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Relationship between knowledge of anemia and attitudes toward adherence to iron supplementation among high school students: A cross-sectional study

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Abstract

Background: Iron deficiency anemia remains a major public health concern among adolescent girls, particularly in developing countries. Iron supplementation programs have been implemented to prevent anemia; however, adherence to iron tablet consumption among adolescents remains low despite educational efforts. Understanding behavioral determinants such as knowledge and attitudes is important for improving program effectiveness.

Objective: To examine the relationship between knowledge of anemia and attitudes toward adherence to iron supplementation among female high school students.

Methods: A quantitative analytic survey using a cross-sectional design was conducted from March to June 2025 at a senior high school in Ogan Komering Ulu Regency, South Sumatra, Indonesia. The study involved 57 female students selected through purposive sampling from grades X and XI. Data were collected using a validated structured questionnaire assessing knowledge about anemia, attitudes toward iron supplementation, and adherence to iron tablet consumption. Descriptive statistics were used for univariate analysis, while the Fisher Exact Test was applied to assess associations between variables due to unmet assumptions for the Pearson Chi-square test. Statistical analysis was performed using SPSS.

Results: Most respondents demonstrated good knowledge about anemia (91.2%). However, adherence to iron supplementation was low, with 89.5% of respondents categorized as non-adherent. Bivariate analysis showed no significant association between knowledge and adherence to iron supplementation ($p = 0.439$). Similarly, no significant relationship was found between attitudes and adherence ($p = 1.000$). The findings indicate that adequate knowledge and attitudes alone may not be sufficient to influence adolescents' compliance with iron supplementation programs.

Conclusion: Knowledge and attitudes toward anemia were not significantly associated with adherence to iron supplementation among adolescent girls. Behavioral, environmental, and motivational factors may play a greater role in influencing adherence, suggesting that future interventions should integrate educational strategies with behavioral support mechanisms to improve program outcomes.

Keyword: Adherence; Anemia; Attitude; Iron; Knowledge; Students

Research Highlights

What is the current knowledge?

- Knowledge and attitudes toward anemia prevention are generally considered important determinants of adolescents' adherence to iron supplementation programs.

What is new here?

- High knowledge levels among adolescent girls do not necessarily translate into adherence to weekly iron supplementation in school-based anemia prevention programs

Background

Iron deficiency anemia (IDA) occurs when the body does not have enough iron to support erythropoiesis, resulting in various health problems. A characteristic laboratory profile includes microcytic hypochromic erythrocytes, decreased serum iron levels, transferrin changes, and alterations in iron-binding indicators such as Total Iron Binding Capacity (TIBC) (Kurniati, 2020). Anemia affects nearly one-third (33%) of women of reproductive age (15–49 years) worldwide,

indirectly threatening the nutritional status and health of children. The prevalence of anemia among adolescent girls varies widely. In 2019, the global prevalence of anemia was 36.5% among pregnant women, 29.6% among non-pregnant women, and 39.8% among children aged 6–59 months (WHO, 2021).

Adolescent girls with hemoglobin levels below 12 g/dL are considered anemic. Anemia commonly occurs due to decreased hemoglobin levels or reduced erythrocyte counts. Adolescent girls who experience anemia are 1.875 times more likely to have decreased academic performance compared with those who are not anemic, particularly if the condition remains untreated (Melyani & Alexander, 2019). Anemia may also cause fatigue, which reduces efficiency and creative ability, increases vulnerability to disease in adulthood, and raises the risk of giving birth to a malnourished generation. In 2019, 31.2% of women of reproductive age in Indonesia experienced anemia, with the highest prevalence occurring among those aged 20–44 years.

Adolescent girls show a much higher prevalence of anemia (27.0%) compared with adolescent boys (20.0%). This prevalence fluctuates monthly, particularly among individuals aged 15–24 years, with an estimated rate of 32.0% (Ministry of Health of Indonesia, 2019). The main reasons adolescent girls do not consume iron supplementation tablets distributed through schools include: perceiving that iron tablets are unnecessary (14.5%), only taking them during menstruation (4.0%), forgetting to take them (22.5%), disliking their taste or smell (31.2%), assuming they are medicines (4.0%), feeling bored (4.0%), and experiencing side effects such as nausea, dizziness, constipation, or black stools (10.2%) (Ministry of Health of Indonesia, 2023).

