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Comparative Study of Providing Iron Supplementation to Adolescent Girls with Anemia by Intermittent Administration Compared to Routine Administration

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Abstract

Anemia is currently still a problem and suffered by many adolescent girls, especially in developing countries. The prevalence of anemia in adolescent girls in Indonesia based on Riskesdas 2018 data is 32%, which means that 3-4 out of 10 adolescent girls experience anemia. In some parts of Indonesia the prevalence of anemia reaches 60%. This study aimed to determine the difference in iron supplementation in adolescent girls with intermittent anemia compared to routine supplementation against the increase in hemoglobin levels and side effects caused. Research methods used quasi experiment with control group. Sampling used by stratified random sampling technique. Data collection was carried out by measuring hemoglobin levels of adolescent girls before and after intervention in both groups. The independent t-test showed that the significance value in the intermittent group and routine group was 0.334, which means that the variation in both groups was the same (>0.05). The results of the t test obtained a p value of 0.379 which means that between giving iron supplementation both intermittently and routinely did not provide a difference in the results of hemoglobin levels in adolescent girls. This shows that intermittent iron supplementation can still increase hemoglobin levels. Giving iron supplementation can be given intermittently or routinely both can increase hemoglobin levels in adolescent girls with anemia. Consideration of giving iron supplementation can be considered on the side effects that may be caused so that intermittent administration can be an alternative to continue to increase hemoglobin levels with fewer side effects felt.

Keywords

adolescent girls, anemia, iron supplementation

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Introduction

Anemia is one of the most common and not easily addressed global health problems in both developing and developed countries affecting human health as well as social and economic development (Organisasi Kesehatan Dunia, 2011). Anemia is defined as a condition of the body with a red blood cell count or hemoglobin level lower than normal which is 12 g / dL in women who are over 12 years old and not pregnant (Tandoh et al., 2021). The WHO report shows that 52% of pregnant women and about 40% of normal women experience anemia in developing countries due to iron deficiency. About 43% of children under 5 years of age have anemia, 27% of adolescents in developing countries, and 6% in developed countrie (Prasanth, 2017). The prevalence of anemia in Indonesia has increased significantly since 2007 – 2018 (Anggraeni, 2021) . Riskesdas 2018 data shows that the prevalence of anemia in adolescents in Indonesia is 32%, meaning that 3-4 out of 10 adolescents suffer from anemia (Kementerian Kesehatan Republik Indonesia, 2021).

Adolescents are included in the population that is prone to anemia. The vulnerability of the adolescent group is associated with an increased need for micronutrients (such as iron and folic acid) for physical growth (Al-Jermmy et al., 2022). Anemia in adolescent girls also occurs due to reproductive maturation and cognitive transformations in the course of life. In addition, anemia also occurs due to direct causes that often appear together, namely parasitic infections, inflammatory disorders, blood loss during menstruation and congenital abnormalities of hemoglobin structure. The most common causes of anemia include nutritional deficiencies, especially iron deficiency which is at least 50% of anemia cases (Balcı et al., 2012).

In adolescents, anemia can cause growth disorders, decreased physical fitness (easily tired, lethargic, dizzy, easily sleepy) and an increased risk of infection. In addition to adversely affecting physical growth and health status, anemia also affects cognitive development, hindering achievement in school as well as future work productivity. Adolescents with anemia who experience pregnancy can increase the risk of maternal and infant death, childbirth complications giving birth to babies with low birth weight, and increase the risk of stunting in children (Anggraeni, 2021), (Al-Jermmy et al., 2022).

The World Health Organization monitors several programs to help reduce the prevalence of anemia through treatment and prevention. The program established by WHO aims to increase dietary diversity, improve infant feeding practices, and increase the availability of micronutrient intake through fortification or supplementation with iron, folic acid, and other vitamins and minerals (world health organization, 2022). In addition, at the 65th *World Health Assembly* (WHA), WHO also agreed on action plans and global targets for maternal, infant, and child nutrition, with a commitment to halve (50%) the prevalence of anemia in WUS by 2025 (Kementerian Kesehatan RI, 2018).

