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The Relationship Between Iron-Rich Food Consumption and Iron Supplement Adherence with the Incidence of Anemia among Adolescent

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Abstract

Introduction: Anemia remains a significant public health problem among adolescents, particularly female students, and is commonly associated with inadequate iron intake and low hemoglobin levels, which can negatively affect physical performance and cognitive function. Patterns of iron-rich food consumption and adherence to iron supplement intake are considered key factors influencing the occurrence of anemia among students, yet these behaviors are often suboptimal and require further investigation.
Objective: Anemia is the result of examining hemoglobin (Hb) levels in the blood that are lower than normal and this condition can be caused by a lower number of red blood cells. The purpose of this study was to determine the relationship between food consumption patterns of iron sources and compliance with the consumption of blood supplement tablets with the incidence of anemia in grade XI students at MAN 1 Lampung Utara.
Method: This type of research is quantitative, employing an analytic research design, specifically a cross-sectional design. The population in this study were all grade XI students at MAN 1 Lampung Utara with a total of 149 students. The sampling technique used a proportionate stratified random sampling method with a total sample of 65 respondents.
Result: The results of this study are the relationship between the pattern of consumption of iron-source foods with anemia characterized by the results of a p-value of 0.001 and the relationship between compliance with consumption of blood supplement tablets with anemia characterized by the results of a p-value of 0.022.
Conclusion: It is hoped that female students can change the frequency of food consumption patterns, especially those containing iron, and routinely consume blood supplement tablets according to their recommendations in order to fulfill and increase iron reserve storage in the body in order to prevent anemia.

Keywords: adolescents, anemia, iron-rich food consumption, iron supplementation

Introduction

Anemia is a condition in which the hemoglobin (Hb) level in the blood is lower than normal. When Hb levels are low, the oxygen supply to the brain and muscles is reduced, causing symptoms such as poor concentration and reduced activity (Ministry of Health of the Republic of Indonesia, 2018). Anemia in adolescents occurs when hemoglobin levels in the blood fall below normal limits. Other factors that can cause anemia include rapid growth in adolescents, a deficiency of iron or other essential nutrients, menstrual bleeding in adolescents, or other health problems (Radjulaeni, 2024).

According to the World Health Organization (WHO), the prevalence of anemia worldwide ranges from 40% to 88%, and this condition remains quite common among young women. In Asia, the prevalence of anemia in adolescent girls reaches 33.0% (Syabani Ridwan & Suryaalamsah, 2023). According to the Indonesian Basic Health Research (RISKESDAS), the anemia rate among adolescent girls increased from 22.7% in 2013 to 32% in 2018 (Syabani Ridwan & Suryaalamsah, 2023).

According to the 2018 Basic Health Research (Riskesdas), Lampung Province has the highest anemia prevalence in Sumatra at 63%, with 24.3% among adolescent girls aged 10-19 (Hidayat et al., 2024). Data on the prevalence of anemia in North Lampung Regency shows that there were 64 cases of anemia among prospective brides, making it one of the top five in Lampung (Lampung Provincial Health Office, 2022). Data from the North Lampung Regency Health Office in 2024 showed that 11 of the 27 community health centers (Puskesmas) that had screened adolescent girls for anemia had recorded 144 cases of anemia.

Anemia is characterized by low hemoglobin levels due to iron deficiency. Iron functions as an oxygen carrier from the lungs to various tissues, facilitating electron transport within cells. Iron deficiency can disrupt the growth of body cells or brain cells, leading to decreased hemoglobin levels and reduced immunity (Syabani Ridwan & Suryaalamsah, 2023). Previous research has shown a link between diet and consumption of iron-rich foods and anemia. Adolescent girls are more susceptible to anemia due to their increased risk of iron loss due to menstruation. Furthermore, women often maintain their appearance and engage in dieting, which can lead to deficiencies in essential nutrients (Muthmainnah S Saad et al., 2023). Iron and hemoglobin levels are essential for blood formation, as iron stores are essential for red blood cells in the bone marrow. An iron imbalance in the body can cause hemoglobin levels to drop below normal limits (Minarfah et al., 2021).

