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(RESEARCH ARTICLE)

The impact of regular consumption of iron tablets on changes in hemoglobin levels of female adolescents with anemia in the *Aksi Bergizi* program: An experimental study

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Abstract

Background: Health problems that often occur in adolescent girls are anemia. The high incidence of anemia, despite the implementation of a blood supplementation tablet program for adolescent girls since 2016, led the government to initiate the Program Aksi Bergizi. Objectives: This study aims to explain the effect of the implementation of Aksi Bergizi on the regularity of blood supplement tablets consumption and changes in hb levels in anemic adolescent girls. Methods: This research is a quantitative study, which uses a quasi-experiment design with a control group pre-test post-test approach. The parallel design is used to compare between two groups. The population of anemic adolescent girls in class VII of SMPN 2 Sedati was 48 female students. The sample of this study was 48 respondents with total sampling. Data collection techniques by giving knowledge questionnaires, iron consumption monitoring checklists and checking Hb levels with easytouch Hb measuring instruments. The independent variable is the provision of Aksi Bergizi. While the dependent variable is the regularity of iron consumption and changes in Hb levels. Data analysis used Mann Whitney U Test with a significant value of $p < 0.05$. Results: The results showed that most respondents in the treatment group had good knowledge (41.7%), iron consumption became regular (79%) and hb levels increased by an average of 0.4 gr/dl after the nutritious action program. The results of this study did not apply to the control group who were not given Aksi Bergizi. In the bivariate test, there was an effect of nutritious action program on the regularity of iron consumption with a p value of $0.037 < \alpha$ (0.05). In addition, there is an effect of Aksi Bergizi on changes in hb levels with a p value of $0.043 < \alpha$ (0.05). It is concluded that the Aksi Bergizi affects the regularity of consumption of blood supplement tablets and changes in hb levels in anemic adolescent girls.

Keywords: Aksi Bergizi; Consumption of Iron; Changes In Hb Levels; Nutrition; Anaemia in Adolescents

1. Introduction

Teenagers are an age group with an age range of 10-24 years [1]. A common health problem in teenage girls is anemia. Anemia is a condition where the hemoglobin (Hb) level in the blood is lower than the normal value. A person can be said to be anemic, when the Hb level is < 12 g/dl in women and < 13 g/dl in men [2].

The impact of anemia if experienced by adolescent girls can cause physical growth delays, behavioral and emotional disorders. This can affect the growth and development of brain cells so that it can cause decreased endurance, easy weakness and hunger, impaired learning concentration, decreased learning achievement and can result in low work productivity [3]. According to the World Health Organization the global prevalence of anemia is 40%[4]. Based on the 2018 Basic Health Research Report, the prevalence of anemia in Indonesia among young women aged 15-24 years is 32%. This shows that anemia is still a health problem in Indonesia.

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The *Aksi Bergizi* Program is a strategic effort to increase the consumption of iron tablets in adolescent girls, which is one of the indicators of specific nutritional intervention services in efforts to accelerate the reduction of stunting. In this program, there are several series of programs including joint exercise, joint breakfast, providing health education to adolescents and implementing joint iron tablet drinking [(1)]

This is in line with research conducted by Sholihah & Wirjatmidi regarding "The Relationship between Consumption Patterns and Habits of Consuming Iron Tablets with the Incidence of Anemia", the results showed a significant relationship between consumption patterns and habits of consuming iron tablets with the incidence of anemia in adolescent girls [(5)].

The gap between the government program in providing iron supplements and adolescent girls who are not compliant in taking iron supplements at SMP NEGERI 2 Sedati is proven by the still high rate of anemia in Sidoarjo district which reached 52.36% (Health Office, 2023). Proven by the results of the 2023 Hb Screening examination on 10,929 junior high and senior high school girls in Sidoarjo Regency, it was found that 2990 students had mild anemia (27.36%), 2605 students had moderate anemia (23.84%) and 127 students had severe anemia (1.16%). This also happened to teenage girls in the Sedati Health Center work area, of the 577 female students examined, 227 of them had anemia (37.89%). The results of the Hb examination on 146 female students of SMP Negeri 2 Sedati, as many as 48 female students (32.8%) had anemia.

Based on these problems, researchers are interested in conducting research on the Effect of Implementing Nutritional Action on the Regularity of Consumption of Iron Supplement Tablets and Increasing Hb Levels in Anemic Adolescent Girls at SMP Negeri 2 Sedati.