The government through the Regulation of the Minister of Health of the Republic of Indonesia Number 88 of 2014 has regulated the standard of giving iron supplementation for women of childbearing age and pregnant women. Furthermore, the Minister of Health was followed up with the Circular Letter of the Director General of Kesmas Number HK.03.03/V/0595/2016 concerning the provision of iron supplementation to adolescent girls and women of childbearing age. One of the intensification strategies for prevention and control of anemia in adolescent girls and WUS is to prioritize the provision of iron supplementation through school institution (Kementerian Kesehatan RI, 2018).

Research by Permatasari, *et al* (2018) showed that the prevalence of anemia in adolescent girls decreased after being given a iron supplementation intervention for 4 months. The prevalence of anemia before

the intervention was 20.9% of 172 subjects decreased to 15.7% after the intervention i.e. decreased by 5.2% (Permatasari et al., 2018). Other studies also showed that the effect of iron supplementation administration on the increase in hemoglobin in adolescent girls who have anemia is with an average increase of 1.550 with p value = 0.001 (Yuanti et al., 2020). This suggests that iron supplementation may increase hemoglobin levels in adolescent girls.

Routine administration of iron supplementation or given every day is associated with side effects that appear namely the presence of mild gastrointestinal symptoms (eg. abdominal pain, vomiting, nausea, diarrhea, constipation). Such side effects are associated with decreased adherence to iron supplementation and may limit the effectiveness of interventions (J. L. Finkelstein et al., 2018). Based on a systematic review it was found that showed that women who received intermittent supplementation with iron alone, or in combination with folic acid or other nutrients, were less likely to develop anemia or iron deficiency than women who did not receive iron supplements or plasebo. In addition, the findings suggest that intermittent supplementation is as effective as daily supplementation in reducing the prevalence of anemia and increasing hemoglobin concentration, with fewer side effects (Fernández-Gaxiola & De-Regil, 2019).

Based on the description of the problem above, the research question in this study is “is there a difference in the provision of iron supplementation in adolescent girls with intermittent anemia compared to routine administration of elevated hemoglobin levels?”

Method

This study used a quasi-experimental research design with control group. The intervention given in this study was the administration of iron supplementation in adolescent girls by measuring hemoglobin levels before and after the intervention was given.

Research instruments that were used in this study include questionnaires on respondent characteristics, hemoglobin measuring devices, the sheet for monitoring the consumption of iron supplementation. The population in this study was adolescent girls. The sample is determined by stratified random sampling technique. The inclusion criteria in sampling are adolescent girls who experience anemia in the mild, moderate and severe categories. Data collection will be carried out in the Working Area of Puskesmas Kedungwuni 1, Pekalongan Regency with the highest anemia prevalence data in Pekalongan Regency, which is 36.97% (Dinas Kesehatan Kabupaten Pekalongan, 2022). The exclusion criteria are adolescent girls who are not willing to be respondents and cannot consume iron supplement due to allergies or other factors. The sample size is calculated based on the mean and standard deviation approaches (Permatasari et al., 2018).

In the initial screening examination, adolescent girls were checked for hemoglobin levels. After knowing the condition of their hemoglobin, adolescent girls who might fall into the category of anemia and were willing to become respondents (given informed consent). The results of the hemoglobin examination become the initial/ pre-intervention hemoglobin examination data. Researchers divided respondents into 2 groups, namely the intervention group (25 respondents) and the control group (25 respondents). Next, researchers gave treatment to the intervention group by giving iron supplementation to adolescent girls for intermittent consumption, namely adolescent girls consume iron supplementation 3 times for 1 week with no consecutive drink every day (eg: iron supplementation consumed on Monday, Wednesday, Friday or Tuesday, Thursday, Saturday) (Fernández-Gaxiola & De-Regil, 2019). In the control group, the intervention was given by giving iron supplementation to adolescent girls with anemia to take iron supplementation daily on a regular basis (J. Finkelstein et al., 2018). This inter-

