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## Iron Consumption and Anemia in Adolescent Girls in Junior High School 1 Tanjung Sari, South Lampung

Anisa Nuraisa Jausal<sup>1\*</sup>, Reni Zuraida<sup>1</sup>, Susianti<sup>1</sup> <sup>1</sup>Department Master of Public Health, Faculty of Medicine, Lampung University,

Indonesia

\*Email: anisa.nuraisa@fk.unila.ac.id

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#### Abstract

The prevalence of adolescents with a lack of macro- and micronutrients is quite high, most of which manifest as anemia. The need for iron in adolescent girls is more than that of boy because every month the adolescent girls have menstruation which causes iron production to increase. In Indonesia, it is estimated that most anemia occurs due to iron deficiency due to insufficient intake of iron source foods.

This study aims to examine the relationship between iron consumption and the incidence of anemia in adolescent girls of Junior High School (SMPN) 1 Tanjung Sari, South Lampung. This study is an analytical observational study with a cross-sectional research design carried out from January to March 2022 with the research sample being adolescent girls in VII and VII grade with total of 41 respondents. Iron consumption assessment was carried out using a semiquantitative food frequency questionnaire (SQ-FFQ) and a 3x24 hour food recall. The results of this study showed that 22 respondents (53.7%) had moderate anemia and 19 respondents (46.3%) respondents had mild anemia, the result of iron consumption assessment using SQ-FFQ is 10.27mg and using food recall is 5.34mg. The results of a bivariate statistical analysis showed no significance relationship between anemia and adolescent girls iron consumption with p value 0.630.

*Keywords*: adolescent girls, anemia, iron consumption

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### Introduction

The prevalence of adolescents with macro- and micronutrient deficiencies is quite high, most of which manifest as anemia (Galloway, 2017). Anemia is a serious global public health problem that mainly affects adolescent girls and pregnant women (WHO, 2022) which is an intermediate when the number of red blood cells or the concentration of hemoglobin that carries oxygen throughout the body is lower than normal (UNICEF, 2022). The need for iron in adolescent girls is more than that of boy because every month the adolescent girls have menstruation which causes iron production to increase. In Indonesia, it is estimated that most anemia occurs due to iron deficiency as a result of insufficient intake of iron source foods (WHO, 2011) especially meat and poultry sources (heme iron) (Ministry of Health of the Republic of Indonesia 2016).

Iron in meat and poultry food sources (heme iron) can be absorbed by the body between 20-30%. Plant-based foods also contain iron (non-heme iron) but the amount of iron that can be absorbed by the intestines is much less than iron from meat and poultry sources. Non-heme iron that can be absorbed by the body is 1-10% (Ministry of Health of the Republic of Indonesia, 2016). In accordance with WHO recommendations in 2011, efforts to overcome anemia in adolescents and women of childbearing age are focused on promotional and preventive activities, namely increasing consumption of iron-rich foods, supplementation of iron tablets, as well as increasing fortification of foodstuffs with iron (wheat flour, rice, cooking oil, butter, and some snacks) and folic acid (Ministry of Health of the Republic of Indonesia, 2018).

The iron intake behavior of adolescent girls in Indonesia is still lacking as in Grobogan Regency (Saptyasih, 2016), in Manado (Paputungan, 2016), in Semarang (Indartanti, 2014), in Jakarta (Junengsih, 2017), in Gresik (Sholicha, 2019), and in Bandar Lampung (Zuraida, 2020). Iron source intake is related to the health of adolescent girls, for example with the incidence of dysmenorrhea (Masruroh, 2019), menstrual length (Novita and Hidayati, 2021), the risk of chronic lack of energy (Telisa and Eliza, 2020), and physical stamina (Dwiati, 2016).

The coverage of iron tablets in adolescent girls in South Lampung in 2018 was 78.62% (Ministry of Health of the Republic of Indonesia, 2019) which indicates that the scope of giving





iron tablets is quite wide. However, the incidence of anemia in young women is still found in South Lampung. This shows that there are other causes that cause the anemia rate of adolescent girls in South Lampung to remain high, so researchers want to analyze the effect of iron consumption with static anemia in adolescent girls in Junior High School (SMPN) 1 Tanjung Sari, South Lampung.