The 2018 Basic Health Research (Riskesdas) showed that 22.9% of adolescent girls in Indonesia had received iron supplements, and 76.2% had received them in the past year. However, only 1.4% of those receiving iron supplements consumed more than 52 tablets, and 98.6% consumed less than 52 tablets (Nasir et al., 2024). Recent data indicates that from 2019 to 2022, the number of adolescent girls receiving iron supplements (TTD) fell from 90.30% to 48.21%, with the figure in North Lampung Regency reaching only 29.3% (Lampung Provincial Health Office, 2022). Based on the results of a pre-survey of 15 female students in May 2025 conducted by researchers, namely examining Hb levels with the results obtained that there were 9 female students who had anemia including 3 female students who were included in the category of moderate anemia, 6 female students were included in the category of mild anemia and 6 female students were not classified as anemia because the results of the examination of normal Hb levels were >12 g / dL. The next data is regarding short educational activities carried out by the Community Health Center about the importance of consuming iron tablets, especially for teenage girls and the provision of iron tablets regularly every 3 months, the total given was 50 boxes consisting of 1 box containing 10 strips. In addition, the

school provides routine provision once a month where each female student gets four iron tablets. Then, researchers interviewed 9 female students whose Hb levels were low regarding whether they had previously had an Hb level check. In addition, 4 female students often stay up late while the other 5 female students feel that their sleep pattern is sufficient, namely 6-8 hours of sleep but are still often sleepy, then the researcher asked what symptoms they often feel and the data obtained includes female students feeling dizzy and experiencing other symptoms such as easily feeling weak, tired, lethargic and listless. In addition, 9 out of 15 female students still rarely consume iron tablets in a month <4 tablets.

Based on the results of a pre-survey of 15 female students in May 2025 conducted by researchers, namely examining Hb levels with the results obtained that there were 9 female students who had anemia including 3 female students who were included in the category of moderate anemia, 6 female students were included in the category of mild anemia and 6 female students were not classified as anemia because the results of the examination of normal Hb levels were >12 g / dL. The next data is regarding short educational activities carried out by the Community Health Center about the importance of consuming iron tablets, especially for teenage girls and the provision of iron tablets regularly every 3 months, the total given was 50 boxes consisting of 1 box containing 10 strips. In addition, the school provides routine provision once a month where each female student gets four iron tablets. Then, researchers interviewed 9 female students whose Hb levels were low regarding whether they had previously had an Hb level check. Furthermore, four students frequently stayed up late, while the other five felt they were getting enough sleep, at 6-8 hours, but still often felt sleepy. Researchers then asked about their frequent symptoms. Data collected included dizziness and other symptoms such as feeling weak, tired, lethargic, and listless. Furthermore, nine of the 15 students rarely consumed iron supplements, typically less than four tablets per month.

With the prevalence data on anemia obtained and the pre-survey conducted, this can be used as a basis for investigating the relationship between iron-rich food consumption patterns and adherence to iron supplement consumption and the incidence of anemia among students at MAN 1 North Lampung.

Objective

The purpose of this study was to determine the relationship between food consumption patterns of iron sources and compliance with the consumption of blood supplement tablets with the incidence of anemia in grade XI students at MAN 1 Lampung Utara.

Method

The present study employed a quantitative research approach with an analytical design using a cross-sectional method to examine the relationship between iron-rich food consumption patterns, adherence to iron supplementation, and the occurrence of anemia among students. The study was conducted at MAN 1 North Lampung. The study population consisted of all female students enrolled in grade XI, totaling 149 students. From this population, a sample of 65 respondents was selected using proportionate stratified random sampling to ensure adequate representation from each class. Inclusion criteria were female students who were present during the data collection period and willing to participate, while students with known chronic illnesses or those currently undergoing medical treatment that could affect hemoglobin levels were excluded from the study.

The independent variables in this study were patterns of iron-rich food consumption and adherence to iron tablet supplementation, while the dependent variable was the incidence of anemia. Data on dietary intake were collected using a Food Frequency Questionnaire (FFQ) to assess the frequency and type of iron-rich foods consumed by the respondents. Adherence to iron supplementation was measured using a structured self-administered questionnaire that assessed the regularity and consistency of iron tablet consumption. The incidence of anemia was determined by measuring hemoglobin levels using a standardized hemoglobin testing device, with anemia defined as a hemoglobin level of less than 12 g/dL, in accordance with established clinical guidelines.

