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The Relationship between the Compliance of TTD Consumption, Nutrition Intake, and Nutrition Status on the Incidence of Anemia in Adolescent Girls at SMPN 1 Gunungsari

Hubungan Kepatuhan Konsumsi TTD, Asupan Zat Gizi, dan Status Gizi terhadap Kejadian Anemia pada Remaja Putri di SMPN 1 Gunungsari

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ABSTRACT

Background: Female adolescents are a group that is prone to having anemia because they are in the second growth spurt phase and experience menstruation monthly. Anemia in young women causes a detrimental effect. The increase in prevalence of anemia can be prevented and reduced by iron supplementation in women of reproductive age, including female adolescents.

Objectives: This study aims to determine the relationship between the compliance of iron supplement consumption, nutrient intake, and nutritional status with the incidence of anemia in female adolescents at SMPN 1 Gunungsari.

Methods: This study used a cross-sectional design. The research population was female students at SMPN 1 Gunungsari, totaling 290 female students. The sample in this study was selected using a stratified random sampling method, totaling 61 respondents. The data collection used Hb examination, SQ-FFQ form, and anthropometric examination. Analysis of the relationship used the Chi-Square test and Fisher's Exact.

Results: The results of this study showed that there was a relationship between the compliance of iron tablets consumption (p=0.002), protein intake (p=0.034), and iron (p=0.046) with the incidence of anemia, and there was no relationship between intake of vitamin C (p=0.139), iron inhibitors (p=0.183), and nutritional status (p=1.000) with the incidence of anemia in female adolescents at SMPN 1 Gunungsari.

Conclusions: This study concludes that there is a relationship between compliance to iron supplement consumption, protein, and iron intake with the incidence of anemia, and there is no relationship between intake of vitamin C, iron inhibitors, and nutritional status with the incidence of anemia.

INTRODUCTION

Based on the 2021 youth profile, 46 million Indonesians are adolescents who experience biological and physiological changes, resulting in a significant increase in nutritional needs to support growth[1,2]. Female adolescents are one of the groups that apply poor eating habits and lifestyles, so this is related to behavioral factors that want to look slim so that they limit food intake to maintain body shape. Long-term implementation of this behavior can cause anemia[3,4].

Generally, anemia is a result of iron deficiency in the body. Based on data from the World Health Organization (WHO), 29.9% of women of reproductive age experienced anemia in the world[5]. There was an increase in the prevalence of anemia in Indonesia in 2018 from 26.4% to 26.8% in children aged 5-14 years and from 18.4% to 32% in adolescents aged 15-24 years. The incidence of anemia was more prevalent among females (27.2%) than males (20.3%)[6,7]. The high prevalence of anemia in women is related to the menstrual cycle experienced every month, allowing the body to lose more iron[8]. The Health Office of Serang conducted a survey in 2018 that showed 92 percent of 1280 school-age girls suffered from iron deficiency anemia, and only 98 young females had normal hemoglobin status[9].

Untreated anemia in female adolescents can cause a decrease in the immune system, which can increase the risk of infection[13]. The decline in learning achievement can also be experienced due to a lack of oxygen distribution to brain and muscle cells so problems with concentration and thinking agility occur. In addition, height growth is not optimal in the peak height velocity phase due to a lack of micronutrient intake. The long-term impact of untreated anemia can affect the pregnancy and childbirth phase, increasing the risk of premature birth, bleeding during and after childbirth, low birth weight, and an increase in maternal mortality rate[10,11,14]. According to WHO, anemia is acquired by a lack of nutrient intake, contagious diseases, hemoglobinopathy, and menstruation[15]. The previous

research also stated that the incidence of anemia can be affected by diet, level of knowledge, infectious diseases, economic level, and nutritional status[10,16,17].

Dietary mistakes that do not pay attention to the regularity of meal frequency and unbalanced nutrient intake that includes macronutrient intake, protein, and fat, as well as micronutrients such as vitamins C, vitamin B12, iron, folic acid, and zinc, affect increasing the prevalence of anemia. In addition, consuming inhibitory substances such as phytate, tannin, oxalate, and calcium is also associated with anemia because they can inhibit iron absorption in the body[18–22]. Protein is a building and regulating substance that plays a role in hemoglobin-producing and circulates iron in the body. Inadequate protein levels can interfere with transporting iron, forming hemoglobin formation and red blood cells, thereby contributing to anemia in the body[23]. Protein joining with iron, with the role of distributing oxygen throughout the body, will form hemoglobin[18]. Iron intake that meets the daily nutritional needs impacts increasing hemoglobin levels, thus preventing anemia[24]. If the hemoglobin level in the body is still low, vitamin C intake is needed to increase iron absorption because it can change the ferrous form in the small intestine. This condition is related to the ability of vitamin C to increase the absorption of nonheme iron up to four times[25,26]. The incidence of anemia can also be due to the consumption of iron absorption inhibitors that can bind iron content in food, so it is hard absorbed in the intestine[18,27].

Inadequate intake of these nutrients can affect the nutritional status of individuals, resulting in macro- and micronutrient deficiencies that cause weight loss, thinness, susceptibility to disease, and micronutrient deficiencies that can cause anemia[28]. Inappropriate eating behavior to maintain a slim body shape in female adolescents impacts the lack of nutrient intake due to excessive food restrictions[16]. Previous research shows that compliance with TTD (iron supplement) consumption, nutrient intake, and nutritional status are some factors influencing the incidence of anemia in adolescent groups[24,29–33]. Based on the "Aksi Bergizi" national action conducted at SMPN 1 Gunungsari in December 2022, out of 71 samples that had their blood hemoglobin levels checked, 34 (47.8%) female adolescents experienced anemia. The prevalence rate was a value of >40%, so the conclusion was that the incidence of anemia in SMPN 1 Gunungsari Serang Regency might constitute a consequential health problem[34]. Therefore, this study aims to investigate the relationship between the compliance of TTD (iron supplement) consumption, nutrient intake, and nutritional status to the incidence of anemia in female adolescents at SMPN 1 Gunungsari, Serang Regency.

