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The Effectiveness of Chia Seeds (*Salvia Hispanica*) on Increasing Hemoglobin (Hb) Levels to Prevent Anemia

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Abstrak
Anemia terjadi ketika kadar hemoglobin dalam darah turun di bawah nilai yang seharusnya. Masalah ini merupakan isu kesehatan yang signifikan, terutama dialami oleh anak-anak, remaja perempuan, Wanita hamil dan menyusui. anemia remaja yang tidak diatasi dapat berdampak negatif pada kesehatan di masa dewasa, termasuk risiko komplikasi kehamilan, yang kemudian meningkatkan risiko stunting serta angka kematian ibu dan bayi. Upaya mencegah anemia meliputi konsumsi makanan yang mengandung zat besi, asam folat, serta vitamin A, C, dan E, ditambah dengan asupan zinc dan pemberian tablet zat besi sebagai suplemen. *Chia seed* merupakan bahan alami dengan potensi kesehatan, kandungan protein dan mineral dalam chia seed mendukung proses pembentukan hemoglobin untuk mencegah anemia. Riset ini dilakukan sebagai mengevaluasi efek konsumsi chia seed terhadap peningkatan kadar hemoglobin. Metode yang dipakai adalah kuasieksperimen dengan *pre* dan *post test* pada dua kelompok. Sampel 80 responden dipilih secara *purposive* dan dibagi menjadi dua grup. Grup pertama diberikan chia seed dosisi 15 gram sekali sehari selama 14 hari, grup kedua menerima vitamin C 50 mg dua kali sehari selama 14 hari. Analisis data dengan uji paired t-test. Hasil menunjukkan adanya peningkatan kadar hemoglobin dengan rata-rata 1,3 gram per desiliter dan nilai *P* kurang dari 0,005, yang berarti pemberian *chia seed* berpengaruh terhadap peningkatan kadar hemoglobin pada siswi pondok pesantren Syamsul Arifin. Kesimpulannya, *chia seed* efektif dalam meningkatkan kadar hemoglobin untuk mencegah anemia.

Abstract
Anemia occurs when hemoglobin levels in the blood fall below normal levels. This is a significant health issue, particularly among children, adolescent girls, and pregnant and breastfeeding women. Untreated anemia in adolescents can negatively impact health in adulthood, including the risk of pregnancy complications, which in turn increases the risk of stunting and maternal and infant mortality. Efforts to prevent anemia include consuming foods containing iron, folic acid, and vitamins A, C, and E, supplemented with zinc and supplementation with iron tablets. Chia seeds are a natural ingredient with health potential, the protein and mineral content in chia seeds supports the process of hemoglobin formation to prevent anemia. This research was conducted to evaluate the effects of chia seed consumption on increasing hemoglobin levels. The method used was a quasi-experimental study with pre- and post-tests on two groups. A sample of 80 respondents was selected purposively and divided into two groups. The first group was given 15 grams of chia seeds once daily for 14 days, and the second group received 50 mg of vitamin C twice daily for 14 days.

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Data were analyzed using a paired t-test. The results showed an increase in hemoglobin levels with an average of 1.3 grams per deciliter and a P value of less than 0.005, which means that giving chia seeds had a effect on increasing hemoglobin levels in female students at the Syamsul Arifin Islamic boarding school. In conclusion, chia seeds are effective in increasing hemoglobin levels to prevent anemia.

