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THE IMPACT OF TEMPEH MILK AND SOYMILK ON ADOLESCENT HEMOGLOBIN LEVEL

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ABSTRACT

Among Indonesia, there is a 42% of anemia in adolescent girls. Study becomes challenging for those with anemia because blood may not bind oxygen from lungs to the rest of the body effectively. Consume soy and tempeh milk can be alternative treatment for anemia patients. In this study, young girls at SMP Negeri 2 Bengkulu City were tested to see how well tempeh milk and soy milk increased hemoglobin level. This study involved 36 young girls, aged 12 to 14, subjected to two-group pretest and posttest quasi-experimental design. The sample was taken by purposive sampling technique followed inclusion criteria namely, do not have infectious diseases and do not have blood disorders. The first treatment was given 200 mL of tempeh milk and the second treatment was given 200 mL of soy milk for 14 days. The average hemoglobin level of adolescent girls before intervention with tempeh milk is 12.8 g/dL and after the intervention was increased to 14.2 g/dL. The average hemoglobin level of adolescent girls before intervention with soy milk was 12.7 g/dL and after the intervention was increased to 13.7 g/dL. Tempeh milk and soy milk had the same effectiveness in increasing hemoglobin levels of adolescent girls at SMP Negeri 2 Bengkulu City.

Keywords*: tempeh milk, soy milk, hemoglobin, adolescent*

INTRODUCTION

Adolescence is an opportunity to catch up growth. Adolescence is a period of growth and development, both physically, mentally, and activity so that the need of nutrients must be fulfill in large quantities. Adolescent girls experience a lot of lack of nutrients in consuming food every day. Iron deficiency is the most common cause of anemia globally. Deficiencies of other nutrients such as folate, vitamin B12, and vitamin A also can cause anemia (Suryani 2015).

Anemia is one of the major nutritional issues in the globe, particularly in developing countries. Southeast Asia, the Middle East and Africa are regions that have the lowest average hemoglobin (Hb). The highest prevalence of anemia is in the Africa at 44.4%, the Asian is 32% and the lowest prevalence is in the America as much as 7.6%.

Indonesia as one of the countries in Southeast Asia that has a prevalence of anemia in fertile women is 28.8 % and in adolescent girls is 42% (WHO, 2015). Based on Riskesdas data in 2013, 37.1% young women experienced anemia and increase to 48.9% in Riskesdas 2018, with the highest proportion of anemia in the age groups 15-24 years and 25-34 years (Riskesdas, 2018).

Tempeh is a traditional Indonesian food that is consumed by almost all levels of society, an average of 5.2 kg/capita per year is consumed by Indonesians. Tempeh contain high nutrients, such as protein and vitamin B12, even tempeh is known to contain antioxidant compounds identified as isoflavones, namely daidzein, genistein, glycitein, trihydroxy isoflavones, and hydroxyantranilic acid. These compounds are believed to have a role in reducing free radical activity (Najih, *et al*., 2011).

Tempeh milk is one of the second generation products of tempeh in addition to tempeh flour, baby porridge, tempeh milk, biscuits, ice cream, burgers, sausages, and other products that do not have a typical tempeh shape (Aryanta 2020). Soy milk contain crude fiber and does not contain cholesterol so it is quite good for health. Soy milk also does not contain lactose so it can be consumed by people with lactose intolerance (Pinasti, et l., 2020).

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The iron content contained in soybeans is quite high compared to other types of nuts such as cashews, green beans, red beans and others. In addition, processed soybeans have a high nutritional value. The content of iron, calcium, carbohydrates, phosphorus, vitamin B complex, water and lecithin can be absorbed more quickly and well in the body of children and pregnant women (Valentina *et al*., 2020).

