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# Peer Education, Nutritionist Education and Combination Education on Intake Nutrition and Iron (Fe) Against Changes of Hemoglobin in a Girls Adolescent

**Irine Christiany[1(CA)], Adin Mu'afiro[2], Kiaonarni Ongko Waluyo[3]**
[1(CA)]Nursing Department, Poltekkes Kemenkes Surabaya, Indonesia; irinesby64@gmail.com (Corresponding Author)
[2]Nursing Department, Poltekkes Kemenkes Surabaya, Indonesia; adinmuafiro@gmail.com
[3]Nursing Department, Poltekkes Kemenkes Surabaya, Indonesia; kiaonarni@gmail.com

## ABSTRACT

Hemoglobin acts as an oxygen-carrying unit from the lungs to the cells. When the formation of red blood cells is disrupted, the formation of hemoglobin levels will be low, this is called anemia. One of the causes of anemia is a lack of iron deficiency in the body. Anemia can happen to anyone, one of them is young women. Studies show that the causes of anemia in adolescents are due to irregular eating patterns, abstinence from eating protein foods, not eating vegetables, eating fast food and junk food so that the body lacks iron. Nutrition education or counseling is an educational approach to produce individual behavior in food improvement. This study compare which education among the three is more effective in improving food pattern behavior so that Hb levels will also increase. This study used pretest-posttest control group design. The research instruments were questionnaire of knowledge, FGD and easytouch GCHB. Data were analyzed using T-test. The results of this study were: 1) peer education did not have a significant effect on Hb levels, 2) education by nutritionist has a positive and significant effect on Hb ($MD_{Nutrisionist}$) = 0.8233, p <0.05), 3) combined group education (peer and nutritionist) has a positive and significant effect on Hb levels ($MD_{combination}$ = 0.2400, p <0.05). This means that carrying out a combination of education (peer group and nutritionist) can be said to be more effective in increasing knowledge and diet in adolescents which will also increase Hb levels in the body.

**Keywords:** hemoglobin, iron (Fe); anemia; nutritionist education; intake nutrition

## INTRODUCTION

Nutritional problems occur at almost all age levels in the life cycle, one of which is adolescents. Teenagers tend to experience nutritional problems due to psychological, physiological, and social changes. Low knowledge of nutrients will have an impact on attitudes and behavior of iron nutrition in adolescents. Iron deficiency anemia is the most common anemia in adolescents, because of the high need for growth. Iron deficiency anemia is more common in adolescent girls than adolescent boys. Iron has a function for the formation of hemoglobin, minerals and the formation of enzymes. Lack of iron intake in adolescents can be caused by lack of knowledge of adolescents about food sources of iron and the role of iron for adolescents. Based on this, increasing knowledge through nutrition education can improve adolescent behavior to consume iron-rich foods according to their nutritional needs.

The synthesis of hemoglobin starts from within eritroblast and continues until normoblast and reticulocyte levels. From investigations with isotopes it is known that the heme portion of hemoglobin is mainly synthesized from acetic acid and glycine and that most of this synthesis occurs in the mitochondria. The initial step of synthesis is the formation of pyrrole. Furthermore, four pyrrole compounds unite to form protoporphyrin compounds, which then bind to iron to form hem molecules. Finally, four hem molecules bind to one globin molecule, a globulin which is synthesized in the ribosomes of the endoplasmic reticulum to form hemoglobin[(1)].

Hemoglobin acts as the oxygen-carrying unit of the blood carrying oxygen from the lungs to the cells, as well as carrying $CO_2$ back to the lungs. When the formation of red blood cells is disrupted, the formation of hemoglobin levels will be low or below normal. WHO estimates the number of anemia sufferers worldwide is close to two billion with at least 50% of this number being associated with iron deficiency. Iron deficiency anemia occurs at all stages of life, but is more common in pregnant women and children. Adolescents, especially girls, are prone to iron deficiency. The results showed that the cause of anemia in adolescents was due to irregular eating patterns, abstinence from eating protein foods, dislike of consuming vegetables, eating habits of fast food and junk food. Adequate iron stores and for normal growth purposes differ according to age group and sex. During growth, adolescent girls experience an increase in blood volume and body tissue so that they need additional iron

for hemoglobin and myoglobin synthesis[2]. One way to treat anemia by increasing the consumption of foods that contain iron in high enough levels, among others, corn, eggs, kale, spinach, beef, fresh fish, potatoes, large shrimp, peanuts, green beans, brown rice biscuits.

