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Program for Providing Iron Tablets in Schools and Reducing the Incidence of Anemia among Adolescent Girls in Padang City

Program Pemberian Tablet Fe di Sekolah dan Penurunan Kejadian Anemia pada Remaja Putri di Kota Padang

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ABSTRACT

Background: Anemia among reproductive-age women can lead to significant nutritional issues for future generations. In Indonesia, the anemia prevalence rate among women is alarmingly high at 30.44%. A key strategy to reduce anemia is the distribution of iron tablets (Fe) in schools.

Objectives: This study aimed to analyze the effectiveness of the iron tablet program in schools and its relationship to the incidence of anemia among adolescent girls in Padang City.

Methods: A mixed-methods approach was utilized, combining quantitative and qualitative techniques. A cross-sectional design assessed the relationship between iron tablet distribution and anemia prevalence. Qualitative data were gathered through in-depth interviews to explore the program's implementation. The study involved two schools in Padang City, randomly selecting a sample of 274 adolescent girls. Data were collected using standardized instruments, analyzed with statistical software, and examined using multiple logistic regression tests.

Results: The iron tablets program hasn't been optimally implemented. The study found 28.1% of adolescent girls were anemic. An iron tablet consumption history (p-value=0.035), the quantity consumed (p-value=0.034), father's education level (p-value=0.039), and nutritional knowledge (p-value=0.032) related with anemic. Girls who did not consume iron tablets were 3.03 times more likely to be anemic. Many expressed concerns about the potential negative effects of iron tablets.

Conclusions: This study reveals a troubling prevalence of anemia among adolescent girls, with nearly one-third affected. Inadequate iron tablet consumption, along with parental education and nutritional knowledge, significantly contributes to this issue. Concerns about side effects emphasize the urgent need for targeted educational interventions.

INTRODUCTION

Adolescents in Indonesia face a triple burden of malnutrition, one key issue being micronutrient deficiencies, with anemia as a prominent example[1]. Anemia, a condition marked by low levels of red blood cells or hemoglobin, can arise from nutritional and non-nutritional factors, with iron deficiency (Iron Deficiency Anemia, or IDA) being the leading cause of nutritional anemia[2]. The World Health Organization (WHO) has set a global target to halve anemia rates among women of childbearing age to 18% by 2025[3]. Nonetheless, anemia remains widespread, with 29.9% of women aged 15-49 affected worldwide in 2020[4]. In Indonesia, data from the 2023 Indonesian Health Survey (SKI) show anemia prevalence rates of 16.3% in adolescents aged 5-14 and 15.5% in those aged 15-24[5]. This reflects a reduction from the 23.7% national prevalence reported in the 2018 Basic Health Research (Riskesdas), where the 15-24 age group

had an especially high anemia rate of 32%[6]. Anemia prevalence was notably higher among females (27.2%) than males (20.3%), with adolescent girls, particularly those aged 15-19 (30.44%), facing a greater risk than boys[7–9]. However, other studies indicate a higher anemia risk in younger adolescent girls, aged 10-14[10]. There was not much data in Padang city about the risk of anemia according to age of girls and specific socio-cultural factors related to anemia among adolescent girls.

The implications of anemia are profound, especially for adolescents. For instance, anemia compromised immune function, reduces resistance to illness, diminishes physical and academic performance, and negatively affects fitness. For young women, anemia increases the risk of physical and mental impairments and may lead to complications during pregnancy, underscoring the need to address iron deficiency well before pregnancy[11]. The Indonesian government has

responded by distributing iron tablets to adolescent girls in schools, intending to meet their iron requirements[12]. However, these initiatives have seen limited success; Riskesdas 2018 reported that only 24.07% of young women had received iron tablets, with a mere 0.97% consuming the recommended 52 tablets annually in West Sumatra[13]. Blood screenings of school entrants in the province indicated an anemia rate of 22.15%, with Padang City accounting for 25.39% of cases. This low adherence to iron supplementation may stem from personal efficacy, knowledge, and social support from teachers, peers, and family[14,15]. Anemia prevalence is also variable across Padang, with junior high schools in the Lubuk Kilangan health center area reporting the highest rate (53.3%), Koto Panjang Ikua Koto Community Health Center (9.2%) and areas like Bungus showing much lower rates (3.2%)[16].

