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The Effect of Giving Green Bean Juice and Red Guava Juice on Hemoglobin Levels in Adolescent Girls

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ABSTRACT

Background : Anemia is still one of the world's health problems, especially in developing countries. The prevalence of anemia in adolescents globally reaches 40-88%. In Indonesia, the incidence of anemia is still relatively high. The highest anemia was 57.1% in the adolescent age group. One way to overcome anemia in pregnant women is non-pharmacological therapy such as the use of mung beans and guava. Green beans contain phytochemicals needed in the formation of red blood cells and guava contains minerals that can facilitate the formation of hemoglobin. The aim of this research is to determine the difference between giving green bean juice and red guava juice on increasing hemoglobin in adolescents at SMP Negeri 2 Kledung.

Methods : The design of this study is quasi-experimental with a pretest-posttest two-groups design. Sampling was done using non-probability sampling techniques. This study was conducted to determine the difference between mung bean juice and guava juice on the increase in Haemoglobin. The population in this study is 73 adolescent girls aged 12-14 years old, namely grade 8, and the sample of this study is 60 people which is divided into 2 groups, namely the group that consumes Fe with mung bean juice and the group that consumes Fe with guava juice based on inclusion and exclusion criteria. The place of research has been carried out at SMP Negeri 2 Kledung the research has been carried out in September – December 2023. For the test in this study, it is a comparative hypothesis with 2 paired groups because the data is normally distributed using the dependent t-test test and for the test in 2 unpaired groups, using an independent t-test. Consumption monitoring of two intervention groups using a monitoring form and haemoglobin levels were measured using a Quick Check gauge.

Result : The average Hb of adolescents before mung bean juice consumption was 12,273 with a standard deviation of 1.3292. The average Hb of adolescents after mung bean consumption is 13.783 with a standard deviation of 1.3383. The average Hb of adolescents before consumption of guava juice was 12.273 with a standard deviation of 1.3292. The average Hb of adolescents after consumption of guava juice was 15.473 with a standard deviation of 1.3916 The mean value in the mung bean juice group was 13,783 and the mean value in the guava juice group was 15,473 (p-value 0.000).

Conclusions : There is a difference between the administration of mung bean juice and guava juice on the increase in haemoglobin in adolescent girls at SMP Negeri 2 Kledung. Health center can make efforts to control anemia through KRR, it is recommended to encourage the consumption of blood-boosting tablets using guava juice or mung bean juice to help increase hemoglobin levels in adolescent girls so that it can reduce the incidence of anemia.

Keywords : Guava Juice, Mung Bean Juice, Haemoglobin Levels

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Background. Anemia is a condition in which red blood cells (erythrocytes) are reduced in blood circulation or hemoglobin mass (Hb) so that they are unable to fulfill their function as oxygen carriers throughout the tissues (Astutik, 2018). Basically, anemia is directly affected by the consumption of daily foods that lack iron. In general, food consumption is closely related to nutritional status. If the food consumed has a good value,

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then the nutritional status is also good, but on the other hand, if the food consumed lacks nutritional value, it will cause malnutrition and can cause anemia.

Anemia is still one of the world's health problems, especially in developing countries. The prevalence of anemia in adolescents globally reaches 40-88%. In Indonesia, the incidence of anemia is still relatively high. The highest anemia of 57.1% occurred in the adolescent age group.

In accordance with the data of Basic Health Research in 2018, it shows that there is an increase in the prevalence of anemia in the adolescent group of 15-24 years, from 21.7% in 2013 to 53.7% in 2018, with the highest percentage, namely anemia in adolescent girls at 75.9%. The prevalence of anemia in adolescent girls in Central Java Province in 2019 was 33.95% (Central Java Health Profile, 2022. n.d.). Based on a report from the Temanggung Regency Health Office in 2022, data shows that cases of anemia in adolescent girls are relatively low in the work area of the Gemawang Health Center with a percentage of 0.08%, and the most occur in the work area of the Kledung Health Center, which is 15%.Data shows that there has been an increase in the number of adolescent girls who experience anemia when compared to previous years' data, which is 4.7% in 2020, 6.1% in 2021, and increased to 15% in 2022. From this data, a total of 254 adolescent girls experienced anemia, namely 131 adolescent girls aged 10-14 years and 123 adolescent girls aged 15-18 years. This shows that adolescent girls who experience anemia most often occur at the age of 10-14 years. According to data from the Kledung Temanggung Health Center, it shows that many young girls at SMP Negeri 2 Kledung experience anemia.

