



Effect of Gaguk Fish (*Arius thalassinus*) cookies on macronutrient and micronutrient intake in anemic adolescent girls

*Pengaruh pemberian cookies pelangi Ikan Gaguk (*Arius Thalassinus*) terhadap asupan makro dan mikronutrien pada remaja putri dengan anemia*

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Abstract

Adolescence is a transition period from childhood to adulthood that requires nutritional intake of iron. Children with iron deficiency are highly susceptible to anemia. This study aimed to determine the effect of rainbow gaguk fish (*Arius thalassinus*) cookies on macro-and micronutrient intake in adolescent girls with anemia. This study used preliminary data from the Bengkulu Provincial Health Office, where many students experienced anemia in one junior high school. In the selection of samples using simple random sampling, 50 g of rainbow gaguk fish biscuits were used. The dependent variable in this study was gaguk fish. The independent variables were the macro-and micronutrient intake. This study employed a quasi-experimental pre-post-test intervention research using a purposive sampling design. Data analysis was performed using the paired t-test and Wilcoxon test at 95% confidence interval (CI). The results showed that before giving fish cookies, energy intake was 44,4%, protein 51,5%, carbohydrate 51,4%, vitamin B12 52,5%, folate 38,5%, iron 54%, and zinc 45,6%; after an increase in energy intake, energy intake was 55,8%, protein 62,3%, carbohydrate 52,1%, vitamin B12 65%, folate 39,1%, iron 74%, and zinc 81,1% ($p < 0,001$). In conclusion, the provision of rainbow biscuits to adolescent girls with anemia improved significantly.

Keywords: *Arius thalassinus*, macronutrient, micronutrient, anemia, fish

Abstrak

Masa remaja merupakan masa transisi dari masa anak-anak ke masa dewasa yang membutuhkan asupan zat gizi, salah satunya zat besi. Anak yang kekurangan zat besi sangat rentan mengalami anemia. Penelitian ini bertujuan untuk mengetahui pengaruh cookies ikan gaguk pelangi (*Arius thalassinus*) terhadap asupan zat gizi makro dan mikro pada remaja putri yang mengalami anemia. Penelitian ini menggunakan data awal dari Dinas Kesehatan Provinsi Bengkulu, dimana terdapat banyak siswi yang mengalami anemia di salah satu sekolah menengah pertama. Dalam pemilihan sampel menggunakan simple random sampling, sebanyak 50 g biskuit ikan gaguk pelangi. Variabel dependen penelitian ini adalah ikan gaguk. Variabel bebasnya adalah asupan zat gizi makro dan mikro. Penelitian ini menggunakan penelitian intervensi pre-post-test quasi eksperimental dengan menggunakan desain purposive sampling. Analisis data menggunakan uji t berpasangan dan uji Wilcoxon pada CI 95%. Hasil penelitian menunjukkan bahwa sebelum pemberian rainbow cookies, asupan energi sebesar 44,4%, protein 51,5%, karbohidrat 51,4%, vitamin B12 52,5%, folat 38,5%, zat besi 54%, dan zinc 45,6%; setelah dilakukan peningkatan asupan energi 55,8%; protein 62,3%; karbohidrat 52,1%; vitamin B12 65%; folat 39,1%; zat besi 74%; dan zinc 81,1% ($p < 0,001$). Kesimpulannya, pemberian biskuit pelangi pada remaja putri yang mengalami anemia mengalami peningkatan yang signifikan.

Kata Kunci: *Arius thalassinus*, macronutrien, micronutrien, anemia, ikan

Introduction

Indonesia is one of the developing countries in the Southeast Asia region where the prevalence of adolescent anemia exceeds 50%, ranking among 11 countries. Based on national Rikesdas data in 2013, 18,4% of adolescent girls experienced anemia, and it increased to 32% in 2018. Adolescent girls are one of the nutrient deficiency problem groups. Nutrients in the blood can be known through hemoglobin levels. Anemia occurs because of insufficient hemoglobin levels to function in the exchange of oxygen and carbon dioxide in tissues (Yulianti et al., 2016). Iron deficiency is considered the most common cause of anemia worldwide (Suryani et al. 2015). This is especially true for adolescent girls because they have experienced menstruation, which causes iron deficiency. (Paryati, 2017).

