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The Effect of Consuming Eggs and Iron Tablets on Increasing Hb Levels in Adolescent Girls at the Aisyiyah Orphanage in Klaten

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ABSTRACT

Background: Anemia is a common problem among teenagers. Anemia control in adolescent girls and women of childbearing age (WUS) by providing Fe tablets..Eggs are one of the foods that contain iron and can be a substitute for Fe tablets.
Objective : This study aims to determine the effect of consuming Fe tablets, eggs, and Fe tablets combined with eggs on increasing hemoglobin levels in adolescent girls at the Aisyah Klaten Orphanage.
Methods: This study was conducted with a quantitative approach using a quasi-experimental design with a pretest-posttest control group design. The location of the study was at the Aisyiah Klaten Orphanage. The research was conducted from January to July 2024. The population in the study were all adolescent girls at the orphanage in Aisyiyah Klaten. The sampling technique was Total Sampling of 45 respondents divided into 15 samples each. The research instruments were Hb meter laboratory examination tools (Easy Touch GCHb) and observation sheets. Analysis of research data using the Paired t-test and Independent t-test.
Results: There was an effect after consuming Fe tablets (p = 0.0003), eggs (p = 0.0099), and Fe tablets combined with eggs (p = 0.0016) on increasing Hb levels in adolescent girls. The average increase in hemoglobin levels after consuming Fe tablets was 1.05 g/dl, egg consumption was 0.98 g/dl, and consumption of Fe tablets combined with eggs was 0.93 g/dl.
Conclusion: Consumption of Fe tablets, eggs, and Fe tablets combined with eggs affected the increase in Hb levels in female adolescents at the Aisyah Klaten orphanage. The comparison of the average increase in Hb levels after consuming Fe tablets was higher than consuming eggs or Fe tablets combined with eggs.

Keyword: ***Hemoglobin Levels, Fe Tablets, Eggs***

INTRODUCTION

Anemia is a common problem among adolescents.[1] According to World Health Organization (WHO) data in World Health Statistics (2021), the prevalence of anemia in women of reproductive age (15-49 years) in the world in 2019 reached 29.9%, and the prevalence of anemia in non-pregnant women aged 15-49 years was 29.6%, including the adolescent age category.[2] Based on the 2018 Basic Health Research report, the prevalence of anemia in adolescent girls in Indonesia is around 27.2% for the 15-24 age group.[3]

Factors that cause high rates of anemia in adolescents include low intake of iron and other nutrients, as well as errors in consuming iron, such as consuming it together with other substances that can inhibit iron absorption.[4] Adolescent girls have a 10 times higher risk of developing anemia than adolescent boys because they menstruate every month[5]. Anemia can cause various impacts, including impaired growth and development, fatigue, increased susceptibility to infection due to a decreased immune system, decreased function and endurance that makes them more susceptible to poisoning, and impaired cognitive function.[6]

To overcome the problem of anemia in adolescents, the Ministry of Health has launched the Anemia Prevention and Management Program for Adolescent Girls and Women of Childbearing Age (WUS) by providing Fe tablets or Iron Tablets.[7] The coverage of iron tablet consumption in adolescent girls (12-18 years) is 76.2%, while 23.8% do not consume them. Iron tablet consumption for a year <52 tablets is 98.6%, and those who consume >52 tablets for a year are only 1.4%. In Klaten Regency/City, the proportion of adolescent girls aged 10-18 years who received Iron Tablets (TTD) is 45.05%, and 87.75% of them received them in the last 12 months.[3]

Previous research by Rini Nuraeni et al. (2019) on the program of providing Fe tablets in SMA Kecamatan Jatinangor-Sumedang called "*Gerakan Jum'at Pintar*," showed an increase in hemoglobin levels before and after giving Fe tablets to adolescents with anemia. This movement aims to prevent and overcome anemia through routine consumption of Fe tablets.[8]

In addition, the Ministry of Health also addresses anemia through education and promotion of balanced nutrition, iron fortification of food ingredients, and the implementation of a clean and healthy lifestyle. [9] Eggs are one of the foods that contain iron and can be a substitute for Fe tablets. Research by Amanda et al. (2024) showed that giving boiled eggs had an effect on increasing hemoglobin levels in female adolescents at SMA Negeri 07 OKU (p=0.000).[10] Eggs are rich in iron and high-quality protein because they have a complete amino acid composition. [11] The nutritional adequacy rate (AKG) in kampung chicken eggs reaches 22.27%, with an iron content of 4.90 mg and protein of 10.80 g. Meanwhile, broiler chicken eggs only have an AKG of 13.64%, with an iron content of 3 mg and protein of 12.40 mg. [12]

Based on the background above, the author is interested in knowing the effect of consuming Fe tablets, eggs, and Fe tablets combined with eggs on increasing hemoglobin levels in adolescent girls who are menstruating at the Aisyah Klaten Orphanage.

