MEDIKA ALKHAIRAAT : JURNAL PENELITIAN KEDOKTERAN DAN KESEHATAN 5(2): 45-49
e-ISSN: 2656-7822, p-ISSN: 2657-179X

EFFECT OF GIVING SPINACH LEAF PUDDING (AMARANTHUS HYBRIDUS) PREVENTING CALCIUM DEFICIENCY AND IRON DEFICIENCY ANEMIA

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ABSTRACT

Background: Growing rapidly during adolescence increases a person's need for nutrients. Anemia is more common among adolescent girls. The dietary needs during adolescence are also very high due to the peak bone mass (PBM) that lasts throughout this period. This study aimed to determine whether adolescent girls who consumed spinach (Amaranthus Hybridus) would have increased levels of hemoglobin and blood calcium. **Methods:** Pre- and post-testing was used in one group of quantitative research employing a time series experiment in a quasi-experimental design to assess the intervention's effects. January 2022 study was conducted. 30 young ladies from Surabaya took part in the study. A method of deliberate sampling was used to collect samples. Data collection was done from primary sources and examined using the statistical paired sample t-test. **Result:** After consuming spinach pudding, blood calcium and hemoglobin levels increased. Shapiro-Wilk Test was normal and significantly different ($p<0.05$) hemoglobin and calcium levels before and after consuming spinach pudding from paired sample test results.
Conclusion: Before and after receiving spinach pudding, there is a considerable difference in the blood hemoglobin and calcium levels.
Keywords: Adolescents, anemia, calcium, vitamin C.

ABSTRAK

Latar belakang: Periode pertumbuhan cepat pada remaja meningkatkan kebutuhan akan zat gizi. Remaja putri merupakan kelompok yang berisiko sering terjadi anemia. Selain itu pada masa remaja terdapat puncak pertumbuhan masa tulang (peak bone mass/PBM) yang menyebabkan kebutuhan gizi pada masa ini sangat tinggi. Penelitian ini bertujuan untuk mengetahui pengaruh pemberian bayam (Amaranthus hybridus) terhadap peningkatan kadar hemoglobin dan kadar kalsium darah pada remaja putri. **Metode:** pre dan post test digunakan dalam penelitian kuantitatif ini menggunakan a time series experiment dalam desain quasi eksperimen kuantitatif untuk menilai efek intervensi. Penelitian dilakukan pada bulan Januari 2022. Populasi dalam penelitian adalah 30 remaja putri di Surabaya. Pengambilan sampel dilakukan secara purposive sampling. Pengumpulan data dilakukan dengan data primer dan analisis data dilakukan dengan menggunakan uji statistik paired sampel t-test. **Hasil:** Setelah mengkonsumsi puding bayam kadar kalsium darah dan hemoglobin meningkat. Hasil rerata hemoglobin dan kalsium diuji normalitas dengan Shapiro-Wilk Test . Hasil uji paired sample test didapatkan $p < 0,05$, terdapat perbedaan yang signifikan kadar hemoglobin dan kalsium, sebelum dan setelah makan puding bayam pada remaja putri. **Kesimpulan:** Ada perbedaan yang signifikan kadar hemoglobin dan kalsium darah, sebelum dan sesudah diberikan puding bayam.
Kata kunci : Remaja putri, anemia, kalsium

INTRODUCTION

Iron deficiency Anemia is among the main health issue in Indonesia, affects about 22.3% of urban teenagers aged 13 to 18 years.[1] Adolescents are a high-risk group for iron deficiency.[2] Anemia is more common

in adolescent girls than adolescent boys.[3] This is because young women lose iron (Fe) during menstruation so they need more iron intake.[4] The prevalence of anemia in adolescent girls is 26.4%.[5] Iron Anemia is most frequently caused by deficiency, this is because the body has a limited ability to absorb iron while the condition of iron loss due to bleeding is common, in addition, in many developing countries, lack of food intake occurs from the period of childhood growth.[6] Several previous studies reported that tea consumption can affect Hb levels, tea consumption habits cause low Hb levels in pregnant women and college students.[7] Iron deficiency anemia is caused by low reticuloendothelial hemosiderin and ferritin stores. Significant iron deficiency can lead to irritability, poor cognitive function, and decreased psychomotor development.[8]