2. Material and methods

This study is a quasi-experimental study with a pretest posttest control group design. Quantitative experimental research that has treatment and measurement of the impact of the treatment is carried out to analyze each variable in the research group. This study aims to compare two groups (group comparison), namely the control group and the intervention group. The control group is anemic female adolescents who are not given a nutritious action program and the intervention group is those who are given a nutritious action program. In this study, the population was all 7th grade students of SMP NEGERI 2 Sedati who had anemia, namely 48 female adolescents. Because the population in this study was considered homogeneous and had met the desired criteria, namely junior high school students who had anemia, the sampling technique used was total sampling. The results of the research data were tested using the Mann Whitney U Test statistical test, namely a statistical test comparing two independent samples using a degree of significance of $p < 0.005$. This study has received ethical approval No. 76 / EC / KEPK / FKUA / 2024.

3. Results and discussion

SMP NEGERI 2 Sedati is an A accredited school. The school building is quite large and spacious, has 30 classrooms that can accommodate 957 students consisting of 488 male students and 469 female students. Class VII consists of 10 classes with a total of 320 students consisting of 148 female students. The results of the Hb screening examination in class VII, found 48 female adolescents who had anemia. Age distribution

Table 1 Age Distribution of Anemic Adolescent Girls at SMP NEGERI 2 Sedati Sidoarjo

Age	**Control group**		**Experimental group**	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
13 years old	20	83.3	18	75
14 years old	4	16.7	6	25
Total	24	100	24 siswi	100

Based on table 1, it can be concluded that most respondents were 13 years old, both in the control group and the experimental group. The results of the study conducted on 48 respondents showed that most of the respondents were 13 years old. According to WHO, adolescents are residents in the age range of 10-19 years, while according to the

Regulation of the Minister of Health of the Republic of Indonesia Number 25 of 2014, adolescents are residents in the range of 10-18 years. This shows that the respondents are included in the middle adolescent category. Adolescence is a transition period from childhood to adulthood which is expressed in years marked by a number of biological, cognitive and emotional changes so that adolescents need twice as much energy and nutrition during growth (6). Rapid growth and the onset of menstruation contribute to the depletion of iron stores which results in the occurrence of anemia in adolescents (7).

Table 2 Frequency Distribution of Data on the Level of Knowledge of the *Aksi Bergizi* Programm*e* for Anemic Adolescent Girls at SMP NEGERI 2 Sedati Sidoarjo**.**

Knowledge level	**Experimental group**				**Control group**	
	Pretest		*Posttest*			
	f	%	*f*	%	*f*	%
Good	0	0	10	41.7	0	0
Enough	22	91.7	14	58.3	20	83.3
Less	2	8.3	0	0	4	16.7
Total	24	100.0	24	100.0	24	100.0

Based on table 2, information was obtained that the respondents in the treatment group (received nutritious action education) were 24 young women. Before receiving education, none (0%) had Good knowledge. The results of the knowledge of young women increased after receiving education on the implementation of the nutritious action program, most respondents (41.7%) had good knowledge. The level of knowledge in the control group did not change because the control group did not receive intervention in providing nutritious action education.

The results of the knowledge analysis before the Nutrition Action program were given showed that the respondents in the treatment group were 24 young women. Before receiving education, no young women (0%) had good knowledge. After receiving education in the Nutrition Action program, most respondents (41.7%) had good knowledge.

Meanwhile, the respondents in the control group (not receiving education) during the implementation of the Nutrition Action program were 24 young women. Before the program, no young women (0%) had good knowledge. This is because the control group did not receive treatment.

The provision of health education in the Nutrition Action program increased the knowledge of young women. Counseling, as a form of non-formal education, aims to provide information, increase awareness, and change the attitudes and behavior of young women to be more positive, especially in efforts to deal with anemia. Counseling functions as an effective bridge to convey important information to adolescents, which will increase their knowledge and encourage positive changes in attitudes and behavior.

Knowledge can be obtained in various ways which states that good knowledge will encourage someone to take actions that are by the knowledge they have gained [(8)].

Table 3 Frequency Distribution of Data on Regularity of Consumption of Iron Supplement Tablets of the *Aksi Bergizi* Program for Anemic Adolescent Girls at SMP NEGERI 2 Sedati Sidoarjo.

Consumption of Blood Supplement Tablets	**Experimental group**				**Control group**			
	Pretest		*Posttest*		*Pretest*		*Posttest*	
	f	%	*f*	%	*f*	%	*f*	%
Regular	12	50	19	79.2	12	50	12	50
Irregular	12	50	5	20.8	12	50	12	50
Total	24	100.0	24	100.0	24	100.0	24	100.0

Based on table 3, information was obtained from 24 respondents in the treatment group. Before being given education, some respondents (50%) regularly took iron tablets. After receiving education in the *Aksi Bergizi* Program, there was an increase to (79%).

