Journal of Health and Nutrition Research
Vol. 5, No. 1, 2026, pg. 324-335, https://doi.org/10.56303/jhnresearch.v5i1.898
Journal homepage: https://journalmpci.com/index.php/jhnr/index

e-ISSN: **2829-9760**

Application of the Health Belief Model to Predict Iron Supplementation Compliance Among Adolescent Girls in Bantul, Indonesia

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ORIGINAL ARTICLES

Submitted: 30 September 2025

Accepted: 06 January 2026

Keywords:
Adolescent girls, Anemia, Consumption of iron supplements

ABSTRACT

Anemia remains a major public health problem among adolescent girls in low-income countries, leading to long-term consequences such as decreased academic performance and increased risks during future pregnancies. Although iron supplementation programs have been widely implemented in schools, adherence among adolescent girls remains low. This study aimed to identify factors associated with compliance with iron supplementation among teenage girls using the Health Belief Model (HBM) framework. A cross-sectional study was conducted from February to June 2024 in Bantul Regency, Yogyakarta Special Region, Indonesia. Data were collected from 230 adolescent girls using a structured questionnaire. Bivariate analysis was performed using the Chi-square test, followed by multivariate logistic regression to identify independent predictors of compliance. The 230 participants, only 49.5% adhered to iron supplementation. Most respondents reported low perceived benefits (62.6%) and low perceived health threats (66.7%). Bivariate analysis showed significant associations between perceived benefits, perceived health threats, and perceived barriers with compliance ($p<0.001$). However, multivariate analysis identified perceived health threats ($p=0.004$; AOR = 3.52; 95% CI: 1.48–8.38) and perceived barriers ($p<0.001$; AOR = 7.11; 95% CI: 3.26–15.51) as independent predictors of compliance. Compliance with iron supplementation among adolescent girls is significantly influenced by perceived health threats related to anemia and perceived barriers to tablet consumption. Interventions should focus on increasing risk awareness and reducing perceived barriers through targeted education, supportive school environments, and multisectoral engagement to enhance anemia prevention efforts.

Key Messages:

- Anemia in adolescent girls is still high even though supplementation programs are running.
- Perceptions of benefits, threats, and barriers significantly influence adherence to iron supplementation among adolescent girls.
- Enhancing positive perceptions and reducing barriers are key strategies to improve iron supplementation compliance

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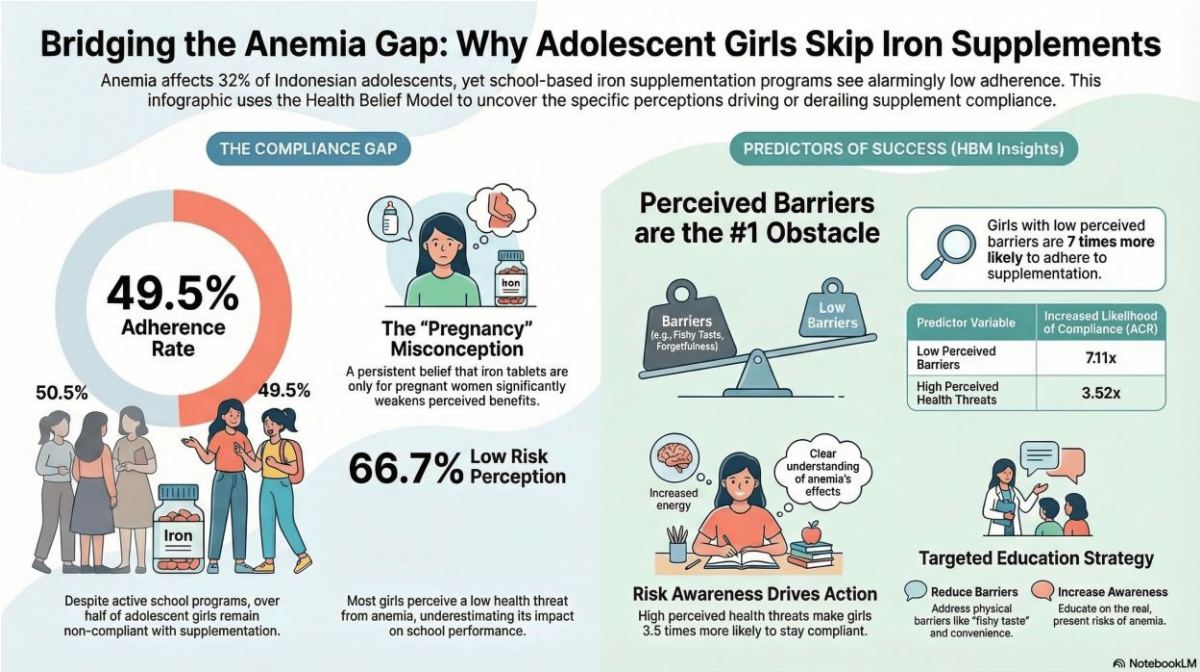
GRAPICHAL ABSTRACT