The purpose of providing iron supplementation tablets is to meet the iron needs of adolescent girls. Adolescents who have previously experienced anemia are at higher risk of developing the same condition during pregnancy. When adolescent girls later become mothers, they may experience difficulty meeting the nutritional needs of both themselves and their fetuses. This situation can increase the risk of pregnancy complications, labor problems, maternal mortality, perinatal mortality, premature birth, and low birth weight (LBW) (Nuraeni et al., 2019).

Iron supplementation functions as a nutritional intervention for adolescent girls, helping to replenish iron lost during menstruation and compensate for deficiencies that cannot be adequately fulfilled through diet alone. Adolescent girls are at particularly high risk of anemia due to blood loss during menstrual cycles and increased iron requirements during growth and development (Handayani, 2019). Therefore, adherence to iron supplementation is essential for the success of this program.

Hemoglobin levels in the blood vary widely, and adherence to iron tablet consumption according to technical guidelines can have a significant impact. Having adequate information is a key factor in promoting adherence. The higher a person's level of knowledge, the greater the likelihood of compliance with recommended health behaviors (Widiyanto, 2003 in Boyoh, 2015). The depth and breadth of knowledge specifically influence behavior, which in turn affects compliance with relevant health recommendations. Individuals with greater knowledge tend to think more critically and maintain a more regular schedule in taking iron supplementation tablets (Husnah, 2014).

According to a 2024 report from the Ogan Komering Ulu District Health Office, 197 adolescent girls were identified as having anemia. To reduce the incidence of anemia, the government has distributed iron supplementation tablets to adolescent girls aged 12–18 years, with the recommendation of one tablet per week for one year (Ministry of Health of Indonesia, 2020).

Therefore, the purpose of this study is to examining the relationship between knowledge of anemia and attitudes with adherence to iron supplementation among high school students.

Methods

Study Design

This study employed a quantitative analytic survey design using a cross-sectional approach. The objective was to analyze the relationship between knowledge about anemia, attitudes, and adherence to iron supplementation among adolescent girls. The study was conducted at a senior high school in Ogan Komering Ulu Regency, South Sumatra, from March to June 2025. The location was selected based on accessibility and the relevance of the population to the research focus.

Sampling

The study population consisted of all female students from grades X to XII at the school, totaling 73 students. Because grade XII students were preparing for final examinations, the sample was selected using non-probability purposive sampling among students in grades X and XI. Inclusion criteria included willingness to participate voluntarily and attendance during the research period. The final number of respondents was 57 students. The exclusion criterion was incomplete questionnaire responses.

Instruments

The research instrument consisted of a structured closed-ended questionnaire divided into three sections 1) Knowledge about anemia, 2) Attitudes toward iron supplementation consumption, and Adherence to iron supplementation consumption. The questionnaire used a scoring system that had undergone validity and reliability testing.

Data Collection

Data collection began with coordination with the school and the local public health center (Puskesmas) regarding the iron supplementation distribution program and the explanation of the study objectives. The researcher created a WhatsApp group to remind respondents about tablet consumption and provide motivation throughout the study period. The questionnaire was distributed during a special meeting session and was completed independently by the respondents under the supervision of the researcher.

Data Analysis

The collected data were analyzed using univariate analysis to describe the frequency distribution of each research variable. Bivariate analysis was conducted using the Chi-Square test. If the assumptions of the Chi-Square test were not met, the Fisher Exact Test was applied as an alternative. All statistical analyses were performed using SPSS software.

Ethical Consideration

This study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Palembang with Approval Number 0467/KEPK/Adm2/IV/2025. All participants were provided with a complete explanation regarding the objectives and benefits of the study and were asked to sign an informed consent form prior to completing the questionnaire. The confidentiality of respondents' data was ensured by using the information solely for research purposes..

Results

Table 1 presents the distribution of respondent characteristics in this study, consisting of variables including age, age at menarche, level of knowledge about anemia, attitudes toward iron supplementation consumption, and the level of adherence to taking iron supplementation tablets.