Introduction

Indonesia faces a nutritional challenge known as the triple burden, namely undernutrition such as *stunting* and *wasting* , overnutrition such as *obesity* and *overweight* , and micronutrient deficiencies such as anemia. Anemia is characterized by a decrease in hemoglobin (Hb) levels in the blood below what is considered normal based on examination results.[1] The adolescent period covers the age range between 10 and 19 years, during which time physical and psychological conditions experience changes. These changes can trigger several health problems such as anemia.[2] Anemia is a significant public health problem, especially experienced by children, adolescent girls, and mothers who are pregnant or breastfeeding. WHO estimates that 40% of toddlers, 37% of pregnant women, and 30% of women aged 15-49 years in the world experience anemia. In 2019, approximately 30% of 539 million non-pregnant women and 37% or approximately 32 million pregnant women aged 15 to 49 years were identified as having anemia.[3] According to the Ministry of Health (2018) the prevalence of anemia is 32% in adolescents aged 10-19 years, meaning 3-4 out of every 10 adolescents. According to the Household Health Survey, the total number of anemia cases in Indonesia reached 40.1%, including a high figure. Nearly half of it, 26.8%, occurred in children and 32% in adolescents, especially in female adolescents, the prevalence of anemia. This number rose from 37.1% in 2013 to 48.9% in 2018.[4] From the results of an initial study at the Syamsul Arifin Pasuruan Islamic Boarding School on 80 female students, most of them did not understand about anemia, and almost half of them had hemoglobin levels of less than 12 grams per deciliter.

Limited knowledge about anemia makes students pay less attention to iron intake, according to the results of Yenny Aulya's research in 2022.[5] Adolescent girls still have limited understanding about anemia, so that the anemia they experience is usually caused by unhealthy eating and sleeping patterns and heavy blood loss during menstruation. As a consequence, they tend not to take steps to prevent anemia and also rarely take iron-boosting tablets (TTD) regularly. The high rate of anemia in adolescents is caused by various factors, including low

intake of iron and important nutrients such as vitamin A, vitamin C, folate, riboflavin, and vitamin B12, as well as consuming iron together with foods that can reduce iron absorption.[6] Anemia in adolescent girls requires special attention because if left untreated it can have a negative impact on health in adulthood, including risks to pregnancy and the fetus such as the risk of bleeding, premature birth and low birth weight babies. In addition, this condition also increases the risk of stunting and maternal and infant mortality rates. Therefore, efforts to prevent anemia in adolescent girls are very crucial [1]. Anemia prevention can be done by consuming foods rich in iron, folic acid, vitamins A, C, E, zinc, and by giving blood-boosting tablets (TTD). [6]

Chia seeds are a natural ingredient with health benefits and can be developed as a primary choice to meet nutritional needs. This plant originates from Central America, particularly Mexico and Guatemala. Chia seeds are often used in various food products, especially those included in the functional food category, due to their high fat content (30–33%), protein (15–25%), carbohydrates (26–41%), and vitamins, minerals, and dietary fiber (18–30%). Every 100 grams of dry seeds contain approximately 486 calories . In 2019, the EFSA confirmed that chia seeds are safe for use in food products **.** Chia seeds contain protein and minerals (Vitamin C and Iron) which are beneficial in the formation of hemoglobin to prevent anemia [7]. The use of chia seeds as a food ingredient is considered safe because it does not cause negative reactions or allergies as long as it is consumed in the recommended amounts. [8] Several studies have examined the functional health benefits of chia seeds, including their ability to aid weight loss in obese individuals. [9], lower and maintain blood cholesterol levels. [10], and possibly reduce the risk of cardiovascular disease. [11] **.** US dietary guidelines published in 2000 recommend that chia seeds be consumed in amounts not exceeding 48 g/day. The amount of chia A lower seed intake (approximately 15 g) has been proposed as the recommended daily intake by the Advisory Committee on New Foods and Processes [12] .

The results of the discussion above attracted researchers to take the research title of Study on the effectiveness of chia (*Salvia hispanica*) in increasing hemoglobin levels as an effort to prevent anemia in female students at the Syamsul Arifin Islamic Boarding School

Method

Data collection was conducted at Syamsul Arifin Islamic Boarding School from July to August 2025. This study applied a quasi-experimental method with a two-group design that was conducted with a pre-test and post-test . The population consisted of 135 female students at Syamsul Arifin Islamic Boarding School. From this population, 80 female students were

selected using a purposive sampling technique based on predetermined inclusion and exclusion criteria, then divided into two groups, namely the group given chia seeds and the other group received vitamin C.