vention is given for 8 weeks or 2 months. The provision of interventions was monitored using a monitoring checklist of iron supplementation consumption and assisted by the next of kin to ensure that iron supplementation has been consumed by adolescent girls. Researchers also helped to remind the iron supplementation consumption schedule through online reminders via short message / WA (*WhatsApp*) with confirmation of answers from respondents. After 8 weeks, researchers conducted hemoglobin tests on respondents to obtain final data / post intervention.

Data analysis was carried out after the data completed. Data processing was carried out with the aim that the information produced in this study can be ascertained to be correct. Data processing carried out by researchers goes through the following stages Editing (checking the completeness of the data), Coding (giving code to the data that has been collected), Processing (entering data from coding done in the previous stage into the computer program), Cleaning (checking the data that has been entered into the computer program and ensuring that all data entered was correct (Amruddin et al., 2022).

After the data was processed, then the data was analyzed univariately and bivariately. Univariate analysis in this study was characteristic of respondents. Age variables include types of numerical data to be analyzed by calculating the mean value, maximum value and minimum value. Other variables of categorical data type was analyzed by calculating the frequency and percentage of variables. Bivariate analysis was performed to see the effect of iron supplementation in each group. The statistical test used a paired sample t-test. After that, proceed with an independent sample t-test to analyze the differences between the two different groups.

Result and Discussion

Univariate analysis describes the characteristics of research respondents based on demographic data related to the dependent variable of the study. The following table 1 is the result of univariate analysis of this study.

The average age in the routine group was older than in the intermittent group, but the age range of the routine group was more at 15-19 years compared to the intermittent group of 16-18 years. Height in both groups had almost the same average value, namely at 153.68 and 153.56. Similarly, the weight variable has almost the same average value of 48.88 and 48.12. Similar to the age variable, the upper arm circumference of the routine group had a greater range of 19.5-31.5 cm than in the intermittent group. However, the average circumference of the upper arm was higher in the intermittent group than in the routine group. The average age of menarche in both groups was around 12 years with the youngest menarche being 10 years old in the intermittent group and the oldest being 15 years old in both groups.

In addition to describing the characteristics of respondents, univariate analysis also described Hemoglobin levels before and after blood tablets were given in both groups. The average Hemoglobin levels before being given blood-added tablets were almost the same in both groups (Purnama Hamudi et al., 2022). The average Hemoglobin levels after being given blood-added tablets in the routine group were higher than intermittent rice, but both groups experienced an increase in Hemoglobin levels after being given blood-added tablets. The increase in Hemoglobin levels in both groups also occurred at minimal and maximum values. The results of univariate analysis of Hemoglobin levels in both groups are presented in Table 2 below.

Hemoglobin is an erythrocyte tetrameric protein that binds to non-protein molecules, namely the iron porphyrin compound called heme (Khoeroh et al., 2024). Hemoglobin has two important transport functions in the human body, namely transporting oxygen to tissues and transporting carbon dioxide and protons from peripheral