Preventive strategies for adolescent anemia focus on promoting iron-rich foods, food fortification, and iron supplementation, particularly during menstruation. In Padang, additional efforts include nutrition education, iron tablet distribution, and screening for anemia risk among new junior high school students. Studies indicate that anemia is driven by numerous factors, including nutrient deficiencies, infections (e.g., malaria, tuberculosis, HIV), chronic diseases, gynecological issues, and genetic disorders[17]. However, the most prevalent causes are iron, folic acid, and vitamin B12 deficiencies, alongside lack of protein, energy, and vitamin A[18-20]. In developing countries, socio-economic constraints such as low parental education and income also play a significant role[9,21]. Research on Indonesian adolescents reveals that consuming iron tablets can improve hemoglobin levels and highlights a correlation between anemia risk and low body mass index (BMI)[22]. Studies have further shown that Mid-Upper Arm Circumference (MUAC) and anemia awareness correlate with anemia risk in adolescent girls in Donggala area, reinforcing the need for region-specific strategies tailored to local risk factors[23,24]. Yet, in Padang City, socio-cultural factors influencing anemia among adolescent girls remain under-researched, underscoring the need for both quantitative and qualitative studies to understand these dynamics better.

This study aimed to determine the dominant risk factors for anemia in adolescent girls in Padang and to investigate the effectiveness of the current iron supplementation program. This could yield valuable insights into improving adherence to iron tablet consumption and developing a more effective strategy for reducing anemia among young women.

METHODS

This research employed field techniques (field research) using multiple research methods within a cross-sectional study design. Using these varied methodologies enhances the research outcomes' representation of the phenomenon under study and strengthens the analytical rigor. A sequential explanatory strategy was applied, where quantitative data were initially collected and analyzed, followed by qualitative data collection to further elaborate on quantitative findings. This approach provided a more comprehensive understanding of the implementation of iron tablet supplementation in schools, as well as an exploration of adolescent girls' behavior and reasons for not consuming iron tablets.

The quantitative component focused on gathering data regarding anemia incidence, history, and the quantity of iron tablet consumption, alongside demographic data on adolescents and their parents. Qualitative data, on the other hand, were collected through in-depth interviews with selected respondents or informants. The study took place from March to June 2024 within the working areas of the Koto Panjang Ikua Koto and Lubuk Kilangan Health Centers in Padang City. The population for the quantitative portion comprised adolescent girls (aged 12-16 years) residing within the jurisdiction of these health centers, specifically those enrolled in Grade VII in middle schools in Padang City in 2024. Adolescent girls were chosen due to their higher risk of anemia following the onset of menstruation, compared to adolescent boys. Using the Lameshow formula with a 10% addition to account for potential dropout, a sample size of 274 was determined. Sampling was conducted through a stratified random sampling technique, with criteria requiring participant willingness to confirm via informed consent (co-signed by a teacher) following authorization from the Padang City Education and Culture Department and the respective school, availability during data collection, and has already commenced menstruation.

Anemia incidence among participants was assessed by measuring hemoglobin (Hb) levels directly with a portable Easy Touch GCHb (Glucose Cholesterol Hemoglobin) digital device, conducted by trained health analysts. Data was collected by trained enumerators through assessed and interviewed according to its variable. Nutritional status data were derived from Body Mass Index (BMI) values, calculated from participants' height and weight, and compared with age norms. Mid-Upper Arm Circumference (MUAC) was obtained using a MUAC tape. Respondent characteristics, including anemia knowledge, menstrual patterns, and parental characteristics, were collected via a standardized questionnaire. Additionally, sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI).

Based on hemoglobin level testing, respondents were categorized as follows: (1) Non-anemic (Hb ≥ 12g/dL) and (2) Anemic (Hb < 12g/dL)[25]. Nutritional status by BMI, as per WHO AnthroPlus guidelines, was classified by Indonesian Ministry of Health standards (2020) into (1) Abnormal (thin, very thin, overweight, obese) if BMI-for-age was < -2 SD or > +1 SD and (2) Normal if BMI-for-age was between -2 SD and +1 SD[26]. MUAC was categorized into two groups: (1) Chronic energy deficiency (MUAC < 23.5 cm) and (2) Normal (MUAC ≥ 23.5 cm)[27]. Iron tablet consumption was assessed by two metrics: frequency (once a week) and total annual intake, categorized as (1) Adequate if ≥ 26 tablets per year and (2) Insufficient if < 26 tablets. This categorization aligns with the standards outlined in Indonesian Ministry of Health Regulation, Number: 88 of 2014 regarding iron supplement standards for women of reproductive age and pregnant women, Circular Letter, Number: HK.03.03/V/0595/2016 on adolescent girls' iron supplementation, and Ministry of Health Regulation, Number: 51 of 2016 concerning