Before collecting data, first ask for consent from the respondent to fill in the willingness to become a respondent. Primary data was collected through questionnaires completed directly by respondents, while secondary data was obtained from examination results. The research instrument was a questionnaire containing general and specific information. Hb level measurement using the Sinocare portable digital device was carried out twice . The initial examination was carried out before giving chia seeds and the second examination after giving chia seeds . *Chia seeds* were given as much as 15 grams in the form of a drink once a day for 14 days to the treatment group, while the control group only received vitamin C at a dose of 50 mg twice a day . After 14 days , HB levels were measured in the treatment group and the control group .

The data were analyzed using the SPSS version 27.0 program with a confidence level of 95% and a significance threshold of $p < 0.05$. Univariate analysis was used to describe the characteristics of respondents, samples, and variable distributions and frequencies. Normality was tested using the Kolmogorov-Smirnov test. Bivariate analysis was used to determine differences before and after chia seed administration using the paired t-test.

Results and Discussion

This section presents the research results obtained through the data collection process from July to August 2025, with the participation of 80 female students at the Syamsul Arifin Islamic Boarding School . Data analysis was conducted to identify differences in hemoglobin levels before and after chia seed administration. Details of the main findings are presented below:

1. Univariate Analysis

Table 1. Frequency distribution of respondent characteristics

No	Characteristics	Number (n)	Percentage (%)
1	**Age**		
	10-14 years	32	40
	15-19 years	48	60
	Total	**80**	**100**
2	**Hb Levels**		
	< 12 g/dl	37	46
	12-16 g/dl	40	50
	>16 g/dl	3	4

	Total	80	100
3	**Nutritional status (Body Mass Index)**		
	BB less	10	12.5
	Normal	50	62.5
	BB more	20	25
	Total	**80**	**100**
4	**Nutritional Status (Upper Arm Circumference)**		
	<23.5	27	33
	>23.5	53	67
	Total	80	100

Primary data source 2025

As listed in Table 1, all 80 respondents (100%) fall into the adolescent age category. According to the World Health Organization (2024), adolescence is the transitional phase from childhood to adulthood, spanning the ages of 10 to 19. This period is a unique developmental stage for building a strong foundation for health.

In addition, 46% of respondents (37 female students) had hemoglobin levels < 12 g/dl, 50% of respondents (40 female students) had Hb levels of 12-16 g/dl and 4% (3 female students) had Hemoglobin levels > 16 g/dl. A common health problem experienced by adolescent girls is anemia. Adolescent girls need sufficient iron intake because it is related to the growth period, in addition, increased activity causes the need for nutrients, including iron, to be higher. Adolescent girls also experience monthly blood loss due to menstruation, as well as dietary restrictions carried out by adolescent girls by limiting food intake to obtain ideal body weight, based on these things if nutritional intake is insufficient, it can increase the risk of anemia in adolescent girls. [1]

Based on the calculation of body mass index, it was found that 12.5% (10 female students) were underweight, 62.5% (50 female students) were normal weight and 25% (20 female students) were overweight. The nutritional status of adolescents reflects the balance between nutrient consumption and absorption, which can be assessed through BMI and LiLA measurements. Nutritional problems in adolescents often take the form of underweight, which causes anemia and fatigue, as well as overweight and obesity, which can be influenced by body image, unbalanced diet patterns, stress, and social environment.[13] Thompson's theory in Nur Sri Atik (2022) states that nutritional status is related to hemoglobin levels, which means that if a person's nutritional status is good, their

hemoglobin levels are also normal. [14] The results of the nutritional status assessment based on upper arm circumference measurements showed that almost half, 33% (27 female students) had an upper arm circumference of less than 23.5 cm, while more than half, namely 67% (53 female students), had an upper arm circumference of more than 23.5 cm. Nutritional status measurements such as LiLA can indicate that there is a lack of energy and protein intake that lasts for a long time. Protein functions in distributing and binding iron in the blood circulation. [15]

2. Normality Test

Before analyzing the data, normality testing was carried out using the Kolmogorov-Smirnov test, with the results presented in Table 4 below.