INTRODUCTION

Adolescent girls are a high-risk group because they often face iron deficiency due to their monthly menstruation (1). In addition, low nutritional intake from these foods appears to be a significant determinant of iron deficiency in adolescent girls (2, 3, 4). A study conducted in China found that a diet high in snacks and fast food was associated with an increased risk of iron deficiency in children and adolescents (5). Another study showed that adolescent girls who followed a vegetarian or vegan diet had a higher risk of iron deficiency compared to omnivores (6). Untreated iron deficiency can lead to iron deficiency anemia, one of the main reasons for impaired cognitive development and low school performance (7). Iron deficiency and anemia can also cause serious health complications for mothers and their offspring during pregnancy that are associated with poor maternal and fetal outcomes, including neurocognitive deficits in children born to iron-deficient mothers (8) and increase morbidity and hurt the Quality of Life (1). According to the World Health Organization's 2023 report, anemia is most prevalent in low- and lower-middle-income nations, with an estimated 32% of women between the ages of 15 and 49 suffering from the condition (9). Based on 2018 health research data, 32% of teenagers in Indonesia suffer from anemia (10). Meanwhile, in Yogyakarta, 19.3% of adolescent girls suffer from anemia (11). Interventions for adolescent girls are crucial because they will significantly impact the quality of human resources for the next generation. Healthy and non-anemic adolescent girls will grow and develop into healthy mothers and give birth to healthy babies. Therefore, reducing anemia in women of childbearing age is an important factor in improving women's health, children's health, school achievement, women's work productivity, healthier pregnancy outcomes, intergenerational benefits for good health, and economic and community development.

In general, three intervention approaches for nutritional anemia have been carried out, namely food-based interventions, nutritional supplementation, and nutritional education. Oral iron therapy is often given as the first-line treatment for iron deficiency and iron deficiency anemia (1). Some progress has been made through increasing iron intake (12). The World Health Organization's recommendations at the 65th World Health Assembly (WHA) agreed on a global plan and targets for maternal, infant, and child nutrition, with a commitment to halve the prevalence of anemia in women of childbearing age by 2025. Several developing countries, including Indonesia, have followed up on these recommendations since 2015 by intensifying the prevention and management of anemia in adolescent girls and women of childbearing

https://doi.org/10.56303/jhnresearch.v5i1.898

age by prioritizing the provision of iron tablets through schools (13). However, until now, there are still many who do not want to and do not comply with taking an iron supplement tablet as recommended for various reasons. Dubik et al (14) reported that of 424 female adolescents randomly sampled in Tamale Metropolis, Ghana, only 26.2% of the adolescents were compliant in taking iron supplements. Thifal et al (15) also reported compliance with iron and folic acid consumption in adolescent girls of 17.6% out of 825 teenage girls. The results of the 2018 Riset Kesehatan Dasar (RISKESDAS) showed that the number of adolescent girls in Indonesia who were compliant with consuming iron supplements every week or ≥52 capsules in one year was only 1.4%, while 98.6% were not compliant with consuming iron supplements (10). In a systematic review conducted by Silitonga et al (16) Failure to comply with taking iron tablets could be caused by a lack of attachment to the iron tablets, such as a lack of motivation, unawareness of the positive effects, a low perceived risk of anemia, and a feeling of being healthy. Gillespie et al (17) reported that adolescent girls, especially those who had never been pregnant or become mothers, had very low awareness of anemia. The side effects also cause decreased compliance felt from giving iron tablet supplements such as nausea, vomiting, abdominal pain, black stools, and other reasons, such as not getting support/permission from parents and forgetting to take the supplements Janz & Becker (18).

