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Perceptions and beliefs of adolescent girls regarding adherence to iron supplementation: An analysis using the health belief model

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***Abstract*:**
Iron deficiency anemia in adolescent girls is a significant public health issue with a high prevalence. Despite the government's launch of the Nutritious Action Program to tackle this problem, its effectiveness is still hindered by low adherence to Iron and Folic Acid (IFA) tablet consumption among adolescents. This qualitative study aims to analyze the factors influencing adherence to IFA tablet consumption in adolescent girls from the Health Belief Model (HBM) perspective. Using a case study design, this research collected data through in-depth interviews with four adolescent girls, one parent, and an expert from IAKMI Kudus. Data analysis was conducted interactively by identifying key themes relevant to the HBM components. The results show that adherence is influenced by the complex interaction of the six HBM components. Adolescents have a good perception of their susceptibility to and the severity of anemia, but this is not enough to overcome the perceived barriers. Physical barriers, such as side effects like nausea, dizziness, and unpleasant taste, are the strongest predictors of non-adherence. Adherence is highly dependent on external cues, such as supervision from teachers and parents, with behavioral differences observed between students living in boarding schools and those who are not. This study concludes that successful interventions must go beyond merely providing IFA tablets. A comprehensive strategy is needed to strengthen adolescents' self-efficacy to overcome barriers and ensure continuous social support from schools and families to achieve sustainable dietary behavior changes.

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INTRODUCTION

Iron deficiency anemia (IDA) represents a critical and pervasive global health challenge, posing a significant barrier to improving public nutrition, particularly among adolescent girls (Kshatri et al., 2022). This condition transcends geographical boundaries, affecting millions of young females worldwide and undermining their fundamental health and developmental potential. The sheer scale of the problem necessitates urgent and targeted interventions, especially within vulnerable demographic groups where physiological demands and social contexts converge to heighten risk. Understanding the magnitude of this burden is the essential first step towards developing effective solutions (Kumar et al., 2021).

The immediate consequences of IDA for adolescent girls are profoundly detrimental to their daily functioning and educational attainment (Abu-Baker et al., 2021). Anemia significantly impairs cognitive abilities, leading to decreased concentration, reduced learning capacity, and diminished academic performance (Samson et al., 2021). Furthermore, it compromises physical fitness and overall energy levels, directly impacting productivity in both scholastic and domestic activities. These short-term effects disrupt the critical developmental phase of adolescence, hindering girls' ability to reach their full potential during formative years (Hargreaves et al., 2022).

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Beyond these immediate disruptions, IDA carries severe long-term health implications, especially concerning future reproductive health (Munro et al., 2023). Adolescent girls suffering from chronic anemia face elevated risks of maternal complications during subsequent pregnancies, including preterm birth, low birth weight, and increased maternal mortality (Obeagu et al., 2025). This intergenerational impact underscores the critical importance of addressing anemia early in life. Compounding the problem, prevalent risk factors such as unbalanced diets, frequent consumption of high-calorie but nutrient-poor fast food, and a general lack of understanding regarding adequate nutrient intake significantly exacerbate the prevalence of anemia in this population (Bathla & Arora, 2021).

Research consistently identifies specific barriers that hinder adherence to Iron and Folic Acid (IFA) supplementation programs among adolescent girls (Atinga et al., 2025). Physical side effects, notably the unpleasant fishy aftertaste of the tablets and associated nausea, emerge as the strongest predictors of non-adherence. These tangible, immediate negative experiences create a powerful disincentive for consistent consumption (Hidayanty et al., 2025). This finding is robustly supported by evidence that negative perceptions of IFA tablet side effects significantly and directly influence consumption behavior (Janah & Trimawartinah, 2025).

Socioeconomic and contextual factors also play a crucial, intertwined role in shaping anemia prevalence and supplementation adherence. Studies have established significant relationships between anemia rates in adolescent girls and variables including family income levels, the educational attainment of mothers, and established eating habits (Novelia & Sari, 2022). These factors influence access to nutritious food, health literacy within the household, and the overall environment in which health behaviors, including tablet consumption, are formed and sustained (Agustina et al., 2025).

Despite the valuable insights gained from prior research on physical barriers and socioeconomic determinants, a significant gap remains in comprehensively understanding how adolescent girls' perceptions and beliefs collectively interact to influence their decision to adhere to IFA supplementation within the specific context of localized public health programs (Conrad et al., 2024). Existing studies often focus on isolated factors, failing to capture the holistic cognitive and psychosocial framework that drives individual health behavior choices in real-world program settings. This gap limits the development of effective, behaviorally informed interventions (Sari et al., 2021).