METHODS

This research is analytic observational research with a cross-sectional approach conducted in May 2023 at SMPN 1 Gunungsari, Serang Regency. The population of this research is 290 students of SMPN 1 Gunungsari, Serang Regency. Calculating the hypothesis test formula for two proportions comparison was done to the number of respondents, and then adding 10% was made to anticipate dropouts. So, the total research sample is 61

respondents. The sample in this research was selected using the stratified random sampling method in which the sample must meet the inclusion and exclusion criteria. The inclusion criteria for this research include active students at SMPN 1 Gunungsari, Serang Regency, grades VII and VIII aged 12-15 years, willing to become respondents, and not having a history of certain diseases such as hemoglobinopathy, worm infections, malaria, cancer, tuberculosis, and HIV. The exclusion criteria for this research are active students who were menstruating, sick, and absent during the research. The data used in this research include respondent characteristics, nutrient intake, nutritional status, and hemoglobin levels. Assessment of nutrient intake was obtained from the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) method, carried out by asking 50 kinds of food ingredients high in protein, iron, vitamin C, and iron inhibitors consumed during the last three months. Meanwhile, data collection on nutritional status was from anthropometric measurements with digital weight scales and microtia, and hemoglobin levels were obtained from direct blood collection by injecting the fingertip previously cleaned with antiseptic, then dripping a little blood sample on the Quick-Check Hb tool with the Point of Care Testing (POCT) method. This research was under a research ethics approval letter issued by the UPN Veteran Jakarta's Research Ethics Committee Number: 52/III/2023/KEPK.

Anemia status grouping in this study is based on Hb levels. If Hb <12 g/dL, then the respondent was considered anemic. Meanwhile, if Hb >12 g/dL, the respondents were non-anemic. Respondents' compliance in consuming TTD (iron supplement) was assessed by summing up the total score of three questionnaire questions and then compared with the median value. If the total score was ≤ the median, the respondent was non-compliant in the consideration. Meanwhile, if the total score was > median, the respondents were compliant in consuming TTD (iron supplement). Protein consumption was adequate if the overall intake was at least 80% of the Nutrient Adequacy Level (NAC). Conversely, protein intake was inadequate if the total intake was <80% of the RDA[35]. Iron and vitamin C consumption was adequate if the total intake was ≥77% of the RDA and inadequate if the total intake was <77% of the RDA[36]. The frequency of iron inhibitor intake was categorized as infrequent if consumed ≤2x/week (less or equal to 2 times per week) and frequent if consumed >2x/week (more than 2 times per week)[37]. The nutritional status grouping in this study was "thin" and "non-thin" nutritional status, whereas the "non-thin" group included respondents with normal, overweight, and obese BMI/U values. Univariate and bivariate analysis of all variables of this study used SPSS Statistics 24 data processing software.

RESULTS AND DISCUSSION
Univariate Analysis

The characteristics of the respondents in this study include age and class. The frequency distribution of respondents' age was between 12 and 15 years old. Meanwhile, the distribution of respondents' classes was in grades 7 and 8.

Amerta Nutrition

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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Table 1. Respondent Characteristics

Characteristics	Frequency	Percentage (%)
Age (Years)		
12	17	27.9
13	26	42.5
14	14	23
15	4	6.6
Class		
7	37	60.7
8	24	39.3

The variables of this study include anemia status, compliance with TTD (iron supplement) consumption, nutrition intake including protein, iron, vitamin C, and iron inhibitor intake, and nutritional status. Anemia status was grouped into "anemia" and "non-anemia". Compliance with TTD (iron supplement) consumption was grouped into "compliant" and "non-compliant". Protein, iron, and vitamin C intakes were grouped into "adequate" and "inadequate". Iron inhibitor intake was grouped into "frequent and infrequent". Nutritional status intake was grouped into "thin" and "non-thin".

Table 2. Univariate Analysis Table

Variables	n	%
Anemia Status		
Anemia	12	19.7
Non-Anemia	49	80.3
Compliance to TTD Consumption		
Non-compliant	21	34.4
Compliant	40	65.6
Protein Intake		
Inadequate	29	47.5
Adequate	32	52.5
Iron Intake		
Inadequate	30	49.2
Adequate	31	50.8
Vitamin C Intake		
Inadequate	29	47.5
Adequate	32	52.5
Iron Inhibitor Intake		
Frequent	20	32.8
Infrequent	41	67.2
Nutritional status		
Thin	6	9.8
Non-Thin	55	90.2

Overview of Anemia Status

Based on the table above, the distribution frequency of respondents' age was dominated by 13 years old (42.5%). The age range of this research respondent was grouped as an adolescent age group that is prone to anemia due to a significant increase in nutrient requirements to support the growth rate in the second growth spurt phase[38]. In addition, 100% of the respondents were female and experienced menstruation every month. These two factors put female adolescents at ten times greater risk of anemia[39,40]. The results of the distribution analysis of anemia status were dominated by the non-anemia category of 49 respondents (80.3%), and the anemia category of 12 respondents (19.7%). Based on the WHO classification, the prevalence rate of anemia was a mild health problem because it had a prevalence value between 5-19.9%[34] . The mean Hb level of respondents was 13.82 ± 1.73 g/dL with a minimum Hb level of 9.9 g/dL and a maximum of 17.8 g/dL.

Overview of Compliance with TTD Consumption

TTD is an iron and folic acid supplement. It is given free of charge to groups of female adolescents as prevention and overcoming activity for anemia incidence. This activity is one of the implementations of a government work program called the Pencegahan dan Penanggulangan Anemia Gizi Besi (PPAGB) or the Prevention and Control of Iron Nutrition and Anemia program[24,41,42]. The results of the distribution analysis of TTD (iron supplement) consumption compliance were dominated by the compliant category, 40 respondents (65.6%), and the non-compliant, 21 respondents (34.4%) with an average score of 2.29 ± 1.12. The minimum score was 0, and the maximum score was 3.

Overview of Protein Intake

The adequacy of protein intake was determined by comparing the RDA in the female adolescents and expressed in percent. The distribution analysis results of the protein intake adequacy were dominated by the adequate category, 32 respondents (52.5%) and 29

respondents (47.5%) with inadequate protein intake. Daily protein intake is enough if it reaches at least 44 grams in the age group of 10 to 12 years and 52 grams in the age group of 13 to 15 years. In this study, the respondent's average consumption of daily protein intake was 49.56 ± 22.37 g with a minimum value of 10.33 g and a maximum value of 117.4 g. Based on the SQ-FFQ findings, high-protein foods consumed frequently by respondents were chicken eggs, tempeh, and tofu.