The Health Belief Model (HBM) is used as a theoretical lens to explain the cognitive processes that shape adolescent adherence to iron supplementation. As one of the most widely used behavioral frameworks in public health, the HBM states that health behavior is influenced by an individual's perceptions of susceptibility, severity, benefits, and barriers, along with cues to action and self-efficacy (19). This model provides a structured approach to understanding how beliefs about anemia and iron supplementation inform decision-making and adherence patterns among adolescent girls. Bantul Regency is one of the areas in the Special Region of Yogyakarta that still faces challenges related to anemia in adolescent girls. Based on a report from the Ministry of Health of the Republic of Indonesia, anemia is one of the nutritional problems that is still high in Indonesia, with the prevalence of anemia in adolescent girls reaching 32% nationally (11). One of the interventions to reduce anemia rates is the provision of iron tablets through school programs, including those in the Bantul area. However, various studies have shown that the level of compliance of adolescent girls in consuming iron tablets is still relatively low. This phenomenon of non-compliance does not only occur in one or two schools, but is almost evenly distributed in various areas in Bantul Regency. For example, a study at SMA N 2 Banguntapan Bantul conducted by Lestari et al (20) showed that out of 64 female students, only 8 took iron tablets. Research Setyorini & Revika (21) also showed that out of 381,109 female students had bad behavior related to consuming iron tablets. One of the schools that actively implements the iron supplementation program is SMA Negeri 1 Sewon Bantul. As one of the favorite state schools with selected students from other private schools, female students at Bantul State Senior High School 1 should be more obedient in taking their iron tablets. However, even though the program has been running, there is still a phenomenon of non-compliance in consuming iron supplement tablets. Several female students are known to have not consumed the tablets because they do not understand the benefits, have the perception that iron supplement tablets are not important, and there are other obstacles, such as unpleasant taste and concerns about side effects. This condition shows that even though the iron supplement tablet program has been running in various schools in Bantul, including SMA Negeri 1 Sewon, the problem of non-compliance is still a challenge. Therefore, SMA Negeri 1 Sewon Bantul was chosen as the research location because it represents a school that is active in implementing the program, but still reflects common problems that are also found in other schools in Bantul Regency.

This study was designed using the HBM approach, which, in theory, can explain individual health behavior based on risk perception, benefit perception, barrier perception, and Coes to action (22). Several previous studies have also shown that the application of HBM is effective in understanding the factors that influence compliance with iron supplement consumption among adolescent girls (23). Many qualitative studies have shown that non-compliance of adolescent girls in consuming iron tablets is caused by the perception that the supplement is not important or not useful. Still, this study is different because it uses a quantitative Health Belief Model approach to measure the dimensions of perception that contribute to compliance. Therefore, this study aimed to quantitatively assess the association between Health Belief

https://doi.org/10.56303/jhnresearch.v5i1.898

Model constructs (perceived benefits, perceived threats, and perceived barriers) and compliance with iron supplementation among female students at SMA N 1 Sewon, Bantul at SMA N 1 Bantul. Through this study, it is hoped that a comprehensive picture can be obtained regarding the factors that influence compliance with iron supplement consumption among female students of SMA N 1 Sewon Bantul, the results of which can be the basis for developing broader interventions in other schools in Bantul Regency.

METHODS

Research Design

The type of research used in this study is analytical observation with a cross-sectional design to find the relationship between the perception of the benefits of iron tablets, the perception of the threat of disease if not taking iron tablets, the perception of obstacles to taking iron tablets, and the compliance of female adolescents in taking iron tablets.

Population and Sample

The population in this study consisted of 572 female students at SMA Negeri 1 Sewon Bantul. The inclusion criteria included female students aged 16–18 years who had experienced menstruation. The number of samples of 230 respondents was determined using the Isaac and Michael formula with a confidence level of 95%. The sampling technique used was stratified random sampling, with class level (X, XI, and XII) as the stratification variable. The sample consisted of 197 grade X students, 197 grade XI students, and 178 grade XII students. Proportional allocation was applied according to the number of female students at each class level, so that the representation of all population strata could be maintained adequately (24).