According to the 2023 IDHS report, 15,5% of adolescent girls aged 15-24 years are recorded as anemic. The prevalence of anemia in adolescent girls shows an increase in the consumption of blood supplement tablets, but few adolescent girls take blood supplement tablets regularly and in accordance with the recommended dose. This is evidenced by data from the 2023 IDHS report, which showed that of the 78,2% of adolescent girls who received blood supplement tablets, only 2,1% consumed more than 52 tablets annually. This indicates that awareness raising in general needs to be further improved. This figure shows a decrease compared to previous data in Rikesdas (2018), where the prevalence was 48,9% (Indonesian Health Survey, 2023).

The impact of anemia on adolescent girls is stunted growth; the body during the growth period is easily infected, resulting in reduced fitness or freshness and decreased learning spirit or achievement. Low iron levels can lead to anemia with symptoms of pallor, lethargy or fatigue, shortness of breath, lack of appetite, and impaired growth. Some direct effects that occur in 2023 adolescent girls who are anemic often complain of dizziness and foggy eyes, eyelids, lips, tongue, skin, and palms, becoming pale, lethargic, weak, tired, and sluggish, as well as long-term effects because women will later become pregnant and have children. Pregnant adolescents who already suffer from anemia will experience more severe anemia if their nutritional needs are not adequately met (Apriyanti, 2023; Fitria et al., 2021).

Anemia in adolescents can be avoided or overcome with some knowledge about the nutrients that can prevent anemia in food. Knowledge is strongly influenced by the intensity of attention and the perception of an object. Adolescents who have good knowledge about anemia will tend to make preventive efforts so that they do not experience anemia. Protein intake plays an important role in the incidence of anemia in adolescent girls. Proteins play an important role in the transport of iron in the body. Lack of protein intake inhibits iron transportation, resulting in iron deficiency (Almatsier, 2009; Murray et al., 2006). In addition to consuming drugs, good protein intake can minimize the possibility of developing anemia.

Gaguk fish (*Arius thalassinus*) is a type of fish that contains more protein and iron than other protein and iron sources, with a protein content of 17,9 g and an iron content of 4,50 mg. The utilization of gaguk fish in the community is not optimal; if processed into gaguk fish flour, it creates a new food product and increases the selling price. Based on the nutritional content of protein and iron, fish flour can be used to fulfill the needs for protein and iron in cookies (Febrianti et al., 2021; Widjaya et al., 2021).

Imandira et al. (2021) reported the effect of Dumbo gaguk fish cookies for 14 days, given three pieces of cookies or as much as 50 g of cookies with substitutions of Dumbo gaguk fish flour and soy protein isolate every day. 50 grams of cookies contain 280 kcal of energy, 9,8 grams of protein, 26,87 grams of carbohydrates, and 10,56 grams of fat. This study concluded that there was a significant increase in hemoglobin levels before and after the intervention.

Anemia can be prevented by providing alternative food diversity that many young women like today. Cookies are one of the choices made from wheat-based ingredients that are well known to the public, especially for young women. Erdiana (2021) showed that gaguk fish contain a lot of protein, which can also meet the needs of adolescent girls to avoid anemia.

Methods

This study was a quasi-experimental pre- and post-trial intervention study. This study used pretests and posttests for both the control and intervention groups. The control group was not given treatment, whereas the intervention group received treatment. The treatment given was in

the form of rainbow gaguk fish cookies, of which as much as 50 g (five pieces) were administered for 14 days. This study was conducted by interviewing and filling out a questionnaire containing nutritional intake, namely the Food Frequency Questionnaire (FFQ), regarding energy, protein, carbohydrate, iron, vitamin B12, folic acid, and zinc intake, and checking the first hemoglobin level (pre-test) before being given rainbow gaguk fish cookies. After that, observation was carried out again through the posttest to see the results of differences in energy, protein, carbohydrate, iron, vitamin B12, folic acid, and zinc intake, as well as to check the hemoglobin levels of adolescent girls after being given rainbow gaguk fish cookies.

