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PAPAYA EXTRACT AND IRON FOLATE CAPSULES ON HB AND FERRITIN LEVEL IN ADOLESCENT GIRLS WITH ANEMIA AT SMA NEGERI 3 KENDARI CITY

Sultan Akbar Toruntju[1]✉, Zakaria[2], Rofiqoh[1], Gani K[1]
[1] Department of Nutrition, Health Polytechnic of Kendari
[2] Department of Nutrition, Health Polytechnic of Makassar

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ABSTRACT

To assess the effect of sea rabbit capsules, papaya fruit juice and iron-folate capsules on Hb and ferritin levels in high school adolescent girls with anemia. Pre-post quasi experiment was used. Location at SMA Neg 3 Kendari. The sample count is 27.6 rounded up to 30 people. The number of treatment samples was 30 people and 20 people as controls. Administered 1 time/day, for 4 weeks Sept 2022. The intervention was carried out in the school room during the break after lunch. Give capsule A to the intervention group, capsule B to the control group. The dose of capsule A is 15 mg/day, and the dose of capsule B is iron 15 mg/day and folate 300 mcg/day. There were 98 participants in the screening, 33.3% suffering from anemia, 48.9% nutritional status Chronic Energy Deficiency. There was an average increase in hemoglobin levels in the five groups, between before and after treatment, but the increase was very small, not statistically significant, $p<0.05$. The same thing with serum ferritin, all treatment groups and control groups experienced an increase between before and after treatment, but the value was very small or not significant ($p<0.05$). The results of the ANOVA test showed that there was no difference in the average hemoglobin and ferritin levels between groups, the significant level (p) = 0.37 or > α = 0.05.There was no difference in hemoglobin levels and serum ferritin levels between before and after treatment, both in the treatment group and in the control group.

Kata Kunci:

Remaja Putri;
Hemoglobin;
Ferritin:
Kelinci Laut;
Jus Pepaya

ABSTRAK

Mengetahui efek kapsul kelinci laut, jus buah pepaya dengan kapsul zat besi-folat terhadap kadar Hb dan feritin pada remaja putri penderita anemia. Menggunakan metode quasi dengan rancangan pre-post dengan group. Lokasi di SMA Negeri 3 Kendari. Jumlah sampel adalah 27,6 dibulatkan menjadi 30 orang. Jumlah sampel perlakuan adalah 30 orang dan 20 orang sebagai kontrol. Sampel dikelompokkan menjadi 2 kelompok, yaitu kelompok perlakuan (diberi kapsul kelinci laut, jus pepaya dan zat besi-folat), kelompok kontrol (diberi kapsul zat besi-folat dan plasebo). Diberikan 1 kali/hari, selama 4 minggu di bulan September 2022. Intervensi dilakukan di ruang sekolah saat istirahat setelah makan siang. Kapsul A diberikan pada kelompok intervensi, kapsul B pada kelompok kontrol. Dosis kapsul A adalah 15 mg / hari dan dosis kapsul B adalah zat besi 15 mg / hari dan folat 300 mcg / hari. Terdapat 98 orang yang dilakukan skrining, 33,3% diantaranya menderita anemia dan 48,9% status gizi KEK. Ada peningkatan rata-rata kadar hemoglobin pada lima kelompok antara sebelum dan sesudah pengobatan, tetapi peningkatannya sangat kecil, tidak signifikan secara statistik, p<0,05. Sama halnya dengan feritin serum, semua kelompok perlakuan dan kelompok kontrol mengalami peningkatan antara sebelum dan sesudah perlakuan, namun nilainya sangat kecil ataut idak signifikan (p<0,05). Hasil uji ANOVA menunjukkan bahwa tidak ada perbedaan kadar hemoglobin dan feritin rata-rata antarkelompok, dengan taraf signifikan (p) = 0,37 atau> α = 0,05. Tidak ada perbedaan kadar hemoglobin dan kadar feritin serum antara sebelum dan sesudah pengobatan, baik pada kelompok perlakuan maupun pada kelompok kontrol.

✉ ***Corresponding Author:***

Sultan Akbar Toruntju
Telp. 081341905666
Email: akbar_toruntju@yahoo.com

INTRODUCTION

There was an increase in the number of anemia sufferers in school children according to Indonesian Basic Health Research data, from 2007, 2013 to 2018, namely 12.8% (70.0% were Iron Deficiency Anemia-IDA), 21.7% increased to 84.6% in pregnant women 15-24 years (Kemenkes RI, 2018). This shows that the largest proportion of anemia is iron deficiency anemia (IDA). Meanwhile, the number of anemia sufferers in SMA Negeri 3 students in Kendari City is 41.3% (Kaimudin et al., 2017).

