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Nutrition Education Using E-Booklet Against Hemoglobin Levels of Young Women

Podojoyo Podojoyo [1], Adillah Syafira[1], Yuli Hartati[1], Ira Kusumawati
[1] Politeknik Kesehatan Kemenkes Palembang, Indonesia

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Corresponding Author:

Yuli Hartati
Politeknik Kesehatan Kemenkes Palembang, Indonesia
Email: yuli.hartati@poltekkespalembang.ac.id

ABSTRACT

One of the nutritional problems of adolescent girls is anemia which is characterized by Hb levels < 12 g / dl. Insufficient nutritional intake is a factor associated with the incidence of anemia. The adequacy of nutritious food intake is greatly influenced by knowledge of the selection of food to be consumed. The magnitude of anemia problems in adolescents is 32% which means there are 3 to 4 out of 10 adolescents experiencing anemia. If this problem cannot be overcome, it will result in learning concentration, fatigue, to a decrease in learning achievement. One of the ways to overcome the problem of anemia in adolescents is the provision of Fe supplements and nutritional education. The purpose of this study was to determine the relationship between nutrition education using e-booklets on hemoglobin levels in adolescent girls. The design of this study was a Quasi-Experiment with a comparison group. The study was divided into a treatment group and a comparison group. Providing nutrition education using e-booklets and Fe supplements for 3 weeks in the treatment group. Giving Fe supplements and anthelmintics for 3 weeks. The number of respondents was 36 in the treatment group and the comparison in the comparison group. The results of the *t-dependent* test showed an *average* difference in the two groups with *a p-value of* < 0.05. The average hemoglobin level of the treatment group was 0.411 g / dl and the comparison group was 0.2 g / dl. The results of the *t-independent test showed no difference in the average hemoglobin levels of the treatment group with a comparison group with a p-value of* > 0.05. The average difference in hemoglobin levels in the treatment group with the comparison group was 0.211 g / dl. It needs to be increased again the length of providing nutritional education to continue to consume Fe supplements and nutritious foods to increase blood hemoglobin levels of adolescent girls.

Keywords: *Nutrition education, e-booklet, hemoglobin, anthelmintics, Fe supplements*

1. INTRODUCTION

Nutritional problems in Indonesia have entered a triple burden status where the problem of undernutrition has not been addressed, but more nutritional problems have emerged and micronutrient deficiencies have not been controlled. Iron nutrition anemia is one of the micronutrient deficiencies, namely iron deficiency or Fe (Kartika et al., 2022). One of the nutritional problems in adolescence is iron deficiency anemia. Anemia can be interpreted as a condition where hemoglobin levels are below normal limits at the time of measurement, which is < 12.0 g / dl [2]; [3]; [4]; [5]. The state of anemia can be characterized by dizziness, fatigue, fireflies, and pale face, causing decreased concentration when learning, decreased activity, and learning achievement in adolescents [6]; [7]; [2]; [8];[9].

In a basic health research report conducted by the Ministry of Health of the Republic of Indonesia in 2013, the prevalence of anemia is higher in women (23.9%) than in men (18.4%). Based on the age group of 15 -24 years, the prevalence of anemia was estimated at 18.4% in 2013. In 2018, the prevalence of anemia was more prevalent in women (27.2%) than men (20.3%). The prevalence of anemia aged 15-24 years is 32 percent.[10].

Anemia in adolescents can affect a decrease in physical activity, decreased endurance, and decreased concentration. The state of anemia results in not enough blood to carry oxygen out of the lungs and flow throughout the body [6]; [4]; [8]. Some factors contributing to the development of anemia problems in adolescent girls are low intake of food (energy, protein, iron, vitamin C), caffeine intake, low knowledge, low income of parents and type of work, menstrual cycle, and intestinal worms [11]; [12]; [6], [13]–[16] [17][18].

Prevention of anemia in adolescents can be done by consuming diverse foods with balanced nutrition guidelines, and increasing consumption of foods containing iron, and iron supplements [19]; [4]; [20]; [15]; [21], and treatment of comorbidities such as chronic lack of energy, malaria, helminthiasis, tuberculosis, and HIV/AIDS [10]. The

government has also tried to prevent adolescent anemia by giving Fe supplements as much as 1 tablet every week, but it has not been effective in preventing anemia.