This study was conducted at Secondary School 15 in Bengkulu. Hemoglobin levels were examined at the Laboratory of Dr. M. Yunus Hospital, Bengkulu City. The study period was from 03 January to January 24, 2024.

The target population of this study was all students who attended public junior high school 15 in Bengkulu City. The target population in this study was adolescent girls with hemoglobin levels <12 g/dL who met the inclusion criteria, namely adolescents who had Hb levels <12 g/dL and adolescent girls who were willing and able to follow research instructions, and exclusion criteria, namely adolescent girls who experienced illness and were not present at the time of the study, and adolescent girls who could not follow research instructions. Samples that met the inclusion criteria were given an explanation of the objectives and treatments that would be provided during the study. The research sample was given two choices: choosing to participate if they agreed and refusing if they did not agree. After the sample understood and agreed to participate, they were asked to fill out and sign a letter of consent to participate in the study.

We evaluated the status of the respondents' hemoglobin and serum ferritin levels after the completion of the administration of rainbow gaguk fish cookies on day 14.

The sample formula used in this study is the Lemeshow sample size formula for the paired mean difference hypothesis test, as follows:

$$n = \frac{\{zn + z\beta\}S^2}{(x_1 - x_2)^2}$$

Description:

n : Minimum sample size

zα : Standard deviation alpha (1,96)

zβ : Standard deviation of beta (1,64)

S : Standard deviation 0,88 (based on research Purwaningsi, 2018)

x1-x2 : Minimum difference in Renata that is considered meaningful (0,78)

Based on these calculations, a minimum sample size of 17 participants was determined. To anticipate the loss of experimental units or dropouts, a correction of 20% was made, so that the number of samples required was 22. Purposive sampling was used to obtain the research sample. Samples were collected based on predetermined inclusion criteria.

Permission to carry out the research was obtained from the research site. This study was conducted after obtaining ethical approval from the Research Ethics Commission.

Each sample was given information about the purpose, risks, and benefits of the study. After they understand the explanation that has been given, the sample will be asked for consent by signing a statement of consent to become a respondent that has been provided. Each sample had the right to know the results of the examination and could withdraw from the study if they were unwilling to continue. Based on the ethical clearance letter SK Number 870/UN.16.2/KEP-FK/2024, this research has been approved by the Research Ethics committee of the Faculty of Medicine, Andalas University.

Implementers and readers were carried out by 2 nurses who had been trained to take blood samples and 2 analysts to check and read the results of the examination of hemoglobin levels. In this study, nurses and health analysts were experienced in their respective fields in the laboratory of Dr. M. Yunus Hospital in Bengkulu City.

All samples were given an explanation of the purpose of this study and the risks and benefits of the study, and they were then asked to sign a statement of consent to become a respondent that had been provided. Each sample had the right to know the results of the examination and could withdraw from the study if they were unwilling to continue. This study was approved by the Research Ethics Commission of the Faculty of Medicine, Andalas University (ethical clearance decision letters SK Number 870/UN.16.2/KEP-FK/2024).

The data were analyzed using SPSS-20. For numerical data, the Shapiro-Wilk test was used to determine if the data were normally

distributed as a condition for using the paired t-test at 95% CI. If the data were not normally distributed, ordinal data were analyzed using the Wilcoxon test at 95% confidence interval (CI). The researcher also completed a Food Frequency Questionnaire (FFQ). Hemoglobin, Ferritin and FFQ results were entered into the master data for further analysis to understand the consumption patterns and nutritional intake.

Result and Discussion

Secondary School 15, Kota Bengkulu, is a public school in the Bengkulu Province. The accredited school had a land area of 22655 m². The school, which is in the working area of Penurunan Community Health Centre, is located on street Cempaka, Kebun Beler Village, Ratu Agung Sub-district, Bengkulu City, Bengkulu Province.