Anemia is a certain condition in which red blood cells (erythrocytes) are unable to provide sufficient oxygen to the body's tissues, mostly due to iron deficiency (Ngui et al., 2012). Iron deficiency can occur due to, from insufficient iron intake and poor absorption, increased iron requirements during growth, and excessive iron loss (Pasricha et al., 2013). Iron deficiency anemia is generally preceded by malnutrition in the child. Another expression as found by (Sumarno et al, 2014), anemia as a result of iron deficiency anemia generally may not be known and felt by children and their parents, but the effect of anemia which causes a decrease in aerobic endurance will have the effect of decreasing physical abilities which will ultimately interfere with the child's own growth and development process.

Iron deficiency at school age can affect immunity, growth rate, effects on intellectual performance, functional neurological and intelligence of children (Igbal et al., 2015; Mesfin et al., 2015). The availability of iron amounts is highly dependent on iron intake. The low intake of iron is caused by more intake of non-heme iron, and intake related to iron absorption inhibitors (Koshy et al., 2020; Ngui et al., 2012).

According to WHO there are four main strategies that can be used to prevent and treat iron deficiency including supplementation with pharmaceutical preparations, disease reduction, diversification of food consumption and food fortification (Kaur et al., 2022; Pandey & Singh, 2013). However, several studies consider that administration of iron-folate supplemented with several other micronutrients is more attractive, better adherence, more effective in reducing the prevalence of anemia as well as a safe and effective means of supplementing a low-iron diet (Pandey & Singh, 2013; Thi Le et al., 2006).

Young adolescent girls are the next generation of the nation in the future. This is because young girls are prospective pregnant women who will give birth to the next generation of a nation who are healthy, productive and of good quality, so that in time a generation with good nutritional status and not stunting will be created. The sea rabbit is a food source of animal protein that is not widely known by the public. Recent research has found that sea rabbits (aplysiidae) are very rich in a number of amino acids such as: aspartate, glutamate and glycine, moreover the amino acid arginine which is an essential amino acid for child growth (Kamiya et al., 2006). The results of other studies reported that sea rabbit extract contains a lot of secondary metabolic compounds such as alkaloids, flavonoids, tannins, saponins and terpenoids (Hayat et al., 2020).

Hemoglobin (Hb) is an element that contains Fero ions (Fe 2+) as its main element. Hb is found in the erythrocytes. Each Hb molecule is bound to one protein (globin) and four molecules of heme. Hb levels are often used as indicators of anemia. Ferritin is the stored form of intact Fe. Serum ferritin is an excellent indicator of iron reserves, unless there is inflammation and malignancy (Kell & Pretorius, 2014). The Research purposes was to assessing the effect of giving Sea Rabbit capsules, Papaya Fruit Juice and iron-folate capsules, on Hb and Ferritin levels in adolescent girls with anemia at senior high school.

METHOD

Types of research

The research design in this efficacy study was a pre and post Quasi Experiment.

Location and Time of Research

This research is located at Senior High School Negeri 3 Kendari. The research was conducted in June - December 2022.

Population and Sample

A total of population 67 students from Senior High School Negeri 3 Kendari City. A sample of young girls with anemia after being calculated by the formula gets as many as 27.6 rounded up to 30 people, (WHO standard criteria). Number of cases 30 people as treatment group and control 30

people as control group. The selection of controls was taken from those who were not selected as treatment based on the order of hemoglobin levels. The total sample was 50 people, comprising 30 people in class A and 20 people in class B. Class A consisted of 3 groups, namely treatment group 1 (Sea rabbit extract 80% + Papaya fruit extract 20%), treatment 2 (Sea rabbit extract 70% + Papaya fruit extract 30%), and treatment 3 (Sea rabbit extract 60% + Papaya fruit extract 40%). While class B comprised 10 negative control (placebo) and 10 people positive control (iron-folate). The inclusion criteria, were not menstruating at the time of the initial blood collection, suffering from Hb anemia < 12.3 g/dL, stating willingness to be a sample, by signing a statement of willingness (informed consent). Exclusion criteria were (1) sufferers of chronic infectious diseases such as tuberculosis, malaria, thalassemia based on the diagnosis of doctors at the Health Centre, (2) suffer from degenerative non-infectious diseases such as CHD, cancer, chronic kidney, and diabetes, (3) suffer from acute-chronic bleeding, (diagnosed by a doctor at the Health Centre). The criteria for dropping out were (1) acute and recurrent bleeding, (2) diarrhea with high frequency and duration, (3) not willing to have blood drawn at the beginning-end, resigned.