The results of the study explained that of the 24 respondents in the treatment group, before being given education, most respondents (50%) regularly took iron tablets in the *Aksi Bergizi* Program, and after receiving education there was an increase to (79%). While in the control group, of the 24 respondents in the control group (not receiving treatment) only (50%) regularly took iron tablets. After an evaluation, there was no change in behavior

The regularity of iron tablet consumption in this study is the behavior of female adolescents in consuming iron tablets according to the instructions of health workers. Compliance is a behavior that is closely influenced by knowledge, the higher the knowledge, the more it affects a person's level of compliance.

The nutritious action program provides good education in preventing anemia. This increase in knowledge encourages anemic adolescents to routinely consume iron tablets and consume foods rich in protein so that adolescents will not experience anemia again.

Table 4 Descriptive Statistical Data of Laboratory Results of Hb Levels of the *Aksi Bergizi* Program for Adolescent Girls at SMP NEGERI 2 Sedati Sidoarjo

Aksi Bergizi Programme	n	Minimum	Mean	Maksimum
Before	24	7.5	10.8	11.9
After	24	8.1	11.2	12.3

Based on table 4, it can be concluded that of the 24 respondents in the treatment group (receiving nutritional action education), the average Hb examination results increased from 10.8 mg/dl to 11.2 mg/dl after receiving education on the *Aksi Bergizi* Program.

Table 5 Descriptive Statistical Data of Laboratory Results of Hb Levels before the Implementation of the *Aksi Bergizi* Program for Adolescent Girls at SMP NEGERI 2 Sedati Sidoarjo

Aksi Bergizi Programme	n	Minimum	Mean	Maksimum
Before	24	7.9	10.7	11.9
After	24	8.2	10.8	12

Based on table 5, it is obtained information that from 24 respondents in the control group (not receiving education in the *Aksi Bergizi* Program), the results of the Hb examination increased from 10.7 mg/dl before the *Aksi Bergizi* Program to 10.8 mg/dl after the *Aksi Bergizi* Program. The results of the Hb examination in the control group increased, although the increase was not as significant as that in the experimental group.

Based on the research results, it was found that from 24 respondents in the treatment group (receiving education), the average Hb level laboratory results increased from 10.8 mg/dl before being educated to 11.2 mg/dl after receiving education in the nutritious action program. Meanwhile, in the control group, it was found that from 24 respondents in the control group (not receiving Nutritional Action education), the average Hb level examination results increased from 10.7 mg/dl before the nutritious action program to 10.8 mg/dl after the nutritious action program, but the increase was not significant.

One of the factors that can affect the increase in hemoglobin levels is the consumption of iron supplements that have been given for 30 days. Iron supplements contain iron in the form of ferrous sulfate and folic acid. After being taken, this tablet is absorbed in the small intestine and the iron is transported to the bone marrow, where red blood cell production occurs. In addition to iron, some iron supplements also contain vitamin C to increase iron absorption, as well as folic acid and vitamin B12 to support red blood cell production. Giving iron tablets to anemic adolescent girls is an important intervention to overcome iron deficiency and prevent the long-term negative impacts of anemia.

Adolescent girls in India, which showed a decrease in the prevalence of anemia from 65.3% to 54.3% after being given iron (100 mg) and folic acid (0.5 mg) supplements for 3 months [9].

Table 6 Effect of the *Aksi Bergizi* Program on the Regularity of Taking Iron Supplement Tablets among Female Adolescents at SMP NEGERI 2 Sedati Sidoarjo.

consumption of iron supplements	***Aksi Bergizi* Programme**				***p value***
	Given Education		No Education Given		
	F	%	F	%	
Regular	19	79.2	12	50	0.037
Irregular	5	20.8	12	50	
Total	24	100	24	100	

Based on table 6, in 24 respondents in the treatment group (given education), more than half of the respondents (79.2%) had regular iron tablet consumption behavior. In contrast, in the 24 respondents in the control group, only half (50%) had regular iron tablet consumption behavior. Based on the results of the Mann Whitney statistical test, there was an Asymp Sig. (2-tailed) result of 0.037. In accordance with the principle that if the Asymp Sig. (2-tailed) value <α 0.05, the conclusion H1 is accepted: there is an effect of the *Aksi Bergizi* Program on the regularity of iron tablet consumption.

In the results of the study, 24 respondents in the treatment group (given education) there were more than half of the respondents (79.2%) whose behavior of taking iron tablets was regular. In contrast, in the 24 respondents in the control group, only half (50%) had regular behavior of taking iron tablets. The results of the Mann Whitney statistical test showed the results of Asymp Sig. (2-tailed) 0.037. In accordance with the principle that if the value of Asymp Sig. (2-tailed) <α 0.05, the conclusion H1 is accepted: there is an effect of the *Aksi Bergizi* Program on the regularity of taking iron tablets.