Iron deficiency can result in decreased iron reserves in the liver, so that the formation of red blood cells is disrupted which will result in the formation of low hemoglobin levels or blood hemoglobin levels below normal. Iron (Fe) is an essential micro element for the body, this substance is especially needed in hemopoesis (blood formation), namely in hemoglobin Hb syntessa. Iron found in all body cells plays an important role in various biochemical reactions, including in the production of red blood cells. These cells are needed to carry oxygen to all body tissues. while oxygen is important in the process of energy formation so that work productivity increases and the body does not tire quickly.

Almost all types of anemia are generally caused by iron deficiency, this can cause a lack of hemoglobin concentration and the number and size of red blood cells. This type of anemia is caused due to a lack of iron eaten, poor absorption of iron in the intestines, or an increase in iron requirements such as during menstruation, growth, and pregnancy. The amount of iron present in the foods we eat that can be utilized by our bodies depends on the level of absorption. It is estimated that only 5-15% of dietary iron is absorbed by adults in good iron status. In a state of iron deficiency absorption can reach 50%. Poor absorption of iron in the intestine is also a cause of anemia[3].

The form of iron in food affects its absorption, hem iron which is part of hemoglobin and myoglobin found in animal meat can be absorbed twice as much as non-heme iron. Approximately 40% of the iron in meat, chicken and meat. Fish is hem iron, while the iron in eggs, cereals, vegetables and fruits is non-heme iron. In general, iron in meat, chicken and fish has a high bioavailability, so that the absorption of animal iron can reach 25% compared to vegetables such as eggs, mashed cereals, beans, green vegetables and several types of fruit which absorption is only 5%. Eating heme and non-heme iron simultaneously can increase the absorption of nonheme iron, because meat, fish and chicken contain a factor consisting of amino acids that can bind iron and help its absorption, whereas cow's milk, eggs and cheese do not contain that factor. So that it cannot help the absorption of iron[4]

The results showed that the cause of anemia in adolescents was due to irregular diet, abstinence from eating protein foods, dislike of consuming vegetables, eating habits of fast food and junk food[2]. One way to treat anemia is by increasing the consumption of foods containing iron in high enough levels. In reality, teenagers tend to like to consume junk food and fast food, consume certain foods, so that their bodies do not get varied nutritional intake. This is what triggers a decrease in the production of red blood cells, making it easy for anemia to occur[5].

Nutrition education or counseling is an educational approach to produce individual or community behavior needed to improve food improvement. In accordance with Beydoun and Wang's statement, in Acharya's research, nutrition education in adolescents will be felt positively, and has a very significant impact on nutritional behavior, so nutrition education is important[6]. Therefore, health education motivates someone to receive health information and act accordingly so that they become more informed and healthier, so that the approach is peer educator expected to convey iron nutrition information and change the knowledge, attitudes and behavior of their peers to be healthier[7]

## METHODS

Type of this research was a quasi experiment using a pretest posttest control group design. The study population was all students of 19th Public High School of Surabaya with the criteria aged 15-18 years and willing to be participants in this study. The research sample was taken randomly (simple random sampling). The research sample will be divided into three intervention groups and one control group. Each group will consist of 30 participants, so the number of participants in this study is 120 people.

The research instruments were:

1) Education was obtained by means of a questionnaire to determine the level of knowledge of each participant. The validity and reliability tests were appropriate ($p<0.05$).
2) A manual based on FGD with experts. The FGDs were conducted by researcher and three experts in the field of nutrition. The purpose of the focus group was to cross-check the material gathered from the literature in order to make it more precise and relevant.
3) An open questionnaire in the form of a food recall form to see iron intake
4) Hemoglobin levels using easytouch GCHB by medical personnel.

Initial data collection will begin with the division of the group into 4 groups, namely the Peer Group, the Nutritionist Group, the Combination Group, and the Control Group, and each group has 30 participants. All groups will then perform a pretest, such as lab tests and BMI measurements. After all groups have done a pretest, the Peer Group, the Nutritionist Group, and the Combination Group will receive treatment in the form of a discussion session. In the Peer Group, a selected student will be a resource person. This selected student was previously equipped with nutrition science by researchers. In the Nutritionist Group, a Nutritionist will be the resource person. In the Joint Group, previously selected students and nutritionists will be the speakers in turn. Meanwhile, the Control Group did not receive any treatment. After all groups received treatment, it was time for all groups to do a posttest by answering the questionnaire and doing the Hb test.