Mineral calcium is the most prevalent element in the body. The amount of 99% in the skeleton and 1% in other tissues and body fluids will be distributed throughout the body by approximately 1200 grams. Blood calcium reserves are stored in the bones. If the body is deficient in calcium, the more it is taken, the faster it will be deleted. Efforts to maintain normal conditions depend on the intake and excretion of calcium from the blood. The body's bones contain the majority of its calcium, which is necessary for bone formation and tooth structure and strength.[9] Calcium in the blood or extracellular fluid (ECF) is crucial for physiological processes such as bone formation, blood clotting, the transmission of nerve impulses, and the contraction of skeletal, cardiac, and smooth muscles. [10]

Consuming iron-rich foods is one way to supplement your iron needs. Vegetables such as spinach (Amaranthus sp) contain iron. Nonheme iron can be found in green crops like spinach up to 8.3 milligrams of iron are present in 100 grams of cooked spinach. For the creation of hemoglobin in the blood, spinach's iron content is beneficial. [11–13] In this study, adolescent females in Surabaya's calcium and hemoglobin levels were monitored concerning their consumption of spinach pudding, tea, and vitamin C. This study aimed to determine whether adolescent girls who consumed spinach (Amaranthus Hybridus) would have increased levels of hemoglobin and blood calcium.

METHODS

This study was a quantitative research, with quasi-experimental research design, the time series experiment, using one group pre-test and post-test by measuring before and after the intervention. The independent variable was spinach leaf pudding. Variables depend on blood hemoglobin levels and blood calcium levels. The population in this study was 30 young women in Surabaya. Sampling was done by purposive sampling. Data collection was carried out using primary data.

To find out the differences between groups, a post hoc test was conducted using the paired sample t-test. The results of the analysis of the paired sample t-test can be concluded that there is a significant difference in the pre-test and post-test groups ($p < 0.05$).

The University of Surabaya's Ethics Committee for the Implementation of Health Research has given the study approval, with the following approval number: 03 / KE / I / 2022.

RESULT

This research involved 30 young women who were divided into 6 groups of 5 people. The average results of hemoglobin with spinach pudding in groups were then tested for normality using the Shapiro-Wilk Test, which showed that groups K1 and P1 were normally distributed with a p-value > 0.05.

The results of the normality test on the average hemoglobin yield with spinach tea and pudding showed normal data distribution ($p>0.05$; Shapiro-Wilk test).

The results of the normality test on the average results of hemoglobin with vitamin C and spinach pudding showed that the data distribution was not normal ($p<0.05$; Shapiro-Wilk test).

To find out the differences between groups, a post hoc test was conducted using the paired sample t-test. From the analysis of the paired sample t-test, it can be concluded that there is an insignificant difference in the pre-test and post-test groups ($p < 0.05$).

The results of the average calcium with spinach tea and pudding for all groups were then tested for normality using the Shapiro-Wilk Test, which showed that groups K5 and P5 were normally distributed with a p-value > 0.05.

To find out the differences between groups, a post hoc test was conducted using the paired sample t-test. From the analysis of the paired sample t-test, it can be concluded that there is a significant difference in the pre-test and post-test groups ($p < 0.05$).

The results of the average calcium with vitamin C and spinach pudding for all groups were then tested for normality using the Shapiro-Wilk Test, which showed that groups K6 and P6 were not normally distributed with a p-value > 0.05.