Based on Table 1, most respondents were in the middle adolescence category (14–16 years) with 49 respondents (86%), while the remaining respondents were in the late adolescence category (17 years) with 8 respondents (14%). There were no respondents from the early adolescence group (10–13 years). Regarding the age at menarche, the majority of respondents experienced menarche in the normal category (11–13 years), totaling 39 respondents (68.4%), while 18 respondents (31.6%) experienced late menarche (>13 years), and none experienced early menarche (<11 years).

In terms of knowledge about anemia, most respondents had good knowledge, totaling 52 respondents (91.2%), while only 5 respondents

(8.8%) were categorized as having poor knowledge. However, regarding the attitude variable, the majority of respondents showed negative attitudes toward the consumption of iron supplementation tablets, with 37 respondents (64.9%), while only 20 respondents (35.1%) demonstrated a positive attitude. Furthermore, the level of adherence to consuming iron supplementation tablets showed unfavorable results, where most respondents, namely 51 individuals (89.5%), were categorized as non-adherent, and only 6 respondents (10.5%) were adherent according to the recommended guidelines.

Table 1. Frequency distribution of respondent characteristics

Variable	n	%
Age		
Early adolescence (10-13 years)	0	0
Middle adolescence (14-16 years)	49	86
Late adolescence (17 years)	8	14
Age at menarche		
Early (<11 years)	0	0
Normal (11-13 years)	39	68.4
Late (>13 years)	18	31.6
Knowledge about anemia		
Good	52	91.2
Poor	5	8.8
Attitude		
Good	20	35.1
Poor	37	64.9
Adherence		
Adherent	6	10.5
Non-adherent	51	89.5

Table 2 shows that based on the frequency distribution data, most respondents had good knowledge of anemia, totaling 52 individuals (91.2%). However, among respondents with good knowledge, 47 individuals (90.4%) were categorized as non-adherent in consuming iron supplementation tablets. The results of the bivariate analysis indicated that because 50% of the expected values in the contingency table were less than 5, the assumptions for the Pearson Chi-Square test were not met. Therefore, the analysis was continued using the Fisher Exact Test, which produced a p-value of 0.439. Thus, it can be concluded that there was no significant relationship between knowledge about anemia and adherence to iron supplementation among high school female students in 2025.

Table 2. Relationship between knowledge and attitude with adherence to iron supplementation consumption

Variable	Adherent (n,%)	Non-adherent (n,%)	Total (n,%)	p-value
Knowledge				
Good	5 (9.6)	47 (90.4)	52 (100	0.439
Poor	1 (20)	4 (80)	5 (100	
Attitude				
Good	2 (10)	18 (90)	20 (100)	1.000
Poor	4 (10.8)	33 (89.2)	37 (100)	

Furthermore, regarding the attitude variable, the majority of respondents showed negative attitudes toward iron supplementation consumption, totaling 37 respondents (64.9%). Of this number, 33 respondents (89%) were non-adherent in consuming iron supplementation tablets. Similar to the previous analysis, the correlation test did not meet the assumptions of the Pearson Chi-Square test because 50% of the expected values were less than 5. Therefore, the Fisher Exact Test was used, resulting in a p-value of 1.000. Based on these results, it can be concluded that there was no significant relationship between attitude and adherence to iron supplementation consumption among female high school students.

Discussion

Based on the results of the Fisher Exact Test, the relationship between knowledge of anemia and adherence to iron supplementation consumption showed that most respondents with good knowledge were categorized as non-adherent, totaling 47 individuals (90.4%). The significance value p = 0.439 (p > 0.05) indicates that there was no significant relationship between knowledge about anemia and adherence to iron supplementation consumption among high school students in 2025. These findings are inconsistent with the study conducted by Ramlah et al. (2022) in the working area of Minahasa Upa Public Health Center, Makassar, which reported a significant relationship between knowledge and adherence to iron supplementation (p = 0.036). However, this result is consistent with studies by Al Hadi (2023) at SMAN 10 in the Andalas Public Health Center working area, Padang (p = 0.542), and Putri (2022) at the Faculty of Public Health, Universitas Indonesia (p = 0.267), which also reported no relationship between knowledge and adherence to iron supplementation consumption.

An individual's level of knowledge does not always correspond directly with adherence behavior. Although most respondents had good knowledge, this did not necessarily encourage them to take iron supplementation tablets regularly. Other factors such as personal experience, social environment, and exposure to information about anemia may influence the way individuals understand and accept health information. Beliefs regarding the effectiveness of supplements also affect adherence. In this case, respondents may understand the importance of iron supplementation but may not believe in its benefits or may feel uncomfortable due to perceived side effects.