Instrument

The number of questions on the perception of benefits is six (6) items, the perception of threats is six (6) items, the perception of perceived barriers is eight (8) items, and compliance with taking iron tablets is five (5) items. A four-point Likert scale is used to assess their agreement on the perception of benefits, perception of threats, perception of barriers, and compliance with taking iron tablets. Positive statements (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree) and negative statements (1=strongly agree, 2=agree, 3=disagree, 4=strongly disagree).

Perceived benefits, perceived threats, and perceived barriers were classified as high and low, while compliance with taking iron supplement tablets was classified as compliant and non-compliant. The categorization was performed using a median split approach, as commonly applied in behavioral health research (25). If the respondent's answer score was higher than the median, the perceived benefits, perceived threats, and perceived barriers were considered high; if lower than the median, the perceived barriers and perceived threats were considered low. Likewise, compliance with taking iron supplement tablets was said to be compliant if the answer score was more than the median, and was said to be non-compliant if the score was lower than the median. Perceived benefits were categorized as high if the score was more than 12, perceived threats were categorized as high if more than 13, perceived barriers were categorized as high if more than 21, while compliance with taking iron supplement tablets was categorized as compliant if more than 14.

The product-moment correlation formula is used to test the validity of the instrument with a p-value of <0.05, while to test the reliability of the instrument, the Cronbach alpha formula is used, with the results of r count > r table (0.312).

Data Analysis

Data completeness and consistency were assessed before analysis. Bivariate associations between independent variables and adherence to iron supplementation were examined using the Chi-square test, followed by multivariate logistic regression analysis to identify independent predictors. Statistical analyses were performed using computer-assisted software, with $p < 0.05$ considered statistically significant.

Ethical Clearance

Participants were informed about the purpose, procedures, risks, and benefits of the study before providing written consent. Anonymity and confidentiality were guaranteed, and data were used for academic purposes only. This study has obtained research ethics approval from the Sekolah Tinggi Ilmu

https://doi.org/10.56303/jhnresearch.v5i1.898

Kesehatan Akbidyo, with ethics number e-KEPK/STIKes Akbidyo/6/111/2024, dated March 19, 2024.

RESULTS

The distribution of respondents by age shows that most are 17 years old, which is 105 people (45.9%). Respondents aged 16 years were 68 people (29.6%), and those aged 18 years were 57 people (24.5%) out of a total of 230 respondents (Table 1).

Table 1. Respondent Characteristics

Age	n	%
16	68	29.6
17	105	45.9
18	57	24.5
Total	230	100

Based on the results of the descriptive analysis of compliance with iron supplementation tablet use among adolescent girls, the minimum and maximum score ranges were 1-4 for all statement items. This indicates substantial variability in respondents' behaviors and attitudes toward iron tablet consumption. Likewise, all items related to perceived benefits, perceived health threats, and perceived barriers also showed minimum and maximum scores ranging from 1 to 4, reflecting a wide range of perceptions from strongly disagree to strongly agree (Table 2). Although the mean scores were relatively high for items reflecting intrinsic motivation to consume iron supplement tablets (e.g., "*I voluntarily take iron supplement tablets*"), a consistently low mean score was observed for the statement "Iron supplement tablets are only consumed by pregnant women." This contrast highlights the coexistence of positive attitudes toward supplementation and persistent misconceptions regarding the intended target group among adolescent girls.

Table 2. Distribution of Respondents by Class Level

Statement	Score		Mean	Median	Modus	SD
	Min	Max				
Iron Tablet Consumption Compliance						
I take iron supplementation tablets once a week	1	4	3.08	3.00	4	0.95
I never take iron supplementation tablets	1	4	2.77	3.00	2	1.05
I willingly take iron supplementation tablets	1	4	3.36	3.00	4	0.756
I take iron supplementation tablets because of external pressure.	1	4	3.09	3.00	4	0.978
I take iron supplementation tablets every day during my menstrual period.	1	4	2.98	3.00	4	0.976
Perceived Benefits						
I believe that iron supplementation tablets are beneficial for my health.	1	4	3.33	3	4	0.763
Iron supplementation tablets help me prevent anemia	1	4	2.93	3	3	0.946
I feel more focused in my studies when I take iron supplementation tablets regularly	1	4	2.96	3	4	1.012
Iron supplementation tablets are only taken by pregnant women	1	4	2.74	3	4	1.070
Perceived Threat						
I am at risk of developing anemia if I do not regularly take iron supplementation tablets	1	4	3.43	4	4	0.713
Adolescent girls are more susceptible to anemia, especially during menstruation	1	4	3.47	4	4	0.603
Anemia can cause severe fatigue and reduce my ability to concentrate in school	1	4	2.77	3	3	1.005
If left untreated, anemia can lead to serious health complications in the future	1	4	3.21	3	3	0.783
Perceived Barriers						