nutrition supplement standards[28]. Knowledge of anemia among adolescents was grouped into (1) High (score ≥ 70%) and (2) Low (score < 70%)[29]. Menstrual patterns were divided as follows: (1) Normal (cycle ≥ 23 days and duration ≤ 3 days) and (2) Abnormal (cycle < 23 days or duration > 3 days)[30]. Sleep quality was classified as (1) Adequate (≥ 8 hours per day) and (2) Poor (< 8 hours per day)[24]. Parental characteristics, including education, were categorized as (1) High, if graduated from senior high school and above and (2) Low, if graduated from middle or junior high school and below[31]. Employment status was grouped into (1) Employed and (2) Unemployed, while income was divided according to the Provincial Minimum Wage (PMW) for West Sumatra, with (1) High (≥ PMW, IDR 2,820,000) and (2) Low (< PMW)[32].

Data collection for both quantitative and qualitative components was conducted in person. Following quantitative data collection, qualitative research was carried out to provide in-depth insights into the school-based iron supplementation program, adolescent girls' iron tablet consumption behaviors, and the program's impact on anemia mitigation. In the qualitative portion, data were obtained from interviews with various informants related to the iron supplementation program, adolescent girls, and pertinent institutions (including program officials and school representatives). In-depth interviews were guided by a structured interview guide. To enhance data quality, triangulation of methods and sources was employed, followed by a systematic analysis involving data reduction and narrative presentation. Before data

collection, ethical clearance was obtained from the Research Ethics Committee at the Public Health Faculty, Universitas Andalas, under approval number: B/20/UN16.12.D/PT.01.00/2024 on 16th May 2024.

Quantitative data processing included editing, coding, entry, and cleaning, with analysis performed in SPSS using univariate, bivariate, and multivariate techniques. Univariate analysis results were tabulated, showing frequency and percentage distributions. Bivariate analysis was conducted via chi-square testing, while multivariate analysis utilized multiple logistic regression with the Enter method. The significance of relationships was determined by p-values < 0.05, with a Confidence Interval (CI) of 95%, and risk levels were expressed via the Odds Ratio (OR). Variables were identified as risk factors for anemia incidence if OR ≥ 1 and as protective factors if OR < 1[33].

RESULTS AND DISCUSSIONS

The study's results revealed that nearly a third of adolescent girls experienced anemia, with a prevalence rate of 28.1%. Additionally, approximately 31.0% of these adolescents exhibited low knowledge levels regarding anemia. Regarding iron tablet consumption, findings indicated that over half of the young women surveyed had never taken iron tablets weekly, and the total number consumed in the year was below 26 tablets, reported at 65.0% and 82.5%, respectively. Furthermore, 30.7% of adolescent girls were found to have irregular menstrual patterns, while 7.3% demonstrated poor sleep quality.

Table 1. Characteristics of adolescent girls

Variables	Frequency (n)	Percentage (%)
Anemia Status		
Anemia	77	28.1
Not anemia	197	71.9
Knowledge of Anemia		
High	189	69.0
Low	85	31.0
History of Consume Iron Tablets once a week		
Ever	96	35.0
No	178	65.0
Number of Consume Iron Tablets in a year		
Sufficient	48	17.5
Less	226	82.5
Menstruation Pattern		
Normal	190	69.3
Abnormal	84	30.7
Sleep Quality		
Adequate	254	92.7
Poor	20	7.3

The characteristics of the respondents' parents revealed that more than half of both fathers and mothers had completed their education at the high school level, at 55.8% and 50.7% respectively. In terms of employment, the majority of fathers were employed in occupations

such as farming, labor, or fishing, comprising 38.9% of the sample. Meanwhile, most mothers of adolescent girls were not formally employed, with 67.9% being homemakers.

Table 2. Characteristics of respondent parents

Parents of Respondent Characteristics	Frequency (n=274)	%
Father's education Level		
Not graduated Elementary School	5	1.8
Graduated Elementary School	22	8.0
Graduated Yunior High School	33	12.0
Graduated Senior High School	153	55.8
Diploma	20	7.3
University	41	15.0
Mother's education Level		
No School	2	0.7
Not graduated Elementary School	4	1.5
Graduated Elementary School	18	6.6
Graduated Yunior High School	42	15.3
Graduated Senior High School	139	50.7
Diploma	28	10.2
University	41	15.0
Father's working status		
Not working	6	2.2
Farmer/Fisherman	109	39.8
Trader	19	6.9
Businessman	58	21.2
Private Employee	42	15.3
Government Employee	40	14.6
Mother's working status		
Not working	186	67.9
Farmer/Fisherman	11	4.0
Trader	18	6.6
Businessman	26	9.5
Private Employee	17	6.2
Government Employee	16	5.8

