Journal of Indonesian Specialized Nutrition | e-ISSN: 3032-3878
Vol. 03 No. 02, 2025

COMPLIANCE WITH IRON TABLET CONSUMPTION AND MACRONUTRIENT INTAKE IN RELATION TO ANEMIA IN FEMALE STUDENTS AT SMAN 2 KOTA JAMBI

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Abstract

Background: Adolescent girls are vulnerable to anemia due to increased iron needs during menstruation and often inadequate dietary intake. This study aimed to analyze the relationship between compliance with Iron Tablet (TTD) consumption and macronutrient intake with the incidence of anemia in female students. **Methods:** This cross-sectional study was conducted at SMAN 2 Kota Jambi with 24 randomly selected female students. Data were collected through a compliance questionnaire, 3x24-hour food recall, and hemoglobin level measurement. Chi-square test was used for analysis. **Results:** A total of 62.5% respondents were non-compliant with TTD consumption. Macronutrient intake was generally poor: 95.8% lacked energy intake, 79.2% lacked carbohydrates, 66.7% lacked protein, and 87.5% lacked fat. Anemia prevalence was 45.8%. No significant relationship was found between TTD compliance and anemia ($p=0.916$). However, fat intake was significantly associated with anemia incidence ($p<0.05$). **Conclusion:** Anemia in adolescent girls is not significantly associated with iron tablet compliance but is related to fat intake. Interventions should target improving diet quality and fat adequacy alongside supplementation.

Keywords: Anemia, Iron Tablet, Macronutrient, Adolescent Girls, Fat Intake

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Introduction

Anemia is a condition characterized by a decrease in the number of red blood cells below normal level.[1] A person is considered anemic if hemoglobin levels are below 13.0 g/dL in adult males and below 12.0 g/dL in adult females with symptoms of anemia are often vague and include fatigue, weakness, and tiredness.[2] In adolescent girls, body image concerns often lead to restrictive eating patterns, particularly avoidance of iron-rich foods, which can increase the risk of anemia. These eating behaviors, including irregular eating patterns and limited intake of animal-source foods, are influenced by lifestyle and nutritional choices.[3]

Adolescent girls are a nutritionally vulnerable group due to rapid growth and the onset of menstruation, which increases iron requirements. Iron losses during menstruation, combined with poor dietary intake, low physical activity, and habits such as drinking tea or coffee during meals, heighten the risk of anemia. Anemia in this group can affect immune function, concentration, academic performance, physical fitness, and overall productivity.[4] If left untreated, anemia in adolescence may persist into adulthood and pregnancy, increasing the risk of complications such as preterm birth, growth retardation, and poor neonatal outcomes. This underscores the importance of early intervention to prevent a cycle of poor health across generations.[4]

According to the Basic Health Research of Indonesia (2018), the national prevalence of anemia among adolescent girls in Indonesia is 32%, indicating that 3 to 4 out of 10 teenage girls were affected.[5] The government has initiated a weekly iron supplementation program known as TTD (*Tablet Tambah Darah*), targeting adolescent girls and women of reproductive age. The program involves providing one iron tablet per week for a total of 52 tablets annually,

with intensified supplementation during menstruation. Implementation is carried out through school health programs (UKS) and community health centers.

Study by Yanti et al (2025)[6] reported that regular consumption of iron tablets is effective in preventing iron deficiency anemia and maintaining normal hemoglobin levels. However, Adolescent girls with iron deficiency anemia (IDA) tend to have lower intakes of essential nutrients.[7] Specifically, anemic individuals are noted to have reduced intakes of calories and macronutrients, particularly protein and fat, when compared to non-anemic controls. These findings support the idea that anemia is closely linked with inadequate dietary habits.

Further supporting this, a study by Suryani (2018)[8] revealed a significant association between nutritional status and anemia incidence among adolescents. The study showed that adolescents with poor nutritional status were 4.2 times more likely to experience anemia highlighting the crucial role of adequate nutrition in anemia prevention. These findings emphasize the importance of nutritional improvement alongside supplementation programs to effectively combat anemia in adolescent girls.

In 2023, the Jambi City Health Office reported that four students at SMAN 2 Kota Jambi were diagnosed with anemia, the highest number compared to other schools in the Talang Banjar Health Center area. Based on this background, the present study aims to examine the relationship between compliance with iron tablet (TTD) consumption and macronutrient intake (energy, protein, fat, and carbohydrates) with anemia among female students at SMAN 2 Kota Jambi.

Method

This research employed a quantitative analytic design with a cross-sectional approach

conducted from August 27–29, 2024. The population consisted of 736 female students from SMAN 2 Kota Jambi. A total sample of 24 students was selected using simple random sampling. Data collection included:

1. TTD compliance via structured questionnaire;
2. Macronutrient intake using 3x24-hour food recall;
3. Anemia status via hemoglobin level test (Hb <12 g/dL defined as anemia).

Data were analyzed using univariate and bivariate (Chi-square) analyses with significance at $p<0.05$.

Results

The findings of this study showed that most respondents (62.5%) were not compliant with TTD consumption, and anemia was found in 45.8% of the female students. As seen on Table 1, Macronutrient intake was generally inadequate, with 95.8% consuming insufficient energy, 79.2% lacking carbohydrate intake, 66.7% lacking protein, and 87.5% with inadequate fat intake.