METHODS

This study was conducted with a quantitative approach using a quasi-experimental design with a pretest-posttest control group design. Group 1 consumed Fe tablets, group 2 consumed eggs, and group 3 consumed Fe tablets combined with eggs. Each group does not have specific criteria for becoming a respondent this is based on randomized. The

dependent variable is the increase in hemoglobin levels, while the independent variables are Fe consumption, egg consumption and consumption of Fe tablets combined with eggs.

The location of the study was at the Aisyiah Klaten Orphanage. The research was conducted in January - July 2024. The population in the study were all teenage girls at the orphanage in Aisyiyah Klaten. The sampling technique was Total Sampling of 45 respondents divided into 15 samples each. Of the 45 participants, they were divided into 3 groups. In one group consists of 15 teenage girls are Group 1 consumed Fe tablets, group 2 consumed eggs, and group 3 consumed Fe tablets combined with eggs. . The research instruments were the Hb meter laboratory examination tool (Easy Touch GCHb), and observation sheets. Analysis of research data using the Paired t-test and Independent t-test using STATA 17 software.

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RESULTS

Table 1. Respondent Characteristics by age and education.

Variabel	F	%
Age		
12 – 15 years	24	53.33
>15 years	21	46.67
Education		
Junior High School	21	46.67
Senior High School/Vacational School	24	53.33

Table 1 shows that the majority of research respondents were aged 12-15 years, as many as 24 respondents (53.33%), and more respondents had high school/vocational school education, as many as 24 respondents (53.33%).

Table 2 shows that the category of Hb levels before the intervention was given was mostly normal, with 33 respondents (73.33%), while after the intervention, the number of respondents in the normal category increased to 41 respondents (91.11%).

Tabel 2. Distribution of Anemia Categories

Variabel	F	%
Hb Pre Level		
Anemia	12	26.67
Normal	33	73.33
Post Hb Level		
Anemia	4	8.89
Normal	41	91.11

Tabel 3. Frequency Distributions Hemoglobin Level Categories

Variables	Hemoglobin Level			
	Anemia		Normal	
	F	%	F	%
Pre				
Fe Tablets	2	13.33	13	86.67
Egg	1	6.67	14	93.33
Fe Tablets Combined With Eggs	9	60.00	6	40.00
Post				
Fe Tablets	0	0.00	15	100.00
Egg	0	0.00	15	100.00
Fe Tablets Combined with Eggs	4	26.67	11	73.33

Table 3 shows that from 45 respondents before the intervention (pre) that the majority of respondents' Hb levels were in the normal category in the Fe tablet group (86.67%) and eggs (93.33%), while the Fe tablet combination egg group had more anemia categories (60.00%). After the intervention (post) the number of respondents in the normal category increased in the Fe tablet group (100.00%), eggs (100.00%), and Fe tablet combination eggs (73.33%).

Table 4 shows the results of the Paired t-test that there is a difference in the average hemoglobin levels before and after being given Fe tablets ($p = 0.0003$), eggs ($p = 0.0099$), and Fe tablets combined with eggs ($p = 0.0016$). So it means that there is an effect of consuming Fe tablets, eggs, and Fe tablets combined with eggs on

increasing Hb levels. The average increase in hemoglobin levels after consuming Fe tablets is 1.05 g / dl, egg consumption is 0.98 g / dl, and consumption of Fe tablets combined with eggs is 0.93 g / dl.