The bivariate analysis results, as presented in Table 3, indicate a significant association between the father's education, adolescent knowledge about anemia, and both the history and amount of iron tablet consumption with anemia status in adolescent girls (p-value=0.039). Conversely, maternal education, father's occupation, maternal employment, income, menstrual patterns, and sleep quality did not show a significant association with anemia status in adolescent girls (p-value>0.05). Analysis of the percentage of factors related to anemia showed that adolescent girls without a weekly history of iron tablet consumption and those who consumed fewer than 26 tablets annually had a higher incidence of anemia than those who consumed iron tablets regularly and in greater amounts.

Table 3. Determinants of anemia status among adolescent girls

Variables	Anemia Status						p-value
	Not Anemia		Anemia		Number		
	n	%	n	%	n	%	
Father's education Level							
High	147	68.7	67	31.3	214	100	0.039*
Low	50	83.3	10	16.7	60	100	
Mother's education Level							
High	146	70.2	62	29.8	208	100	0.338
Low	51	77.3	15	22.7	66	100	
Father's working Status							
Working	192	71.6	76	28.4	268	100	1.000
Not Working	5	83.3	1	16.7	6	100	
Mother's working Status							
Working	65	73.9	23	26.1	88	100	0.723
Not Working	132	71.0	54	29.0	186	100	
Income							

Variables	Anemia Status						p-value
	Not Anemia		Anemia		Number		
	n	%	n	%	n	%	
High	107	71.3	43	28.7	150	100	0.925
Low	90	72.6	34	27.4	124	100	
Knowledge of Anemia							
High	128	67.7	61	32.3	189	100	0.032*
Low	69	81.2	16	18.8	85	100	
History of Consume Iron Tablets once a week							
Ever	77	80.2	19	19.8	96	100	0.035*
No	120	67.4	58	32.6	178	100	
Number of Consume Iron Tablets in a year							
Sufficient	41	85.4	7	14.6	48	100	0.034*
Less	156	69.0	70	31	226	100	
Menstruation Pattern							
Normal	143	75.3	47	24.7	190	100	0.086
Not Normal	54	64.3	30	35.7	84	100	
Sleep Quality							
Adequate	182	71.7	72	28.3	254	100	0.950
Poor	15	75.0	5	25.0	20	100	

*) Chi-square test, significant if p-value<0.05

The univariate analysis revealed that nearly one-third of young women in the study suffered from anemia, and compliance with weekly iron tablet consumption was low, with 65% of respondents not taking the tablets as recommended. Factors such as the father's education level, nutritional knowledge, and the history and quantity of iron tablet consumption were significantly associated with anemia. Educated parents, especially fathers, play a key role in raising awareness about nutritious food choices, encouraging their daughters to take iron tablets[34,35]. However, in the present study showed that it was not only education level had association with the prevalence of anemia, but it might be other factor in parental characteristic such as a higher knowledge about healthy and nutritious diet might had contribution to its occurrence of anemia among adolescent girls.

The anemia incidence found in this study closely aligns with findings by Priyanka Pareek et al. (2022) in Navi Mumbai, India, and Siti Masfiah et al. (2021) in Central Java, Indonesia, where anemia prevalence was around 30%[19,36]. However, results differed from those of Nazneen Habib et al. (2020) in Azad Jammu and Kashmir, Pakistan, where almost 50% of adolescent girls were anemic due to factors such as parental education, economic conditions, infection prevalence, menstrual issues, exercise habits, meal regularity, and sanitation practices[37]. Puspa Sari et al. (2022) also reported a lower anemia prevalence (14%) in Soreang, Bandung, West Java, attributing anemia among adolescent girls primarily to MUAC and the duration of menstrual blood loss [38]. Variations in causal factors across these studies could be attributed to differences in age groups, target variables, and study locations. While previous studies often focused on young women aged 15–19 and were conducted in rural areas, this study targeted adolescents aged 12–17 in urban and suburban school settings.