The Secondary School Negeri 15 Kota Bengkulu has 436 students in the 2023/2024 academic year, with 240 male and 195 female students. The staff of the Negeri 15 Bengkulu City secondary school consists of 16 people, staff, one janitor, and one security guard. The school facilities room has nine classrooms, one lab room, one library room, one teacher's room, one principal's room, and two fields, namely, ceremony and sports.

Teaching and learning activities in secondary school countries 15 Bengkulu City start from 7.15 a.m. to 2.30 pm on Mondays to Thursdays and Friday from 7.15 am to 11.15 am. Extracurricular activities are usually held on Friday afternoons from 2 pm to 3.30 pm. School Health Unit activities in secondary school country 15 Bengkulu City have not played an active role in empowering students and the school community to carry out health education, health services, and school guidance.

During the intervention, girls were given cookies directly by the researcher in their respective classes; however, some were in the school environment. Meanwhile, on holidays, young women's homes are used to conduct compliance monitoring after giving cookies, so that researchers remain in place until young women finish consuming the cookies. In addition to providing rainbow gaguk fish cookies,

Researchers also administered a Food Frequency Questionnaire (FFQ) to determine the nutritional intake of adolescent girls at the beginning and end of the intervention. The Frequency distribution of research data

characteristics based on the sex and age of adolescent girls is presented in Table 1.

Tabel 1. Ferritin levels of adolescent girls before and after intervention

Group	Ferritin Level (ng/mL)		p value
	Before	After	
Intervention, median (min-max)	22,10 (13,22-24,86)	24,88 (16,12-28,22)	0,001 ^a
Control mean±SD	23,22±3,7	21,33±3,6	0,001 ^b

a Uji Wilcoxon, b. paired-test

Based on Table 1, showed that ferritin levels increased from before the intervention (22,10 ng/mL) to after the intervention (24,88 ng/mL); there was an increase in ferritin levels of 2,78 ng/mL. Further statistical tests using the Wilcoxon test revealed a difference in average ferritin levels before and after the intervention. In the control group, the average ferritin level decreased from before (23,22 g/dL) to after (21,33 g/dL). There was a decrease in the average ferritin level of 1,89 g/dL in further statistical tests with paired tests, which showed that there was a difference in the average ferritin levels before and after.

As shown in Table 2, there was an increase in the intake and nutritional adequacy (energy, protein, carbohydrate, vitamin B12, folate, iron, and zinc) before and after the intervention. Further statistical tests using the Wilcoxon test for energy, protein, and iron showed a difference in intake before and after the intervention; the intake increased in energy by 234,7 kcal, protein by 7 g, and Fe by 3 g, so that it could increase the nutritional needs of adolescent girls. Further statistical tests on carbohydrates, vitamin B12, folate, and zinc using the paired t-test showed a difference in intake before and after the intervention, and an increase in carbohydrates, vitamin B12, folate, and zinc. The Frequency Questionnaire was then entered into the master's data for further analysis, where the study sample was not taking Fe tablets.

In the results of daily food intake before and after the provision of gaguk fish rainbow cookies compared to the intake of nutritional adequacy rate, there were differences in nutrient intake before and after the intervention on the intake of energy, protein, KH, Fe, and Vit. B12, folate, and Zn. Nutrient

intake after the intervention was higher than before the intervention. The increase in intake met the nutritional adequacy of adolescents based on the Regulation of the Indonesian Ministry of Health number 28 of 2019 concerning the recommended nutritional

adequacy of energy, protein, carbohydrates, iron, magnesium, and zinc for people in Indonesia. The recommended adequacy for children aged 13-15 years in women per person per day is 2050 kcal, 65 g, 70 g, 15 mg, 220 mg, and 9 mg (AKG, 2019).