According to (Hasyim, 2018), adolescent women who have experienced menstruation are one of the groups of Women of Childbearing Age and are a transition period from children to adults who have the opportunity to experience increased social life activities, thus affecting the habit of often consuming fast food, practical, but low in nutritional content. Lack of nutrient content in food can be at risk of causing anemia. Anemia in adolescents is defined as a condition in which the level of Hemoglobin (Hb) in the blood is less than the normal number according to the gender and age group. The threshold value of anemia based on the WHO decree for adolescent girls is 12 g/dL (Andriyani & Bambang, 2014).

Anemia in adolescents, if not treated, can cause various adverse effects, namely it can reduce the body's immune system so that anemia sufferers are susceptible to infectious diseases, decreased fitness and thinking agility due to lack of oxygen into muscle cells and brain cells, and can reduce learning achievement and work productivity or performance in anemia patients.

Efforts are made in accordance with the Circular Letter of the Director General of Public Health of the Ministry of Health Number HK.03.03/V/0595/2016 concerning the Administration of Blood Supplement Tablets to Adolescent Girls and Women of Childbearing Age, the provision of TTD to adolescent girls is carried out through UKS/M in educational institutions (junior high and high school equivalent) by determining the day of drinking TTD together. The dosage given is one tablet every week for the rest of the year. The coverage of TTD for adolescent girls in Indonesia in 2018 was 46.56%. This has met the target of the 2019 Strategic Plan, which is 30%. In Central Java province, the coverage of TTD for adolescent girls reached 74.20% (Profile-Health-Indonesia-2019, n.d.).

The factors that cause the high incidence of anemia in adolescents are most common due to a deficiency of iron, vitamin B12, and folic acid. Iron deficiency often occurs due to an unbalanced diet or medical conditions that cause a decrease in iron absorption by the body. Meanwhile, vitamin B12 and folic acid deficiency can be caused by absorption problems or an unbalanced diet (Saras, 2023). Iron in food is divided into two forms, namely hemp iron and non-hemp iron. Hemp iron has a higher bioavailability which can be found as hemoglobin and myoglobin in meat, poultry and fish. Hemp iron is an important component of red blood cells that provides oxygen transport throughout the body. Non-hemp iron absorption varies and is influenced by the iron status of each individual, the amount of non-hem iron available and the balance between iron enhancer and inhibitor factors. Enhancer factors that can accelerate iron absorption include vitamin C, protein, folate and also zinc. Meanwhile, substances that can inhibit iron absorption or inhibitors include caffeine,

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tannins, oxalate, phytate, and calcium which are widely found in dairy products.

The absorption factor of non-hemp iron from food is assumed to be an average of 5-15%. In anemia conditions, hemp iron is more recommended because of its higher absorption capacity so that hemoglobin levels can increase faster than iron in non-heme form (Ayuningtyas et al., 2022). However, not all are able to make a variety of animal side dishes in daily food consumption, so it is not enough both in quantity and quality for the needs of young women. Geographically, Kledung District is also a mountainous area where the majority of the results of its natural resources are vegetable raw materials, so the frequency of vegetable side dishes is more than animal side dishes.

To help increase hemoglobin levels, it can be done with two therapies or treatments, namely with pharmacological therapy that can be applied by consuming blood-boosting tablets. Meanwhile, non-pharmacological therapy that can be done is by consuming foods that are high in iron levels. Based on these data and explanations, researchers are interested in further studying the analysis of increased hemoglobin levels in adolescent girls using high-iron enhancers to help the Fe absorption process in the body.

Green beans are one of the food ingredients that contain many substances needed by the body for the formation of red blood cells. Green beans also play an important role in the formation of red blood cells and prevent anemia because the phytochemical content in green beans is very complete so that it can help the hematopoesis process. Green beans also contain vitamins and minerals such as calcium, phosphorus, iron, sodium and potassium, so that the content contained in the mung bean juice can be used as a substitute for animal protein foods which can also affect the increase in hemoglobin levels. Of several processed mung bean products, mung bean juice drink is one of the processed foods that are very easy to make personally by the public. In addition to green beans, guava fruit also contains amino acids (tryptophan, lysine), iron, phosphorus, calcium, Vitamin A, sulfur, Vitamin C, and Vitamin B1. The mineral content contained in guava fruits can be used to overcome anemia sufferers because guava contains mineral substances that can facilitate the formation process of hemoglobin in red blood cells (Mei et al., 2020). Thus, mung bean juice and guava juice are an easy alternative to help increase hemoglobin levels in adolescent girls who experience anemia, balanced by regularly taking blood-boosting tablets (TTD).

