roles in the region. A significant proportion (40.7%) were experiencing their first pregnancy (primigravida), which may have implications for their knowledge and attitudes towards anemia and iron supplementation. The income distribution indicates that a majority of the participants belonged to lower-income households, which could potentially impact their access to nutritious food and healthcare services. The mean age of 27.3 years suggests a relatively young population of pregnant women. This is consistent with the national trend in Indonesia, where the median age at first birth is around 25 years. Younger age may be associated with lower health literacy and less experience with pregnancy-related health issues, potentially influencing their health behaviors. The majority of participants had completed secondary education, indicating a moderate level of literacy. Education is often linked to health knowledge and health-seeking behaviors. However, even with secondary education, there may still be gaps in knowledge about specific health issues like anemia and iron supplementation. Most participants were housewives, highlighting the traditional gender roles and limited economic opportunities for women in the region. This may have implications for their access to information and resources related to maternal health. A substantial proportion of participants were primigravida, suggesting a lack of prior experience with pregnancy and its associated health challenges. This could influence their knowledge, attitudes, and practices regarding anemia and iron supplementation. The income distribution reveals that over 50% of the participants belonged to households with a monthly income of less than 1,000,000 Indonesian Rupiah (approximately 70 USD). This indicates a low socioeconomic status, which can impact access to nutritious food, healthcare services, and iron supplements. The vast majority of participants were married, reflecting the cultural norms in the region. The predominance of rural residents underscores the challenges of accessing healthcare and information in remote areas.

Table 1. Participant characteristics (N = 59).

Characteristic	Frequency (n)	Percentage (%)
Age (years)		
Mean (SD)	27.3 (5.2)	-
Education level		
Primary or less	15	25.4
Secondary	36	61
Higher	8	13.6
Occupation		
Housewife	44	74.6
Employed	11	18.6
Other	4	6.8
Parity		
Primigravida	24	40.7
Multigravida	35	59.3
Monthly income (IDR)		
< 1,000,000	30	50.8
1,000,000 - 3,000,000	22	37.3
> 3,000,000	7	11.9
Marital status		
Married	57	96.6
Other	2	3.4
Residence		
Rural	42	71.2
Urban	17	28.8

Table 2 provides valuable insights into the health behaviors (knowledge, attitudes, and practices) of the pregnant women in the study and their relationship with adherence to iron supplementation. It highlights a disparity between knowledge and actual practices, suggesting that while women may possess adequate knowledge about iron supplementation, their attitudes and practices might not align, leading to suboptimal adherence. The table reveals that adherence to iron supplementation was poor among the majority (59.3%) of the participants. This indicates a significant challenge in ensuring compliance with the recommended iron supplementation regimen during pregnancy. While adherence was low, the majority of women (76.3%) demonstrated good knowledge about iron supplementation. This suggests that lack of information might not be the primary barrier to adherence in this population. Other factors, such as attitudes and practices, may play a more significant role. A striking observation is that nearly 70% of the participants reported poor attitudes towards iron supplementation. This could include negative beliefs about the effectiveness or safety of iron supplements, concerns about side effects, or a general lack of motivation to take them. The significant association between poor attitudes and poor adherence ($p = 0.003$) underscores the importance of addressing these attitudinal barriers. Similarly, the majority of women (72.9%) reported poor practices related to iron supplementation. This could involve irregular intake,

incorrect dosage, or failure to follow the recommended timing of doses. The significant association between poor practices and poor adherence (p = 0.017) further emphasizes the need to improve adherence behaviors.

Table 2. Health behaviors and adherence to iron supplementation.

