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Anemia Knowledge and Its Relationship with Iron Supplement Consumption and High-Iron Diet among Adolescents at SMP Muhammadiyah 7 Surabaya

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ABSTRACT

Anemia is a common health problem among adolescent girls and can negatively affect both health and academic achievement. Knowledge of anemia is considered to play a role in influencing iron supplement consumption behavior and adherence to a high-iron diet. This study aimed to analyze the relationship between anemia knowledge and iron supplement consumption practices as well as high-iron dietary patterns among adolescents. An observational analytic study with a cross-sectional design was conducted on 52 female students at SMP Muhammadiyah 7 Surabaya. Data were collected using questionnaires to assess anemia knowledge, iron supplement consumption, and high-iron dietary intake measured with SQ-FFQ, and analyzed using the Spearman rank correlation test. The results showed that most respondents had good knowledge about anemia (82.7%), while only 38.5% demonstrated good iron supplement consumption practices and 51.9% reported a good high-iron diet. Statistical analysis revealed no significant relationship between anemia knowledge and iron supplement consumption ($p = 0.066$) or between anemia knowledge and high-iron diet ($p = 0.051$). These findings indicate that good knowledge alone does not guarantee healthy behavior, and other factors such as attitudes, motivation, and social support may contribute to anemia prevention practices. The study is limited by its cross-sectional design and reliance on self-reported data, which may restrict causal interpretation and introduce recall bias.

Key Messages:

- Most adolescent girls at SMP Muhammadiyah 7 Surabaya had good knowledge about anemia (82.7%), but their compliance with iron supplement (TTD) consumption remained low (38.5%).
- A gap was identified between knowledge and behavior, as high knowledge levels did not translate into consistent TTD consumption or optimal dietary practices.
- Statistical analysis found no significant association between anemia knowledge and iron supplement consumption ($p = 0.066$) or high-iron diet ($p = 0.051$), suggesting other influencing factors.
- Interventions should not only focus on increasing knowledge but also address motivation, family support, and environmental factors to improve adherence to anemia prevention behaviors.

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INTRODUCTION

Anemia is one of the nutritional problems that is still quite high in adolescent girls in Indonesia (1–5). The prevalence of anemia in adolescents nationally reached 18.4% and increased significantly to 32% in 2018 (6). The latest data in 2024 shows that the prevalence of anemia among adolescents in Surabaya is 21.62%. In the school environment, this figure can be higher, as recorded in SMP Muhammadiyah 7 Surabaya, which is 24%. These figures show that anemia is still an important public health problem and requires serious treatment, especially in adolescent girls who are experiencing puberty and increased nutrient needs.

Adolescent girls are more prone to anemia because they lose blood regularly through menstruation. This causes iron needs to increase about three times compared to adolescent boys (2). Adolescent girls need about 35 mg/kg of daily iron (Fe), while adolescent men need about 50 mg/kg (3). Anemia that is not treated properly can have a serious impact on various aspects of adolescent life. Physically, anemia can cause symptoms such as weakness, lethargy, lack of concentration, and fatigue easily, which of course can interfere with learning activities and achievements at school (4). If left untreated and persisted into pregnancy, anemia can increase the risk of complications such as miscarriage, premature delivery, low birth weight, stunting, and bleeding or infection during childbirth, all of which contribute to high maternal and infant mortality rates (5). Therefore, anemia in adolescents not only has an impact today, but can also affect the health of the next generation.

The Government of Indonesia has established an anemia prevention program by providing free Tablet Tambah Darah (TTD) every week for 52 weeks per year for adolescent girls, as stipulated in the Minister of Health Regulation No. 51 of 2016. This program is also followed by education on the importance of TTD consumption and iron fulfillment through diet. However, even though the coverage of TTD distribution in East Java has reached 91.1% (6), challenges are still found in terms of adolescents' compliance in consuming it regularly. A preliminary study at SMP Muhammadiyah 7 showed that 75% of adolescent girls had good knowledge about anemia, but the rate of anemia remained high. This suggests that knowledge alone is not necessarily enough to change behavior, including TTD consumption practices and diets high in iron (Fe).

Although adolescents' knowledge of anemia is generally good, adherence in the consumption of blood-boosting tablets and the implementation of a diet high in iron is still low. Previous research has highlighted more aspects of knowledge or compliance separately, so the relationship between the two in the context of schools has not been widely studied. Therefore, this study has a novelty by analyzing the relationship between anemia knowledge and TTD consumption behavior and a diet high in iron in adolescent girls at SMP Muhammadiyah 7 Surabaya. The results of this study are expected to be the basis for designing more effective school-based interventions, with an emphasis not only on cognitive aspects, but also on behavioral and environmental factors that affect the prevention of anemia.