Study by Astuti (2014) showed that soybeans that had been processed into tempeh could have higher level of iron even though not in significant amount. In raw tempeh, the iron levels in each treatment increased by 90 mg, 110 mg, 130 mg and 150 mg per 1 kg of wet soybean making its iron level per 100 gram tempeh increased to 3.46 mg, 3.45 mg, 3.57 mg and 4.32 mg respectively. Based on the background above, the researchers wanted to know the effect of giving soy milk and tempeh milk on changes in hemoglobin levels in female adolescents.

METHOD

The research design is Quasy Experimental with Two Group Pretest and Posttest Design. This research was conducted by dividing subjects into two groups. The first treatment was given 200 mL of tempeh milk and the second treatment was given 200 mL of soy milk for 14 days to teenage girls aged 12-14 years. Each group will be measured hemoglobin before treatment (pretest) and after treatment (posttest). The population was female students (12-14 years) in SMPN 2 Bengkulu City.

The sample in this research were adolescent respondents with hemoglobin level below 12 g/dL. After the initial data collection on the population, subjects were taken according to the inclusion criteria. The subjects was taken by purposive sampling technique who meet the following criteria; do not have infectious diseases, aged 12-14 years, and do not have blood disorders.

The sample in this study were 36 young women. The sample group that will be given tempeh milk intervention is 18 people and the control group sample given soy milk is 18 people. This research was conducted for 14 days.

RESULTS AND DISCUSSION

Table 1 showed the total respondents in this study were 36 people with the division of students aged 12 years amount to 6 people (16.7%), aged 13 years amount to 25 people (69.4%), and aged 14 years amount to 5 people (13.9%).

Table 1. Distribution of Respondents Characteristics by Age

Age (yrs)	n	%
12	6	16.7%
13	25	69.4%
14	5	13.9%
Total	36	100%

Table 2. The average 24-hour recall intake for 14 days between intervention

Nutrition Intake	Tempeh Milk Group	Soy Milk Group
Protein	72.5 g	104.6 g
Iron	7.1 mg	18.2 mg

The results of food recall showed the average protein intake of respondents in tempeh milk group is 72.5 g and in soy milk group is 104.6 g, this value is higher than the daily RDA for protein, which is 65 g/day. Based on this study, it is known that the average iron intake of respondents in the tempeh milk group is 7.1 mg and in the soy milk group is 18.2 mg.

The soy milk group has a higher iron value than the tempeh milk group, but the iron value in the tempeh milk group is still lower than the daily RDA of iron, which is 15 mg/day, while the iron value in the soy milk group is higher than the daily RDA for Iron.

Table 3. Average Value of Hemoglobin Levels Before Giving Treatment of each group

Group	Hemoglobin level before intervention
Tempeh Milk	12.9 g/dL
Soy Milk	12.5 g/dL

From the table above, it can be seen that there is a difference between blood hemoglobin levels before being given treatment. In the tempeh milk

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group there was an increase in blood hemoglobin levels before being given, namely 12.9 g/dL, in the soy milk group there was also an increase in blood hemoglobin levels before being given, namely 12.5 g/dL.

Tabel 4. Overview of Adolescent Hemoglobin Average Levels Before Intervention in Each Group

Group	Hemoglobin Level (g/dL)		
	Min	Max	Mean±SD
Tempeh Milk	10.9	15.6	12.8±1.27
Soy Milk	10.2	14.0	12.7±0.9

Based on table 4, it shows that the average hemoglobin level before the treatment of tempeh milk was 12.8 g/dL. Likewise, the average hemoglobin level before giving soy milk was 12.7 g/dL.

Table 5. The Average Value of Hemoglobin Levels After Intervention

Group	Hemoglobin Levels After Treatment
Tempeh Milk	14.3 g/dL
Soy Milk	13.8 g/dL

From the table above, it can be seen that there is a difference between the levels of blood hemoglobin after treatment. In the tempeh milk group there was an increase in blood hemoglobin levels after intervention (14.3 g /dL), in the soy milk group there was also an increase in blood hemoglobin levels after being given (13.8 g/dL).