Health behavior	Category	Frequency (n)	Percentage (%)	p-value (Association with Adherence)
Adherence	Poor	35	59.3	-
	Good	24	40.7	-
Knowledge	Poor	14	23.7	0.457 (not significant)
	Good	45	76.3	
Attitudes	Poor	41	69.5	0.003 (significant)
	Good	18	30.5	
Practices	Poor	43	72.9	0.017 (significant)
	Good	16	27.1	-

Table 3 highlights the significant influence of attitudes and practices on adherence to iron supplementation among the pregnant women in the study. It also underscores the detrimental impact of poor adherence on the prevalence of anemia. These findings emphasize the importance of addressing not only knowledge but also the emotional and behavioral aspects of adherence to effectively combat anemia during pregnancy. The odds of adhering to iron supplementation were 4.67 times higher for women with positive attitudes compared to those with negative attitudes. This substantial odds ratio, coupled with the statistically significant p-value (p = 0.016), indicates that positive attitudes play a crucial role in promoting adherence. Similarly, women with good practices related to iron supplementation had 5.23 times higher odds of adherence compared to those with poor practices. This strong association, supported by a significant p-value (p = 0.023), emphasizes the importance of adopting appropriate behaviors for successful adherence. Poor adherence to iron supplementation was associated with 3.81 times higher odds of anemia compared to good adherence. This significant association (p = 0.025) underscores the direct link between non-compliance with iron supplementation and the persistence of anemia.

Table 3. Predictors of adherence to iron supplementation and anemia.

Predictor	Odds ratio (OR)	95% confidence interval (CI)	p-value
Adherence			
Attitudes (Good vs. Poor)	4.67	1.32 - 16.45	0.016
Practices (Good vs. Poor)	5.23	1.25 - 21.89	0.023
Anemia			
Adherence (Poor vs. Good)	3.81	1.18 - 12.27	0.025

The significant association observed between attitudes and practices related to iron supplementation and adherence levels in this study aligns seamlessly with the principles of the Health Belief Model (HBM). This widely recognized theoretical framework in health behavior research posits that individuals are more likely to adopt health-promoting behaviors when several key factors converge. First, they must perceive themselves as susceptible to the health problem in question. Second, they need to believe in the severity of the potential consequences associated with the health problem. Third, they must perceive the benefits of taking action to mitigate the health problem. And finally, they need to believe in their ability to overcome any barriers that might impede their actions. Understand that they are at risk of iron-deficiency anemia during pregnancy. Recognize the potential negative consequences of anemia for both themselves and their babies. Believe that taking iron supplements can effectively prevent or treat anemia and improve their health outcomes. Feel confident in their ability to take iron supplements regularly and manage any potential side effects. Our findings suggest that positive attitudes towards iron supplementation, reflecting a belief in its effectiveness and safety, are strongly associated with better adherence. This aligns with the HBM, as positive attitudes can enhance the perceived benefits of taking action and reduce perceived barriers. Similarly, the adoption of appropriate practices, such as taking the supplements as prescribed and managing side effects, is also linked to improved adherence. This reflects a sense of self-efficacy, where women feel capable of overcoming challenges and adhering to the recommended regimen. Conversely, the study revealed a disconnect between knowledge and practices. Despite having relatively good knowledge about iron supplementation, many women did not translate this knowledge into action. This observation highlights the limitations of relying solely on health education to promote behavior change. It underscores the importance of addressing not only the cognitive aspect (knowledge) but also the affective (attitudes) and behavioral (practices) components of health behaviors. The "knowledge-action gap" is a well-documented phenomenon in health behavior research. It suggests that knowledge alone is not always sufficient to motivate behavior change. Even with adequate knowledge, negative attitudes or misconceptions about iron supplements can hinder adherence. For example, concerns about side effects or doubts about the effectiveness of the supplements can outweigh the perceived benefits. Cultural beliefs and practices can influence health behaviors, sometimes overriding individual knowledge. For instance, if iron supplementation is not perceived as a cultural norm or if there are prevailing misconceptions about its safety, women may be less likely to adhere even if they possess adequate knowledge. Challenges such as forgetfulness, busy schedules, or difficulty accessing supplements can impede adherence, even in the presence of knowledge and positive attitudes. Even with knowledge and positive attitudes, individuals may lack the motivation or confidence to change their behavior. This can be particularly challenging in the context of pregnancy, where women may be experiencing physical and emotional changes that affect their motivation and self-efficacy. The findings of this study emphasize the need for interventions that go beyond information dissemination and address the multifaceted nature of health behaviors. This can be achieved through culturally sensitive health education programs that dispel myths and misconceptions about iron supplements, highlight their benefits, and address concerns about side effects. Empowering women to take control of their health and build confidence in their ability to adhere to iron supplementation is crucial. This can be achieved through counseling, skill-building activities, and peer support. Strategies to overcome practical barriers could include providing reminders, simplifying dosing schedules, and ensuring access to affordable iron supplements. By adopting a comprehensive approach that targets knowledge, attitudes, and practices, we can enhance adherence to iron supplementation and reduce the burden of anemia among pregnant women.