Table 1. Macronutrient Intake Profile, compliance to consume TTD, and Anemia status of Respondents

Variable	Category	n	%
TTD Compliance	Compliant	9	37.5
	Non-compliant	15	62.5
Energy Intake	Adequate	1	4.2
	Inadequate	23	95.8
Carbohydrate Intake	Adequate	5	20.8
	Inadequate	19	79.2
Protein Intake	Adequate	8	33.3
	Inadequate	16	66.7
Fat Intake	Adequate	3	12.5
	Inadequate	21	87.5
Anemia Status	Anemia	11	45.8
	Not Anemia	13	54.2

As shown on Table 2 and Table 3, further analysis was conducted to see whether there are any positive relationship between the compliance on consuming TTD as well as the intake profile of female teenagers with anemia incident.

Table 2. Relationship Between TTD Compliance and Anemia

Compliance	Anemia (n/%)	Not Anemia (n/%)	Total	p-value
Compliant	5 (55.6%)	4 (44.4%)	9	0.916
Non-compliant	8 (53.3%)	7 (46.7%)	15	
Total	**13 (54.2%)**	**11 (45.8%)**	**24**	

Table 3. Relationship Between Macronutrient Intake and Anemia

Nutrient	Anemia (n/%)	Not Anemia (n/%)	p-value
Energy	11 (47.8%)	12 (52.2%)	>0.05
Carbohydrate	10 (52.6%)	9 (47.4%)	>0.05
Protein	8 (50.0%)	8 (50.0%)	>0.05
Fat	10 (71.4%)	4 (28.6%)	<0.05

Statistical analysis revealed no significant association between TTD compliance and anemia (p=0.916), suggesting that compliance alone may not be sufficient to prevent anemia without adequate nutrient intake. Interestingly, a significant association was found between fat intake and anemia (p<0.05), where students with inadequate fat intake were more likely to experience anemia. This study found a significant association between dietary fat intake and the incidence of anemia among adolescent girls.

Discussion

This study examined the relationship between compliance with iron tablet consumption and macronutrient intake—including energy, protein, fat, and carbohydrates—with anemia status among female students at SMAN 2 Kota Jambi. The results indicated no significant

association between compliance with weekly iron tablet (TTD) intake and anemia status. This finding aligns with Sungkar et al[4] who reported that distribution of iron-folic acid tablets alone is insufficient to combat anemia due to low compliance, poor understanding of anemia, side effects, and lack of supervision in school-based programs.

Similarly, no significant relationship was observed between energy, protein, or carbohydrate intake and anemia status. However, a significant association was found between fat intake and anemia. Fat is not only essential as an energy source but also plays a physiological role in micronutrient absorption. Sonnweber et al (2012)[10] highlighted that iron metabolism is regulated by hepcidin—a hormone controlling iron release through ferroportin—and systemic conditions, such as dietary changes or inflammation, may alter hepcidin expression and consequently iron absorption. While the study does not directly address dietary fat, it provides biological plausibility that nutrient imbalance, including inadequate fat intake, could influence iron regulation.[10]

Additionally, Study found that a large proportion of adolescents in Delhi had inadequate intake of fats, energy, and micronutrients. This poor dietary quality was linked to increased risk of anemia, underscoring the need to evaluate both the adequacy and quality of macronutrient intake in addressing adolescent anemia.[11] While our study did not examine body fat composition directly, another previous findings suggest that both iron intake and body fat percentage may influence anemia status in adolescents, pointing to the multifactorial nature of this condition.[9]

The strength of this study lies in its use of three-day dietary recall combined with objective hemoglobin measurements. However, limitations include a small sample size (n = 24),

potential dietary recall bias, and the cross-sectional design may precludes causal inference. Nevertheless, the study emphasizes the importance of a comprehensive approach to anemia prevention. Programs should not solely focus on iron supplementation but also ensure balanced macronutrient intake and education. Nutritional counseling, peer-based health promotion, and dietary interventions are necessary to improve both compliance and overall dietary quality. School-based health programs should also consider meal timing and dietary inhibitors (e.g., tea or coffee during meals) to enhance iron bioavailability and effectiveness of anemia interventions.

These findings underscore the complexity of anemia development in adolescents, which is influenced not only by iron supplementation but also by overall dietary patterns and nutrient interactions. Integrating dietary quality into anemia prevention strategies is crucial for more effective outcomes.

Conclusion

This study found that almost half of SMAN 2 Kota Jambi's female students were anemic. Even thought this percentage might not represent all female students, some notes can be taken from the findings. In this studi, we found no significant association between iron tablet compliance or intake of energy, protein, and carbohydrates with anemia status, however fat intake was significantly related. These findings highlight the need for anemia prevention strategies that address both supplementation and balanced macronutrient intake. These findings suggest that public health interventions targeting anemia among adolescents should extend beyond iron tablet distribution. Comprehensive strategies that integrate nutritional education, dietary behavior improvement, and regular monitoring of both supplementation

and dietary intake are crucial. Schools can serve as effective platforms to deliver these interventions, especially when combined with peer education and tailored counseling efforts.

Acknowledgment

The author would like to express sincere gratitude to all individuals and institutions who have contributed to the completion of this research, including those who provided academic guidance, technical support, and assistance during data collection and analysis.

Conflict of Interest

There are no conflict interest of this publication.

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