Overview of Iron Intake

The adequacy of iron intake was determined by comparing the RDA in female adolescents and expressed in percent. The distribution analysis results of iron intake adequacy were dominated by the adequate category, 31 respondents (50.8%) and 30 respondents (49.2%) with inadequate iron intake. Based on the iron intake adequacy threshold established in this study, it is recommended that daily iron intake should meet a minimum threshold of 6.16 mg for 10 to 12 years old and 11.55 mg for 13 to 15 years old. This study showed that the mean respondent's daily iron intake was 11.28 ± 6.15 mg, with the lowest iron intake being 1.88 mg and the highest being 37.42 mg. Based on the findings from the SQ-FFQ questionnaire in this study, respondents often consumed chicken eggs, tempeh, and tofu as their daily iron source.

Overview of Vitamin C Intake

The adequacy of vitamin C intake was determined by comparing the RDA in female adolescents and expressed in percent. The distribution analysis results of adequate vitamin C intake were dominated by the adequate category, 32 respondents (52.5%) and 29 respondents (47.5%) with inadequate vitamin C intake. The age range of 10-12 years is considered adequate to consume at least 38.5 mg of vitamin C daily, while the group aged 13-15 years target consumption of at least 50 mg. In this study, the mean respondent's daily consumption of vitamin C intake was 64.40 ± 47.80 mg with a minimum value of 3.90 mg and a maximum of 212.31 mg. Based on the SQ-FFQ results, the food ingredients high in vitamin C that respondents consumed frequently were guava, sweet orange, and mango.

Overview of Iron Inhibitor Intake

Iron inhibitors are nutrients that can bind iron in food, so the body finds it difficult to absorb. Nutrients that fall into the iron inhibitor group include phytates, tannins, oxalates, and calcium[18,27]. The distribution analysis results of iron inhibitor intake were dominated by the infrequent category, 41 respondents (67.2%) and 20 respondents (32.8%) with frequent iron inhibitor intake. The mean frequency of respondent's inhibitor intake consumption was 2.77 ± 2.94 times with a minimum value of 0 and a maximum value of 12 times per week. Based on the SQ-FFQ results, food ingredients high in iron inhibitor content consumed by respondents with frequent frequency were milk, chocolate, and wheat.

Overview of Nutritional Status

The nutritional status is a manifestation of the balance of nutrient intake with daily nutrition needs according to each individual over a long period of time[43]. The assessment of nutritional status in adolescent groups is carried out by measuring anthropometry in the form of body mass index according to age (IMT/U). The distribution analysis results of IMT/U nutritional status were dominated by the non-thin category by 55 respondents (90.2%), and 6 respondents (9.8%) had the thin category of nutritional status.

Bivariate Analysis

Bivariate analysis was conducted to determine the relationship between the independent variables and the dependent variables. This was done with the Chi-Square test. The confidence level value was 95% or p-value = 0.05.

Table 3. Relationship between The Compliance to TTD (iron supplement) Consumption, Nutrient Intake, and Nutritional Status to the Incidence of Anemia in Female Adolescents at SMPN 1 Gunungsari

Variables	Anemic		Non Anemic		p-value	PR (Prevalence Ratio)
	n	%	n	%		
Compliance to TTD Consumption						
Non-compliant	9	42.9	12	57.1	0.002*	5.714
Compliant	3	7.5	37	92.5		
Protein Intake						
Inadequate	9	31	20	69	0.034*	3.310
Adequate	3	9.4	29	90.6		
Iron Intake						
Inadequate	9	30	21	70	0.046*	3.1
Adequate	3	9.7	28	90.3		
Vitamin C Intake						
Inadequate	8	27.6	21	72.4	0.139	-
Adequate	4	12.5	28	87.5		
Iron Inhibitor Intake						
Frequent	6	30	14	70	0.183	-
Infrequent	6	14.6	35	85.4		
Nutritional status						
Thin	1	16.7	5	83.3	1.000	-
Non-Thin	11	20	44	80		

(*) : There is a relationship between the independent variable and the dependent variable

Compliance to TTD (iron supplement) Consumption with The Incidence of Anemia

Based on the table, the research findings showed that 37 respondents (92.5%) who were compliant in taking TTD (iron supplement) did not experience anemia, but 9 respondents (42.9%) with a non-compliant attitude taking TTD (iron supplement) experienced anemia. Fisher's exact bivariate test findings showed a p-value of 0.002 (p-value <0.05) that indicated a correlation between TTD (iron supplement) consumption compliance and the incidence of anemia in female adolescents at SMPN 1 Gunungsari. The Prevalence Ratio value obtained, 5.714, suggested that non-compliance with iron tablet consumption behavior among female adolescents was associated with a 5.7 times higher chance of developing anemia compared to the group with compliance to TTD (iron supplement) consumption.

Research on female adolescents in Jambi showed an increase in Hb levels by 0.2-2.4 g/dL, so there was a change in average Hb levels from 10.125 g/dL to 11.12 g/dL after iron supplementation. Meanwhile, there is a correlation between TTD (iron supplement) consumption compliance and anemia in female adolescents in the North Konawe Regency, where the samples (95.5%) who obediently consume TTD (iron supplement) had the standard Hb values. It happened because TTD (iron supplement) consumption could meet the iron needs to reduce the risk of anemia. A similar thing also happened in female adolescents in Ghana, Africa, where there was a decrease in the percentage of anemia by 5.4% and an increase in the average Hb of 0.15 g/dL after consuming TTD (iron supplement) for eight months. Based on the data obtained, the total average TTD (iron supplement) consumption of 26.7 tablets within eight months was considered efficacious in the research population. This figure is close to the WHO recommendation of intermittent iron supplementation (1 time/week) for 12 weeks and then paused for three months, so the total TTD (iron supplement) given is 24 tablets per year. This number of TTD (iron supplement) differs from the Indonesian Ministry of Health's recommendation that the iron supplementation dose is one tablet per week, that the TTD (iron supplement) dose in one year is 52 tablets[44–47].

It was found that 3 respondents (7.5%) of female adolescents at SMPN 1 Gunungsari were obedient to consuming TTD (iron supplement) but experienced anemia. It might happen due to the respondent's habit of consuming foods and drinks containing inhibitors with a consumption frequency of 3 to 4 times a week. Compliance with TTD (iron supplement) consumption among female adolescents was also influenced by the participation of community health center officers and teachers who worked together to distribute TTD (iron supplement) to female students and provide counseling related to anemia to increase knowledge. It follows the theory that increasing knowledge will provide a cognitive foundation that will influence a person's behavior in acting so that changes in behavior will occur[48].