tissues to respiratory organs. The amount of hemoglobin in erythrocytes is low, so the ability of erythrocytes to carry oxygen to all body tissues will also decrease and the body will become deficient in oxygen. This will cause anemia (Gunadi et al., 2016). Measurement of hemoglobin levels in this study was carried out before and after administration of blood supplement tablets (Limbong & Koro, 2022). On average, young women in both the intermittent and routine groups still had hemoglobin levels below normal before being given blood supplement tablets. This is influenced by the age, gender and nutritional status of the female adolescent (Jacobus et al., 2016). As a person gets older, a person will increasingly experience a physiological decline in all body organs, including a decline in the spinal cord which produces red blood cells. Adolescence occurs when children grow towards maturity and become adults. Physical, biological and psychological changes occur during adolescence. If there is an imbalance between meeting nutritional intake and needs, including iron, this can be the cause of anemia in adolescents. Unbalanced nutritional intake can result in nutritional problems, both under nutrition and excess nutrition (Nuradhiani et al., 2017). The average age of teenagers in this study shows that in late adolescence the body has prepared for maturity towards a more complex adulthood so that it requires nutritional intake that is balanced with the menstrual process that occurs every month and the daily activities of young women. Blood supplement tablets are supplements given to individuals which are useful for increasing hemoglobin levels in the blood. As in this study, giving blood supplement tablets to the group of young women was proven to increase hemoglobin levels by 0.92 respectively in the intermittent group and 1.20 in the routine group. This means that both groups experienced an increase in hemoglobin levels whether they were given blood supplement tablets intermittently or regularly. Previous research results stated that the increase in hemoglobin levels could be increased by 1.5 by administering blood supplement tablets (Yuanti et al., 2020). This research shows that the increase in hemoglobin levels in

Table 1. Description of respondents' characteristics based on age, height, weight, upper arm circumference, and menarche (n_1=25; n_2=25)

Variable	Group	Mean	Median	Std.Dev	Variance	Min-Max
Age	Intermittent	16,80	17	0,71	0,5	16-18
	Routine	17,24	17	1,09	1,19	15-19
Height	Intermittent	153,68	155	5,33	28,39	144-164
	Routine	153,56	155	4,76	22,67	144-165
Weight	Intermittent	48,88	46	8,83	77,94	39-68
	Routine	48,12	47	7,95	63,19	38-75
Upper arm circumference	Intermittent	24,12	23	2,72	7,40	21-29,5
	Routine	23,78	24	2,50	6,23	19,5-31,5
Menarche	Intermittent	12,12	12	1,27	1,61	10-15
	Routine	12,4	12	1,04	1,08	11-15

Table 2. Overview of Hemoglobin levels of respondents before and after based on intermittent and routine groups (n_1=25; n_2=25)

Variable	Group	Mean	Median	Std.Dev	Variance	Min-Max
Hemoglobin Levels before intervention	Intermittent	11,07	11,3	0,85	0,72	8,1-11,9
	Routine	11,08	11,2	0,62	0,38	9,4-11,9
Hemoglobin Levels after intervention	Intermittent	11,98	12	1,01	1,02	10,6-14,9
	Routine	12,28	12	1,30	1,68	9,6-15

the group given blood supplement tablets regularly was higher than those given intermittently. However, this research also found that there was no difference in the increase in hemoglobin in the group given blood supplement tablets either intermittently or regularly. This means that giving blood supplement tablets can be given intermittently or regularly, both of which can increase hemoglobin levels. This is supported by previous research which states that whether given regularly or intermittently, blood supplement tablets are equally effective in increasing hemoglobin levels in the blood and reducing the incidence of anemia [17]. Consideration of giving blood supplement tablets can be considered when side effects appear. In line with previous research, it is stated that giving blood supplement tablets can cause unpleasant side effects, namely stomach discomfort, nausea, vomiting, diarrhea and constipation (J. Finkelstein et al., 2018). In contrast, intermittent administration of blood supplement tablets is said to cause fewer side effects (Fernández-Gaxiola & De-Regil, 2019). Similarly, in this study, although the incidence of side effects was very small in both groups, the results of brief interviews with researchers showed that the routine group experienced more serious side effects in the form of gastrointestinal disorders accompanied by dizziness. Gastrointestinal disorders such as constipation and black stools without other side effects occurred in the intermittent group.

Conclusion

The results of the study showed that there was no difference in the increase in hemoglobin in the group given iron supplementation either intermittently or regularly. This means that giving iron supplementation can be given intermittently or regularly and can both increase hemoglobin levels. The consideration of giving iron supplementation can be taken in the emergence of side effects. Adolescent girls with anemia can be given iron supplementation intermittently to avoid possible side effects and reduce boredom when consuming iron supplementation.

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