This gap is particularly pertinent in Kudus Regency, Central Java, Indonesia, where anemia among adolescent girls constitutes a serious public health concern demanding attention. Recognizing this challenge, the local government has proactively implemented the Nutritious Action Program (Aksi Bergizi). This initiative strategically integrates the provision of IFA tablets with comprehensive nutrition education, aiming to tackle anemia through a multi-pronged approach. The program benefits from cross-sectoral collaboration involving health, education, and potentially other local government departments, reflecting a holistic commitment to addressing the issue (Saville et al., 2022).

However, despite the program's design and cross-sectoral support, adherence to IFA tablet consumption among the target adolescent girls in Kudus Regency remains persistently low, as indicated by initial program data and field observations. This discrepancy between program availability and actual consumption behavior is alarming, given the program's vital role in anemia prevention. It strongly suggests that factors extending far beyond mere tablet availability—namely, the girls' internal perceptions, beliefs, and the social context surrounding the intervention—critically influence their adherence, factors that are inadequately understood or addressed (Salim et al., 2025).

To bridge this critical knowledge gap and inform more effective strategies, this study focuses on adolescent girls participating in the Nutritious Action program within Kudus Regency. Employing the Health Belief Model (HBM) as its theoretical foundation, the research aims to analyze the complex interplay of perceptions and beliefs that shape adherence behavior. The HBM is exceptionally well-suited for this purpose, as it provides a structured framework to examine key constructs: perceived susceptibility to and severity of anemia, perceived benefits of taking IFA tablets, perceived barriers to adherence (including those physical and socioeconomic factors identified previously), and the influence of cues to action and self-efficacy. This comprehensive

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analysis will illuminate the root causes of non-adherence within this specific regional context, ultimately serving as a vital evidence base for formulating more targeted, effective, and sustainable intervention strategies to improve IFA adherence and combat anemia among adolescent girls (Mekonnen et al., 2021).

METHOD

This study uses a qualitative approach with a case study design in Kudus Regency, Central Java. The research sample consists of 4 adolescent girls who are students at Junior High Schools (SMP) and Senior High Schools (SMA) targeted by the Nutritious Action Program, as well as two parents of these students. Purposive sampling was used to select relevant informants with in-depth experience regarding Iron and Folic Acid (IFA) tablet consumption.

The study was conducted in July 2025. Primary data were collected through in-depth interviews using a semi-structured interview guide. In addition to interviews with key informants, data were enriched with an interview with a public health expert, the Head of IAKMI Kudus (Indonesian Public Health Association), to gain an expert perspective. This expert's statement was used to support and strengthen the findings from the informants' interviews, providing greater validity and depth of analysis. All collected data were analyzed using the Health Belief Model (HBM) as an analytical framework. The use of HBM aims to identify and categorize the factors influencing adherence to IFA tablet consumption based on the model's six main components: Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues to Action, and Self-Efficacy.

This study received ethical approval from the Faculty of Medicine, Universitas Negeri Semarang, ensuring that all research procedures adhered to the ethical standards for protecting human subjects. The approval confirms that the study was conducted per national and institutional guidelines, including informed consent, confidentiality, and the right of participants to withdraw at any time without penalty. Ethical oversight was maintained throughout the research process to uphold the integrity and welfare of all participants involved.

RESULT

Table 1. Participants Characteristics

Participant ID	Age	Position	Class	Educational Level	School Name	Status
P1	16	Student	12nd	Senior High School	TBS Keramat Kudus	Boarding
P2	13	Student	9th	Junior High School	TBS Keramat Kudus	Regular
P3	13	Student	9th	Junior High School	Jati 1 Kudus	Regular
P4	14	Student	9th	Junior High School	Jati 1 Kudus	Regular
P5	46	Parent	-	-	-	-
P6	38	Parent	-	-	-	-

Table 1 shows that the study involved four adolescent girls and two parents. The adolescent girls, aged 13 to 16, were students from SMA TBS Keramat Kudus, SMP TBS Keramat Kudus, and SMP 1 Jati Kudus. The two parents were women aged 38 and 46, providing an additional perspective from the family's point of view.

The research results show that the perceptions and beliefs of adolescent girls in Kudus Regency regarding adherence to IFA tablet consumption are heavily influenced by the interaction of the six components of the Health Belief Model. Based on in-depth interviews, several key points were found.

Perceived Susceptibility

Adolescent girls showed a good understanding of their vulnerability to anemia. They linked this risk to biological factors like menstruation and unhealthy eating habits, such as a dislike for vegetables.

> *"The possibility of getting anemia is high because girls menstruate. On average, girls do not like vegetables; you can see a lot of leftover vegetables when we eat at the dorms"* (P1)

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"You can get anemia because friends do not want to take iron tablets, do not eat nutritious food, eat spicy food, and do not eat vegetables" (P2)

This statement aligns with the expert's opinion, the Head of IAKMI Kudus, who, as a public health expert, significantly emphasized that the main problem of anemia in adolescent girls in Kudus lies in eating habits that favor unhealthy foods.