Meanwhile, 21 respondents were non-compliant with taking TTD (iron supplement). Based on interviews with the teacher, non-compliant respondents admitted that they often felt nauseous and dizzy and felt that menstrual blood became more abundant after taking TTD. It is relevant to research conducted on female adolescents in North Molawe where one of the reasons for non-compliance of female adolescents in taking TTD (iron supplement). is the onset of nausea after consumption of supplements45. In addition, there were also 12 respondents with non-compliant attitudes but did not suffer from anemia. It might happen due to the contribution of iron and sufficient protein to the formation of Hb[45].

The researcher assumed that other factors that caused respondents to be non-compliant in consuming TTD (iron supplement) were because there was no Aksi Bersama Minum TTD (drink TTD together movement), so respondents forgot to take it, so TTD (iron supplements) was wasted. It is relevant to the theory that TTD (iron supplement) consumption compliance is influenced by individual factors, including low knowledge and awareness, forgetting, and perceived side effects. Meanwhile, other research also mentioned that TTD (iron supplement) consumption compliance is influenced by support from teachers and parents[12,49].

Protein Intake with The Incidence of Anemia

According to the table, 29 respondents (90.6%) with adequate protein intake did not experience anemia. However, 9 respondents (31%) with inadequate protein consumption were found to have anemia. The Chi-square bivariate test showed a p-value of 0.034 <0.05, indicating a significant correlation between protein consumption and anemia in female adolescents of SMPN 1 Gunungsari. The study findings showed that the Prevalence Ratio value was 3.31, indicating that female adolescents with inadequate protein intake were 3.3 times more likely to experience anemia than those with adequate protein intake.

The correlation between protein consumption and the incidence of anemia is relevant to the findings of research conducted on young women in Gresik, where the correlation between protein consumption and anemia was shown by an increase in Hb levels[50]. Similar research conducted on female adolescents in Pakistan showed a correlation between protein consumption and the prevalence of anemia[51]. Most anemic respondents consumed protein less than the recommended daily protein portion, where the recommendation is two servings per day. In this study, the Odds Ratio value of 17.188 showed that female adolescents with inadequate protein consumption were 17 times more prone to anemia than those with adequate protein intake. The correlation between protein consumption and the prevalence of anemia connects to the crucial function of protein in Hb synthesis. In addition, protein also plays a significant role in the absorption and transportation of iron throughout the human body. As a result, inadequate protein consumption leads to impaired iron absorption, resulting in iron deficiency in the body[50,51].

Meanwhile, research on female adolescents in Jakarta showed no correlation between protein consumption and the prevalence of anemia[52]. Research conducted by Lewa on female adolescents in Palu also showed Similar findings[25]. The occurrence of anemia in the respondents was perhaps due to the higher

frequency of consumption of plant-based protein sources, such as tofu and tempeh, compared to animal-based protein sources. Plant-based food sources often contain lower amounts of protein than animal-based protein, making it difficult to meet daily protein requirements. Based on the findings of research conducted on female adolescents in Makassar, there was no correlation between protein consumption and the incidence of anemia. This conclusion was highly due to the observation that the frequency of vegetable protein intake tended to be greater in female adolescents. Vegetable protein has lower quality than animal-based protein due to iron inhibitors' presence, such as phytic acid found in legumes[25,52,53].

There were 29 female adolescent respondents at SMPN 1 Gunungsari who had a protein intake that was less than the daily recommendation based on AKG (RDA: Recommended Dietary Allowance). The lack of protein intake in female adolescents is mostly due to the perception that consumption of animal-based protein will make them fat, economic status that affects the availability of food sources of such protein at home, and lack of access to snacks with animal protein content at school. The majority of school snacks contain high carbohydrate and low protein foods. Based on interviews, snacks available at SMPN 1 Gunungsari include Batagor (fried tofu with meatballs), Siomay (steamed fish cake), fried meatballs, donuts, noodles, chocolate bananas, and otak-otak (fish cake)[33,52].

There were 20 respondents (69%) with inadequate protein intake but non-anemia. The researcher assumed this was due to compliance with TTD (iron supplement) consumption and low frequency of consuming food ingredients with iron inhibitor content. There were also 3 respondents (9.4%) with adequate protein intake but anemia. It might be related to the average respondent of female adolescents at SMPN 1 Gunungsari who tended to consume vegetable protein with non-heme iron content. The iron cannot be absorbed by the body directly; as a result, the available protein does not function properly to increase Hb production[54].

Incidence of Anemia

Based on the table above, 28 people (90.3%) consumed adequate iron and did not experience anemia. 9 people (30%) consumed inadequate iron supplements and experienced anemia. The chi-square bivariate test showed a p-value of 0.046 <0.05, indicating a correlation between iron intake and the incidence of anemia. The study findings showed that the Prevalence Ratio value was 3.1, which means that female adolescents with inadequate iron consumption were 3.1 times more at risk of anemia than female adolescents who received enough iron.

The correlation between iron intake and anemia was relevant to research conducted on female adolescents in Serang Regency, where there was a decrease in the prevalence of anemia in research respondents from 100% to 17.2% after being given spinach and chicken liver[9]. Spinach is a food that has a lot of iron and folic acid. Chicken liver is a food with protein and iron content that the body needs to make red blood

cells and Hb[9].

There were 30 adolescent female respondents at SMPN 1 Gunungsari who experienced iron deficiency from daily recommendations based on AKG (RDA: Recommended Dietary Allowance). The cause was that nearly all respondents consumed nonheme iron, such as tempeh and tofu frequently. It is relevant to research conducted on female adolescents in Lamongan, where the consumption of nonheme iron is considered to have low bioavailability due to the content of phytic acid and oxalate, causing iron absorption to be inhibited[21]. The same reason was found in research at Palu and Bogor on female adolescents, that the dominant factor of anemia was the tendency of respondents to consume nonheme iron. However, both studies stated that there was no correlation between protein intake and anemia due to the lack of respondent iron intake and research limitations in collecting food data through food recall questionnaires[25,43].

It was found that 21 respondents (70%) of female adolescents at SMPN 1 Gunungsari who were deficient in iron intake did not experience anemia. It might be due to the habit of respondents who routinely consumed TTD (iron supplement) every week or have an infrequency of consuming iron absorption inhibitors. At the same time, 3 respondents (9.7%) who consume enough iron still experienced anemia. It might be due to the habit of respondents who consumed foods with iron inhibitor content at a high frequency of 3-4 times a week, making it difficult for the body to absorb enough iron[55].