METHODS

This research was carried out at SMP Muhammadiyah 7 Surabaya from September 2024 to April 2025. The research population included all female students in the school, with a sample of 52 female students selected using *a simple random sampling* technique. Data collection is carried out through primary and secondary sources. Primary data included respondent identity, knowledge of anemia, consumption of blood-boosting tablets (TTD), and diet high in iron (Fe). Meanwhile, secondary data includes information on the number of all female students at SMP Muhammadiyah 7 Surabaya and school profiles. The independent variable in this study was knowledge about anemia, while the bound variable was TTD consumption practices and a diet high in iron (Fe) in adolescents.

Data on anemia knowledge in adolescents was obtained through filling out questionnaires with interview methods. The assessment of the practice of consuming blood plus tablets (TTD) was also carried out in the same way, namely using an interview method questionnaire. The results of the assessment were then categorized into two, namely good if the respondents consumed TTD ≥ 4 tablets in the past month, and less if they consumed TTD < 4 tablets in the past month. Consumption patterns are grouped into two categories, namely good and poor, based on three main indicators: type, amount, and frequency of consumption. The good category is given if the three indicators are on the good or frequent criteria, while the less category is given if one of the indicators is on the criteria for less or rare. The assessment of type indicators is based on the number of different types of foods consumed, which

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is said to be less if you eat less than 4 types of food, and good if you eat 4 or more types of food. The amount indicator is assessed from iron (Fe) intake, which is less if the amount of Fe consumed is less than 8 mg per day and good if it reaches or exceeds 8 mg per day according to the 2019 Nutritional Adequacy Rate (Indonesian Nutritional Adequacy Figure, 2019). Meanwhile, the frequency indicator is said to be rare when the frequency of meals is less than three times a day, and often when it reaches or exceeds three times a day.

Data processing and analysis in this study is carried out through several stages. First, editing, which is the process of reviewing the data that has been obtained to ensure completeness and accuracy before being analyzed. Second, coding, which is the provision of code for each variable to facilitate the process of analysis and drawing conclusions. Third, data entry, which is entering data into a format that can be processed using the SPSS application. Fourth, data cleaning, which is a re-examination of the data that has been inputted to ensure the accuracy and completeness of the information.

Data analysis was carried out univariate and bivariate. The univariate analysis aims to describe the characteristics of each study variable, which includes age, knowledge of anemia, consumption of blood-added tablets (TTD), and diet high in iron (Fe), with presentation in the form of frequency distribution. Meanwhile, bivariate analysis is used to look at the relationship between independent variables and bound variables. In this study, the relationship between anemia knowledge and TTD consumption practices and a diet high in iron was analyzed using the Spearman correlation test.

RESULTS

Table 1 Frequency Distribution of Individual Characteristics of Students

Characteristics	n	%
Education Level		
Grade 7	41	37,2%
Grade 8	30	27,2%
Grade 9	39	35,4%
Knowledge About Anemia		
Good	43	82,7%
Less	9	17,3%
Practice of Consuming Tablet Tambah Darah (TTD)		
Good	20	38,5%
Less	32	61,5%
High-Iron Diet		
Good	9	17,3%
Less	43	82,7%

Source : Primary Data 2025

Based on Table 1 Frequency Distribution, it can be seen that the study respondents came from various levels of education, namely grades 7, 8, and 9. Most of the respondents were in class 7 with 41 people (37.2%), followed by class 9 with 39 people (35.4%), while class 8 was the lowest number of 30 people (27.2%). This shows that the distribution of respondents is relatively even at each grade level.

Judging from the aspect of knowledge about anemia, the majority of respondents have good knowledge, which is as many as 43 people (82.7%), while only 9 people (17.3%) have less knowledge. These findings show that most respondents already understand anemia quite well.

However, in the variable of the practice of consuming blood plus tablets (TTD), different conditions were seen. A total of 32 respondents (61.5%) had poor TTD consumption practices, while only 20 respondents (38.5%) carried it out well. This illustrates the gap between knowledge and real behavior in consuming TTD.

Meanwhile, for a diet high in iron (Fe), the distribution of respondents was quite balanced. Respondents with a good diet were recorded as many as 27 people (51.9%), while those who lacked were 25 people (48.1%). Thus, although the majority of respondents have knowledge good regarding anemia, TTD consumption practices and a diet high in iron are still not optimal.