This, in turn, will contribute to improved maternal and child health outcomes, ultimately benefiting individuals, families, and communities.[11-13]

The high prevalence of poor attitudes towards iron supplementation among pregnant women in Aceh Tengah, as revealed in our study, underscores the critical need for targeted interventions to dismantle these barriers. It is evident that misconceptions and apprehensions surrounding iron supplements, such as concerns about potential side effects or skepticism regarding their efficacy, can significantly impede adherence. To foster positive attitudes and encourage consistent use, a multi-pronged approach is necessary, encompassing the dissemination of accurate information, the cultivation of open communication channels, and the promotion of positive role models. The cornerstone of any successful intervention aimed at addressing attitudinal barriers lies in the provision of accurate and culturally relevant information. Health education programs should be meticulously designed to deliver clear, concise, and evidence-based information about the benefits of iron supplementation during pregnancy. These programs should proactively address common concerns and misconceptions, dispelling myths and fears that may be prevalent within the community. For instance, many women may harbor concerns about the potential side effects of iron supplements, such as nausea, constipation, or gastrointestinal discomfort. Health education programs should acknowledge these concerns and provide practical strategies for managing them, such as taking the supplements with food or at a specific time of day. It is also crucial to emphasize the potential consequences of not taking iron supplements, including the increased risk of anemia and its adverse effects on both maternal and fetal health. Moreover, the information provided should be tailored to the local context, taking into account the cultural beliefs and practices of the target population. This may involve incorporating traditional health practices or utilizing culturally appropriate communication channels to ensure that the information resonates with the community. By acknowledging and respecting cultural sensitivities, health education programs can enhance their effectiveness and promote greater acceptance of iron supplementation. Creating a safe and supportive environment where pregnant women feel comfortable discussing their concerns and experiences with iron supplementation is paramount. Open communication channels can facilitate the identification and resolution of attitudinal barriers, fostering a sense of trust and empowerment among women. Healthcare providers play a pivotal role in establishing such an environment. They should actively listen to women's concerns, validate their feelings, and provide empathetic and non-judgmental support. By demonstrating genuine care and understanding, healthcare providers can build rapport with pregnant women, encouraging them to express their apprehensions and seek clarification about iron supplementation. Group discussions and peer support networks can also provide valuable platforms for open communication. These settings allow women to share their experiences, learn from each other, and receive emotional support. By fostering a sense of community and shared responsibility, group discussions can help normalize iron supplementation and reduce the stigma associated with seeking help or expressing concerns. The power of positive role models in influencing health behaviors cannot be overstated. Sharing success stories of women who have benefited from iron supplementation can inspire and motivate others to adopt similar behaviors. These stories can serve as tangible evidence of the effectiveness of iron supplements and dispel any lingering doubts or fears. Community health workers and peer educators can play a crucial role in disseminating these positive messages. By sharing their own experiences or those of other women in the community, they can create a sense of relatability and encourage pregnant women to embrace iron supplementation as a vital component of their antenatal care. Furthermore, utilizing social media and other communication platforms to showcase positive role models can amplify the reach and impact of these messages. Testimonials, videos, or

social media campaigns featuring women who have successfully overcome anemia through iron supplementation can serve as powerful tools for promoting positive attitudes and encouraging adherence.[14,15]