Vitamin C Intake with The Incidence of Anemia

Based on the table above, it was found that 28 respondents (87.7%) who consumed vitamin C in adequate amounts were not anemic. Meanwhile, 8 respondents (27.6%) who consumed inadequate vitamin C were anemic. The findings of the Chi-square bivariate test showed a p-value of 0.139 (p-value> 0.05), so there was no correlation between vitamin C intake and the incidence of anemia among female adolescents at SMPN 1 Gunungsari.

The absence of a correlation between these two variables might be due to unmet daily iron intake from food or supplements. It is shown by the fact that some respondents experienced anemia despite receiving enough iron and vitamin C. The function of vitamin C will not be optimal if it doesn't meet the total daily iron intake. Vitamin C and iron intake must be met both to achieve a significant impact in increasing hemoglobin levels. This reasoning is relevant to the research on female adolescents in Palu, where there was no correlation between vitamin C intake and anemia[25]. One of the reasons for no correlation between vitamin C and anemia was that they didn't consume vitamin C and iron simultaneously. It relates to the increase in iron absorption that can occur 3-6 times if vitamin C is taken with meals[25,53]. Similar research on female adolescents in Bogor and Lamongan also stated that there was no correlation between vitamin C intake and anemia. The majority of the respondents tended to consume non-heme iron sources. The total daily vitamin C intake is below the recommended amount based on the RDA due to the limited access, so the body can only absorb 5-10%

Amerta Nutrition

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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of iron[21,43,56].

A different statement was found in research conducted in Gresik and Depok where there was a correlation between vitamin C intake and anemia in female adolescents[32,50]. Vitamin C has a role as an enhancer so that it can increase the amount of iron absorbed by the body. Specifically, vitamin C plays a role in changing the form of nonheme iron by reducing its ferrous form so that absorption can increase up to four times in the small intestine. In addition, vitamin C also has a role in transferring iron from plasma transferrin to liver ferritin[32,50].

There were 4 respondents (12.5%) female adolescents at SMPN 1 Gunungsari with adequate vitamin C intake but experienced anemia. Besides the lack of iron intake, the consumption of inhibitors at high frequency might be the reason for the disruption of iron absorption. Improper processing or serving of food sources of vitamin C can damage the existing vitamin C content because vitamin C can be broken easily by oxidation and heat and is easily soluble in water, for example, orange juice in warm or hot temperatures[25,33]. Then, there were 21 respondents (72.4%) whose vitamin C intake did not meet the daily recommendation based on the AKG (RDA: Recommended Dietary Allowance) but were not anemic. The researcher assumed that it might have happened because the respondents had been compliant in taking a TTD (iron supplement) tablet once a week. Adequate protein intake can also increase Hb levels because of its role as an iron enhancer. In addition, the respondents' habit of consuming heme iron sources in adequate quantities also directly affected increasing Hb levels because it can be absorbed directly by the body[27,32].

Iron Inhibitor Intake with The Incidence of Anemia

Based on the table, 35 respondents (85.4%) who rarely took iron inhibitors did not experience anemia. In addition, anemia occurred in 6 people (30%) who often took iron inhibitors. Fisher's exact bivariate test findings showed a p-value of 0.183 > 0.05, which means there is no correlation between iron inhibitor intake and anemia in the group of female adolescents at SMPN 1 Gunungsari.

These findings are also relevant to research on female adolescents in Bengkulu[57]. In that study, the number of people who frequently consumed iron inhibitors was higher than those who consumed iron inhibitors infrequently. No correlation was found between inhibitor consumption and anemia cases among female adolescents at SMPN 1 Gunungsari concerning the timing of consumption of food-containing inhibitors. The respondents possibly consumed inhibitors two hours before or after meals, giving time for the body to absorb the iron content in the food[58].

Different research in Bekasi and Jakarta stated that there was a correlation between inhibitor intake and anemia among female adolescents[27,37]. Iron inhibitors, which include tannins, phytates, oxalates, and calcium, bind to iron and can interfere with iron absorption in the intestines. The majority of respondents in the study frequently consumed inhibitors contained in tea. Similar research on female adolescents in India showed a 49% decrease in iron absorption in patients with iron anemia who drank one cup of tea a day[59]. Consumption of two cups of tea a day can reduce iron absorption in the body by 67% in anemia patients and 66% in the group with normal Hb status[27,37,59].

Female adolescents at SMPN 1 Gunungsari tended to consume milk, chocolate, and wheat more often. Calcium content can reduce iron absorption by 50-60% and inhibit heme and nonheme iron absorption. Chocolate and wheat are foods derived from plants that contain polyphenols, so they inhibit heme iron absorption[60,61]. This study only examined the frequency of consumption of iron-inhibiting foods without looking at the time respondents consumed these foods or beverages. It is related to the 14 respondents (70%) who frequently consumed iron inhibitors but did not experience anemia. It might relate to the timing of consuming food sources of inhibitors. Drinking tea one hour after a meal can cut iron intake by 85%. Drinking tea with meals can reduce iron intake by 60%. Therefore, it is better to eat foods containing inhibitors two hours before or after consuming iron-containing foods[10,37]. Meanwhile, there were 6 respondents (14.6%) whose frequency of iron-consuming inhibitors was infrequent, but experienced anemia. The researcher assumed that it could be due to other factors, such as inadequate daily intake of iron, protein, and vitamin C, so Hb formation could not rightly take place.

Nutritional Status with The Incidence of Anemia

This research showed that 44 respondents (80%) had a nutritional status that was non-thin and non-anemia. Meanwhile, 1 respondent (16.7%) was thin and had anemia. Fisher's exact bivariate test findings showed a p-value of 1.000 > 0.05, which means that there is no correlation between nutritional status and anemia in female adolescents at SMPN 1 Gunungsari.

These findings are also relevant to research on female adolescents in Mataram and West Java[60,62]. The tendency of female adolescents to desire a slim body encourages them to adopt an unhealthy diet, resulting in a lack of nutritional intake that is adjusted to daily needs based on the RDA. When a person does not get enough food, the body slows down the metabolism. If this continues prolonged, it can lead to anemia. Research on female adolescents in Mataram and West Java shows anemia is caused by other things such as education, knowledge level, duration of menstruation, iron and protein intake, and consumption patterns of iron inhibitors[60,62]. The absence of a relationship between nutritional status and anemia in female adolescents at SMPN 1 Gunungsari is because the anthropometric index IMT/U can only be applied to measure macronutrient status, not micronutrients, especially iron and vitamin C that are associated with anemia[65].