Table 6. Average of Hemoglobin Levels After Intervention

Variable	Hemoglobin Level (g/dL)		
	Min	Max	Mean±SD
Tempeh Milk	13.5	15.9	14.2±0.5
Soy Milk	12.5	15.8	13.7±0.8

Based on table 6 shows that the average hemoglobin level after the treatment of tempeh milk is 14.2g/dL. Likewise, the average hemoglobin level after soy milk was given treatment was 13.7g/dL.

Table 7 showed the average hemoglobin levels before being given tempeh milk was 12.8 g/dL and after being given treatment was 14.2 g/dL. The results of statistical tests showed that there was a difference in the average hemoglobin level before and after giving tempeh milk to adolescent girls with a p-value of <0.001. The average hemoglobin level before soy milk was given was 12.7 g /dL and after treatment was 13.7 g/dL. The results showed that there was a difference in the average hemoglobin level before and after giving soy milk to adolescent. girls with a p-value of <0.001. Based on independent t-test between groups of tempeh milk and soy milk before being given treatment, it was obtained p-value 0.120, which indicates that there is no difference in hemoglobin levels before giving tempeh milk and soy milk. For the results after being given tempeh milk and soy milk, a p-value of 0.091 (p>0.005) was obtained, which means that there was a difference in the average of giving tempeh milk and soy milk after being given treatment.

The total respondents in this study were 36 people with the division of students aged 12 years amount to 6 people (16.7%), 13 years old as many as 25 people (69.4%), and aged 14 years amounting to 5 people (13.9%). The 24-hour food recall method is one of the food consumption survey methods (SKP) that can be used to explore information on individual food consumption and family food consumption (Sirajuddin *et al.*, 2018) and is one of the instruments used by researchers as a tool to control all the type of food and drink consumed by the respondent during the last 24 hours.

Table 7. Differences in Average Hemoglobin Levels in Adolescents Before and After intervention

Group	Before		After		Δ Mean±SD	p-value[a]
	Min-Max	Mean±SD	Min-Max	Mean±SD		
Tempeh Milk	10.9-15.6	12.8±1.27	13.5-15.9	14.2±0.59	1.42±0.86	<0.001
Soy Milk	10.2-14.0	12.7±0,92	12.5-15.8	13.7±0.89	1.02±0.73	<0.001
p-value[b]	0.120		0.091		0.328	

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The results of the food recall show that the average protein intake of respondents in the tempeh milk group is 72.5 g and in the soy milk group is 104.6 g, this value is higher than the daily RDA for protein, which is 65 g/day. Based on this study, it is known that the average iron intake of respondents in the tempeh milk group is 7.1 mg and in the soy milk group is 18.2 mg.

The soy milk group has a higher iron value than the tempeh milk group, the iron value in the tempeh milk group is still lower than the daily RDA of iron, which is 15 mg/day, while the iron value in the soy milk group is more than the daily iron value. The daily RDA for iron is 15 mg/day.

In this case, the adequacy of protein and iron needs of the respondents has been fulfilled, because the amount of protein and iron consumption is already above the adequacy value of the daily requirement based on the RDA. But on the intake of iron needs in the tempeh milk group, the iron value obtained was 7.1 mg, which means it was still below the value of the adequacy of iron needs per day based on the RDA.

The findings of the study are also in line with Knutson (2017) idea that protein is crucial to the body's iron transportation system. Iron deficiency will result from a lack of protein intake since it will prevent iron from being transported. The liver produces the glycoprotein transferrin. Transferrin distributes circulating iron to areas of the body that require it, such as from the intestines to the bone marrow to create new hemoglobin. This protein is crucial to the body iron metabolism. Another protein crucial to iron metabolism is ferritin. In a healthy state, ferritin stores iron that may be retrieved as needed (Yuniwati 2018).