This finding is supported by Al Hadi (2023), who reported that despite adequate knowledge, respondents still showed low adherence due to distrust in iron supplementation tablets and dissatisfaction with side effects such as nausea, dizziness, or constipation. This condition indicates that the information obtained has not been sufficient to shape attitudes and actions in accordance with the objectives of health education, namely improving adherence to supplementation.

According to health behavior theory, good knowledge should function as a predisposing factor that encourages healthy behavior. However, this study found an anomaly where good knowledge was not necessarily followed by adherence behavior. Many respondents ignored the recommended schedule for taking iron tablets due to forgetting, disliking the taste of the tablets, or losing the tablets before consumption. Fear of side effects also reinforced reluctance to take the tablets, leading to apathetic attitudes that ultimately resulted in low adherence.

The results of the Fisher Exact Test examining the relationship between attitude and adherence to iron supplementation showed that most respondents with negative attitudes were categorized as non-adherent, totaling 33 individuals (89.2%). The value p = 1.000 (p > 0.05) indicates that there was no significant relationship between attitude and adherence to iron supplementation among high school students. This finding contradicts the results reported by Ramlah et al. (2022), who found a significant relationship between attitude and adherence (p = 0.020), as well as the study by Al Hadi (2023), which also reported a significant association (p = 0.002).

On the other hand, these findings are consistent with the study conducted by Sekar et al. (2024) at SMPN 8 Banjarmasin, which found no relationship between adolescent girls' attitudes and adherence to iron supplementation (p = 0.092). This suggests that although attitudes are theoretically closely related to behavior, they do not necessarily influence actual actions unless supported by intrinsic motivation, supportive environments, and well-internalized habits.

Negative or indifferent attitudes toward iron supplementation may lead to negligence in consuming the supplement regularly. According to Ramlah et al. (2022), adolescents who underestimate the importance of iron supplementation are at risk of increasing the long-term prevalence of anemia. Attitudes are shaped by knowledge and experiences, both personal and environmental. When perceptions of iron supplementation tend to be negative, individuals may develop a tendency to avoid it, even when information about its importance has been provided (Hastuti, 2022).

Further analysis also revealed that most respondents used mobile phones for 5–8 hours per day. High smartphone usage may divert adolescents' attention from their health responsibilities, including the schedule for taking iron supplementation tablets. Respondents tended to show indifferent attitudes and frequently forgot or felt reluctant to take the tablets, contributing to low adherence. These findings indicate that educational interventions alone may not be sufficient without reinforcement through motivation, supervision, and innovative approaches that align with the lifestyle habits of contemporary adolescents.

Conclusion and Recommendation

The results of this study indicate that although most respondents had good knowledge about anemia, this was not followed by adherent behavior in consuming iron supplementation tablets. Similarly, most respondents demonstrated less favorable attitudes toward iron supplementation consumption and remained non-adherent to the recommended regimen. Therefore, it can be concluded that both knowledge and attitude were not significantly associated with adherence to iron supplementation among adolescent girls in high school.

These findings suggest that other factors beyond knowledge and attitude may influence adherence, such as perceptions of side effects, personal motivation, environmental support, and daily habits. Therefore, future interventions should not only focus on improving knowledge but also incorporate behavioral reinforcement strategies, peer and family support, digital reminder systems, and adolescent-friendly health promotion approaches to improve adherence to iron supplementation programs.

Declaration of Conflict of Interest
The authors declare no competing interests.

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Authors' Contributions
All authors contributed substantially to this work, including involvement in the conception and design of the study, as well as the execution, data collection, analysis, and interpretation. All authors participated in drafting the manuscript or revising it critically for important intellectual content and approved the final version for publication. Furthermore, all authors have agreed to submission of the manuscript to this journal and accept responsibility for all aspects of this work, ensuring that questions related to the accuracy or integrity of any part are appropriately investigated and resolved.

Data Availability
The data that support the findings of this study are not publicly available due to privacy restrictions but are available from the corresponding author upon reasonable request.

Declaration on the Use of AI
No AI tools were used in the preparation of this manuscript.

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