Iron tablets play an important role in overcoming iron deficiency anemia by providing the iron needed for hemoglobin synthesis. Through the mechanism of iron absorption, transportation to the bone marrow, and increasing red blood cell production, regular consumption of iron tablets can significantly increase hemoglobin levels in the blood, improve symptoms of anemia, and improve the quality of life of adolescent girls with anemia.

Awareness of consuming iron tablets cannot be separated from the information and knowledge obtained by adolescent girls, this is because knowledge is a factor that influences the behavior of consuming iron tablets for adolescent girls. The behavior of consuming iron tablets is the action of young women in consuming iron tablets regularly as an effort to prevent anemia in order to increase hemoglobin levels in the blood. The *Aksi Bergizi* Program that was implemented had a positive impact on young women in terms of the regularity of consuming iron tablets. A series of nutritional action programs increased the knowledge and awareness of young women to consume iron tablets for 30 days [10].

Table 7 Effect of the *Aksi Bergizi* Program on Laboratory Results of Hb Levels of Female Adolescents at SMP NEGERI 2 Sedati Sidoarjo.

Aksi Bergizi Programme	**Hemoglobin levels**				**p value**
	Before the Program		After the Program		
	n	Mean	n	Mean	0,43
Given Education	24	10,8	24	11,2	
No Education Given	24	10,7	24	10,8	

Based on table 7, it is obtained information that the average increase in Hb levels of respondents that appears significant is in the treatment group (given education) before and after the *Aksi Bergizi* Program, with an average increase in lab results from 10.8 mg/dl to 11.2 mg/dl. On the other hand, in the control group, the increase was not significant from an average of 10.7 mg/dl to 10.8 mg/dl.

Results of the Mann Whitney Statistical Test on the Effect of the *Aksi Bergizi* Program on Laboratory Results of Hb Levels of Adolescent Girls at SMP NEGERI 2 Sedati Sidoarjo. Based on the results of the Mann Whitney statistical test, there is an Asymp Sig. (2-tailed) result of 0.043. In accordance with the principle that if the Asymp Sig. (2-tailed) value <α 0.05, the conclusion H1 is accepted: there is an effect of the *Aksi Bergizi* Program on increasing Hb levels.

In the research results, it was found that the average increase in Hb levels of respondents that appeared significant was in the treatment group (given education) before and after the *Aksi Bergizi* Program, with an average increase in lab results from 10.8 mg/dl to 11.2 mg/dl. On the other hand, in the control group, the increase was not significant from an average of 10.7 mg/dl to 10.8 mg/dl. Based on the results of the Mann Whitney statistical test, there was an Asymp Sig. (2-tailed) result of 0.043. In accordance with the principle that if the Asymp Sig. (2-tailed) value <α 0.05, it is concluded that there is an effect of the *Aksi Bergizi* Program on increasing Hb levels.

Effective efforts to treat anemia are by combining regular consumption of iron tablets with a diet containing protein. Iron tablets provide the iron needed for hemoglobin production, while foods rich in protein provide the amino acids needed for globin synthesis and red blood cell regeneration. This combination helps increase hemoglobin levels, reduce symptoms of anemia, and improve overall quality of life. Consistency in taking supplements and maintaining a balanced diet are key to optimal results. The *Aksi Bergizi* Program is one way to increase the knowledge of young women about the importance of taking iron tablets to prevent anemia. In addition, education is also provided about balanced nutrition that is rich in protein. The program of providing iron tablets for 30 days for anemia sufferers in adolescents can indeed affect the increase in blood hemoglobin levels in young women. However, if this program is not consumed regularly and supplemented with food intake containing protein, an increase in blood hemoglobin levels will not occur.

4. Conclusion

Based on the results of the study conducted on anemic female adolescents at SMP NEGERI 2 Sedati, it can be concluded that there was an increase in knowledge after being given education through the *Aksi Bergizi* Program, there was a change in behavior after being given education through the *Aksi Bergizi* Program, from initially not regularly consuming iron tablets, to being regular and there was a change in the Hb levels of anemic female adolescents after being given education through the *Aksi Bergizi* Program.

The time of the study was one of the limitations of this study because if the study was conducted for at least 3 months, it might be possible to obtain more optimal specific data on hemoglobin levels. The condition of the adolescents during the study can also be identified and evaluated more when the hemoglobin examination is carried out. Researchers have difficulty ensuring that no information is disseminated from the treatment group to the control group. This can cause the results of the study to be biased because the control group is no longer a pure comparison.

Compliance with ethical standards

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Disclosure of Conflict of interest

There is no conflict of interest in this study.

Statement of ethical approval

This study has received ethical clearance approval from the Ethics Committee of the Faculty of Medicine, Universitas Airlangga.

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