Different findings found in research in South Sumatra and Denpasar showed a correlation between nutritional status and anemia among female adolescents[63,64]. Poor eating habits and excessive dislike for certain foods are some factors associated with nutritional status. The desire for a slim body causes adolescents to apply the wrong eating restrictions so that the body's nutrition needs do not meet the requirements.

Amerta Nutrition

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
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It causes the body of female adolescents to be in a macro and micronutrient deficiency status so that various diseases, one of which is anemia, can occur[63,64].

There were 11 respondents (20%) whose nutritional status was non-thin but had anemia. It might occur due to the application of eating habits that tend to consume foods high in fat and carbohydrates that can be influenced by a lack of knowledge and access to a nutritionally balanced diet. The snacks at school that tend to be high in fat and carbohydrates and low in protein and micronutrients such as iron and vitamin C are some of the factors that correlate with this phenomenon[58,60]. Meanwhile, there were 5 respondents (83.3%) whose nutritional status was thin but had non-anemia. The researcher assumed that it was due to the compliance of female adolescents in consuming TTD (iron supplement). It is relevant to research on female adolescents in East Jakarta, where there was a statement that the IMT/U anthropometric index could only interpret macronutrient balance but not micronutrient status in the body[65].

This research has several limitations, including data collection using the SQ-FFQ interview method within the last three months, so it could potentially provide inaccurate answers because it relies on respondents' memory. In addition, this study did not collect data on when respondents consumed iron enhancers and inhibitors. It could lead to bias as the timing of consumption affects the amount of iron absorbed by the body.

CONCLUSIONS

This research concludes that there is a relationship between TTD (iron supplement) consumption compliance, protein intake, and iron intake with the incidence of anemia among female adolescents at SMPN 1 Gunungsari. Meanwhile, there is no relationship between vitamin C intake, iron inhibitor intake, and nutritional status with the incidence of anemia in female adolescents at SMPN 1 Gunungsari. This study implies that it can be used as a reference source in future research, especially in the Serang area, Banten. Meanwhile, based on the findings of this research, it is hoped that future research can examine the variable of respondents' time in consuming iron enhancers and inhibitors.

REFERENCES

1. IDAI. Nutrisi Pada Remaja. *Ikatan Dokter Anak Indonesia*
   https://www.idai.or.id/artikel/seputar-kesehatan-anak/nutrisi-pada-remaja (2013).
2. UNICEF. Profil Remaja 2021. https://www.unicef.org/indonesia/media/9546/file/Profil%20Remaja.pdf (2021).
3. Dewi, E. O. P. Pengalaman Merubah Perilaku Begadang untuk Menghindari Penyakit Anemia Kronik. *Journal of Materials Processing Technology* (2018).
4. Sitanggang, M. R. Faktor yang Mempengaruhi Anemia pada Remaja Putri di SMA Prima Tembung Tahun 2019. (2019).
5. WHO. Anaemia in Women and Children. https://www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children (2021).
6. Kemenkes RI. Laporan Nasional Riskesdas 2013. https://pusdatin.kemkes.go.id/resources/download/general/Hasil%20Riskesdas%202013.pdf (2013).
7. Kemenkes RI. Laporan Nasional Riskesdas 2018. http://repository.bkpk.kemkes.go.id/3514/1/Laporan%20Riskesdas%202018%20Nasional.pdf (2019).
8. Khairani, S. S. Faktor-faktor yang Berhubungan dengan Anemia pada Remaja di SMP Muhammadiyah Serpong Tahun 2018. (Fakultas Ilmu Kesehatan Universitas Islam Negeri Syarif Hidayatullah Jakarta, 2019).
9. Paurina, R. & Masluroh, M. Efektivitas Pemberian Bayam dan Hati Ayam Terhadap Perubahan Kadar Hemoglobin pada Remaja Putri. *Journals of Ners Community* **13**, 125–131 (2022).
10. Kemenkes RI. Pedoman Pencegahan dan Penanggulangan Anemia Pada Remaja Putri dan Wanita Usia Subur (WUS). https://gizi.kemkes.go.id/katalog/revisi-buku-pencegahan-dan-penanggulangan-anemia-pada-rematri-dan-wus.pdf (2018).
11. Kemenkes RI. Profil Kesehatan 2021. https://www.kemkes.go.id/downloads/resources/download/pusdatin/profil-kesehatan-indonesia/Profil-Kesehatan-2021.pdf (2022).
12. Savitri, M. K., Tupitu, N. D., Iswah, S. A. & Safitri, A. Hubungan Kepatuhan Konsumsi Tablet Tambah Darah dengan Kejadian Anemia pada Remaja Putri: A Systematic Review. *Jurnal Kesehatan Tambusai* **2**, 43–49 (2021).
13. NHS. Iron Deficiency Anaemia Symptoms and Treatments. https://www.nhsinform.scot/illnesses-and-conditions/nutritional/iron-deficiency-anaemia (2023).
14. Rahayu, A. *Metode ORKES-KU (Raport Kesehatanku) dalam Mengidentifikasi Potensi*

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
Abby et al. | Amerta Nutrition Vol. 7 Issue 2SP (December 2023). 213-223

221

Kejadian Anemia pada Remaja Putri. (CV Mine, 2019).

15. WHO. *Nutritional Anemias: Tools for Effective Prevention and Control*. (2017).

16. Muhayati, A. & Ratnawati, D. Hubungan Antara Status Gizi dan Pola Makan dengan Kejadian Anemia Pada Remaja Putri. *Jurnal Ilmiah Ilmu Keperawatan Indonesia* **9**, 563–570 (2019).

17. Nurrahman, N. H. *et al.* Faktor dan Dampak Anemia pada Anak-Anak, Remaja, dan Ibu Hamil serta Penyakit yang Berkaitan dengan Anemia. *Journal of Science, Technology and Entrepreneur* **2**, (2020).

18. Damanik, A. H., Simanungkalit, S. F. & Arini, F. A. Gambaran IMT/U, Asupan Zat Besi (Fe) dengan Anemia Remaja Putri di SMA Muhammadiyah 7 Sawangan , Depok Tahun 2018. *Medika Respati : Jurnal Ilmiah Kesehatan* **14**, 255–264 (2019).

19. Listiana, A. Analisis Faktor-Faktor yang Berhubungan dengan Kejadian Anemia Gizi Besi pada Remaja Putri di SMKN 1 Terbanggi Besar Lampung Tengah | Listiana | Jurnal Kesehatan. (2016).