Case and Control Groups

1 Case : A young woman with anemia who was given sea rabbit extract and papaya fruit extract.
2 Control : - Positive control : A young woman with anemia who was given Iron-Folat tablets.
- Negative control : A young woman with anemia who given placebo.

Data collection

Data collection was performed by taking blood from students before and after being given treatment, then measuring Hb and ferritin levels at the Kendari Maxima Laboratory. Administering semi-quantitative FFQ interviews to students before and after receiving treatment (prior to the final blood draw). Measure Hight and weigh to determine nutritional status using the Body Mass Index indicator.

Treatment Material

Sea Rabbit Extract

Sea rabbit samples were taken from the beach of Soropia Village, Toronipa District. A total of 379 sea rabbits or about 30 kg were rinsed with fresh water 7 times, to reduce the salt content to make the extract easier to make. Next the sea hare was dried at <50 ^{o}C, without being exposed to direct sunlight. After approximately 3 weeks, the sea rabbit is ready to be extracted. This drying process is performed in Kendari. Sea hare extract is made for approximately 3 weeks because it is depends highly on the ambient air temperature. The extraction process was conducted at the Phytochemical Laboratory of the Faculty of Pharmacy, Hasanuddin University, Makassar.

Papaya Fruit Extract

The papaya is cleaned, peeled, cut into small pieces and then dried, ready to extraction.

Intervention Implementation

Perform control for the following variables:
1. Measuring Protein Energy Intake through Food Frequency Questionnaire (FFQ) results.
2. Calculate Body Mass Index (BMI).

Processing and Analysis of Data

FFQ - Semi Quantitative (FFQ-SQ) results data, average score, consumption frequency level classified with average score, analyzed by Nutrisurvey, DKPI (Indonesian Food Composition List) and RDA, 2019. Laboratory results data : Hemoglobin and Ferritin processed in the Maxima Laboratorium Kendari. Bivariate analysis was performed to test differences in hemoglobin and ferritin levels at the beginning and end. Statistical test using paired t-test and ANOVA for different tests on the same sample and independent t-test is used to test the difference between cases and controls.

RESEARCH RESULTS

Hemoglobin Examination Results (Screening)

Table 1. Hemoglobin Levels Screening Results

Class	Nutritional Status (Hb Level)				Total	
	Anemia		Normal			
	n	%	n	%	n	%
A	18	32.7	44	55.6	62	56.1
B	12	27.9	35	54,4	47	43.8
Amount	**30**	**33.3**	**79**	**76.0**	**109**	**100**

Table 1 shows that of the 98 screening participants, 33.3% of them had anemia with Hb levels < 12 gr/dL and 67.0% were normal. This amount is as much as 56.1% of class I and 43.8% of class II Senior High School.

Interview Results of Nutrient Intake Before and After Treatment

Table 2. Nutrient intake of the five sample groups before and after treatment

Group	Before				After			
	Energy (Kkl	Prot (gr	Fe (mg)	*p*-value	Energy (Kkl)	Prot (gr	Fe (mg)	*p*-value
Control (+)	1917	53.1	15,1	0.231	1909	54.2	15.5	0.315
Control (-)	1981	50.2	15,3		1993	51.5	15.1	
Treatment -1	1893	48.8	14,6		1895	49.3	13.9	
Treatment -2	1878	49.2	14,3		1883	47.2	13.6	
Treatment -3	1859	47.3	13,8		1867	46.8	12.9	

Table 2 shows the results of the ANOVA test for nutrient intake levels (Energy, Protein and Fe). This table shows that the five groups did not differ from each other in terms of energy, protein and Fe intake. So that it can be said that the level of energy, Protein and Fe intake in these students did not differ between groups.

The Homogeneity Test of Hemoglobin Level

Table 3. Initial Hemoglobin Level Homogeneity Test Results by Group

Variable	n	Hb Level (mg/dL)	SD	*p*-value
Control (+)	10	11.03	3.87	0.37
Control (-)	10	12.85	0.25	
Treatment -1	10	11.04	1.09	
Treatment -2	10	10.30	3.81	
Treatment -3	10	10.33	3.70	

Table 3 shows the results of the ANOVA test showing that the significant level (p) = 0.37 or > α = 0.05, then Ho is accepted, there is no difference in the average of hemoglobin level between groups in the five groups. This shows that the initial data between groups is quite homogeneous or does not show a significant difference. Thus, the provision of treatment or intervention can be carried out.