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Statement	Score		Mean	Median	Modus	SD
	Min	Max				
I do not take iron supplementation tablets because I am unaware of their benefits	1	4	2.65	3	2	1.030
I dislike taking iron supplementation tablets due to their fishy taste and the nausea they cause	1	4	3.24	3	3	0.772
I avoid taking iron supplementation tablets because I believe they make my blood thicker	1	4	2.79	3	3	1.006
I do not take iron supplementation tablets because I lack motivation from others	1	4	3.34	3	4	0.729
I do not take iron supplementation tablets because I feel too lazy	1	4	2.64	2	2	1.051
I take iron supplementation tablets because I believe they are important for my health	1	4	3.43	4	4	0.655
I do not take iron supplementation tablets because I believe they are not important for me	1	4	3.02	3	4	1.008

The results of the study showed that respondents in the non-compliant category were 50.5%, while respondents in the compliant category were 49.5%. Most respondents had a low perception of the benefits of 62.6%, a low perception of threats of 66.7%, and a low perception of the barriers of 57.6% (Table 3).

Table 3. Perception of the benefits, perception of threat, perception of barriers, and compliance of adolescents

Variable	Category	n	%
Perception of the Benefits of Iron Supplement Tablets	High	86	37.4
	Low	144	62.6
Perception of Threat to Health	High	78	33.3
	Low	152	66,7
Perceived Barriers	High	98	42.4
	Low	132	57.6
Compliance with Taking Iron Supplement Tablets	Compliance	114	49.5
	Non Compliance	116	50.5

Table 4 shows the distribution of iron supplement tablet compliance by perceived benefits, perceived health threats, and perceived barriers among adolescent girls. The compliance rate was higher among respondents with high perceived benefits (28.7%) than among those with low perceived benefits (20.87%), while a greater proportion of non-compliance was observed among those with low perceived benefits (41.73%). A similar pattern was also observed in perceptions of health threats: respondents with high perceived threats had a greater proportion of compliance (28.7%) than those with low perceived threats (20.87%), while non-compliance was more common in the low perceived threats group (45.21%). For the perceived barriers variable, the proportion of compliance was higher among respondents with high perceived barriers (35.22%) compared to those with low perceived barriers (14.34%), with a greater proportion of non-compliance in the low perceived barriers group (43.04%). Statistically, there were differences in the distribution of iron supplement tablet compliance based on these three variables ($p < 0.001$). Since the data are presented as row percentages, these results are interpreted as a snapshot of the association and are not intended to infer causality. Further analysis using logistic regression was performed to identify predictors of adherence, while controlling for confounding factors.

The results of the multivariate logistic regression showed that perceived barriers were the strongest predictor of adherence to iron supplementation (AOR = 7.113; 95% CI: 3.262–15.510; $p < 0.001$). Perceived health threats were also independently associated with adherence (AOR = 3.524; 95% CI: 1.482–8.380; $p = 0.004$) (Table 5).

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Table 4. Bivariate analysis of factors associated with compliance with iron supplement consumption

Independent Variable	Compliance with Taking an Iron Supplement Tablet				p
	Compliance	%	Not Compliance	%	
Perception of the Benefits of Iron Supplement Tablets					
High	66	28.7	20	8.7	<0.001
Low	48	20.87	96	41.73	
Perception of Threat to Health					
High	66	28.7	12	5.22	<0.001
Low	48	20.87	104	45.21	
Perceived Barriers					
High	81	35.22	17	7.4	<0.001
Low	33	14.34	99	43.04	

Table 5. Multivariate analysis of factors affecting compliance with iron supplement consumption

Predictor Variable	df	P-Value	Adjusted OR	95% (CI)
Perception of Threat to Health	1	0.004*	3.524	1.482 – 8.380
Perceived Barriers	1	<0.001*	7.113	3.262 – 15.510