20. Masthalina, H., Laraeni, Y. & Dahlia, Y. P. Pola Konsumsi (Faktor Inhibitor dan Enhancer Fe) Terhadap Status Anemia Remaja Putri. *Jurnal Kesehatan Masyarakat* (2015).

21. Nabilla, F. S., Muniroh, L. & Rifqi, M. A. Hubungan Pola Konsumsi Sumber Zat Besi, Inhibitor dan Enhancer Zat Besi dengan Kejadian Anemia pada Santriwati Pondok Pesantren Al-Mizan Muhammadiyah Lamongan. *Media Gizi Indonesia* **17**, 56–61 (2022).

22. Nisa, E. C. Hubungan Pola Makan dengan Kejadian Anemia pada Remaja Putri. (Universitas dr. Soebandi, 2021).

23. Sari, A. A. & Muwahkidah. Hubungan Asupan Protein dan Zat Besi Dengan Kadar Hemoglobin Remaja Putri di SMA N 1 Weru Sukoharjo. (Universitas Muhammadiyah Surakarta, 2018). doi:10/LAMPIRAN.pdf.

24. Rianti, R. Tingkat Pengetahuan, Kepatuhan Konsumsi Tablet Tambah Darah dan Asupan Zat Besi (Fe) dengan Status Anemia pada Remaja Putri di SMKN 1 Molawe Kecamatan Molawe Utara Kabupaten Konawe Utara. (Poltekkes Kemenkes Kendari, 2021).

25. Lewa, F. Hubungan Asupan Protein, Zat Besi dan Vitamin C dengan Kejadian Anemia pada Remaja Putri di MAN 2 Model Palu. **3**, (2016).

26. Wahyuni, E. S. Pengaruh Suplementasi Fe dan Vitamin C terhadap Hemoglobin dan Indeks Eritrosit Remaja Putri. *Jurnal Kesehatan* **12**, 162–172 (2021).

27. Hanjani, N. A. Hubungan Asupan Protein, Fe, Zinc, Asam Folat, Vitamin B12, Konsumsi Zat Inhibitor dengan Kejadian Anemia Gizi Besi pada Mahasiswi Prodi Gizi UPNVJ. (Universitas Pembangunan Nasional Veteran Jakarta, 2022). doi:10/LAMPIRAN.pdf.

28. Harahap, N. R. Faktor-Faktor yang Berhubungan dengan Kejadian Anemia pada Remaja Putri. *Nursing Arts* **12**, 78–90 (2018).

29. Nurjannah, S. N. & Putri, E. A. Hubungan Status Gizi dengan Kejadian Anemia pada Remaja Putri di SMP Negeri 2 Garawangi Kabupaten Kuningan. *Journal of Midwifery Care* **1**, 125–131 (2021).

30. Ariningrum, N. Y. Hubungan Antara Asupan Zat Besi dan Vitamin C dengan Kejadian Suspek Anemia pada Remaja Puteri di Kabupaten Sukoharjo. (Universitas Muhammadiyah Surakarta, 2021).

31. Hearttalini, A. D. Hubungan Asupan Zat Besi dan Pengetahuan Tentang Anemia dengan Kadar Haemoglobin pada Remaja Putri di SMAN 1 Nguter Sukoharjo. (Universitas Muhammadiyah Surakarta, 2020). doi:10/LAMPIRAN.pdf.

32. Laraswati, N. L. E. Hubungan Pola Konsumsi Inhibitor dan Enhancer Zat Besi, Kebiasaan Sarapan dan Siklus Menstruasi dengan Gejala Anemia Remaja Putri SMA IT Daarul Rahman III Tahun 2022. (Universitas Pembangunan Nasional Veteran Jakarta, 2022). doi:10/ARTIKEL%20KI.pdf.

33. Tania, L. E. Hubungan Asupan Zat Besi, Protein, dan Vitamin C dengan Kejadian Anemia pada Remaja Putri di SMK Yamas Jakarta. (2019).

34. Nidianti, E. *et al.* Pemeriksaan Kadar Hemoglobin dengan Metode POCT (Point of Care Testing) sebagai Deteksi Dini Penyakit Anemia Bagi Masyarakat Desa Sumbersono, Mojokerto. **2**, 29–34 (2019).

35. WNPG. *Widyakarya Nasional Pangan dan Gizi X Presentasi dan Poster*. (LIPI Press, 2014).

36. Kustiyah, L., Damayanthi, E., Fazaarah, W. H. & Dwiriani, C. M. Keterkaitan antara Konsumsi Pangan, Gaya Hidup, dan Status Gizi pada Pegawai Obes dan Normal | Jurnal Ilmu Pertanian Indonesia. (2014).

37. Putri, H. P. Determinan Kejadian Anemia Remaja Putri di Mts Fadlurrahman Kota Bekasi Tahun 2022. (Universitas Pembangunan Nasional Veteran Jakarta, 2022). doi:10/RIWAYAT%20HIDUP.pdf.

38. Sofiatun, T. Gambaran Status Gizi, Asupan Zat Gizi Makro, Aktivitas Fisik, Pengetahuan dan Praktik Gizi Seimbang pada Remaja di Pulau Barang Lompo Makassar. (Universitas Hasanuddin, 2017).

39. Astuti, D. & Kulsum, U. Pola Menstruasi dengan Terjadinya Anemia pada Remaja Putri. *Jurnal Ilmu Keperawatan dan Kebidanan* **11**, 314–327 (2020).

40. Dieniyah, P., Sari, M. M. & Avianti, I. Hubungan Tingkat Pengetahuan tentang Anemia dengan Kejadian Anemia pada Remaja Putri di SMK Analis Kimia Nusa Bangsa Kota Bogor Tahun 2018. *PROMOTOR* **2**, 151–158 (2019).

41. Widiastuti, A. & Rusmini, R. Kepatuhan Konsumsi Tablet Tambah Darah pada Remaja Putri. *Jurnal Sains Kebidanan* **1**, 12–18 (2019).

42. Yuhana, S. Hubungan Status Gizi dengan Kejadian Anemia pada Remaja Putri di SMK N 1 Rangkasbitung. *Jurnal Obstretika Scienta* **7**, 439–451 (2019).

43. Permatasari, W. M. Hubungan Antara Status Gzi, Siklus dan Lama Menstruasi dengan Kejadian Anemia Remaja Putri di SMA Negeri 3 Surabaya. (Universitas Airlangga, 2016).