Following the bivariate analysis, a multivariate analysis was conducted to identify the most significant factors associated with anemia status among adolescent girls. The multivariate analysis was performed using the Multiple Logistic Regression Test with the enter method, beginning with model selection to determine which factors were appropriate for inclusion in the test. The analysis results are as follows:

Table 4. Dominant factor of anemia status among adolescent girl

Variables	p-value	OR*	95% CI	
			Lower	Upper
First Model				
Father's education Level	0.084	0.511	0.239	1.094
Knowledge of Anemia	0.018**	0.457	0.239	0.875
History of Consume Iron Tablet once a week	0.198	1.641	0.722	3.488
Number of Consume Iron Tablets in a year	0.180	2.067	0.715	5.977
Menstruation Pattern	0.034**	1.884	1.050	3.380
Last Model				
Father's education Level	0.065	0.491	0.230	1.046
Knowledge of Anemia	0.028**	0.489	0.258	0.926

Variables	p-value	OR*	95% CI	
			Lower	Upper
History of Consume Iron Tablet once a week	0.013**	3.034	1.260	7.307
Menstruation Pattern	0.037**	1.861	1.040	3.330

*) OR = Odds Ratio

**) Multivariable logistic regression test, significant if p-value<0.05

The results of the multivariate analysis indicated that the most significant variable associated with the incidence of anemia in adolescent girls was a history of consuming iron tablets once a week. Specifically, the analysis revealed that teenagers who had never consumed iron tablets once a week were 3.03 times more likely to experience anemia compared to those who had consumed iron tablets weekly, even after controlling for factors such as father's education, knowledge about anemia, and menstrual patterns of female adolescents.

Based on the quantitative data, an investigation was conducted into the iron tablets program and the consumption behavior of young women at school. In-depth interviews with nutrition officers revealed that the iron tablets program's implementation was relatively effective, with collaboration between the Community Health Center and the school. However, educational activities to support the program, along with monitoring and evaluation, were still suboptimal. Additionally, the understanding of young women regarding efforts to combat anemia varied, with many expressing concerns about the negative side effects associated with consuming iron tablets. The lack of consistent program follow-up and insufficient educational efforts may contribute to the low compliance rates (65% of participants had never consumed iron tablets in a week). Improvement the aspects in the next intervention could effective and increase the compliance of iron tablets consumption and overcome anemia among adolescent girls.

The relationship between iron tablet consumption and the incidence of anemia was analyzed based on the history of iron tablet intake over one week and the total amount consumed. The findings indicated that the iron tablets program for adolescent girls in Padang City was not functioning effectively, as only 35% of adolescent girls reported consuming iron tablets within the past week, and merely 17.5% consumed 26 or more tablets in a year. In-depth interviews with adolescent girls revealed that concerns about side effects and a lack of confidence in the efficacy of iron tablets contributed to their reluctance to consume them. This hesitance may be attributed to the fact that anxiety disorders are prevalent among the 10-19 age group, particularly in younger adolescents compared to adults. The anxiety experienced by young women may stem from insufficient knowledge regarding the importance of iron tablets for their health.

This research had both strengths and limitations. One strength was the use of a mixed-methods approach, which not only provided a comprehensive overview of the factors most related to anemia status in adolescent girls but also yielded in-depth information about the implementation of iron tablets distribution program and its connection to efforts in combating anemia and the consumption behaviors of adolescent girls in Padang City.

However, a limitation of this study was the sample representativeness which represented the results for adolescent girls aged 12 until 16 years. Besides, the lack of exploration into dietary quality, health status, and physical activity among adolescent girls, which also play a role in anemia. Therefore, further investigation is necessary to examine these factors in future research to offer a more holistic understanding of the causes of anemia and to enhance intervention strategies. This research aimed to address the reasons why young women are hesitant to take iron tablets, enabling the design of more effective strategies to combat anemia in this demographic and improve the success of the iron tablets program.

CONCLUSIONS

The issue of anemia among adolescent girls primarily arises from their inadequate consumption of iron tablets, alongside factors such as poor nutritional conditions and limited knowledge about anemia. Consequently, the program for distributing blood supplement tablets, or iron tablets, has not been effectively implemented to address anemia in this demographic. To combat this issue, intensive nutrition education emerges as a crucial strategy to enhance the understanding of both adolescent girls and their parents. This education aims to promote better consumption behaviors regarding iron tablets, especially since many adolescent girls begin menstruating during this critical period. Moreover, collaboration between educational institutions, schools, and health organizations is essential for designing innovative nutrition programs. Such partnerships will not only facilitate the effective implementation of the iron tablets program but also ensure robust monitoring and evaluation processes. This collaborative approach will help accelerate efforts to address anemia in adolescent girls while also contributing to the broader goal of alleviating stunting among this population.

AUTHOR CONTRIBUTIONS

RA: conceptualization, investigation, writing–original draft; AZ: methodology, supervision, and writing–review; FE: methodology, formal analysis; KD: writing–review and editing.

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