## RESULTS

### The Influence of Peer Group Education, Groups Nutritionist and Combined Group on Nutrient and Iron (Fe) Intake of Changes in Hemoglobin Levels

Table 1. Hb difference test before and after giving education about nutrient and iron intake to students at 19th Public High School of Surabaya, April-September 2019

| Data | Mean | SD | 95% CI | Mean Difference | P | Information |
|---|---|---|---|---|---|---|
| HB_Pretest | 13.084 | 1.4295 | 12.826 - 13.343 | 0.0125 | 0.904 | There is no |
| HB_Postest | 13.072 | 1.3456 | 12.828 - 13.315 | | | difference |

The results of the analysis in table 1 show that the average Hb value before education was 13.084 with a standard deviation of 1.4295 (95% CI: 12.826 – 13.343). From the results of the interval estimation, it can be believed 95% that the mean Hb before giving education ranged from 12.826 – 13.343. Whereas on Hb after giving education it had a mean value of 13.072 with a standard deviation of 1.3456 (95% CI: 12.828 - 13.315). The average difference between Hb before and after education was 0.0125. Based on the results of calculations using the *paired t-test, the* conclusion is that there is no significant difference between Hb before and after giving education with a significance value of 0.904 (p> 0.05).

Table 2. Hb Difference Test before and after education regarding nutritional and iron intake for all groups of students at 19th Public High School of Surabaya, April-September 2019

| Group | Data | Mean | SD | 95% CI | Mean Difference | P | Information |
|---|---|---|---|---|---|---|---|
| Peer | Pre | 12.500 | 1.3516 | 11.995 - 13.005 | 0.3867 | 0.097 | There is no difference |
| | Post | 12.887 | 1.4680 | 12.339 - 13.435 | | | |
| Nutritionist | Pre | 13.747 | 1.6179 | 13.143 - 14.351 | 0.8233 | 0.001 | There is a difference |
| | Post | 12.923 | 1.5384 | 12.349 – 13.498 | | | |
| Combination | Pre | 12.973 | 1.3206 | 12.679 -13.555 | 0.2400 | 0.037 | There is a difference |
| | Post | 13.213 | 1.2870 | 12.866 - 13.661 | | | |
| Control | Pre | 13.117 | 1.1730 | 12.480 -13.466 | 0.1460 | 0.361 | There is no difference |

In table 2, it can be seen that the calculation results using the *paired t-test* show that the Hb level before and after administration education on iron intake had a significant effect on the nutritionist group and the combination with a significance value <0.05. Whereas in the peer and control groups, there was no significant effect between Hb before and after education with a significance value> 0.05.

In the peer group, the average value of Hb before giving education was 12.500 with a standard deviation of 1.3516 (95% CI: 11.995-13.005), while in Hb after giving education, it had a mean value of 12.8870 with a standard deviation of 1.4680 (95% CI: 12.339 – 13.435). The average difference between Hb before and after education was 0.3867. Based on the results of calculations using the paired t test, the conclusion is that there is no significant influence between Hb before and after giving education with a significance value of 0.097 (p> 0.05).

In the nutritionist group, the mean value of Hb before education was 13.7470 with a standard deviation of 1.6179 (95% CI: 13,143 – 14.351), while in Hb after giving education a mean value of 12.9230 with a standard deviation of 1.5384 (95% CI; 12.349 – 13.498). The average difference between Hb before and after education was 0.8233. Based on the results of calculations using the paired t test, it shows the conclusion that there is a significant effect between Hb before and after giving education with a significance value of 0.001 (p <0.05). The Hb value before education was greater than after education. This shows that there is a significant decrease between Hb levels before and after education provision.

In the combination group, the mean value of Hb before giving education was 12.9730 with a standard deviation of 1.3206 (95% CI: 12.679 – 13.555), while in Hb after giving education had a mean value of 13.213 with a standard deviation of 1.287 (95% CI : 12.866 – 13.661). The average difference between Hb before and after education was 0.2400. Based on the results of calculations using the paired t test, the conclusion is that there is a significant influence between Hb before and after giving education with a significance value of 0.037 (p <0.05). The Hb value before education was less than after education. This shows that there is a significant increase between Hb levels before and after the provision of education.

In the control group, the average Hb value before education was 13.117 with a standard deviation of 1.173 (95% CI: 12.480 – 13.466), while in Hb after the post test had a mean value of 13.263 with a standard deviation of 1.0653 (95% CI: 12.733 – 13.694). The average difference between Hb after education was 0.1460. Based on the results of calculations using the paired t test, the conclusion is that there is no significant effect between Hb before and after giving education with a significance value of 0.361 (p> 0.05).