44. Riastawaty, D. & Imelda. Pengaruh Pemberian Tablet Fe Terhadap Kadar Hemoglobin pada Remaja Putri di SMPN 17 Wilayah Kerja Puskesmas PIR II Bajubang Muaro Jambi Tahun 2023. *Jurnal Maternitas Kebidanan* **8**, 34–41 (2023).

45. Rianti, R., Fatmawati, F. & Suwarni, S. Tingkat Pengetahuan, Kepatuhan Konsumsi Tablet Tambah Darah dan Asupan Zat Besi (Fe) dengan Status Anemia pada Remaja Putri di SMKN 1 Molawe Kecamatan Molawe Kabupaten Konawe Utara. *Jurnal Gizi Ilmiah : Jurnal Ilmiah Ilmu Gizi Klinik, Kesehatan Masyarakat dan Pangan* **9**, 12–18 (2022).

46. Gosdin, L. *et al.* A School-Based Weekly Iron and Folic Acid Supplementation Program Effectively Reduces Anemia in a Prospective Cohort of Ghanaian Adolescent Girls. *The Journal of Nutrition* **151**, 1646–1655 (2021).

47. Sutanti, Y., Briawan, D. & Martianto, D. Suplementasi Besi Mingguan Meningkatkan Hemoglobin Sama Efektif dengan Kombinasi Mingguan dan Harian pada Remaja Putri. *1* **11**, (2016).

48. Pramardika, D. D. & Fitriana. Hubungan Kepatuhan Konsumsi TTD dengan Kadar Hemoglobin pada Remaja Puteri Wilayah Puskesmas Bengkuring Tahun 2019. *Jurnal Kebidanan Mutiara Mahakam* **7**, 58–66 (2019).

49. Risanti, E. D., Putra, P. I. M., Dasuki, M. S. & Khoirunnabila, A. M. Gizi, Konsumsi Tablet Tambah Darah (TTD), dan Sarapan dalam Meningkatkan Kadar Hemoglobin pada Remaja Putri. (2020).

50. Sholicha, C. A. & Muniroh, L. Hubungan Asupan Zat Besi, Protein, Vitamin C dan Pola Menstruasi dengan Kadar Hemoglobin pada Remaja Putri di SMAN 1 Manyar Gresik. *Media Gizi Indonesia* **14**, 147–153 (2019).

51. Hassan, F., Salim, S. & Humayun, A. Prevalence and Determinants of Iron Deficiency Anemia in Adolescents Girls of Low Income Communities in Lahore. *Annals of King Edward Medical University* **23**, (2017).

52. Restiana, G., Manggabarani, S. & Tanuwijaya, R. R. Correlaction of Protein Intake, Consumption of Fruit and Vegetables, Sodium Intake in Packaged Food with the Incidence of Anemia. *Journal of Nutrition Science* **3**, 45–50 (2022).

53. Marina, Indriasari, R. & Jafar, N. Konsumsi Tanin dan Fitat Sebagai Determinan Penyebab Anemia pada Remaja Putri di SMA Negeri 10 Makassar. https://journal.unhas.ac.id/index.php/mkmi/article/view/516 (2018).

54. Nugroho, F. A., Handayani, D. & Apriani, Y. Asupan Protein Nabati dan Kejadian Anemia Wanita Usia Subur Vegan. https://journal.ipb.ac.id/index.php/jgizipangan/article/view/11578 (2015).

55. Marissa, M. & Hendarini, A. T. Hubungan Asupan Zat Besi, Zinc, dan Asam Folat dengan Kejadian Anemia pada Remaja Putri di SMAN 1 Kampar Utara Tahun 2021. *Jurnal Kesehatan Tambusai* **2**, 391–397 (2021).

56. Putri, T. F. & Fauzia, F. R. Hubungan Konsumsi Sumber Zat Besi dengan Kejadian Anemia pada Remaja Putri SMP dan SMA di Wilayah Bantul. *Jurnal Ilmu Keperawatan dan Kebidanan* **13**, 400–411 (2022).

57. Jaelani, M., Simanjuntak, B. Y. & Yuliantini, E. Faktor Risiko yang Berhubungan dengan Kejadian Anemia pada Remaja Putri. *Jurnal Kesehatan* **8**, 358–368 (2017).

58. Novelia, S., Rukmaini & Sari, I. P. The Analysis of Factors Associated with Anemia Among Adolescent Girls. *Nursing and Health Sciences Journal (NHSJ)* **2**, 266–273 (2022).

59. Thankachan, P., Walczyk, T., Muthayya, S., Kurpad, A. V. & Hurrell, R. F. Iron Absorption in Young Indian Women: The Interaction of Iron Status with The Influence of Tea and Ascorbic Acid. *Am J Clin Nutr* **87**, 881–886 (2008).

60. Anwar, I. V. F. S., Arifin, D. Z. & Aminarista, A. Faktor-Faktor yang Berhubungan dengan Kejadian Anemia Gizi Besi pada Remaja Putri di SMAN 1 Pasawahan Tahun 2020. *Journal of Holistic and Health Sciences (Jurnal Ilmu Holistik dan Kesehatan)* **5**, 28–39 (2021).

61. Susantini, P. & Bening, S. Konsumsi Inhibitor dan Enhencer Zat Besi Sebagai Faktor Risiko

Terjadinya Anemia Pada Remaja Putri Di Kota Semarang. *Jurnal Gizi* **12**, 12–19 (2023).

62. Handayani, S., Pratiwi, Y. S. & Ariendha, D. S. R. Hubungan Status Gizi Remaja dengan Kejadian Anemia pada Remaja Putri. *JOMIS (Journal of Midwifery Science)* **7**, 69–78 (2023).

63. Indrawatiningsih, Y., Hamid, S. A., Sari, E. P. & Listiono, H. Faktor-Faktor yang Mempengaruhi Terjadinya Anemia pada Remaja Putri. *Jurnal Ilmiah Universitas Batanghari Jambi* **21**, 331–337 (2021).

64. Ariani, M. Hubungan Kebiasaan Konsumsi Tablet Fe dan Pola Makan dengan Kadar Hb pada Remaja Putri. (Institut Teknologi dan Kesehatan Bali, 2019).

65. Warda, Y. & Fayasari, A. Konsumsi Pangan dan Bioavailabilitas Zat Besi Berhubungan dengan Status Anemia Remaja Putri di Jakarta Timur. *ilgi* **4**, 135 (2021).