#### Methods

This study is an analytical observational study with a cross-sectional research design carried out from January to March 2022 with the research sample being adolescent girls in VII and VII grade in Junior High School (SMPN) 1 Tanjung Sari with total of 41 respondents. The sampling technique used is total sampling, which is a sample determination technique when all members of the population are used as samples. The inclusion in this study are adolescent girls with mild and moderate category anemia, ages between 12-14 years, menarche, live in with family, willing to be a research respondent, and not in a state of pregnancy. The exclusion criteria in this study are respondents changed schools; respondents who experience diseases that can interfere with research (suffering from thalassemia, tuberculosis, HIV / AIDS, chronic malaria); respondents who experienced excessive menstruation (irregular menstrual schedule (< 21 days), excessive menstrual blood, > 7 days and bleeding occurred outside the menstrual cycle); respondents who regularly took multivitamins and iron supplements.

Blood examination to determine hemoglobin levels was carried out at the Tanjung Sari Health Center laboratory, South Lampung. Iron consumption assessment was carried out using a semi-quantitative food frequency questionnaire (SQ-FFQ) and a 3x24 hour food recall. The research was conducted when the Tanjung Sari area was in the phase of imposing restrictions on community activities level 2 because COVID-19 cases were on the rise, so that learning activities in schools were divided into 2 sessions and each session was only attended by 50% of all students. Research data collection was carried out with visits to schools and direct visits to the homes of each research subject which were carried out by implementing appropriate health protocols.

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#### **Results and Discussion**

The characteristics of the respondents in this study can be seen in table 1. The age of respondent ranged from 12-13 years old (95,1%) and 14-15 years old (4,9%). Most of the nutritional status was normal (59%), while underweight (39%) and overweight (2%). The duration of the respondents' menstruation was more than 7 days are 70%. The anemia status of the respondents was mostly moderate (53,7%) and the rest were mild (46,3%).

Several previous researchers have researched the incidence of anemia in Lampung but did not examine the degree of anemia that occurs in adolescent girls. The study included adolescent girls who experienced anemia in Central Lampung by 60.8% (Listiana, 2016), 80.9% of adolescent girls who had anemia in East Lampung (Astuti, 2016), 50.6% of adolescent girls had anemia in Mesuji (Nurhayati, 2019) and adolescent girls in Bandar Lampung as much as 49.30% (Zuraida, 2020b).

able 1. Respondent characteristics of Adolescent Onis in 515 1 Tanjung San							
	Characteristic			N	%		
_	Age		12-13 years old	39	95.1		
τ	1 T		14-15 years old	2,	1 (14.9 ' 1 /1	THEO	
Internai	Grade	na.	VII Feath.	24	59%	IHEN	
************	Journe		VIII	17	41%	0 * * * * * * *	
	Nutritional Status		Underweight	16	39%		
			Normal	24	59%		
			Overweight	1	2%		
	Duration Menstruation	of	$\leq$ 7 Days	12	29%		
			$\geq$ 7 Days	29	70%		

Table 1. Respondent Characteristics of Adolescent	Girls in JHS	1 Tanjung Sari
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At the beginning of the reproductive age, adolescent girls need a lot of iron reserves, if the adolescent girls has anemia and accompanied by an increasing need for iron for growth, menstrual periods and reserves for pregnancy, it is feared that the amount of iron contained in the adolescent girls' body is insufficient for future pregnancy (Beard, 2000) which can result in anemia in the early trimester of pregnancy which can result in low baby weight and preterm labor (Means, 2020).

Data collection on the assessment of iron consumption of young women was carried out using a semi-quantitative food frequency questionnaire (SQ-FFQ) questionnaire and food recall 3

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times 24 hours, the results were obtained as stated in table 2. Based on the results of SQ-FFQ, it was found that the average iron consumption of respondents was 10.27mg which means that it only met 68% of the daily nutritional needs of adolescent girls, but when further studied using food recall 3 times 24 hours it was found that the average iron consumption of respondents was only 5.34mg which only meant that it met 36% of the daily iron needs of dolescent girls, which was 15mg per day Ministry of Health of the Republic of Indonesia, 2014), while the highest iron consumption was only 8.8mg. It must be done to meet the daily iron needs of adolescent girls as much as 4.73mg.