Methods. This research used a quasi-experimental design with a pretest -posttest two groups design. Sampling used a non-probability sampling technique. This research was conducted to determine the difference between green bean juice and red guava juice in increasing hemoglobin.

The population in this study was 73 teenage girls aged 12-14 years, namely class 8, and the sample for this study was 60 people. The targets of the research were all young women aged 12-14 years, where the research was carried out at SMP Negeri 2 Kledung when the research was carried out in September – December 2023.

Bivariate analysis was carried out on 2 variables that were suspected to be related or correlated (Notoatmodjo, 2018). For the test in this study, it is a comparative hypothesis with 2 paired groups because the data is normally distributed using the dependent t-test test and for the test in 2 unpaired groups, using an independent t-test test with the interpretation of the results if the P value is <0.05, then Ho is rejected (Dahlan, 2020).

Result and Discussion.

Hemoglobin Levels in Adolescent Girls Before and After Mung Bean Juice

Table 1 Hemoglobin levels of adolescent girls before and after mung bean juice

Group Category	Mean	Standar Deviasi
Hb levels before Fe administration and mung bean juice	12.273	1.3292
Hb levels after Fe administration and mung bean juice	13.783	1.3383

Based on table 4.1 of 30 adolescent female respondents, it is known that the hemoglobin level of adolescent girls before being given mung bean juice with an average of 12,273 and afterwards increased to 13,783, meaning that there was an increase in Hb levels of 1.51 gr/dl. The standard deviation before being given mung bean juice with an average of 1.3292

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increased to 1.3383, meaning there was a difference of 0.0091.

Anemia conditions can be caused by several factors including lack of nutritional intake, lack of knowledge about anemia, nutritional status, and menstruation. The amount of iron released by the body in a day reaches 0.1mg and will increase by 0.5mg during menstruation. The iron that will be absorbed by the body is only 10% of the recommended iron nutrient consumption, which is 15mg. Iron needs can be met by consuming fe tablets. (Yanuarti, 2014) said that if iron supplements are consumed in large quantities, they will have a number of serious side effects, such as damage to the intestinal lining.

Another alternative way that can be taken to meet iron needs is to consume foods rich in iron, such as green beans. Mung beans can be processed into various processed foods and ready-to-eat drinks, for example such as mung bean porridge or mung bean juice.research conducted by (Suryani, 2019) shows that mung beans are good for consumption because they have many health benefits, one of which is that they can treat anemia or increase hemoglobin levels in adolescents. The iron content in mung beans is estimated to reach 6.7mg/100g. The iron content in mung beans is among the highest among the legumes. Iron is the main component needed in the formation of hemoglobin, so if the intake is insufficient, the process of hemoglobin formation in the blood will be disrupted until it finally results in a deficiency of hemoglobin levels or what is further known as anemia.

In addition to iron, the increase in hemoglobin levels is also influenced by other nutrients contained in mung bean juice, namely vitamin C. According to (Adriani & Wirjatmadi 2018), vitamin C is able to increase the absorption of non-hemp iron by up to four times. This process occurs because vitamin C will convert ferri-iron into ferrous in the small intestine so that iron becomes easier to absorb.

Based on research conducted by (Maulina & Sitepu, 2019) on white rats, the administration of green cabbage at a dose of 18g/kgBB/day and 36g/kgBB/day is effective in increasing hemoglobin levels. The hemoglobin level in white rats before being given green beans at a dose of 18g/kgBB/day was 12.41g/dl, the figure increased to 16.50g/dl after the intervention. Meanwhile, at a dose of 36g/kgBB/day, the hemoglobin level of white rats increased from 13.06g/dl to 16.37g/dl. Similar results were found by (Rahmadita, 2019) who stated that giving mung bean juice can increase the hemoglobin levels of adolescent girls in the work area of the Gayamsari Health Center.

Hemoglobin Levels in Adolescent Girls Before and After Being Given Guava Juice

Table 2. Hemoglobin Levels in Adolescent Women Before and After Guava Juice

Group Category	Mean	Standar Deviasi
Hb levels before Fe administration and guava juice	13.610	1.5621
Hb levels after administration of Fe and guava juice	15.473	1.3916

Based on table 4.2 from 30 adolescent female respondents, it is known that the hemoglobin level of adolescent girls before being given guava juice with an average of 1.3610 and afterwards increased to 1.5473, meaning that there was an increase in Hb levels of 1.86 gr/dl. The standard deviation before being given mung bean juice with an average of 1.5621 decreased to 1.3916, meaning there was a difference of 0.17.