"The main problem of anemia in adolescent girls in Kudus lies in eating habits that tend to choose unhealthy foods just to feel full, not for their nutritional content, which is the cause of the continuous cases of anemia" (The Expert)

Perceived Severity

Adolescent girls also have a strong perception of the severity of anemia. They can identify symptoms that interfere with daily activities, such as dizziness, weakness, sleepiness during class, and a pale face.

"Dizzy, easily sleepy, and the person looks pale" (P1)

"Head is dizzy, studies are disturbed because of sleepiness, and pale" (P3)

"I have. I feel dizzy, when I wake up, my eyes are cloudy. My body is weak" (P4)

Perceived Benefits

The perception of the benefits of consuming IFA tablets is also high. Adolescent girls felt direct positive impacts, such as feeling healthier and more active in learning. Parents also felt these benefits, seeing their children more enthusiastic and able to concentrate easily.

"I feel healthier" (P2)

"More diligent and active in learning" (P4)

"As a parent, I am happy to see my child diligently taking Fe tablets and living healthily now, so she looks healthy and enthusiastic." (P5)

This positive perception is strongly reinforced by the view of the Head of IAKMI Kudus, who emphasized that the success of the Nutritious Action Program is highly dependent on continuous implementation to form healthy living behaviors. He also stated that adolescents tend to be more obedient if given good examples and support from schools and parents. According to him, efforts to reduce the prevalence of anemia in adolescent girls cannot be carried out partially. However, all parties must be involved and ensure the program's sustainability.

"A clear perception of the benefits of IFA tablets and the program as a whole shows that education and support efforts have been successful in instilling awareness, even though behavioral challenges still exist" (The Expert)

Perceived Barriers

Barriers are the most significant factor influencing adherence. The main barriers expressed are the fishy taste and smell of the IFA tablets, side effects of nausea and dizziness, and difficulty swallowing the tablets. Forgetting to take them is also a common obstacle.

"The smell is fishy, I personally am too lazy to take it regularly, sometimes I forget" (P1)

"Because I am afraid I cannot drink (swallow) the pill" (P2)

"I have a friend who, if she does not want to take the medicine, puts it in her bag, because she feels nauseous when she takes it" (P3)

"Often forget, and after taking the IFA tablet, I feel dizzy" (P4)

From the perspective of the parents (P4 and P5), they added barriers experienced by their children.

"It is hard to swallow the IFA tablet with water, so sometimes she uses a banana to take the Fe tablet" (P4)

"When she takes the Fe tablet, she often feels nauseous because of the unpleasant smell of the medicine, according to my child" (P5)

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Cues to Action

Cues from the closest environment play an important role in encouraging adherence. Adolescent girls mentioned reminders from their mother and a schedule to take the IFA tablets together at school every Friday as the primary triggers.

“In the dorms, we take them every Monday” (P1)

"My mom reminds me, and we take it to school every Friday" (P3)

"We take it every Friday at school" (P4)

Although there are supervision efforts from schools, such as taking IFA tablets on certain days, and reminders from parents, personal obstacles like side effects and forgetfulness remain significant barriers, especially for adolescents without a strict supervision structure like in a boarding school. Thus, the expert's view not only confirms the challenges on the ground but also provides a theoretical and practical basis for understanding the root of the problem and the necessary direction for improvement.

“The Nutritious Action program is a form of effort of a nutrition program that is carried out continuously and needs to be always supervised and evaluated” (The Expert)

Self-Efficacy

Adolescents' self-confidence in overcoming barriers still varies. Some adolescents showed awareness and commitment to overcoming bad habits, while parents actively ensured their children's adherence.

"I became aware of the need to eat vegetables and take the medicine (IFA) so that my Hb is normal" (P1)

"I take the water and the medicine to ensure my child takes her Fe tablet." (P5)

This finding is in line with the view of the Head of IAKMI Kudus, who emphasized that the main problem lies in the mindset of adolescents who feel healthy and therefore neglect to take the IFA tablets, even if they experience side effects. The expert also stated that good knowledge is the main factor in forming behavior that must be supported and strengthened. The expert states that adolescents are more obedient if given good examples and support from schools and parents.

"Adolescents tend to be more obedient if given good examples and support from schools and parents. Thus, strong support is needed to strengthen understanding, which is the main factor in the formation of behavior" (The Expert)

DISCUSSION

This study's findings comprehensively strengthen the Health Belief Model theory regarding adherence to IFA tablet consumption among adolescent girls in Kudus Regency. Adherence shows variation influenced by personal awareness, perceived side effects, and the level of supervision. The level of adherence differs among adolescent girls. Student P1, a 16-year-old adolescent from a private high school who lives in a boarding school, showed better adherence. As a more mature high school student, she tends to understand her body's needs better and the importance of IFA tablets. The boarding school environment also provides additional supervision from caregivers, which encourages routine adherence. Although she acknowledged common challenges, she sometimes observed or experienced, such as the fishy smell, laziness to take them regularly, and occasional forgetfulness, she overcame them with self-awareness. In contrast, other students faced different challenges, especially younger students who do not live in boarding schools. Student P3 (age 13, from a public junior high school) observed her friends' reluctance to take IFA tablets due to side effects.