#### Table 2. Iron Consumption of Adolescent Girls in JHS 1 Tanjung Sari

-	Iron Consumption	Mean	Minimum	Maximum
_	SQ-FFQ	10.27	3.9	17.1
_	Food Recall	5.34	2.5	8.8

The fulfillment of daily iron needs can be carried out nutritional interventions by adding menus or portions of iron sources such as animal protein or foods rich in vitamin C which act as *an enhancer* of iron absorption in the body (Tahir et al., 2020) which is consumed daily by adolescent girls. Protein plays a role in the process of transporting iron to the spinal cord for the formation of new hemoglobin so that if there is a lack of protein body, the iron transportation process will be disturbed and affect hemoglobin levels in the body (Akib, 2017).

The addition of food portions that can be added can be modified from the variations of the menu that are often consumed by respondents, such as the results obtained from SQ-FFQ in table 3. Based on the SQ-FFQ analysis, it was found that the source of heme iron commonly consumed by respondents was eggs, meatballs, which are sometimes consumed are fresh fish, chicken and what is rarely consumed is sausage, while for non-heme iron sources commonly consumed are tempe, tofu, which are sometimes consumed are water spinach, spinach, and what is rarely consumed is mung beans.



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Table 3. SQ-FFQ Analysis Results of Heme and Non Heme Iron Sources of Adolescent Girls' Daily Consumption in JHS 1 Tanjung Sari

Food Groups	Food	Feeding Frequency	Iron Content per Serving (mg)
Heme Iron Source	Eggs	Commonly consumed	1,65
	Meatballs	Commonly consumed	4,79
	Fresh fish	Occasionally	0,4
	Chicken	Occasionally	0,75
	Sausage	Infrequently	0,55
Non Heme Iron Source	Tempe	Commonly consumed	0,75
	Tofu	Commonly consumed	3,4
	Water spinach	Occasionally	2,3
	Spinach	Occasionally	3,5
	Mung beans	Infrequently	1,87

Information:

- a. Commonly consumed: 3x/ weeks to >1x/ day
- b. Occasionally: 1-2x/ weeks
- c. Infrequently: < 1x/ weeks a of feath fall and botta (171) Another SQ-FFQ analysis was in the food group of iron enhancers and inhibitors listed in

table 4. Based on the analysis, it was found that the enhancer that is commonly consumed is banana, while for inhibitors that are commonly consumed are tea.

Table 4. Analysis of SQ- FFQ	Enhancers and Inhibitors of	of Adolescent Girls	' Daily Consumption	on in JHS 1
Tanjung <u>Sari</u>				

Food Groups	Food	Feeding Frequency
Enhancer	Banana	Commonly consumed
	Orange	Occasionally
	Papaya	Infrequently
	Vit C Drinks	Infrequently
	Apple	Infrequently
Inhibitor	Tea	Commonly consumed
	Coffee	Infrequently

Information:

a. Commonly consumed: 3x/ weeks to >1x/ day



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- b. Occasionally: 1-2x/ weeks
- c. Infrequently: < 1x/ weeks

Based on the analysis of adolescent girls' iron consumption using SQ-FFQ, researchers have several suggestions for nutritional interventions as a solution to increase daily iron consumption of adolescent girls, namely as follows:

a. Additional portions and food menu

Additional portions or food menus of 4.73mg of iron that can be done to meet 15mg of the daily needs of adolescent girls (Ministry of Health of the Republic of Indonesia, 2014) based on the results of the SQ-FFQ analysis as stated in the following table:

 Table 5. Recommendation of Additional Menus and Meal Portions for Adolescent Girls' Daily

 Consumption in JHS 1 Tanjung Sari

Food	Food Menu	Iron Household Size Content (mg)		Daily Consumption Recommendations
		- G1-11		2 servings / day (1 serving in the
Internat	Omelette	l of Health, 1	Educatio	morning and 1 serving in the afternoon)
				2 servings / day (1 serving in the
	Sunny side up	1	3,4	morning and 1 serving in the
				afternoon)
				2 servings / day (1 serving in the
	Kalio	1	1,9	morning and 1 serving in the
				afternoon)
Meatballs	Meatballs	5 big meatballs + 20 small meatballs	4,79	1 servings / day
	Sautánd broccoli	10 small meatballs		2 servings / day (1 serving in the
	and meatballs	<sup>1</sup> ⁄ <sub>2</sub> glass	2,1	morning and 1 serving in the
				afternoon)