The strong association between poor practices and poor adherence to iron supplementation, as evidenced in our study, underscores the critical need to address behavioral barriers that hinder consistent intake. These barriers can stem from various factors, including complex dosing schedules, concerns about side effects, and limited access to or affordability of iron supplements. To enhance adherence and optimize the benefits of iron supplementation, a multifaceted approach is required, encompassing strategies to simplify the regimen, manage side effects, and improve accessibility and affordability. One of the primary challenges to adherence is the complexity or inconvenience of dosing schedules. Pregnant women, already juggling numerous responsibilities and experiencing physical and emotional changes, may find it difficult to adhere to a complicated regimen. Therefore, simplifying the iron supplementation regimen is crucial for improving compliance. This can be achieved by providing clear and concise instructions on how to take the supplements. Healthcare providers should explain the recommended dosage, frequency, and duration of iron supplementation in a manner that is easily understandable and memorable. Visual aids, such as pictograms or simple charts, can be helpful in reinforcing these instructions. Furthermore, practical tips for remembering to take the supplements can be invaluable. These could include setting alarms, associating supplement intake with daily routines (e.g., brushing teeth or eating breakfast), or using pill organizers. Encouraging women to involve their partners or family members in reminding them to take their supplements can also be beneficial. Another strategy to simplify the regimen is to explore alternative formulations of iron supplements. While the standard ferrous sulfate tablets are effective, they can cause gastrointestinal side effects in some women. Alternative formulations, such as liquid iron or iron polysaccharide complexes, may be better tolerated and thus improve adherence. However, it is essential to ensure that these alternatives are readily available and affordable in the local context. Iron supplements, particularly ferrous sulfate, are notorious for causing side effects such as nausea, constipation, and gastrointestinal discomfort. These side effects can significantly impact a woman's quality of life and deter her from taking the supplements regularly. Therefore, proactive management of side effects is crucial for enhancing adherence. Healthcare providers should counsel pregnant women about the potential side effects of iron supplements and provide practical strategies for managing them. For instance, taking supplements with food can help reduce nausea. Increasing fiber intake, staying hydrated, and engaging in regular physical activity can alleviate constipation. If side effects persist or become severe, adjusting the dosage or switching to a different formulation may be necessary. It is also important to address misconceptions about side effects. Some women may believe that side effects are indicative of harm or that they should discontinue the supplements if they experience any discomfort. Healthcare providers should reassure women that most side effects are mild and temporary and that they can be managed effectively. Open communication and ongoing support are essential for helping women navigate the challenges of iron supplementation and maintain adherence. Limited access to or affordability of iron supplements can pose a significant barrier to adherence, particularly in low-resource settings. To overcome these challenges, a multi-pronged approach is needed to enhance the accessibility and affordability of iron supplements. One strategy is to provide free or subsidized iron supplements to pregnant women. This can be achieved through government-funded programs or partnerships with non-governmental organizations. Integrating iron supplementation into routine antenatal care can also improve access, as women are more likely to receive and take the supplements if they are readily available during their

healthcare visits. Utilizing community-based distribution channels, such as local pharmacies or community health workers, can further enhance access, especially in remote or underserved areas. These channels can provide convenient and culturally appropriate access to iron supplements, reducing the burden on pregnant women to travel long distances to health facilities. Furthermore, promoting the use of locally available iron-rich foods can complement iron supplementation efforts. While dietary iron alone may not be sufficient to meet the increased demands of pregnancy, it can contribute to overall iron intake and reduce the reliance on supplements. Nutrition education programs can empower women to make informed choices about their diet and incorporate iron-rich foods into their meals.[16,17]