Table 4. Average Hb Levels Before After and Difference

Group	Kadar Hemoglobin			
	Before	After	Difference	SD
Control (+)	11.3 ± 3.87	11.13 ± 3.91	0.10	0.15
Control (-)	12.86 ± 0.25	12.92 ± 0.26	0.06	0.14
Treatment -1	11.04 ± 1.09	11.80 ± 0.51	0.76	1.22
Treatment -2	10.30 ± 3.81	11.38 ± 4.01	1.08	1.36
Treatment -3	10.33 ± 3.70	10.98 ± 3.87	0.65	0.13

Table 4 shows that although there was an average increase in hemoglobin levels in the five groups, between before and after treatment, the increase was very small, not statistically significant, P < 0.05. Shows the results of the difference in hemoglobin levels between before and after treatment. It appears that all groups experienced a small increase, so the statistical test results were not significant (P < 0.05). The increase in hemoglobin levels in the five groups did not show a significant difference.

Table 5. The test results for Hb levels between groups used an Independent t-test

Group	Mean	t- test	Sig (2-tailed)
Control (+)	- 0.110	- 2.031	0.075
Control (-)	- 0.072	- 1.570	0.301
Treatment -1	- 0.670	- 1.834	0.073
Treatment -2	- 1.081	- 2.156	0.069
Treatment -3	- 0.703	- 2.213	0.058

Table 5 shows that the results of the paired t-test showed no difference in hemoglobin levels in each group as a result of the treatment given.

Average Serum Ferritin Before After and Difference

Table 6. Average Serum Ferritin Before After and Difference

Group	Serum Feritin Level			
	Before	After	Difference	SD
Control (+)	13.32 ± 7.16	15.68 ± 7.12	- 2.36	53.01
Control (-)	27.54 ± 16.82	43.39 ± 59.25	-15.85	5.15
Treatment -1	12.06 ± 16.88	18.68 ± 12.83	- 6.65	11.14
Treatment -2	8.7 ± 4.89	10.70 ± 8.48	- 2.0	9.74
Treatment -3	14.55 ± 20.02	21.8 ± 15.26	- 6.63	13.24

Table 6 shows that all treatment and control groups experienced an increase in serum ferritin between before and after treatment, but the value was very small or not significant (P <0.05). Table 6 also shows the results of the difference in serum ferritin from the five groups, between before and after treatment. Shows that although there is a difference in the increase in serum ferritin in the group, but the difference is not statistically significant (P < 0.05).

Table 7. The test results for Feritin Serum between groups used an Independent t-test

Group	Mean	t – test	Sig (2-tailed)
Control (+)	- 2.360	- 1.448	0.181
Control (-)	15.849	- 0.795	0.447
Treatment -1	- 6.627	- 1.880	0.093
Treatment -2	- 4.994	- 1.621	0.139
Treatment -3	- 6.630	- 1.583	0.148

Table 7 shows that the results of the paired t-test showed no difference in serum ferritin in each group as a result of the treatment given.

DISCUSSION

The effect of treatment on hemoglobin Level

Hemoglobin (Hb) is one of the main markers used as an indicator of the presence of anemia of malnutrition, if the level is lower than normal. Another thing is said that hemoglobin is a protein with a molecular weight of 64,450, is a red pigment. Hb is a globular oxygen-carrying protein (O_2), where each molecule contains 5% heme which contains iron and 95% globular polypeptide. This pigment is a chromogen which has 4 pyrrole metal groups (Kumar et al., 2022).

The results of the study showed that 33.3% had anemia and the average hemoglobin level before and after treatment did not show a significant difference or did not differ between the treatment and control groups, both before and after treatment. Numerous factors can influence this, including inadequate intake of nutrients, inadequate intervention period. Determination of hemoglobin requires a number of vitamins and minerals. It is said that the formation of hemoglobin requires many factors with a long time. Providing food sources of vitamin C and β-carotene influences the mechanism of action of Fe in forming hemoglobin (Toruntju et al., 2020). Until you need to combine the sea rabbit with papaya juice. The Hb molecule consists of two parts, namely: the globin part and the heme part. This globin part is a protein that is formed from four polypeptide chains that are folded. The heme portion is a non-protein nitrogenose containing iron, each bound to one polypeptide (M. H. Ahmed et al., 2020).