				2 servings / day (1 serving in the	
Fish	Fish Gulai	2 medium pieces	2,2	morning and 1 serving in the	
				afternoon)	
	Fried	2 medium pieces	7,68	1 servings / day	
Tofu	Fried	1 large pieces	4,1	1 servings / day	
				2 servings / day (1 serving in the	
	Mun tofu	1 large pieces	2,5	morning and 1 serving in the	
				afternoon)	
Tempe	Chips	1 glass	6,9	1 servings / day	
Fried 4 m		4 medium pieces	3,0	1-2 servings / day	
<b>XX</b> 7 /				2 servings / day (1 serving in the	
water	Pelecing	1 glass	2,1	morning and 1 serving in the	
spinach				afternoon)	
Spinach	Chips	1 glass	3,6	1 servings / day	
	Sautéed with	- and		<i></i>	
T	coconut milk	I glass	0,8	5 servings / day $1 (1 + 1)$	
Internat	ional lourna	al of Health. I	ducatio	on and Social (IIIIIES)	

The addition of food menus, for example, variations of the egg menu, namely omelets or sunny side up, variations of the chicken menu, namely chicken noodles and green vegetables such as spinach chips. In table 3, which shows five kinds of heme iron sources commonly consumed by respondents, it shows that respondents rarely or never consume chicken liver, it can be modified into ground chicken nuggets mixed with chicken liver so that it becomes more attractive to consume by adolescent girls.

In Indonesia, especially in Lampung, students' lunches are not provided by the school, coupled with the pandemic situation so that students are only in school for only 2 to 3 hours without being accompanied by rest time. The addition of portions and menus of food or lunch programs has been carried out in several studies, one of which is the provision of lunch for elementary school students in West Java (Sekiyama, 2017) which was carried out for 1 month and showed an increase in hemoglobin levels in anemia



students. Research in China provided dietary interventions to students suffering from anemia in the form of consuming 30-40gr of pork liver, lamb liver, chicken liver or 1-2 eggs or 30 red date seeds (jujube or *Ziziphus jujuba*) before or after eating once a day effectively in improving the state of iron deficiency anemia (Sun et al., 2018). Research in Uganda in 2005 (Adelman, 2019) conducted a food for education (FFE) program, namely by providing food in schools and showed results of a decrease in the degree of anemia in people with moderate-severe anemia.

b. Home food fortification

Nutritional interventions by providing fortification to food have been carried out in several studies, for example in Laos (Barffour et al., 2019) which provided *micronutrient powder* (MNP) fortification in children aged 6-23 months and showed an increase in iron levels in their research samples, other research in Kenya (Suchdev, 2012) shows that the administration of MNP can reduce the rate of anemia in children with lower economic class. For larger populations, fortification can be given to foodstuffs such as cornmeal (Garcia-Casal, 2018). Some studies on the administration of MNP are mainly carried out in children under 5 years of age, for giving to adolescents have not been widely studied, so it can be an inspiration for further research.

c. Supplementary feeding or drinks (biscuits or juices)

Supplementary feeding in adolescent girls can increase hemoglobin levels as in the research of Syahwal (2018) and Dewi (2017) in adolescent girls who were given *snack bars* made of nagara bean flour and herring, as well as research by Kartika Sari (2015) giving biscuits added with snakehead fish meal to anemic adolescent girls and an increase in hemoglobin levels.

Giving biscuits as an additional food can be used as an option to increase the hemoglobin levels in adolescent girls, especially in adolescents who are reluctant to eat more frequent. Another option is the administration of supplementary drinks such as

100mg mung bean drink or 100mg red guava juice which can also raise hemoglobin levels (Amalia, 2021).

## d. Iron Tablets Supplementation

Daily iron supplementation in the form of iron tablets is recommended as a public health intervention in adult women who menstruate and adolescent girls. The composition of the iron supplementation given is elemental iron 30–60mg which is equivalent to 150–300 mg of ferrous sulfate heptahydrate, 90–180 mg of ferrous fumarate or 250–500 mg of ferrous gluconate in the form of tablets (World Health Organization, 2016).

Iron tablets can be given per week through school (Gosdin et al., 2021) or twice a week (Gupta et al., 2014) for three consecutive months of the year (World Health Organization, 2016). Research conducted by Susanti (2016) shows that iron supplementation on a weekly basis has the same effectiveness as weekly and during menstruation in increasing hemoglobin levels in adolescent girls. Iron supplementation in adolescents should be given on an intermittent basis (weekly) with the added added benefit of high adherence to supplement consumption (Susanti, 2016).