Data collection was carried out by trained researchers following standardized procedures to ensure data accuracy and reliability. Prior to data collection, respondents were informed about the objectives and procedures of the study, and informed consent was obtained. The collected data were processed and analyzed using statistical software. Univariate analysis was performed to describe the characteristics of respondents and the distribution of each study variable. Bivariate analysis was conducted using the Chi-square test to identify the relationship between iron-rich food consumption patterns, adherence to iron supplementation, and the occurrence of anemia. A p-value of less than 0.05 was considered statistically significant. Ethical principles, including voluntary participation, confidentiality, and anonymity, were strictly observed throughout the research process.The present study employed a quantitative research approach with an analytical design using a cross-sectional method to examine the relationship between iron-rich food consumption patterns, adherence to iron supplementation, and the occurrence of anemia among students. The study was conducted at MAN 1 North Lampung. The study population consisted of all female students enrolled in grade XI, totaling 149 students. From this population, a sample of 65 respondents was selected using proportionate stratified random sampling to ensure adequate representation from each class. Inclusion criteria were female students who were present during the data collection period and willing to participate, while students with known chronic illnesses or those currently undergoing medical treatment that could affect hemoglobin levels were excluded from the study.

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statistically significant. Ethical principles, including voluntary participation, confidentiality, and anonymity, were strictly observed throughout the research process.

Result

Table 1. The Relationship between Iron-Sourcing Food Consumption Patterns and the Incidence of Anemia

Iron-Sourcing Food Consumption Pattern	Incidence of Anemia						*P value*
	Not Anemia		Anemia		Total		
	N	%	N	%	N	%	
Deficit or deficiency	20	30.8%	18	27.7%	38	58.5%	**0,001**
Normal	25	38.5%	2	3.0%	27	41.5%	

Based on Table above, the results obtained using the chi-square test in this study indicate that 38 female students (58.5%) at MAN 1 North Lampung experienced iron-sourcing food consumption deficits or deficiencies, and 18 of them 27.7% of female students experienced anemia. Furthermore, 27 (41.5%) students had normal/good iron-rich food consumption patterns, while 2 (3.0%) had anemia.

The chi-square test for iron-rich food consumption patterns showed a p-value of 0.001 (p-value <0.05). Based on these results, it can be concluded that Ha1 (the alternative hypothesis) is accepted, indicating a relationship between iron-rich food consumption patterns and the incidence of anemia among female students at MAN 1 North Lampung.

Table 2. The Relationship between Iron Supplement Tablet Compliance and Anemia

Iron Supplement	Iron Supplement Tablet Consumption						*P Value*
	Not Anemia		Anemia		Total		
	N	%	N	%	N	%	
Non-Compliant	25	38.5%	17	26.1%	42	64.6%	**0,022**
Compliant	20	30.8%	3	4.6%	23	35.4%	

Based on Table above, the results obtained using the chi-square test in this study indicate that 42 (64.6%) of female students at MAN 1 North Lampung were non-compliant with iron supplement tablet consumption, and 17 students were non-compliant. (26.2%) had anemia. Furthermore, 23 female students (35.4%) were compliant with iron supplementation, and 3 female students (6.2%) had anemia.

The chi-square test for iron supplementation compliance showed a p-value of 0.022 (p-value <0.05). Based on these results, it can be concluded that Ha2 (the alternative hypothesis) is accepted, indicating a relationship between iron supplementation compliance and the incidence of anemia among female students at MAN 1 North Lampung.

Discussion

Iron intake among female students at MAN 1 North Lampung was 58.5%, while 41.5% had a normal or good diet. Therefore, 30.8% of female students had a deficiency in iron-rich

foods and were not anemic, while 27.7% had a deficiency in iron-rich foods and were anemic. The results showed that the proportion of female students with a deficiency in iron-rich foods and not anemic was higher than that of anemic students (30.8%). This indicates that the proportion of students with a deficiency in iron-rich foods and not anemic was higher than that of anemic students. Statistical tests showed a significant relationship between dietary patterns and the incidence of anemia among female students at MAN 1 North Lampung, as evidenced by a p-value of 0.001 ($p<0.05$).