Guava is high in iron and vitamin C. According to (C. Eliagita et al., 2017), vitamin C contained in guava can help the process of iron absorption in the body, and plays an important role in the reduction of ferrous iron into ferrous in the small intestine. This reduction process will become greater as the pH in the stomach becomes more acidic, in this case vitamin C will make stomach acid increase so that it can increase iron absorption.

The results of this study are in line with research conducted by (Haninda & Rusdi, 2020) which stated that the administration of guava juice has an effect on the hemoglobin levels of adolescent girls. Another study conducted by Putri and Isnaeni (2017) strengthened the results of this research, the results showed that guava juice had an effect on changes in hemoglobin levels in pregnant women in the third trimester who routinely consumed Fe.

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Differences in Hemoglobin Levels in Adolescent Women Before and After Mung Bean Juice

Table 3 Differences in Frequency Decrease in Hemoglobin Levels of Adolescent Girls Before and After Being Given Mung Bean Juice

Frequency of Hemoglobin Levels in Adolescent Girls	Mean	SD	P-value
Green Bean Juice Pretest – Posttest	-1.5100	.9689	0,000

Based on the paired samples t test in table 4.5, it can be known that the p-value is 0.000 < 0.05 so it can be concluded that there is an average difference between the frequency of hemoglobin levels pre test and post test which means that there is an effect of giving mung bean juice on the increase in the frequency of hemoglobin levels. Mean shows the mean difference between the pre-test and the post-test. From the results of the mean analysis is -1.5100, so because the value is negative, the frequency of hemoglobin levels during the pre-test is lower than the frequency of hemoglobin levels during the post-test is higher.

Green beans are one of the food sources rich in protein, fiber, healthy fats, low in carbohydrates and have abundant vitamins. (Amalia, 2016) said that the vitamins contained in mung beans, including other B vitamins such as B6, riboslavin, riasin, and pantothenic acid, will help increase the body's energy and metabolism. In addition, green beans also contain minerals that have many active enzymes.

Processed green beans have high digestibility, but with low flatulence. The hemagglutinin in green beans will clot red blood cells and is toxic. The toxic properties of hemagglutinin can be destroyed by a heating process at a temperature of 100 degrees Celsius. Phytic acid is able to form a complex with Fe and mineral elements such as Mg, Zn, and Ca which are insoluble and difficult to absorb by the body, reducing their availability in the body because it is difficult to digest. The fermentation process that occurs will increase the availability of iron for the body. This process is very important to prevent anemia in adolescents. In addition, mung beans also contain vitamin C which will help the process of absorption of fe in the body. Vitamin C will play a role in changing the shape of ferrite into ferrous. In addition to adolescent girls, mung bean juice can also be used by pregnant women who experience anemia. This opinion was conveyed by (Suheti et al., 2020) who stated that there was a difference in the average hemoglobin level before and after the mung bean juice intervention was given.

A study conducted on 20 respondents in grade 10 of SMK Al-Islam Kudus by (Faridah & Indraswari, 2017) stated that 10 respondents were given mung bean juice treatment as an intervention group for 7 days with a frequency of 2 cups in the morning and evening. Meanwhile, 10 other respondents who were not given mung bean juice were used as a control group. The results found an increase in hemoglobin levels by 0.13 from 10.57 to 11.10 after being treated with mung bean juice in the intervention group. Meanwhile, in the control group, the increase in hemoglobin levels was only 0.03 from the original 10.60 to 10.3.

Differences in Hemoglobin Levels in Adolescent Women Before and After Guava Juice

Table 4 Differences in the Frequency of Hemoglobin Levels Increase in Adolescent Girls Before and After Being Given Guava Juice

Frequency of Hemoglobin Levels in Adolescent Girls	Mean	SD	P-value
Guava Juice Pretest – Posttest	-1.8633	1.2585	0,000

Based on the paired T test of table 4.6, it can be known that the P-value is 0.000 < α0.05 so it can be concluded that there is an average difference between the frequency of pre-test and post-test hemoglobin levels, which means that there is an effect of guava juice on the increase in the frequency of hemoglobin levels. The mean shows the average difference between the pre-test and the post-test. From the results of the analysis, the mean is -1.8633, so because the value is negative, the frequency of hemoglobin levels during the pre-test is lower than the frequency of hemoglobin levels during the post test is higher.