## DISCUSSION

The results of the analysis were obtained in the Nutritionist group, the average value of Hb levels before education was 13.7470 with a standard deviation of 1.6179 (95% CI: 13,143 - 14,351), while the Hb levels after giving education had an average value of 12.9230 with a standard deviation of 1.5384 (95% CI; 12,349 - 13,498). The average difference between Hb before and after education was 0.8233. The results of the calculation showed that the Hb level before and after education had a significant effect on the group nutritionist and the combination with a significance value of 0.001 ($p < 0.05$) and 0.037 ($p < 0.05$). The Hb value in nutritionists was higher in the pre-test and in the combination group was higher in the post. The Hb value before giving education was greater than after giving education. This shows that there is a significant decrease between Hb levels before and after giving education on iron intake.

The average difference between Hb before and after education was 0.2400. Based on the conclusion that there is a significant influence between Hb before and after giving education with a significance value of 0.037 ($p < 0.05$). The Hb value before education was less than after education. This shows that there is a significant increase between Hb levels before and after providing education on iron intake.

This can be explained that providing education about iron intake to the nutritionist education group is the role of nutritionists who are expertise in providing nutrition counselors. A person who provides nutrition education which is an effort to explain, use, select, and process food ingredients to increase the knowledge, attitudes and behavior of individuals or communities in consuming food so as to improve their health and nutrition[8]. Nutrition education / education can increase adherence to the program and education about diet and the importance of consuming iron-rich foods can complement. To inform this, it is important to identify the determinants of behavior (barriers and drivers) among those who consume iron-rich diets ('offenders') and those who do not ('non-actors') in this age group[6]. This study looked at the barriers and drivers of iron-rich food consumption among adolescent girls in the treatment group and the control group in the area of school adolescents.

The combination group is a treatment group that provides education by nutritionists or nutritionists together with their peers is an effort to change health behavior through peer groups that emphasize behavior change. In this method interaction occurs in groups, individuals will feel there is something in common with one another, and individuals will develop a social sense in accordance with personality development. Knowledge can form a supportive attitude and will influence adolescent motivation to behave healthily. Knowledge can be increased by a learning process peer group[9].

In the combination group, the mean value of Hb before giving education was 12.9730 with a standard deviation of 1.3206 (95% CI: 12.679 – 13.555), while in Hb after giving education had a mean value of 13.213 with a standard deviation of 1.287 (95% CI : 12.866 – 13.661).

The results of the analysis in Table 2 show that the Hb level before and after education was given a significant effect on the nutritionist group and the combination with a significance value <0.05. This condition shows that doing combination group education can be said to be more effective together with peer groups and nutritionists. Giving education about iron intake is given by peers who have been trained in advance by nutritionists and given handbooks in the form of modules and food pictures as a provision to provide education on iron intake to students or participants by explaining that the correct diet greatly affects adolescent growth. However, in reality, there are many teenagers who do not fulfill their nutrition because they are afraid of fat and some are lazy or do not have an appetite for nutritious foods. This causes adolescence to be said to be a vulnerable period for nutrition. Whereas with the occurrence of changes, sources of iron in food can be divided into two sources of iron derived from animals which are often referred to as hem iron, for example: meat, fish, poultry and others. Meanwhile, sources of iron derived from vegetable sources are called non-heme iron sources, for example vegetable, soy beans, green leafy vegetables and seaweed. Consumption of iron in the formation of hemoglobin, where iron in the body will bind to heme and globin molecules which eventually form hemoglobin[10].

In addition, the knowledge and behavior of participants in the young women participant group where young women often consume iron is the largest component in hemoglobin and has a large function. Iron is the largest component in hemoglobin and has a major function in binding oxygen to the blood. The form of iron in food affects its absorption, hem iron which is part of hemoglobin and myoglobin found in animal meat can be absorbed twice as much as non-heme iron. Approximately 40% of the iron in meat, chicken and fish is hem iron, while the iron in eggs, cereals, vegetables and fruits is non-heme iron. Eating heme and non-heme iron simultaneously can increase the absorption of nonheme iron, because meat, fish and chicken contain a factor consisting of amino acids that can bind iron and help its absorption, whereas cow's milk, eggs and cheese do not contain that factor. so that it cannot help the absorption of iron[4].

## CONCLUSION

The provision of educational interventions to increase knowledge also changed the habitual behavior of consuming food, however, when looking at the experimental group, the hemoglobin level was significantly higher in the nutritionist group and in the combuination group after being observed there was also an increase. This is because the combination method participants get more detailed information and support. The learning process

with nutritionists, participants gain knowledge that can increase knowledge. In the learning process with peers, participants feel the same feelings as others, so that participants indirectly feel support from peers. Although the increase was not statistically significant in the communicating group, the changes were towards the positive side. The percent increase in hemoglobin indicated that no change had occurred in the control group, but a high increase in both experimental groups.

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