DISCUSSION

Respondents in this study were female adolescents aged 16–18 years who represent the late adolescence phase, a period categorized as high-risk for iron deficiency anemia due to regular menstruation, rapid physical growth, and increased iron requirements (26). At this developmental stage, adolescents have experienced cognitive maturation that allows for an understanding of the consequences of health behaviors, including adherence to iron tablet consumption, although decision-making is still heavily influenced by external factors such as peer pressure, family support, and the role of teachers. The predominance of 17-year-old respondents indicates that most participants are in a transitional phase toward greater cognitive maturity, but still require social support to maintain consistent health behaviors (27). This finding is in line with previous qualitative research, which confirmed that the influence of peers, parents, and teachers plays an important role in encouraging adherence to iron supplement consumption in female adolescents, where social support functions as a reinforcing factor for health behaviors (28). The results of descriptive analysis of the five compliance statement items showed that the level of compliance with iron tablet consumption was in the sufficient category with a tendency to be suboptimal (50.5%), which indicates that although respondents had relatively good intrinsic motivation, the consistency of routine consumption behavior was not yet fully optimal, as also reported in previous research that positive attitudes and understanding of the benefits of iron tablets were associated with higher levels of compliance (29).

Perception is the process of receiving, organizing, and interpreting information through the senses and cognition to form an individual's understanding of an object or condition (30). Within the HBM framework, changes in health behavior are influenced by perceived vulnerability, perceived disease severity, perceived benefits of preventive measures, and perceived barriers, with the assumption that individuals will act rationally when they have adequate information and believe in the importance of behavioral change for health (31). The results of this study indicate that the majority of adolescents have a low perceived threat to the risk of anemia, which can be explained by the tendency of adolescents to focus more on current health conditions and underestimate long-term health risks, so that anemia is not perceived as an urgent problem (32, 33). This low perceived threat is also related to limited knowledge regarding the severity and long-term impact of anemia, especially on reproductive health, learning capacity, and future productivity, which causes adolescents not to feel personally vulnerable to the consequences of anemia (31, 26). In the context of the HBM, low perceptions of vulnerability and severity have an impact on low motivation to take preventive measures, including compliance with iron tablet consumption. Furthermore, the low perceived benefits found reflect the limitations of adolescents' health literacy in

https://doi.org/10.56303/jhnresearch.v5i1.898

processing and interpreting health information, as explained by Nutbeam (34), so that the specific benefits of consuming iron tablets are not optimally understood. In fact, the perception of benefits is a major determinant of behavioral change in the HBM (19), where adolescents need to believe that consuming iron tablets according to recommendations plays an important role in preventing anemia and supporting cognitive function and concentration (35). This study identified a prominent misconception among respondents, namely the assumption that iron tablets are only intended for pregnant women. This misperception further weakens the perception of benefits among adolescent girls, because iron supplementation is not seen as a relevant health need for them. This condition indicates that the benefits of iron supplementation for adolescent girls have not been effectively socialized, which is likely influenced by the lack of information specifically targeted at adolescent groups and the strong visual and programmatic association of iron tablets with maternal health services. Furthermore, sociodemographic factors, particularly the level of knowledge, play an indirect role in health behavior through their influence on perceptions of susceptibility, severity, benefits, and barriers, where adequate knowledge can strengthen intentions and encourage compliance with iron tablet consumption, while low knowledge can inhibit behavioral change (19, 36).

Perceived barriers in the Health Belief Model refer to an individual's perception of various challenges that can hinder engagement in health behaviors, both cognitive, psychological, and physical (19). Within the HBM framework, perceived barriers are a construct that plays a role in shaping health behaviors, as individuals tend to consider the ease or difficulty of acting. The results of the univariate analysis in this study indicate that most respondents reported low levels of perceived barriers to iron tablet consumption. However, at the same time, adherence to iron tablet consumption remained low in this group. This pattern indicates that low perceived barriers do not necessarily translate into adequate preventive behaviors. This condition can be understood in the context of the low perception of anemia severity and personal vulnerability also found among respondents. When anemia is not perceived as a serious health problem, and adolescents do not feel personally vulnerable, motivation to take preventive action is limited, even though practical barriers are relatively minimal, as described in the conceptual framework of Glanz et al (37). These descriptive findings emphasize the importance of understanding the HBM constructs holistically and interrelatedly. Interpretation of health behavior cannot be based on a single construct in isolation, but rather requires consideration of how perceptions of threats, benefits, and barriers simultaneously shape an individual's readiness to act, as emphasized by Glanz et al (19) and supported by the developmental characteristics of adolescents who tend to underestimate long-term health risks (33).