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Table 2 Cross-Tabulation of Anemia Knowledge with TTD Consumption Practices

Anemia Knowledge	TTD Consumption Practices				Total	r	p-value
	Good		Less				
	n	%	n	%			
Good	19	44,2%	24	55,8%	43	-0,257	0,066
Less	1	11,1%	8	88,9%	9		
Total	20	38,5%	32	61,5%	52		

Source : Primary Data 2025

Based on the cross-tabulation in table 2 above, it illustrates that there are 9 adolescents who have a low level of knowledge, 8 adolescents (88.9%) are not compliant in consuming TTD and only 1 person (11.1%) shows compliance in consuming TTD. On the other hand, of the 43 respondents with good knowledge, as many as 24 adolescents did not comply with the consumption of TTD and 19 other adolescents complied with the consumption of TTD. Overall, 38.5% of respondents complied with TTD consumption and 61.5% did not comply.

From the analysis of the spearman rank test, it was found that there was a weak negative correlation between the level of knowledge and the practice of TTD consumption with the value of the correlation coefficient (r = -0.257) and the level of significance (p = 0.066). The value is greater than 0.05 so it can be concluded that the relationship is not statistically significant. This means that there is no relationship between the knowledge of anemia in adolescents and the practice of TTD consumption.

Table 3 Cross-Tabulation of Anemia Knowledge with High-Iron Diet

Anemia Knowledge	High-Iron Diet				Total	r	p-value
	Good		Less				
	n	%	n	%			
Good	25	58,1%	18	41,9%	43	0,272	0,051
Less	2	22,2%	7	77,8%	9		
Total	27	51,9%	25	48,1%	52		

Source : Primary Data 2025

Based on the cross-tabulation in table 11 above, 43 respondents with good knowledge, there were 18 adolescents (41.9%) who had a diet that did not contain Fe and 25 adolescents (58.1%) had a diet high in Fe. Of the 9 respondents with less, there were 2 adolescents (22.2%) who had a diet that did not contain Fe and 7 adolescents (77.8%) had a diet high in Fe. These findings indicate that even if a person has a good knowledge of anemia, it is not necessarily reflected in their eating habits.

The analysis using the *spearman rank* correlation test, showed a weak negative relationship between adolescent knowledge level and high-iron diet, shown by the value of the correlation coefficient (r = 0.272) and the significance level (p = 0.051). This value is above the significance threshold of 0.05 so it is concluded that there is no meaningful relationship between the level of knowledge about anemia and a high-iron diet.

DISCUSSION

1. Research Characteristics

This study was conducted on adolescent girls at SMP Muhammadiyah 7 Surabaya, an age group that is physiologically very susceptible to anemia, especially due to the increased iron requirement during growth and reproductive development. Adolescence is a critical period for meeting nutritional needs, including iron, so that growth can run optimally and the risk of anemia can be minimized. The main focus of this research includes three important aspects, namely knowledge about anemia, the practice of consuming Tablet Tambah Darah (TTD) (TTD), and a diet high in iron (Fe). To measure the level of knowledge, the researcher used a questionnaire consisting of several in-depth questions regarding the definition of anemia, causes, symptoms, negative impacts, and preventive measures that can be taken. The measurement results showed that the majority of respondents had quite good knowledge, which could be linked to access to diverse and easily accessible information,

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including through electronic media, the internet, the family environment, as well as counseling and education directly from the local health center.

In addition to the knowledge aspect, the study also evaluated the practice of TTD consumption as one of the efforts to prevent anemia that has been recommended by the government. Compliance assessments are conducted through in-depth interviews and hands-on observation in the field. The factors that affect this level of compliance are not only related to individual understanding, but also support from health workers, in the form of consistent education and motivation provided regularly. An individual's self-awareness of the importance of maintaining health is also a key factor that influences the success of consuming these supplements (8). As for a diet high in iron, this study analyzed the frequency and amount of consumption of various sources of iron, such as liver, duck eggs, green vegetables, beef, chicken, and catfish. The research method used is *cross-sectional*, so as to provide an overview of the conditions of knowledge, behavior, and eating habits simultaneously at a certain time. This approach involves collaboration between schools, health centers, and families as the main environment of respondents in shaping behavior and patterns of nutritional consumption.

2. Interesting Findings in Research

One of the findings that is quite interesting and at the same time a challenge in efforts to prevent anemia is the mismatch between the level of good knowledge and the practice of TTD consumption and the application of a diet high in iron. Although the majority of adolescents showed a fairly good understanding of anemia, no statistically significant association was found between knowledge level and adherence to TTD consumption or diets that supported iron adequacy (9). There is a gap between theoretical knowledge and actual behavior in TTD consumption, which is influenced by the individual's self-perception and awareness of the risk of anemia (10). Cognitive knowledge does not necessarily drive behavior change without the support of personal awareness, internal motivation, and the perception of anemia risk (11). This shows that having information and knowledge alone is not enough to change daily behavior. Health education conducted by health centers has been proven to be effective in increasing adolescents' understanding of anemia, especially through direct counseling and educational media (12). In addition, adolescents who obtain information from various sources ranging from print media, electronics, internet, family, to health workers generally have a better level of knowledge than those who are less exposed to this information (13).