Adolescent nutritional intake is related to nutritional knowledge possessed by adolescents, nutrition education in adolescents is expected to increase knowledge about nutrition in adolescents. The discrepancy in the selection of foods that become the nutritional intake of adolescents is the result of a lack of knowledge and information related to nutrition so it becomes a factor causing the increase in anemia cases. Nutrition education aims to provide information to the public so that they understand how to choose foods rich in nutrients, including iron and vitamin C, to maintain health. [22]; [3]; [23]. Efforts to reduce anemia cases through nutrition education by using interesting ones so that readers are more effective in receiving information [24]; [25]; [12];

The incidence of anemia is not only due to lack of food intake, but the incidence of anemia also has a relationship with helminthic [19];[8]; [26]. However, nutrition education programs are needed to prevent anemia [27]. Health promotion is one of the countermeasures of nutritional and health problems such as infectious diseases and consumption of nutritious food, public knowledge about the signs and symptoms of intestinal worms as well as prevention and mode of transmission.[28];[29]. Prevention of infectious diseases by worms can be done by taking deworming drugs for 6 months. The frequency of deworming for 6 months is the minimum time to prevent worms that result in anemia [30]; [21].

2. METHOD

This type of research research uses *a quasi-experimental* design with a comparison group. The study population was adolescent girls at SMAN 6 Palembang Indonesia, with a sample of 36 girls in the treatment group and 36 people in the comparison group taken at random simply. Intervention in the treatment group by providing nutritional education using e booklet and Fe supplements with a composition of 60 mg Ferrous Fumarate and 400 mcg folic acid consumed 1 tablet every week. In the comparison group, Fe supplements with a composition of 60 mg of Ferrous Fumarate and 400 mcg of folic acid were consumed 1 tablet every week and consumed 2 tablets of deworming with a composition of pyrantel pamoate 250 mg within the last 6 months. Measurement of hemoglobin levels before and after the intervention in the comparison group and treatment group for 3 weeks. This study also measured macronutrient intake and iron intake from food consumption. The research instruments are e booklet, recall form 1x24 hours, and hemoglobin level measuring instrument using a hemoglobinometer (easy touch GCHB) with a confidence level of ≥ 96%. The results of data collection are then processed and analyzed with statistical computers. The statistical tests used are t-dependent and t-independent with a meaning limit of 0.05.

3. RESULTS AND DISCUSSION

The following are the results of measuring energy intake, macronutrients, vitamin C, and iron (Fe) obtained through recall of food consumption for the past 1 x 24 hours in the comparison group and the treatment group.

Table 1. Intake of energy, macronutrients, vitamin C and Fe there is a Comparison Group

Energy intake	Mean	SD	SE	p-*value*	n
Before Treatment	1698.20	71.13211	11.85535	0.001	36
After Treatment	1744.73	79.08273	13.18046		
Carbohydrates	Mean	SD	SE	p-*value*	n
Before Treatment	241.33	9.25203	1.54200	0.0001	36
After Treatment	248.75	9.41541	1.56924		
Fat	Mean	SD	SE	p-*value*	n
Before Treatment	56.33	2.16555	0.36093	0.001	36
After Treatment	57.98	2.23562	0.37260		
Protein	Mean	SD	SE	p-*value*	n
Before Treatment	52.46	2.11688	0.35281	0.0001	36
After Treatment	53.95	2.13612	0.35602		
Vitamin C	Mean	SD	SE	p-*value*	n
Before Treatment	67.02	7.68002	1.30657	0.072	36
After Treatment	67.86	7.41695	1.38188		
Fe	Mean	SD	SE	p-*value*	n
Before Treatment	13.94	1.52674	0.25446	0.884	36
After Treatment	13.92	1.33242	0.22207		

The average energy intake before the intervention in the comparison group was 1698.2 kcal and after the intervention was 1744.73 kcal. The difference in the average increase in energy intake in the comparison group increased by 46.53 kcal. The minimum and maximum energy intake in the comparison group before the intervention was 1575.00 kcal and 1848.00 kcal respectively. The minimum and maximum energy in the comparison group after the intervention was 1558.00 kcal and 1890.00 kcal respectively.

The average carbohydrate intake before the intervention was 241.33 grams and after the intervention was 248.75 grams. The difference in the average increase in carbohydrate intake in the comparison group was 7.42 grams. The minimum and maximum carbohydrate intake in the comparison group before the intervention was 228.00 grams and 267.00 grams, respectively. The minimum and maximum carbohydrate intake in the comparison group after the intervention was 231.00 grams and 264.00 grams, respectively.