The protein content of tempeh can be compared with the protein content of meat, even tempeh contains more protein, the quality of tempeh is proven to be higher than soybeans because the water-soluble protein content will cause an increase in preteolytic enzymes (Indrasari et al., 2021). The treatments given in this study were in the form of tempeh milk and soy milk. Tempeh was chosen because every 100 grams of tempeh contains 4 mg of iron (Indrasari et al., 2021). And soybeans were chosen because they contain high enough iron compared to other types of nuts, in addition, processed soybean products have a fairly high nutritional value (Valentina, et al., 2020).

This study shows that there is a difference in the average value of hemoglobin levels which is not much different between tempeh milk and soy milk before the intervention, in the tempeh milk group the average value of hemoglobin levels is 12.8 g/dL and in the soy milk group the average value is - The average hemoglobin level is 12.7 g/dL. This shows that the average hemoglobin level before the intervention was carried out between the tempeh milk and soy milk groups, although not much different.

In this study, there was an average hemoglobin level between tempeh milk and soy milk after the intervention, in the tempeh milk group the average hemoglobin level was 14.2 g/dL and in the soy milk group the average hemoglobin level was 13.7 g/dL. This shows that there is an effect on hemoglobin levels after the intervention in the form of giving tempeh milk and soy milk.

This is in accordance with research conducted by Novianti (2019) where there is an effect of giving tempeh milk to pregnant women with third trimester. Hemoglobin levels after consuming tempeh milk were higher than before consuming tempeh milk. This happens because tempeh has 24 times higher quality and nutritional value. The fermentation process can increase levels of vitamin B2, Vitamin B6, folic acid, panthothenic acid, and nicotinic acid, while vitamin B1 decreases due to mold growth and also vitamin B12 is formed by bacteria which is not present in other vegetable products (Novianti 2019) .

Similar to the research conducted by and Novita (2021), which stated that the Hb level in respondents before being given tempeh milk was 9 g/dL and after being given tempeh milk it increased to 12.2 g/dL. As a result, pregnant women in the third trimester in the Independent Practice of Midwife Zuhrah HH, Samudera Subdistrict, North Aceh Regency, have higher hemoglobin levels after ingesting tempeh milk.

In this study, there was a difference in the average hemoglobin level before and after the intervention in the form of giving soy milk, which was 12.7 g/dL, and after being given treatment, the average hemoglobin level of adolescent girls increased to 13.7 g/dL. The results of this study are

in line with Valentina research (2020) where there is a difference in the average hb levels before and after the intervention in the control group, namely 9.95g/dL to 10.71g/dL and the intervention group which is 9.84g/dL to 10, 71g/dL.

Based on the statistical results with the Shapiro-Wilk test, it was found that the p-value for tempeh milk was 0.936 and the p-value for soy milk was 0.780. This indicates that the data is normally distributed. Giving tempeh milk and soy milk as much as 200 ml for 7 days has an effect in increasing the value of hemoglobin levels, but between tempeh milk and soy milk have the same effectiveness in increasing hemoglobin levels.

This is evidenced by the results of statistical tests based on independent t-test between the tempeh milk and soy milk groups before being given treatment, a p-value of 0.120 (p> 0.05) was obtained, which indicated that there was no difference in hemoglobin levels before giving tempeh milk and soy milk. For the results after being given tempeh milk and soy milk, a p-value of 0.091 was obtained, which means that there was no difference in the effect of giving tempeh milk and soy milk after being given treatment.

CONCLUSION

Characteristics of age in this study were teenage girls aged 12 years 16.7%, age 13 years 69.4%, and age 14 years 13.9%. For the average protein and iron intake was 72.5–104.6 gram. The average of hemoglobin levels before intervention in the tempeh milk and soy milk groups was 12.8 g/dL for tempeh milk and 12.5 g/dL for soy milk. The average of hemoglobin level after intervention in the tempeh milk and soy milk groups was 14.3 g/dL for tempeh milk and 13.8 g/dL for soy milk. Tempeh milk and soy milk both increase teenage girl hemoglobin levels in SMPN 2 Bengkulu City.

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