Table 1 Average of yield hemoglobin and calcium

		Paired.. 95% Confidence Interval of the Upper..	t	df	Sig.(2-tailed)
Pair 1	P_Hb_Pr - P_Hb_Po	.05743	-1.978	9	.079
Pair 2	P_Ca_Pr - P_Ca_Po	-.05693	-3.162	9	.012
Pair 3	T_Hb_Pr - T_Hb_Po	-.13127	-6.034	9	.000
Pair 4	T_Ca_Pr - T_Ca_Po	-.74783	-6.808	9	.000
Pair 5	C_Hb_Pr - C_Hb_Po	-.12687	-3.748	9	.005
Pair 6	C_Ca_Pr - C_Ca_Po	-.17493	-3.172	9	.011

Note:

a) Group Pair 1 = Experimental group hemoglobin with spinach pudding
b) Group Pair 2 = Experimental group of hemoglobin with tea and spinach pudding
c) Group Pair 3 = Experimental group of hemoglobin with vitamin C and spinach pudding
d) Group Pair 4 = Experimental group calcium with spinach pudding
e) Group Pair 5 = Experimental group of calcium with tea and spinach pudding
f) Group Pair 6 = Experimental group of calcium with vitamin C and spinach pudding

Paired sample t-test was utilized for the post hoc analysis with conclusion that there is a substantial variation in all groups between pre- and post-testing ($p<0.05$), there is an effect of giving spinach on hemoglobin and calcium.

DISCUSSION

According to this study, spinach pudding effectively affects variations in hemoglobin levels. The study's results are in agreement with previous study, which found that there were variations in the effects of administering green spinach extract on alterations in hemoglobin levels.[12]

By consuming spinach, one can maintain normal hemoglobin levels and ward off anemia since spinach's iron concentration is helpful for the process of producing hemoglobin levels in the blood.[12] Hemoglobin levels after treatment were greater than before treatment.[13] As a means of preventing anemia, spinach has a high iron concentration. Spinach's iron concentration aids in the formation of hemoglobin levels in the blood, allowing a person to maintain hemoglobin levels within normal ranges and preventing anemia by consuming spinach regularly. Spinach pudding contains iron which is needed by the body for the process of forming hemoglobin.[14] On the inside, hemoglobin is like a wax (waxy), and on the outside like soap (soapy) which causes it to dissolve in water but cannot be penetrated by water (impermeable), so that iron that enters the body will be easily absorbed and can help in

the process of increasing a person's hemoglobin level.[15]

Foods or drinks containing iron and calcium will experience inhibition of iron absorption by 79-94% in these foods when consumed together with tea.[16] This is due to the reaction between tea and iron that forms chelates, namely organic molecules from tea in the form of polyphenols that will bind iron so that the iron that will be absorbed by the body is reduced.[17] Disruption of the absorption of iron in the body results in reduced production of hemoglobin in the body, so when an examination of hemoglobin levels is carried out, it shows a low increase in hemoglobin levels. Therefore, spinach pudding increases the production of hemoglobin.

One of the crucial components in addition to assisting the body's absorption of iron, particularly non-heme iron, for the formation of hemoglobin is vitamin C and converting ferrous form of the mineral into ferrous, which is easier for the body to absorb. [18] The functions of vitamin C include collagen synthesis, iron absorption, calcium absorption, infection prevention, and increased infection resistance.[19] Even while the specific kind of vitamin C aids in iron absorption.[20] Because vitamin C and iron combine to form a complex iron acrobat compound that is easier for the body to absorb, vitamin C consumption can increase non-heme iron absorption by four times. Vitamin C also facilitates the absorbency of converting ferric iron into ferrous iron, easily absorbed in the human digestion .[21]

Calcium is one of the many elements found in green spinach that is helpful for health.[22] Tea tannins do not block calcium absorption, and the caffeine in tea does not cause the body to lose more calcium, additionally, nutritional and non-nutritional elements like vitamin K, calcium (Ca), mineral flour (F), magnesium (Mg), and flavonoids have a protective effect on bones.[23] Ascorbic acid increased calcium levels linked to membrane and cell wall permeability alterations.[24]

CONCLUSION

In conclusion, there is a significant difference on the average hemoglobin and calcium levels before and after being given spinach pudding to 30 young women in Surabaya. It is recommended for further research to consider other factors, such as other consumptions that can affect the increase in hemoglobin and calcium during the study.

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