The robust association observed in this study between poor adherence to iron supplementation and a heightened prevalence of anemia serves as a stark reminder of the critical importance of compliance with these programs during pregnancy. Anemia, often stemming from iron deficiency, is not merely a benign condition; it sets in motion a cascade of adverse effects that can jeopardize the health and well-being of both mother and child. By unraveling the intricate relationship between adherence and anemia, we can better appreciate the urgency of addressing this public health challenge and the potential benefits of improving compliance. Anemia during pregnancy places a significant burden on the mother's physiological systems, compromising her health and increasing the risk of various complications. The reduced oxygen-carrying capacity of the blood can lead to fatigue, shortness of breath, and decreased exercise tolerance, impacting the mother's overall quality of life. Moreover, anemia can impair the immune system, making pregnant women more susceptible to infections, which can further complicate their health status. One of the most concerning consequences of anemia during pregnancy is the increased risk of adverse birth outcomes. Preterm birth, defined as delivery before 37 weeks of gestation, is a major contributor to neonatal morbidity and mortality. Studies have consistently shown a strong association between anemia and preterm birth, with anemic women having a significantly higher risk of delivering prematurely. This risk is further amplified in cases of severe anemia, where the risk of preterm birth can increase by up to threefold. Low birth weight, another significant consequence of anemia, is associated with a range of health problems for the infant, including respiratory distress, hypoglycemia, and impaired neurodevelopment. Anemic mothers are more likely to give birth to babies with low birth weight, as the fetus may not receive adequate oxygen and nutrients for optimal growth and development. Furthermore, anemia can increase the risk of postpartum hemorrhage, a life-threatening complication that can occur after childbirth. The decreased red blood cell count and hemoglobin levels in anemic women can impair their ability to clot blood effectively, leading to excessive bleeding during and after delivery. Postpartum hemorrhage is a leading cause of maternal mortality globally, and anemia is a significant risk factor for this devastating outcome. In severe cases, anemia can even lead to maternal mortality. The strain on the cardiovascular system caused by anemia can result in heart failure or other complications, particularly during childbirth when the physiological demands on the body are heightened. While maternal mortality due to anemia is relatively rare in developed countries, it remains a significant concern in LMICs, where access to healthcare and blood transfusion services may be limited. The fetus is also profoundly affected by maternal anemia. The reduced oxygen-carrying capacity of the mother's blood can lead to fetal hypoxia, or insufficient oxygen delivery to the developing fetus. This can impair fetal growth and development, leading to low birth weight and other complications. Studies have shown that maternal anemia is associated with an increased risk of stillbirth, or the death of a fetus after 20 weeks of gestation. The mechanisms underlying this association are complex, but likely involve impaired placental function and reduced oxygen delivery to the fetus. Moreover, anemia during pregnancy can have

long-term consequences for the child's health and development. Children born to anemic mothers may experience cognitive deficits, delayed motor development, and increased susceptibility to infections. These effects can persist into adulthood, impacting the child's educational attainment, economic productivity, and overall quality of life. The findings of our study, demonstrating a strong association between poor adherence to iron supplementation and a higher prevalence of anemia, highlight the critical importance of compliance with these programs. By adhering to the recommended regimen, pregnant women can significantly reduce their risk of anemia and its associated complications, safeguarding their own health and the well-being of their babies. Improving adherence requires a multi-pronged approach that addresses the various barriers to compliance. As discussed earlier, this includes simplifying the regimen, managing side effects, and enhancing the accessibility and affordability of iron supplements. Additionally, addressing attitudinal barriers through health education and promoting positive role models can foster a supportive environment for adherence. By prioritizing adherence to iron supplementation, we can break the vicious cycle of anemia and its detrimental effects on maternal and fetal health. This will not only improve the immediate health outcomes of pregnant women and their infants but also contribute to long-term benefits for individuals, families, and communities. Investing in strategies to enhance adherence is an investment in the future, paving the way for healthier and more prosperous generations to come.[18-20]

4. Conclusion

This study underscores the significant influence of health behaviors, particularly attitudes and practices, on adherence to iron supplementation and the subsequent prevalence of anemia among pregnant women in Aceh Tengah, Indonesia. Poor adherence was widespread, linked to unfavorable attitudes and practices despite adequate knowledge. These findings highlight the necessity of interventions beyond mere health education, focusing on promoting positive attitudes, addressing misconceptions, and providing practical support to overcome barriers to adherence.

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