Foods with abundant iron content combined with guava juice can help the process of iron zar absorption while overcoming anemia in adolescent girls. The intake of fe that enters the body will be handed over with the help of vitamin C in guava juice. Vitamin C will help the process of reducing

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ferrous iron (Fe3+) to ferro (Fe2+) in the small intestine so that iron becomes easier to absorb. The iron reduction process will be greater if the pH in the stomach becomes more acidic (Sambou et al., 2019).

In (Sambou et al., 2019), vitamin C can increase the pH in the stomach so that it has an impact on increasing iron absorption by up to 30%. Vitamin C will transfer iron from transferin located in the plasma to the liver ferritin. Most blood transferins will carry iron to the bone marrow and other parts of the body as iron reserves.

The results of a study conducted by (Rusdi et al., 2018) showed the effect of guava juice on serum ferritin and hemoglobin levels in patients with anemia in the adolescent phase. This is supported by the research of (Chunaeni et al., 2020), which stated that the administration of guava extract can increase hemoglobin levels. Another study with similar results was conducted by (Muthmainnah, 2018), which stated that the results of the One Way ANOVA test of p=0.000 meant that there was an effect of giving guava juice on hemoglobin levels during menstruation.

The Effectiveness of Mung Bean Juice and Guava Juice on Hemoglobin Levels in Adolescent Girls

Table 5 Effectiveness of Mung Bean Juice Compared to Guava Juice on Hemoglobin Levels in Adolescent Girls

Hemoglobin Levels	N	Mean	SD	ρ value
Guava Juice	30	15.473	1.3916	0,000
Green Bean Juice	30	13.783	1.3383	

Based on the bivariate statistical test, the Independent sample T-test in table 4.7 was used to determine the effectiveness of guava juice and mung bean juice on the increase in the frequency of hemoglobin levels in adolescent girls. It is known that the number of data on the results of the post guava juice is 30 people, while for the Green Bean Juice group is 30 people. The average post test or Mean value for the guava juice group was 15,473 while the Green Bean Juice group was 13,783, so there was a difference in hemoglobin levels of 1.69 gr/dl. The results of the independent T-test show a p-value of 0.000 < 0.05, so as the basis for making decisions on the independent sample t test, it can be concluded that Ho is rejected and Ha is accepted. Thus, it can be concluded that there is a significant (real) difference between the average frequency of Hemoglobin levels in the Guava Juice group and the Mung Bean Juice group.

Guava juice is more effective in increasing hemoglobin levels in adolescent girls than giving mung bean juice because red guava contains more vitamin C. Research conducted in the Sukoharjo Junior High School area showed that adolescent girls who were anemic after being given guava juice for 8 weeks along with consuming mung bean juice for 8 weeks, showed a significant increase in Hb levels (Mahmudah, 2023).

Another study conducted by (Nurhidayah et al., 2022) also showed that the administration of guava juice was able to increase Hb levels in adolescent girls with anemia. The results of this study are supported by the findings of (Andaruni et al., 2018) conducted at the University of Muhammadiyah Mataram showing that the administration of iron (Fe) tablets, vitamin C and guava fruit juice increases the Hb levels of adolescent girls. The intervention was carried out for 8 weeks and the Fe+vitamin C tablet group received an average increase in Hb levels of 1.23 gr/dL, while the Fe tablet group received an average increase in Hb levels of 0.83 gr/dL.

From the results of the study, it can be concluded that giving guava juice is more effective in increasing the Hb level of adolescents than giving mung bean juice.

Conclusion and Suggestions. In statistical tests, the administration of Fe tablets with guava juice and Fe with mung bean juice showed a relationship with an increase in hemoglobin levels. The results of the difference between the mung bean juice and guava juice interventions showed that the average posttest value of the mung bean juice group was 13.78 gr/dl while the average posttest value of the red guava juice group was 15.47 gr/dl, with a difference of 2.0 gr/dl. So the administration of Fe and guava juice is more effective in increasing hemoglobin levels in adolescent girls compared to Fe and mung bean juice.

Health center can make efforts to control anemia through KRR, it is recommended to encourage the consumption of blood-boosting tablets using guava juice or mung bean juice to help increase hemoglobin levels in adolescent girls so that it can reduce the incidence of anemia.

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