There are differences in compliance with iron supplement tablet consumption based on perceived benefits, perceived health threats, and perceived barriers in adolescent girls, where high perceived benefits are associated with a greater proportion of compliance. This finding is in line with the HBM, which states that individuals are more likely to adopt health behaviors when the benefits of these actions are perceived as real (19). The low perception of benefits in adolescent girls is likely due to the preventive and long-term nature of iron supplementation, as benefits such as anemia prevention, increased learning capacity, and reproductive health readiness are not directly felt and are therefore less perceived as urgent needs. Low perception of threats is also common in adolescents due to the tendency to view themselves as healthy and less susceptible to disease, especially when anemia symptoms are not clear, which reduces perceptions of vulnerability and severity (38). Within the HBM framework, this condition harms motivation to engage in preventive behaviors. Variations in perceptions of barriers reflect the dynamic nature of barriers, both in the form of physical side effects and non-physical barriers such as forgetfulness, boredom, and lack of social support, where the influence of peers, teachers, and parents plays an important role in compliance with iron tablet consumption (39, 16, 28, 40). The results of the multivariate analysis showed that perceived health threats and perceived barriers were significant predictors of iron supplementation adherence, confirming the relevance of the HBM as a conceptual framework for anemia prevention in adolescent girls (19). This finding is consistent with previous studies showing a significant relationship between perceived susceptibility and the severity of anemia with adherence (41), and that perceived barriers, especially side effects and discomfort, were the most dominant factors, where adolescents with low barriers in this study were more than seven times more likely to adhere than those with high barriers (16, 42).

https://doi.org/10.56303/jhnresearch.v5i1.898

The findings of this study indicate that low perceptions of the health benefits and threats associated with anemia in adolescent girls contribute to low compliance with iron tablet consumption. Within the HBM framework, this condition reflects weak perceptions of benefits and severity, which impacts low motivation to engage in preventive behaviors. Therefore, anemia prevention policies in adolescents need to integrate HBM-based educational interventions that are targeted at correcting misconceptions, increasing awareness of anemia risks, and emphasizing the short- and long-term benefits of iron tablet consumption for adolescent health and cognitive function. This approach is supported by evidence that the use of appropriate educational media is effective in improving knowledge, dietary patterns, and compliance with iron tablet consumption in adolescent girls with anemia (43). Furthermore, program implementation policies need to consider efforts to reduce perceived barriers, such as concerns about side effects and lack of environmental support, by providing accurate information and strengthening the roles of teachers, health workers, and families as cues to action. Thus, a focused and integrated HBM-based health promotion strategy has the potential to increase the effectiveness of iron supplementation programs and support the sustainable prevention of anemia in adolescent girls.

CONCLUSION

In conclusion, this study demonstrates that compliance with iron supplementation among adolescent girls in Bantul, Indonesia, remains suboptimal, with only 49.5% of participants adhering to the recommended protocol. Utilizing the Health Belief Model (HBM) framework, the research identifies perceived health threats and perceived barriers as the most significant independent predictors of supplementation compliance. Notably, perceived barriers emerged as the strongest predictor, with respondents experiencing fewer barriers being seven times more likely to adhere to the program.

These findings highlight a critical need for public health interventions that shift focus toward enhancing risk awareness regarding the long-term consequences of anemia and mitigating perceived barriers, such as unpleasant side effects and misconceptions. To improve anemia prevention efforts, it is essential to implement HBM-based educational strategies and foster a supportive multisectoral environment involving schools, families, and healthcare providers to ensure sustainable behavioral change among adolescent girls.

FUNDING

This research received no external funding.

ACKNOWLEDGMENTS

The authors would like to express their deepest gratitude to the colleagues who took the time to provide helpful recommendations for the preparation of this report. They also extend their gratitude to all the female students who participated in this research.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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