Table 2. Macronutrient and micronutrient intake on food frequency questionnaire (FFQ) and nutrient adequacy levels

Nutrients	Before		After		P-value
	Intake	% NAR	Intake	% NAR	
Energy (kcal) Median (min-max)	910,2 (722,8-1576,0)	44,4 (35,2-76,9)	1144,9 (722,8-1902,5)	55,8 (35,2-92,8)	0,001**
Protein (g) Median (min-max)	33,5 (7,5-46,6)	51,5 (11,5-71,7)	40,5 (9,4-47,8)	62,3 (14,5-73,5)	0,001**
Carbohydrates (g) (Mean ± SD)	154,1 ± 45,7	51,4 ± 15,2	156,2 ± 57,1	52,1 ± 19,0	0,001*
Vitamin B12 (Mean ± SD)	2,1 ± 0,3	52,5 ± 7,5	2,6 ± 0,3	65 ± 7,5	0,001*
Folate (g) (Mean ± SD)	154,1 ± 45,7	38,5 ± 11,4	156,2 ± 57,1	39,1 ± 14,3	0,001*
Iron (g) Median (min-max)	8,1 (6,6-10,1)	54,0 (44,0-67,3)	11,1 (9,8-14,8)	74,0 (65,3-98,6)	0,001**
Zink (g) (Mean ± SD)	4,1 ± 1,6	45,6 ± 17,8	7,3 ± 0,6	81,1 ± 6,7	0,001*

**Wilcoxon-test, *Paired-test; NAR= Nutrient Adequacy Ratio

The results of this study are similar to those of Annisa (2023) on the effect of cookies made from chicken liver flour and soy flour as anemia prevention foods in adolescent girls. It was found that in adolescent girls at the Petobo refugee camp in Palu city, the results of the Food Frequency Questionnaire (FFQ) on daily food intake of nutritional substances on energy intake, iron, protein, and fat increased after the provision of interventions from the recommended nutritional adequacy rate, which is due to the consumption of more rice than other side dishes, so that it does not meet the nutritional needs per day. Aureli (2022) in adolescent girls at secondary school 02 Bengkulu City, protein intake is not fulfilled; adolescent girls consume only 45% of the recommended nutritional adequacy rate. Lack of protein intake is one of the factors associated with anemia if the protein intake is long-term. Adolescent girls in secondary school 02 in Bengkulu City also often consume foods that contain iron-blocking substances, such as phytates contained in corn, soybeans, and other types of beans, and tannins contained in tea, coffee, and spinach. Lime/calcium substances in foods contained in milk and cheese can inhibit

iron absorption, which in the long run can cause anemia. Other research results from Putri (2023) Interview results from the Food Frequency Questionnaire (FFQ) on zinc and iron intake were found to have increased nutrient intake after being given the intervention compared to before giving the intervention.

According to the Food Frequency Questionnaire (FFQ) after treatment in the intervention group, energy intake, protein intake, fat intake, carbohydrate intake, and energy intake were 75,3% and 80,7%, 84%, 76,7%, 82%, 81,1%, and 83%, respectively. The results of the average intake of Food Frequency Questionnaire (FFQ) nutrients that have met the recommended nutritional adequacy rate are protein intake, fat intake, iron intake, magnesium intake, and zinc intake, which are sufficient; in energy intake and carbohydrate intake, the average intake results are lower, and the nutritional adequacy rate can affect the need to increase hemoglobin. In the control group, after treatment, energy intake was 52,8%, protein intake was 47,3%, fat intake was 53,4%, carbohydrate intake was 50,7%, iron intake was 30,3%, magnesium intake was 43,3%, and zinc intake was 41,1%; the average results of the

Food Frequency Questionnaire (FFQ) nutrition intake did not meet the recommended nutritional adequacy. The average nutrient intake in the intervention group was higher than that in the control group. Most nutrients in the intervention group increased after receiving rainbow fish cookies for 14 days.