Table 5 Results of the Kolmogorov-Smirnov Test

No	Group	Results
1	Treatment group	0.200
2	Control Group	0.091

Primary data source 2025

Table 4 shows the results of the normality test using the Kolmogorov-Smirnov test, where the p-value for the treatment group was 0.200 > 0.05 and for the control group was 0.091 > 0.05, so the data in both groups were considered to be normally distributed. Thus, the hypothesis test used was the paired T-test. [16]

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3. Bivariate Analysis

Table 5: Difference in average hemoglobin levels in the treatment group and the control group

No	Hb levels	Treatment	Control	P-value
1	Before	10.68	13.2	0,000
2	After	12.02	13.09	0.433
3	Difference	1.34	0.1	

Primary data source 2025

Table 5 shows the results of the bivariate analysis using the Paired T-test. which was used to compare hemoglobin levels before and after the intervention in the treatment group and the comparison group. The results showed that the treatment group experienced an increase in the average hemoglobin concentration in the treatment group increased by 1.34 gr / dl, from 10.68 gr / dl to 12.02 gr / dl with a p value of 0.00 < 0.005. Through this analysis, it can be concluded that the administration of chia seeds has a significant effect in increasing hemoglobin levels in students of the Syamsul Arifin Islamic Boarding

School. These results are consistent with research from Yayang et al., which showed that a mixture of red dragon fruit (Hylocereus polyrhizus), red beet (Beta vulgaris), and chia seed (Salvia hispanica) played a role in increasing hemoglobin levels in women of reproductive age. [11]

The high incidence of anemia in adolescents is caused by low consumption of iron and other essential nutrients, including vitamins A, C, folate, riboflavin, and vitamin B12, as well as consuming iron together with foods that can inhibit its absorption. [6] Chia seeds are widely used in food production, especially in food utilization, because of their high lipid content (30–33%), protein (15–25%), carbohydrates (26–41%), vitamins, bioelements, and dietary fiber (18–30%). The caloric value of 100 g of dry seeds is 486 kcal . Chia seeds contain protein, minerals (Vitamin C and Iron) which are useful in the formation of hemoglobin to prevent anemia. The amount of protein in chia seeds is quite high compared to other types of seeds, and most importantly, chia seeds are free from gluten protein. [17] .

Protein is related to the incidence of anemia, because one of the functions of protein is to distribute and bind iron in the bloodstream. [15] . Iron absorption affects the incidence of anemia, Iron is an essential micronutrient that plays a major role in the process of hemoglobin formation. [18] These results are consistent with research conducted by Setyaningsih et al. (2018) and Jumiati et al. (2023), which revealed a positive correlation between protein intake and anemia. In other words, increased protein consumption contributes to increased hemoglobin levels and decreased prevalence of anemia. These findings are also in line with studies conducted by Setyaningsih et al. (2018) and Jumiati et al. (2023) which showed a positive relationship between protein intake and anemia levels, in other words, higher protein intake , higher hemoglobin levels and lower incidence of anemia. [19] , [20] . Iron requirements in adolescent girls increase due to rapid growth and intense activity, as well as blood loss during menstruation. In addition, some adolescent girls restrict their food intake to achieve an ideal body weight, which increases the need for various nutrients, including iron. If these nutritional needs are not met, the risk of anemia will increase. [21] . These findings are consistent with the study by Angreani Besuni et al., which identified a relationship between iron, folic acid, vitamin E, and

vitamin B12 with hemoglobin levels, while vitamin C intake had no correlation with hemoglobin levels. [22]

Conclusion

The results of the data analysis showed a significant difference in hemoglobin levels before and after chia seed administration with a p-value of <0.005. Therefore, Islamic boarding schools, especially female Islamic boarding schools, should utilize chia seeds as a food ingredient that can be consumed every morning by students.

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