The average fat intake before the intervention was 56.33 grams and after the intervention was 57.98 grams. The difference in the average increase in fat intake in the comparison group was 1.65 grams. The minimum and maximum fat intake in the comparison group before the intervention was 53.20 grams and 62.30 grams, respectively. The minimum and maximum fat intake in the comparison group after the intervention was 54.60 grams and 63.00 grams, respectively.

The average protein intake before the intervention was 52.46 grams and after the intervention was 53.95 grams. The difference in the average increase in protein intake in the comparison group was 1.48 grams. The minimum and maximum protein intake in the comparison group before the intervention was 49.40 grams and 57.85 grams, respectively. The minimum and maximum protein intake in the comparison group after the intervention was 50.05 grams and 58.50 grams, respectively.

The average intake of vitamin C before the intervention was 67.02 mg and after the intervention was 67.86 mg. The difference in the average increase in vitamin C intake in the comparison group was 0.84 mg. The minimum and maximum vitamin C intake in the comparison group before the intervention was 55.90 mg and 77.25 mg, respectively. The minimum and maximum vitamin C intake in the comparison group after the intervention was 52.00 mg and 77.25 mg, respectively.

The average iron intake before the intervention was 13.94 mg and after the intervention was 13.92 mg. The difference in the average increase in iron protein intake in the comparison group was 0.02 mg. The minimum and maximum iron intake in the comparison group before the intervention was 11.40 mg and 15.45 mg, respectively. The minimum and maximum iron intake in the comparison group after the intervention was 11.85 mg and 15.45 mg respectively.

Table 2. Intake of Energy, Macronutrients, Fe, and Vitamin C in the Treatment Group

Energy intake	Mean	SD	SE	p-*value*	n
Before Treatment	1681.58	83.21062	13.86844	0.0001	36
After Treatment	1810.93	69.81682	11.63614		
Carbohydrates	Mean	SD	SE	p-*value*	n
Before Treatment	241.00	11.17906	1.86318	0.0001	36
After Treatment	258.58	11.53721	1.92287		
Fat	Mean	SD	SE	p-*value*	n
Before Treatment	56.23	2.54873	0.42479	0.0001	36
After Treatment	60.39	2.74756	0.45793		
Protein	Mean	SD	SE	p-*value*	n
Before Treatment	52.19	2.29846	0.38308	0.0001	36
After Treatment	56.20	2.27559	0.37926		
Vitamin C	Mean	SD	SE	p-*value*	n
Before Treatment	68.96	7.83942	1.30657	0.0001	36
After Treatment	72.86	8.29126	1.38188		
Fe	Mean	SD	SE	p-*value*	n
Before Treatment	13.79	1.40573	0.2329	0.0001	36
After Treatment	14.51	1.40260	0.23377		

The average energy intake before the intervention in the treatment group was 1681.58 kcal and after the intervention was 1810.93 kcal. The difference in the average increase in energy intake in the treatment group was 129.35 kcal. The minimum and maximum energy intake in the treatment group before the intervention was 1558.00 kcal and 1869.00 kcal, respectively. The minimum and maximum energy intake in the treatment group after the intervention was 1659.00 kcal and 1974.00 kcal, respectively.

The average carbohydrate intake before the intervention was 241 grams and after the intervention was 258.58 grams. The difference in the average increase in carbohydrate intake in the treatment group was 17.58 grams. The minimum and maximum carbohydrate intake in the treatment group before the intervention was 225.00 grams and 267.00 grams, respectively. The minimum and maximum carbohydrate intake in the treatment group after the intervention was 237.00 grams and 282.00 grams, respectively.

The average fat intake before the intervention was 56.23 grams and after the intervention was 60.39 grams. The difference in the average increase in fat intake in the treatment group was 4.16 grams. The minimum and maximum

values in the treatment group before the intervention were 53.20 grams and 62.30 grams, respectively. The minimum and maximum values in the treatment group after the intervention were 55.30 grams and 65.10 grams, respectively.

The average protein intake before the intervention was 52.19 grams and after the intervention was 56.2 grams. The difference in the average increase in protein intake in the treatment group was 4.01 grams. The minimum and maximum protein intake in the treatment group before the intervention was 49.40 grams and 57.85 grams, respectively. The minimum and maximum protein intake in the treatment group after the intervention was 51.35 grams and 60.45 grams respectively.

The average intake of vitamin C before the intervention was 68.96 mg and after the intervention was 72.86 mg. The average difference in the increase in vitamin C intake in the treatment group was 3.9 mg. The minimum and maximum vitamin C intake in the treatment group before the intervention was 52.00 mg and 78.75 mg, respectively. The minimum and maximum vitamin C intake in the treatment group after the intervention was 53.95 mg and 81.00 mg, respectively.