However, in the practice of TTD consumption, the majority of respondents still show a low level of compliance. Interviews revealed various reasons, such as unpleasant taste of tablets, difficulty swallowing pills, and forgetting to take regularly (14). Furthermore, many adolescents stated that they did not feel significant changes or positive effects after consuming TTD, so the motivation to continue consuming decreased (15). These findings confirm that psychological and sensory factors, including perceptions of side effects or drug tastes, have a major influence on compliance, even more dominant than knowledge alone. In addition, support from families, especially parents, plays an important role. This form of support includes the provision of physical TTD at home, the provision of clear and convincing information, verbal motivation, and the provision of nutritious foods high in iron that can complement daily needs (16).

In the aspect of diet, it was found that most adolescents tend to avoid major sources of iron such as liver, duck eggs, and green vegetables due to reasons of taste preferences or habits. Instead, they prefer fast food and snacks that are more popular among their age. Diets dominated by fast food often lack essential micronutrients such as iron, calcium, and vitamins, which can lead to anemia, growth disorders, and developmental problems (17). Although there is consumption of beef, chicken, and catfish, the portions do not meet the nutritional recommended standards of "Isi Piringku", so overall daily iron intake has not reached the optimal level (18). The habit of consuming tea immediately after meals that can inhibit iron absorption is also still common even though there is knowledge about its effects (19). This reinforces the view that behavioral factors, habits, social support, and internal motivation play a significant role in shaping real action in the prevention of anemia, much more complex than just cognitive understanding.

https://doi.org/10.56303/jnhd.v1i1

3. Advantages and Disadvantages of Research

This research has a number of prominent advantages, especially in terms of the coverage of variables that are quite comprehensive, including knowledge about anemia, TTD consumption practices, and a diet high in iron. The use of a combination of quantitative methods through questionnaires and qualitative methods through in-depth interviews allowed researchers to not only measure the level of knowledge and behavior, but also to understand the factors that are the inhibitions or drivers behind these behaviors, such as discomfort with TTD and low motivation to live a healthy life. Thus, the results of this study are able to provide a more complete and in-depth picture of the real conditions experienced by young women in the school environment. The clear local context, namely SMP Muhammadiyah 7 Surabaya, makes the results of this research very relevant and can be a basis for consideration in designing policies and integrated health intervention programs at the school and puskesmas levels.

However, this research is also inseparable from several limitations that need attention. The *cross-sectional* design used did not allow for the definitive drawing of cause-and-effect relationships between knowledge, TTD consumption behavior, and diet (20). The nature of the data that is mostly obtained through interviews has the potential to experience *recall bias*, as respondents may not always remember or report their behavior accurately. In addition, this study did not measure hemoglobin levels directly in all respondents, so the relationship between TTD consumption compliance and physiological anemia status could not be strongly proven. Psychosocial factors such as peer influence, social pressure, and body image, which have been shown to influence adolescent behavior, have also not been explored in depth. Finally, because the research sample was limited to one school, the results were limited in generalization to the broader adolescent population, particularly in areas with different social, economic, and cultural conditions.

Given these limitations, follow-up research is strongly recommended to use a longitudinal design that allows evaluation of behavioral changes and the impact of interventions over a period of time. The recommended intervention approaches are integrated, combining nutrition and health education, modification of the school and family environment, emotional and social support from parents and health workers, and motivational strategies that can overcome sensory and behavioral barriers. With this more comprehensive and sustainable approach, it is hoped that compliance in consuming TTD and the implementation of a high-iron diet can increase significantly, so that efforts to prevent anemia in adolescent girls will be more effective and have a long-term impact.

CONCLUSION

This study shows that most of the students of Muhammadiyah 7 Surabaya Junior High School have good knowledge about anemia, but the adherence to the consumption of Tablet Tambah Darah (TTD) (TTD) is still low and the diet pattern high in iron is not optimal. Statistical analysis did not find a significant relationship between knowledge and TTD consumption adherence or dietary patterns. This confirms that knowledge alone is not enough to drive behavior change.

As a recommendation, anemia prevention interventions in schools should not only emphasize educational aspects, but also prioritize practical strategies, such as TTD drinking assistance in schools, involvement of teachers and parents in monitoring compliance, provision of a variety of iron-rich foods in school canteens, as well as motivational campaigns that emphasize the long-term benefits of reproductive health and learning achievement. With this strategy, TTD consumption compliance and adolescent dietary improvements are expected to increase sustainably.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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