The dynamic interaction of all HBM components influences adherence. Adolescent girls and parents showed a high perception of susceptibility and severity to anemia. They are aware of the risk of anemia due to biological factors like menstruation and unhealthy eating habits. The Head of IAKMI Kudus also affirms this view as a significant ongoing problem. This indicates that they are aware of the health risks they face. However, the feeling of "being healthy" in some adolescents

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shows that perceived susceptibility is not always strong; perceived barriers can inhibit the intention to consume IFA tablets (Sedlander et al., 2021). This perception is reinforced by personal experiences and observations of their friends who experience anemia symptoms, such as dizziness and weakness, which disrupt their learning activities. This strong threat perception should be the primary motivation for preventive action (Klankhajhon et al., 2021).

The aspect of Perceived Benefits is very prominent, with adolescent girls reporting feeling "healthier, more diligent in learning, and less tired" after regularly taking IFA tablets. This positive perception strongly drives adherence, knowledge of IFA benefits, and increased consumption behavior (Sanghvi et al., 2023). However, a complete change in overall nutritional behavior, such as choosing healthy foods or reducing the consumption of iron-inhibiting drinks, has not fully occurred. This suggests that the perceived benefits are more substantial for the specific IFA tablets than general eating habits (Ramachandran et al., 2023).

Nevertheless, the positive perception of benefits, such as feeling healthier and more active in learning, is often not strong enough to overcome the dominant perceived barriers. Physical barriers such as the fishy smell, unpleasant taste, side effects of nausea, and difficulty swallowing are the strongest predictors of non-adherence (Sawudatu et al., 2024). Quotes from informants, including the parents' perspective on their children's difficulties, clearly illustrate how these barriers are a real obstacle. The difference in age and school status of the triangulation informants shows that these barriers vary; younger, non-boarding junior high school students tend to be more vulnerable to side effects and forgetfulness, perhaps due to less optimal physical maturity in swallowing pills and a lack of strict supervision compared to boarding high school students. These barriers significantly influence behavior, and perceived barriers influence IFA tablet consumption. IFA side effects have a significant influence on adolescent girls' adherence to consumption (Haile et al., 2024). These barriers are crucial in explaining why changes in adolescent nutritional behavior are not as fast as expected, as the discomfort of taking IFA tablets can reduce the motivation to implement other healthy eating habits.

Cues to action play an important role. Given that most adolescents collectively consume IFA tablets at school under teacher supervision or are reminded by their parents, external cues are necessary to trigger behavior. Adherence tends to decrease outside of the school environment or when parental supervision is absent (Yanniarti et al., 2023). This shows that adolescents' self-efficacy to overcome barriers independently is still limited. This low self-efficacy directly contributes to the suboptimal change in nutritional behavior, as adolescents may not feel capable of overcoming the barriers to consuming IFA tablets or consistently choosing healthy foods (Hidayanty et al., 2025). Although some adolescents are aware of changing their behavior, most still need active support from parents or teachers to ensure compliance. Overall, the results of this study strengthen the HBM theory that a complex interaction of various perceptions influences health behavior. Intervention programs in Kudus Regency need to re-evaluate their education strategies to increase knowledge, strengthen self-efficacy, and involve the active role of parents in overcoming the barriers that adolescents feel.

CONCLUSION

The participation of adolescent girls in adherence to IFA tablet consumption and their perceptions of implementing the Nutritious Action Program have been examined. Participation and adherence vary, influenced by age, education level (class), and school status (boarding or regular). Younger, non-boarding adolescents tend to be more vulnerable to IFA side effects (nausea, dizziness, difficulty swallowing) and forgetfulness, as well as having looser supervision. Although they positively perceive the program's benefits (feeling healthier and more diligent in learning), adherence and a lack of independent awareness often hinder adherence.

These research results reinforce the HBM theory that a complex interaction of various perceptions influences adherence. Therefore, a coordinated effort is needed that not only focuses on providing IFA tablets but also on a comprehensive strategy to overcome behavioral barriers, optimize implementation resources, and adapt the program to the socio-cultural context of

adolescents and the role of family and school to achieve sustainable changes in nutritional behavior and a significant reduction in anemia prevalence.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest, either financial or non-financial, related to this research. This research was conducted purely for academic and scientific purposes, without third-party influence. All data and findings are presented objectively and transparently.

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