Table 4. Analysis of the Effect of Consuming Eggs and Fe Tables on Increasing Hb

Variables	Hb Levels				*p-value*
	Pre		Post		
	Mean ± SD	Min – Max	Mean ± SD	Min – Max	
Fe Tablets	13.71 ± 1.61	9.7 – 15.5	14.76 ± 1.29	12.1 – 16.5	0.0003
Egg	13.93 ± 1.16	10.8 – 15.8	14.91 ± 0.89	13.7 – 16.7	0.0099
Fe Tablets Combined with Eggs	11.70 ± 0.79	9.7 – 12.9	12.63 ± 0.79	11.5 – 14.1	0.0016

Tabel 5 Analysis of the Difference in Average Hb Levels Before and After Consuming Egss and Fe Tablets

Variables	*p-value*	
	Pre	Post
Control : Fe Tablet		
Egg	0.6808	0.7200
Fe Tablets Combined with Eggs	0.0002	0.0000

Table 5 shows the results of the Independent t-test in the Fe tablet consumption group with egg consumption, it was found that before the intervention (pre) there was no difference in the average Hb levels (p = 0.6808). The average hemoglobin levels of respondents in both groups before the intervention were the same (Mean Tablet Fe = 13.71 g / dl; Mean Egg = 13.93 g / dl). However, after the intervention (post) it was found that there was no difference in the average hemoglobin levels between the Fe tablet consumption group and the Fe tablet combination egg consumption group (p = 0.6808). The average hemoglobin levels of respondents in both groups after the intervention experienced the same increase in Hb levels (Mean Tablet Fe = 14.76 g / dl; Mean Egg = 14.91 g / dl).

Meanwhile, in the control group of Fe tablet consumption and Fe tablet consumption combined with eggs showed a difference in the average Hb levels (p = 0.0002). The average Hb levels of respondents in both groups before the intervention were different (Mean Fe Tablet = 13.71 g / dl; Mean Fe Tablet combined with Eggs = 11.69 g / dl). However, after the intervention (post), there was a difference in the average Hb levels between the Fe tablet consumption group and the Fe tablet consumption group combined with eggs (p = 0.0000). The average Hb levels of respondents in both groups after the intervention experienced different increases (Mean Fe Tablet = 14.76 g / dL; Mean Fe Tablet combined with eggs = 12.63 g / dL), and the average increase in Hb levels in the Fe Tablet group was greater.

DISCUSSION

The Effect of Consuming Fe Tablets on Increasing Hemoglobin Levels

This study shows a significant effect of consuming Fe tablets on increasing hemoglobin levels in adolescent girls at Panti Aisyah Klaten (p = 0.0003). This finding is consistent with previous studies by Nadila et al. (2023) and Silitonga et al. (2024) which also showed that consuming Fe tablets had a positive impact on increasing hemoglobin levels in adolescent girls (p = 0.000 < 0.05).[13, 14] The average increase in hemoglobin levels

was 1.05 g/dl after consuming Fe tablets and is in accordance with the study of Yuanti et al. (2020) which reported an average increase of 1.550 g/dl.[15]

Fe tablets are iron supplements containing 200 mg of elemental iron and 0.25 mg of folic acid, which play an important role in the formation of red blood cells.[16] The Indonesian government recommends iron supplements containing 60 mg of elemental iron and 400 mcg of folic acid.[17] This recommendation, based on Minister of Health Regulation No. 88 of 2014, is recommended for consumption by women of childbearing age once a week and once a day during menstruation.[18] The increase in hemoglobin levels after consuming Fe tablets is due to the important role of iron in the synthesis of hemoglobin, which functions to transport oxygen from the lungs to body tissues, as a means of transporting electrons in cells, and as an integral part of various enzyme reactions in body tissues.[19, 20]

Consuming Fe tablets can increase endurance and energy, so that individuals can be more productive in daily activities.[21] Iron deficiency in the body can cause various health problems such as fatigue, dizziness, and lack of concentration. If iron stores run out, the body will lack red blood cells, which causes a decrease in the amount of hemoglobin and potentially causes anemia.[22] Therefore, researchers emphasize the importance of maintaining adequate iron intake by consuming Fe tablets regularly.

The Effect of Egg Consumption on Increasing Hemoglobin Levels

This study shows that egg consumption has a significant effect on increasing hemoglobin levels in adolescent girls at Panti Aisyah Klaten (p=0.0099). This finding is in line with several previous studies that revealed that egg consumption contributes positively to increasing hemoglobin levels in adolescent girls.[23, 24, 25] Pharmacologically, anemia can be overcome by consuming Fe tablets, but this method is often less preferred due to side effects such as nausea and vomiting due to the smell of iron.[25] Therefore, consuming eggs can be an effective alternative to increase hemoglobin levels in adolescent girls.