The average iron intake before the intervention was 13.79 mg and after the intervention was 14.51 mg. The difference in the average increase in iron intake in the treatment group was 0.72 mg. The minimum and maximum iron intake in the treatment group before the intervention was 11.40 mg and 15.15 mg, respectively. The minimum and maximum iron intake in the treatment group after the intervention was 12.00 mg and 16.05 mg, respectively.

Table 3. Differences in Average Hemoglobin Levels Before and After Treatment in the Treatment Group

Hemoglobin Level	Mean	SD	SE	p-*value*	n
Before Treatment	14.003	2.7211	0.4535	0.003	36
After Treatment	14.414	2.3379	0.3897		

From Table 3, it is known that hemoglobin levels increased significantly in the treatment group after nutrition education using *e-booklets* and consumption of Fe supplements. The average increase in hemoglobin levels was 0.411 g / dl. Based on the results of statistical tests using *the t-dependent test*, the *p-value* in the treatment group was 0.003, which is 0.05, < so it was concluded that there was an effect of providing nutritional education using *e-booklets* and consumption of Fe supplements on increasing hemoglobin levels.

This research is in line with previous research by [31] Hb levels of adolescents who were given nutrition education increased compared to the control group. Research Marfuah (2017) The effect of providing nutrition education with e-booklet media on increasing hemoglobin levels in adolescent girls. This research is also in line with research by Rotua (2018) explained that nutrition education given every week for 2 weeks had a statistically significant difference in changes in hemoglobin levels with average hemoglobin levels before 13.419 g / dl and average hemoglobin levels after 13.741 g / dl [34] . While in research conducted by Indriani et al., (2019) reported that adolescent girls who were given nutrition education experienced an increase in hemoglobin levels for 30 days by 0.72 g / dl ± 0.92 g / dl, as well as the results of the study [36], Teens who are educated about local foods can increase Hb levels.

In this study, the average intake from the recall results was obtained, namely the intake of energy, protein, fat, carbohydrates, vitamin C, and iron. The average energy intake consumed by adolescent girls in the treatment group was 1744.58 kcal where the intake ≥ 80% RDA which means good energy intake. The average protein intake consumed by adolescent girls in the treatment group was 54.13 grams where the intake ≥ 80% RDA which means good protein intake. The average fat intake consumed by adolescent girls in the treatment group was 58.3 grams where the intake ≥ 80% RDA which means good fat intake. The average carbohydrate intake consumed by adolescent girls in the treatment group was 249.83 grams where the intake ≥ 80% RDA which means good carbohydrate intake. The average intake of vitamin C consumed by adolescent girls in the treatment group was 70.74 kcal where the intake was 75 < mg which means vitamin C intake is less. The average iron intake consumed by adolescent girls in the treatment group was 14.19 kcal where the intake was 15 < mg which means iron intake is less.

Taking iron supplements with vitamin C-rich foods (such as oranges, mangoes, and guavas) can improve iron absorption. You can also consume animal protein sources such as chicken liver, fish, and chicken. Tea and coffee contain tannins and phytate compounds that bind iron into complex compounds that prevent it from being absorbed by the body so that it can interfere with iron absorption.

Table 4. Differences in Average Hemoglobin Levels Before and After treatment in the comparison group

Hemoglobin Level	Mean	SD	SE	p-*value*	n
Before Treatment	13.892	2.5548	0.4258	0.0001	36
After Treatment	14.092	2.4283	0.4047		

Based on Table 4, it is known that hemoglobin levels in the comparison group increased significantly after the consumption of Fe supplements and deworming. The average increase in hemoglobin levels is 0.2 g / dl. Based on the results of statistical tests with t-dependent, a p-value was obtained in the comparison group of 0.000 where 0.05 <, so it can be concluded that there is an effect of consuming Fe supplements and deworming drugs on the increase in hemoglobin levels.

This research is in line with research by Rofiatun, (2018) that there was a significant difference in hemoglobin levels in the group given deworming drugs and Fe supplements with an average hemoglobin level before 11.27 g / dl and an average hemoglobin level after 12.87 g / dl [38]. This is in line with the research of Mukhtar et al., (2014) There was an increase in hemoglobin levels by 0.2 g / dl in the group given deworming drugs and Fe supplements [40].