Compliance is required in the consumption of iron tablets. According to research conducted by Putra (2020) adherence to iron tablet consumption is related to the incidence of anemia, in line with the research of Pramardika and Fitriana (2019) which states that hemoglobin levels in adolescent girls are influenced by adherence to iron tablet consumption. Research by Savitri (2021) shows that the more obedient it is in consuming iron tablets, the hemoglobin levels of young women will increase.

To maintain compliance with the consumption of iron tablets in adolescent girls, monitoring is needed by the supervisor, especially the adolescent girls' homeroom teacher. The procurement of iron tablets can be coordinated by schools and local health centers, it is better to avoid hoarding iron tablets in schools so that the packaging is not damaged and it is easier to evaluate the remaining iron tablets. Research conducted by

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Nuradhiani et al (2017) showed that compliance in the consumption of iron tablets was highest in the group of respondents who were given monitoring cards in the form of leaflets, teacher signatures and the addition of information about anemia and iron tablets. In line with research conducted by Widiastuti and Rusmini (2019) where the school determines the days for simultaneous consumption of iron tablets in order to monitor the development of obedient students in the consumption of iron tablets.

The results of a bivariate analysis of the status of anemia and iron consumption of young women are listed in table 6, it was found that as many as 52.4% of young women who experienced mild anemia had insufficient iron consumption, but as many as 60.0% of young women who had moderate anemia had sufficient iron consumption. Based on statistical analysis, it was found that the status of anemia and iron consumption had a meaningless relationship with a *p-value of* 0.630. This is in line with research conducted by Lestari (2018) that there is no meaningful relationship between iron consumption and the incidence of anemia in students of SMP Negeri 27 Padang.

Based on a bivariate analysis, 60% of adolescent girls who have anemia are consuming enough iron, it can be assumed that the absorption of iron by the adolescent girls' body is not good enough. The absorption of iron in the body is affected by the consumption of iron *enhancers* and *inhibitors* as shown in table 4. Research by Masthalina (2015) states that there is a significant relationship between *inhibitor* consumption and anemia status (p= 0.004).

The inhibitor most often consumed by adolescent girls of SMPN 1 Tanjung Sari is tea. Consumption of 1 cup of tea a day can reduce Fe absorption by 49% in people with iron deficiency anemia, while consumption of 2 cups of tea a day decreases Fe absorption by 67% in people with Fe deficiency anemia. Tea consumed after eating for up to 1 hour will reduce the absorption of red blood cells to iron by 64% therefore it is recommended to consume tea 2 hours after meals (Masthalina, 2015), while the consumption pattern of adolescent girls in Tanjung Sari likes to drink sweet tea or *Thai tea* at the same time as meals.

Apart from being caused by *inhibitors*, impaired iron absorption can also occur due to infections that occur in the body, for example helminthiasis and malaria. In Indonesia, infections



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of soil-borne worms are still very high, with prevalence ranging between 20% and 50%, and even higher in some districts (Global Atlas of Helminth Infections, 2022). Although the prevalence of malaria has begun to decline in 2017 with more than half of Indonesia's territory being malaria-free, the incidence of malaria still remains. In 2004 there was an overall decrease of 17% and 87% in 2014 in malaria cases and deaths (Sitohang et al., 2018).

Table 6. Bivariate Analysis of Anemia Status and Adolescent Girls' Iron Consumption in JHS 1 Tanjung Sari

Dall							
Adolescent			An	emia Statu	S		
Girl's Iron	Mild Ar	Mild Anemia Moderate Anemia		Total			
Consumption –	n	%	n	%	n	%	- P-value
Sufficient	8	40.0%	12	60.0%	20	100.0%	
Insufficient	11	52.4%	10	47.6%	21	100.0%	0.630
Total	19	46.3%	22	53.7%	41	100.0%	

## **Conclusion and Recommendation**

There was no significance relationship between iron consumption and the incidence of anemia in adolescent girls of Junior High School 1 Tanjung Sari Lampung Selatan (p > 0.05). Recommendations that can be done are additions of portion and food menu, home food fortification, supplementary food or drinks (biscuits or juices) and iron tablets supplementation.



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