The significant increase in hemoglobin levels after egg consumption can be explained by the heme iron content in eggs. Heme iron, which is bound to protein, is found in abundance in animal foods such as meat, poultry, fish, and eggs.[26] The heme iron content in animal foods ranges from 22% to 80%.[27] In addition, eggs are also rich in important vitamins and minerals that play a role in the formation of hemoglobin. Eggs contain various vitamins such as vitamins A, D, and vitamin B complex, including B12. Eggs are also rich in minerals such as iron, calcium, phosphorus, sodium, and magnesium.[28, 29] Eggs also contain important micro minerals such as iron, zinc, and selenium. The Fe content in eggs is quite high, with 1.04 mg in whole eggs and 0.95 mg in egg yolks.[30] The average increase in hemoglobin levels in adolescent girls in this study after egg consumption was 0.98 g/dl. Previous research by Nilma et al. (2023) also supports this finding, showing that consuming chicken eggs for 3 days can increase hemoglobin levels by 0.16 g/dl in adolescent girls.[31] Therefore, researchers assume that eggs can be a good alternative source of iron to increase hemoglobin levels, especially for adolescent girls who do not like red meat or Fe tablets. In addition, eggs are also affordable and easy to obtain.

The Effect of Consuming Fe Tablets Combined with Eggs on Increasing Hemoglobin Levels

This study shows that the consumption of a combination of Fe tablets and eggs has a significant effect on increasing hemoglobin levels in adolescent

girls at Panti Aisyah Klaten (p=0.0016), with an increase in hemoglobin levels of 0.93 g/dl after consuming Fe tablets. This study is consistent with the findings of Sulastri & Amin (2024), who also found that consuming boiled chicken eggs and Fe tablets together increased hemoglobin levels, with an average increase of 1.5133 g/dl.[32] These results indicate that the combination of Fe tablets and eggs is effective in increasing hemoglobin levels in adolescent girls.

Eggs contain heme iron, the form of iron most easily absorbed by the body, while Fe tablets contain non-heme iron. When consumed together, iron absorption from both sources increases. Iron in food is divided into two types, namely heme and non-heme.[33] Heme iron, found in meat, poultry, eggs, and fish, has high bioavailability, with an average absorption of around 25%.[34] Providing blood supplement tablets to adolescent girls and women of childbearing age is part of the Indonesian government's efforts to meet iron needs. Consuming these tablets at a dose of 1 tablet per week can prevent anemia and increase iron reserves in the body. Consuming these tablets together with sources of vitamin C from fruits such as oranges, papaya, mango, guava, and animal protein sources such as liver, fish, poultry, and meat, helps iron absorption.[35]

Adolescent girls need to combine the consumption of Fe tablets with a balanced nutritious diet rich in iron, such as eggs, to meet the body's needs.[36] Eggs contain important nutrients that support the absorption of iron in the body, such as choline (4%), riboflavin (6%), folate (2%), pantothenic acid (3%), vitamin A (2%), vitamin B12 (6%), iron (2%), phosphorus, and selenium.[37] The combination of Fe tablets with the nutrients in eggs provides holistic benefits in preventing anemia and maintaining blood health.[38] Researchers assume that consuming a combination of Fe tablets and eggs can increase hemoglobin levels in adolescent girls faster than consuming either one alone.

Factors that inhibit iron absorption are phytic acid, oxalic acid, tannins, calcium, phospitin and fiber. Phytic acid is abundant in cereal foods, oxalic acid is abundant in vegetables, phospitine is abundant in egg yolks. The compound will bind iron so that iron becomes difficult to absorb. Protein sources derived from soybeans reduce iron absorption. This is due to the very high phytate content. In addition to phytate and oxalate, tannins also inhibit iron absorption. This tannin is found in tea and coffee.

CONCLUSION

Conclusion

This study showed that there was an effect after being given Fe tablets (p=0.0003), eggs (p=0.0099), and Fe tablets combined with eggs (p=0.0016) on increasing Hb levels in female adolescents at Panti Aisyah Klaten. The average increase in hemoglobin levels after consuming Fe tablets of 1.05 g/dl was greater than consuming eggs of 0.98 g/dl, and consuming Fe tablets combined with eggs of 0.93 g/dl.

Suggestion

This research can be used as a reference or study material for health science literature in the prevention and management of anemia in adolescent girls. Health service institutions, especially midwives, provide preventive and curative services to the community in handling anemia in adolescent girls. The community can be motivated to prevent and manage anemia, especially in adolescent girls, by increasing knowledge,consume Fe and eat nutritious food (including eggs). The limitations of this study are that the sample size is small and the intervention carried out still takes a short time. The hope for future research can involve a large research

sample and with a long enough intervention time.

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