In this study, the average intake from the recall results was obtained, namely the intake of energy, protein, fat, carbohydrates, vitamin C, and iron. The average energy intake consumed by adolescent girls in the comparison group was 1711.78 kcal where the intake ≥ 80% RDA which means good energy intake. The average protein intake consumed by adolescent girls in the comparison group was 53.07 grams where the intake ≥ 80% RDA which means good protein intake. The average fat intake consumed by adolescent girls in the comparison group was 57.05 grams where the intake ≥ 80% RDA which means good fat intake. The average carbohydrate intake consumed by adolescent girls in the comparison group was 244.5 grams where the intake ≥ 80% RDA which means good carbohydrate intake. The average intake of vitamin C consumed by adolescent girls in the comparison group was 67.38 kcal whereas the intake was < 75 mg which means vitamin C intake is less. The average iron intake consumed by adolescent girls in the comparison group was 13.84 kcal where the intake was 15 < mg which means iron intake is less.

Table 5. Difference in Average Increase in Hemoglobin Levels in the Treatment Group and Comparison Group

Hemoglobin levels	n	Selisih rata-rata	SD	SE	p-*value*
Treatment Group	36	0.411	0.7708	0.1285	0.117
Comparison Group	36	0.200	0.2111	0.,0352	

Based on Table 5, the results of statistical tests using *t-independent* tests from 72 respondents obtained *a p-value of* > 0.05 so that it was known that there was no difference in the average hemoglobin levels in the treatment group and the comparison group. The difference in the average increase in hemoglobin levels in the treatment group given nutrition education using *e-booklet* and consumption of Fe Supplements and the comparison group given consumption of Fe supplements and deworming was 0.2111 g / dl. That is, there is no effect of providing nutrition education using *e-booklets* on hemoglobin levels.

Based on Table 5, the results of statistical tests using *t-independent* tests from 72 respondents obtained *a p-value of* > 0.05 so that it was known that there was no difference in the average hemoglobin levels in the treatment group and the comparison group. The difference in the average increase in hemoglobin levels in the treatment group given nutrition education using *e-booklet* and consumption of Fe Supplements and the comparison group given consumption of Fe supplements and deworming was 0.2111 g / dl. That is, there is no effect of providing nutrition education using *e-booklets* on hemoglobin levels

In the results of *the t-independent* test carried out, it was found that there was no difference in the average difference in the increase in hemoglobin levels in the treatment group and the comparison group so the researchers conducted correlation and regression tests to determine whether there was a relationship between protein intake and hemoglobin levels. In the treatment group, a value of r = 0.586 was obtained so that it can be seen that protein intake has a strong correlation with hemoglobin levels, which means that the more protein intake consumed, the more hemoglobin levels increase. The results of statistical tests found a significant relationship between protein intake and hemoglobin levels with a *p-value of* < 0.05. In the comparison group, a value of r = 0.320 was obtained so that it can be seen that protein intake has a moderate/weak relationship with hemoglobin levels. The results of statistical tests found no significant relationship between protein intake and hemoglobin levels with *a p-value of* > 0.05.

The treatment group and comparison group had an average increase in hemoglobin levels of 0.411 g/dl and 0.2 g/dl respectively. From these results, it can be seen that the treatment group has a faster average increase in hemoglobin levels compared to the comparison group, this is in line with research by Zaddana et al., (2019) There was an increase in hemoglobin levels after intervention by providing nutrition education, the increase in hemoglobin levels was related to the increased food intake of respondents after being given nutrition education. Protein and iron intake have a strong relationship and influence on hemoglobin levels so if you consume good protein and iron intake, hemoglobin levels can be classified as good conditions too, however, if you consume low protein intake and hemoglobin levels, there can be a decrease in hemoglobin levels [42].

4. CONCLUSION

The difference in average hemoglobin levels before and after treatment in the treatment group was 0.411 g / dl *p-value* < 0.05, It can be concluded that there is an effect of providing nutritional education using *e-booklets* and consumption of Fe supplements on the increase in hemoglobin levels of adolescent girls. The difference in average hemoglobin levels before and after treatment in the comparison group was 0.2 g / dl *p-value* < 0.05, it can be concluded that there is an effect of Fe supplements and deworming drugs on the increase in hemoglobin levels of adolescent girls. So in the *t-independent test* conducted, there was no effect of nutrition education using *e-booklets* on hemoglobin levels of adolescent girls *p-value* > 0.05. The mean difference in hemoglobin levels between the treatment group and the comparison group was 0.211 g / dl. Based on the results of the data obtained, it is necessary to provide nutrition education and deworming regularly and regularly so that adolescent girls avoid anemia.

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