Based on the content of iron (Fe), Hb appears reddish when it binds to O_2 and is bluish when it has undergone deoxidation, (binds with CO). Thus perfectly oxygenated arterial blood appears red and venous blood that has lost O_2 in the tissues will appear bluish. The results of the initial screening examination of hemoglobin levels in this study showed that as many as 33.3% of the sample suffered from anemia. Anemia in adolescence will greatly affect their health in the future (Al-Jermmy et al., 2022). The low Hb level of school children, especially at the beginning of the growth spurt, will greatly affect their growth in adolescence. The results of the study reported that giving short Multi Micronutrient supplements 2 times a week for 12 weeks, with the United Nations International Multiple Micronutrient Preparation formula, which contains iron and other micronutrients that are equivalent to the dose (Recommended Dietary Allowances (RDA) can increase Hb concentration in urban Bangladeshi girls. A study reported that low Hb levels in response to reduced iron is an indicator of chronic malnutrition and deficiency of multiple micronutrients in pra-school children (F. Ahmed et al., 2010).

The statistical analysis in table 4-7 reveals no significant difference in hemoglobin levels before and after treatment. This can be attributed to various factors, including insufficient consumption of protein, iron, and vitamin C, as well as conditions related to infection and inflammation. The most important things that may be the cause of the insignificant results of this study are as follows: the intervention period may not be sufficient because it is only 1 month and the dosage and frequency of capsule administration are insufficient. Another study reported that there was no significant effect on changes in hemoglobin levels between the two study groups before and after treatment based on changes (delta) in hemoglobin levels, in studies of iron-vitamin C and vitamin C supplementation on hemoglobin levels (Lauryn et al., 2022).

Many things can possibly affect this problem. Included here is reduced intake of nutrients that function as hemoglobin forming such as: protein, vitamin A, vitamin B12, folic acid, vitamin C and iron. In addition, impaired absorption of nutrients, especially iron, also plays an important role in the formation of hemoglobin. A history of infectious and inflammatory diseases also greatly influences the process of hemoglobin formation. Besides that, the temperature of the location where you live also greatly affects the formation of hemoglobin (Toruntju et al., 2020). What also needs to be considered as a cause of low hemoglobin levels is the presence of a number of things that interfere with the body's absorption of iron. Deficiency of a number of nutrients that function as a hemoglobin builder, will affect the process of hemoglobin formation or synthesis. This is because the anabolic process in the formation of hemoglobin requires a complete number of certain nutrients. Deficiency of one or more of these nutrients will inhibit or even cause hemoglobin not to form.

The effect of treatment on Ferritin Serum

Serum ferritin is a protein that is found in many blood cells, as a reserve of Fe, which one day can be used by the body. The amount of serum ferritin in the blood can be directly related to the amount of

Fe stored in the body (Toruntju et al., 2020). Another study found that serum ferritin is an excellent indicator of iron reserves, except in certain inflammatory and malignant conditions (Dignass et al., 2018). This study showed that the distribution of serum ferritin between groups did not show a significant difference between before and after treatment. This is likely due to quite sufficient factors that can influence. Among them is that ferritin is a reserve of iron stored in the blood, the formation and use of which go through various stages.

Serum ferritin levels are not only affected by the body's Fe reserves, but also by various other conditions, as it has been said that serum ferritin levels can increase in acute & chronic infectious diseases, such as inflammatory bowel disease (IBD), viral, bacterial infections, endotoxin poisoning without accumulation Fe, the state of hyperferritinemia can describe the degree of damage to the hepatocellular and rheumatic fever. Increased serum ferritin levels are also associated with malignancy (Garcia-Casal et al., 2015). In connection with the results of this study where there was no difference in serum ferritin levels between before and after treatment. Various possible causes can affect this. This includes both acute and chronic infectious diseases. Unfortunately, this study does not examine infectious diseases, so it cannot control for the effect of infection variables on increased serum ferritin levels.