The results of this study are similar to those of Safitri (2023) regarding the effect of protein pumpkin and gaguk fish flour cookies on hemoglobin levels in adolescent girls experiencing a positive increase in the results of the Food Frequency Questionnaire (FFQ) intake of protein, iron, and zinc after administering the intervention of pumpkin

and gaguk fish cookies for 14 days. The conclusions of this study are as follows: In addition, in a study conducted by Rahma (2022) on the effect of red spinach chocolate cookies on the hemoglobin levels of adolescent girls, it was found that the results of the Food Frequency Questionnaire (FFQ) on protein, carbohydrate, and iron intake in the intervention group before intervention were 66,3%, 58%, and 61,8%, respectively, and increased in protein, carbohydrate, and iron intake after intervention for 15 days, namely 81%, 83,7%, and 80,7%, respectively, compared to the recommended nutritional adequacy rate, which was sufficient.

Table 3. Difference in mean hemoglobin level of respondents before and after intervention

Hb Level	n	Mean	Min	Max	Standard Deviation	p value
Hb Before (g/dL) intervention class	22	10,25	9,30	10,90	0,5	0,001*
Hb After (g/dL) intervention class	22	12,34	11,50	12,90	0,4	
Hb Before (g/dL) control class	22	11,16	10,20	11,80	0,48	
Hb After (g/dL) control class	22	10,28	9,70	11,00	0,52	

*Paired-test

Table 3 Hemoglobin Levels of Adolescent Girls Before and After Intervention. The average hemoglobin level in the intervention group increased by 2,09 g/dL, from before the intervention (10,25 g/dL) to after the intervention (12,34 g/dL). In further statistical tests with paired tests, there was a difference in the average hemoglobin levels before and after the intervention.

There was also a decrease in hemoglobin levels in the control group of 0,9 g/dL from before (11,0 g/dL) to after (10,10 g/dL) in further statistical tests with the Wilcoxon test.

From the results of all samples examined, the average hemoglobin level was below the normal limit, which was classified as mild or moderate anemia. The above results indicate that the sample is anemic but not iron-deficient because the results show that the ferritin level is still within normal limits. Other factors that affect the blood cells include vitamin B12 and amino acids. The nutritional content of gaguk fish cookies is quite complete, including iron and protein, which can increase hemoglobin levels.

Gaguk fish is a food ingredient that contains substances necessary for the formation of red blood cells and prevents anemia because the content of gaguk fish is complete, which can help the process of hematopoiesis (the process

of forming blood cells). Gaguk fish have many benefits, one of which is as a source of iron and protein, which is a component of hemoglobin in red blood cells that determines the oxygen-carrying capacity of the blood. Gaguk fish have iron and protein content, which are very important in the production of red blood cells and can help prevent anemia (Fajri, 2020).

In rainbow gaguk fish cookies, haem iron is secreted in the stomach, reduced to the ferrous form, and dissolved in solvents such as hydrochloric acid (HCl), ascorbic acid, and amino acids. Both heme and non-heme iron are then lifted to the surface of small intestine cells to be bound by transferrin receptors. In the small intestinal mucosal cells, iron can bind to apoferritin and form ferritin as a temporary iron store in cells. When the body is iron-deficient, the iron consumed is directly carried by blood transferrin into the bone marrow and used to produce hemoglobin, which is part of the red blood cells (Almatsier, 2011).

This research is the same as that found by Syahwal (2018), namely an increase in hemoglobin levels of 11,65 g/dL before intervention and after intervention for 15 days increased to 12,69 g/dL in adolescent girls who were given snack bars from nagara bean flour

and gaguk fish. Likewise stated by Novianti, (2019) In adolescent girls who were given symbiotic fermented milk for 14 days, Hb levels increased from 10,39 g/dL to 13,11 g/dL. These results indicate that there was a difference in the average hemoglobin levels in the intervention group.

Another study by Thalib (2021) on the effect of giving anchovy cookies on increasing hemoglobin levels in adolescent girls at SMK 1 Rangas Mamuju Regency showed that there was an effect of giving anchovy cookies on increasing the hemoglobin levels of adolescent girls at secondary school 1 Rangas Mamuju Regency. The results of the data analysis and evaluation of the intervention of anchovy cookies showed a difference in increasing hemoglobin levels after the anchovy cookie intervention for 10 days in adolescent girls at secondary school 1 Rangas Mamuju Regency.