This study aligns with research conducted by Sihotang et al. (2025), which stated that the chi-square test results showed a significant result of 0.042, or a p-value (<0.05), thus concluding a relationship between dietary patterns and the incidence of anemia. Iron deficiency is the main cause of anemia, but poor eating habits in adolescents can also contribute to anemia (Sihotang et al., 2025). The consumption pattern of iron-rich foods from staple foods was determined with a maximum iron content of 11.23 mg/day, while the consumption pattern of iron-rich foods from plant-based side dishes was 7.00 mg/day, while the maximum iron intake from animal-based side dishes was 7.88 mg/day. Furthermore, the frequency of consumption patterns showed that, of the <55 staple foods, the female students consumed noodles, twice a week. Furthermore, the average 50% of female students consumed heme iron, namely animal protein. The most frequently consumed foods were chicken, twice a week, saltwater fish (scad) twice a week, freshwater fish (tilapia) twice a week, tuna once a week, salted fish

once a week, and chicken eggs three times a week. Meanwhile, non-heme iron sources include tofu twice a week, tempeh twice a week, spinach twice a week, mustard greens twice a week, long beans twice a week, cassava leaves once a week, and kale three times a week. As for fruits, the students most frequently consumed were sweet oranges once a week, mangoes once a week, and bananas twice a week. The results of iron-rich food consumption among female students varied considerably, but were still far from the iron intake based on the 2019 RDA. Interview results indicated that the frequency of iron-rich food consumption among female students was still low, and they had irregular eating patterns, such as eating twice a day and once a day. Therefore, female students need to be provided with information in the form of materials or counseling on how to consume good iron-rich foods to prevent anemia. This aims to increase their knowledge and encourage them to change their dietary patterns, including the type, amount, and frequency of consumption. Therefore, it is recommended that schools collaborate with community health centers to further educate students to increase their knowledge and reduce the incidence of anemia. Therefore, in addition to focusing on diet, it is important to conduct further examinations to identify the specific causes of anemia in adolescents (L. Handayani et al., 2025).

Regular iron supplementation over a period of time aims to rapidly increase hemoglobin levels and should be continued to increase the body's iron stores. This is necessary when dietary iron intake is insufficient to meet the body's iron needs and to increase iron reserves (Ministry of Health of the Republic of Indonesia, 2018).

Female students who are noncompliant with iron supplementation may increase the risk of anemia. This low compliance is largely due to reluctance to take iron supplements. This occurs due to side effects such as nausea, indigestion, constipation, and a fishy odor. Furthermore, some students fail to take iron supplements by accident or forgetfulness. Students feel more disciplined if there is a special program for iron supplementation at school. This demonstrates the significant role iron supplementation plays in helping meet iron deficiencies.

Taking iron supplements is one of the government's efforts for adolescent girls. This study aims to determine the level of compliance with iron supplements among female students at MAN 1 North Lampung to assess the success of the anemia prevention and management program for female adolescents. Therefore, a specific schedule is needed at school for easier monitoring and education regarding iron supplements to ensure student compliance.

Conclusion

There is a significant relationship between iron-rich food consumption patterns and the incidence of anemia in MAN 1 North Lampung. This is demonstrated by the statistical analysis results with a p-value of 0.001 (p-value <0.05). There is a significant relationship between iron supplementation compliance and the incidence of anemia in MAN 1 North Lampung. This is demonstrated by the statistical analysis results with a p-value of 0.022 (p-value <0.05).

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Authors' Contribution

All authors contributed equally to every stage of the research, from proposal preparation, data collection, and analysis, to the writing of the article. All authors have read and approved the final manuscript and are responsible for the content and originality of this work.

Conflict of Interest

The researchers declare that there is no conflict of interest regarding the implementation or publication of this research. The entire research process was carried out independently, without any influence from any party. Respondent participation was voluntary, with informed consent obtained, and their confidentiality and privacy were protected in accordance with ethical research standards. The researchers hope that the results of this study can serve as a valid reference for the development of nursing education and mental health support.

Ethical Considerations

This research received ethical approval from the nursing education institution and the hospital where the clinical practice was conducted. All respondents were informed about the purpose and benefits of the study and signed an informed consent form. The research was conducted with a strong commitment to ethical principles, including data confidentiality and the right to voluntary participation.

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