The ferritin concentration is proportional to the amount of iron stored in the body of healthy subjects and subjects with uncomplicated iron deficiency. The results of this study showed the same thing with hemoglobin, also there was no significant difference between serum ferritin levels before and after treatment. There are many possible factors that can cause this to happen. Among the factors that may be related to this is the existence of a history of infectious diseases that the subjects in this study had suffered or, perhaps, were currently suffering from. In addition to the things above, other possibilities can also be the cause of this, such as the intervention period, which is only 1 month, with the administration dose which may also be less. Serum Ferritin as a reserve of body iron stored in the liver, muscles, bone marrow and all blood circulation. Ferritin levels in the blood are strongly influenced by a person's infection and inflammation status. This is because a patient with anemia who is known from a low hemoglobin level, does not necessarily have a low ferritin level. Likewise, a person with low ferritin levels may still have normal hemoglobin levels. In line with this, it was reported that administration of several doses (100 mg/kg BW, 150 mg/kg BW, and 250 mg/kg BW) of extract of the sea hare (Dolabella auricularia) can increase hemoglobin levels in mice (BALB/c) anemia and showed an increase in the average hemoglobin level along with the size of the dose given. This is not in line with the results of this study (Baker et al., 2022).

The immune response of an individual can be influenced by the existence of iron in their body, which can also affect their vulnerability to infections. Especially for specific immune processes or responses requiring iron in eliminating microorganisms that enter the body. Microorganisms need iron when they enter the host's body for their self-multiplication process. Therefore, iron deficiency and iron excess will be very closely related to the incidence of infection, inflammation and changes in the immune system. Iron deficiency is closely related to dietary patterns and income levels, while excess iron is rarely caused by dietary patterns. Excess iron is associated with disorders of Fe metabolism such as hemochromatosis. Concerning iron is also related to macrophages. Macrophages are immune cells that play a direct role with iron levels in the body. This is related to the fact that macrophages require iron to produce highly toxic hydroxyl radicals, macrophages are also the main iron storage site during an inflammatory process (Garcia-Casal et al., 2015).

From various studies it has been found that there is a direct relationship between ferritin and body iron reserves, the level of 1 ng/mL ferritin is equal to (equivalent) to 8 mg of body iron reserves. Therefore the measurement of ferritin levels is very helpful in diagnosing diseases such as iron deficiency, sideroblastic anemia, hemoglobinopathy and hemochromatosis (Lynch et al., 2018). It is said that IDA will affect the concentration of learning resulting in decreased learning achievement; Decreased hemoglobin levels and decreased enzymes that bind iron in the Krebs cycle result in changes in the metabolism of porphyrins and monoamine oxidase enzymes. Reducing the monoamine oxidase enzyme will reduce the release (excretion) of norepinephrine which is the continuation (transmission) of neurons from the sympathetic nervous system, after being released from the sympathetic nerve endings it will function in motor cells (Henrika et al., 2018).

Intake of Nutrient

Fulfillment of intake of nutrient in accordance with nutritional needs, can maintain good nutritional status. There is an increase in the need for a number of nutrients in adolescence, especially nutrients related to hematology, in particular: protein, vitamin A, folic acid, vitamin B12, vitamin C and iron. A deficiency in one particular nutrient will trigger a number of metabolic disorders that affect health status. Specifically related to CED, adequate intake of energy and protein is related to normal nutrition, thus minimizing the risk of chronic energy deficiency. This is due to a lack of muscle protein, especially the arms, which is preceded by a lack of energy intake that occurs over time, so that not enough protein is used to performits main function of building muscle, but is used to meet the body's energy needs. Related to the adequacy of protein consumption, protein will function as an alternative energy which shows the dominance of protein as an energy source which will be conducted as compensation if there is an energy deficit (Drummen et al., 2018).

Table 3 shows that the three intakes of energy, protein and iron nutrients between groups 1 and 2 (control) and groups 3, 4 and 5 (treatment) at the start before treatment did not show significant differences (quite homogeneous). This means that the treatment can be done. Iron or Fe intake is closely related to protein intake. This is because between Fe and protein, some have the same function, namely in forming Hemoglobin (Hb), where both of them form the Hb structure. The results of the study stated that to stimulate growth factors in the formation of hemoglobin, several nutrients were needed, especially globin (protein) and Fe (Schoorl, 2015). After conducting this research, there are a number of weaknesses in its implementation, including treatment or intervention, only given for one month. This study does not control for confounding variables, such as intake of nutrients from other foods and beverages. This study also do not control the possible infectious diseases.

CONCLUSIONS AND RECOMMENDATIONS

There was no difference in hemoglobin levels and serum ferritin levels between before and after treatment, both in the treatment group and in the control group. For further research, the intervention period should not only be 1 month but at least 2 months in order to have a significant effect. The number of doses given also needs to be increased to meet nutritional needs. Other confounding variables need to be controlled for, such as nutrient intake levels and infection status.

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