Research conducted by Nafilah (2024) reported that the intervention of administering cookies balai (spinach flour and soybean sprouts) as much as 100 g carried out for 10 days can increase the hemoglobin level of adolescent girls with anemia from the average hemoglobin level before being given cookies balai, which is at least 8,9 d/dL, maximum 11,8 g/dL, and an average of 0,6 g/dL, After consuming cookies, balai hemoglobin levels are at least 9,8 g/dL, a maximum of 12,9 g/dL, and an average of 11,9 g/dL so that there is an increase in hemoglobin levels on average of 1,3 g/dL.

Briawan (2019), entitled The Efficacy of Sweet Potato Cookies Fortification to Improve the Anemia of School Children, showed that the provision of cookies in as much as 65% of the sample experienced an increase in hemoglobin levels, and the interaction of several minerals with vitamins generally has an effect on nutrition. Iron and folic acid can increase metabolism and iron production by vitamin B12.

During the administration of rainbow sturgeon fish cookies, 99% of the participants finished the cookies, which was corroborated by their desire to continue participating in the study. The level of compliance in consuming rainbow gaguk fish cookies greatly influences the prevention of anemia. These cookies could be an additional source of food for adolescent girls. The more obedient or routine the respondent is in consuming cookies, the more aware he will be that anemia prevention is very beneficial for health, and with this awareness, a

concern will form, especially for one's own health in preventing anemia.

The results of this study are in line with research conducted by Riana (2020) After consuming mung bean porridge, the results of a study with 30 respondents showed that 23 respondents experienced a decrease in the incidence of anemia to 7 respondents who were not anemic. It was concluded that the increase in Hb levels in respondents was also due to respondents following what the researcher recommended: they consumed mung porridge for 15 days to help increase their Hb levels.

This study is in line with Rahmat (2023), who concluded that there is a difference in the occurrence of a decrease in the incidence of anemia before and after giving gaguk fish cookies to adolescent girls. This study was conducted for 15 days by giving 50 g of gaguk fish cookies three times a week, obtaining a p-value of 0,016, which shows that there is a relationship between giving cookies made from gaguk fish meat and hemoglobin levels.

In a study by Shafrina (2022), the provision of yellow sweet potato cookies as an alternative product for adolescent girls with anemia reduced the incidence of anemia among junior high school and vocational high school students in Bekasi City, showing an improvement in anemia. The average Hb level before supplementation was 11,4 g/dL and subsequently increased to 12,3 g/dL. After the provision of pumpkin cookies, there was a change in the incidence of anemia, with 5% of students remaining anemic.

Based on the researcher's experience during the research process, there were several limitations. These limitations can be a factor that can be considered by future researchers to improve their research, because this research certainly has shortcomings that must be overcome in future research. Regarding the shortcomings of this study, especially the small sample size of 22 respondents, it is still not sufficient to describe the actual situation.

Conclusion

Based on the research that has been done, namely the Effect of Giving Rainbow Fish Cookies Gaguk (*Arius Thalassinus*) on increasing Hemoglobin Levels and Ferritin Levels in Iron Deficiency Anemia Teenage Girls in Bengkulu City, the average hemoglobin level of respondents before being given Rainbow Fish

Cookies Gaguk in adolescent girls $10,25 \pm 0,25$ and ferritin levels were $22,10 \text{ ng/mL}$ ($13,22-24,86$), the average hemoglobin level of respondents after being given Rainbow Fish Cookies Gaguk in adolescent girls $12,34 \pm 0,16$ and ferritin levels $23,75 \text{ ng/mL}$ ($16,12-28,22$).

This research shows that, to overcome anemia, the nutrition of the body must be considered. This study aimed to help young women who tend to dislike blood-boosting drugs by offering an alternative to Gaguk fish-based cookies that are popular among teenagers.

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