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Red guava (*Psidium guajava L*) juice increases hemoglobin levels in female adolescent

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ABSTRACT

Background: One nutritional issue Indonesian adolescents face is micronutrient deficiency, with approximately 12% of male adolescents and 23% of female adolescents experiencing anemia, predominantly due to iron deficiency. Anemia in adolescent girls is particularly concerning as they are future mothers who will conceive and give birth, thereby increasing the risk of maternal mortality, preterm birth, and low birth weight. An initial survey of 7 female students revealed that 4 were anemic. This study aims to determine the effect of red guava juice on hemoglobin levels in female adolescents at a junior high school of SMP N 2 Belang, Belang District.

Methods: This quasi-experimental study employed a pretest-posttest with control group design, involving a total sampling of 30 respondents divided into 15 respondents in the treatment group and 15 in the control group. Data were collected through observation sheets and analyzed using paired sample t-tests.

Results: The paired sample t-test results indicated a significant effect of red guava juice on increasing hemoglobin levels in female adolescents, with a p-value of 0.002 and a mean value of 11.46 during the pretest and 12.58 during the posttest in the treatment group. In contrast, the control group did not receive any treatment and had a p-value of 0.334, indicating no significant increase in hemoglobin levels during the posttest. After consuming red guava juice, there was a considerable change from anemia to non-anemia.

Conclusion: Consuming red guava (*Psidium guajava* L.) juice demonstrates potential as a non-pharmacological intervention for increasing hemoglobin levels in adolescent females, with research findings indicating a significant improvement in the treatment group compared to the control group. Nevertheless, further studies with larger sample sizes and extended durations are necessary to validate red guava juice's efficacy in managing anemia among the general population of adolescent females.

KEYWORDS

Anemia, Adolescent Health, Functional Drinks, Preventive Nutrition.

INTRODUCTION

Adolescence is a transitional period from childhood to adulthood. According to the WHO (2024)[1], adolescents or young people are between 10 and 24 years old. Age is considered a poor indicator because growth and development vary among individuals. Physiologically, adolescence is defined as the period when physiological development begins, specifically the maturation of reproductive organs[2].

One nutritional issue Indonesian adolescents face is micronutrient deficiency, with approximately 12% of male adolescents and 23% of female adolescents experiencing anemia, predominantly due to iron deficiency (iron deficiency anemia)[3]. The prevalence of anemia is higher among female adolescents compared to their male counterparts. Anemia in

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adolescents adversely affects immunity, concentration, academic performance, fitness, and productivity[4]. Additionally, anemia in female adolescents is particularly concerning as they are future mothers who will conceive and give birth, thereby increasing the risk of maternal mortality, preterm birth, and low birth weight[5].

The factor influencing hemoglobin levels in the blood is the adequacy of iron in the body. Adolescents suffering from anemia may experience suboptimal growth, such as osteoporosis, in later life[6,7]. Osteoporosis can occur rapidly if adolescents experience eating disorders and reduced cognitive abilities[8]. Furthermore, female adolescents with anemia may experience decreased concentration, lack of enthusiasm in activities due to fatigue, and deficiencies that can affect attention, intelligence, and academic performance at school[9–11].

Research by Sulistiyowati (2016)[12] Sulistiowaty found that red guava juice can aid in iron absorption and treat anemia. Iron in food is absorbed with the help of vitamin C. Vitamin C can increase the pH in the stomach, thereby enhancing iron absorption by up to 30%. Research by Prasetyanti & Putri (2017)[13] demonstrated that hemoglobin levels can increase significantly with the consumption of iron tablets, and factors such as the consumption of vitamin C-rich fruits also influence the absorption of iron tablets.

Based on the number of students at a junior high school of SMP N 2 Belang, totaling 362 students, an initial survey was conducted on 11 February 2019. Among the 7 female students surveyed, 4 were identified to be anemic. Thus, many female adolescents still suffer from anemia. Anemia can be defined as a deficiency in hemoglobin levels. This study aims to analyze the effect of red guava juice on changes in hemoglobin levels in female adolescents at a junior high school of SMP N 2 Belang, Belang District.

METHOD

This study used a quasi-experimental design with a pretest-posttest control group design. The main variable to be compared in this study was hemoglobin levels in female adolescents. Hemoglobin levels were measured before and after the intervention in both groups (treatment and control). This study was conducted on adolescent girls aged 12-15 years at Junior High School 2 Belang, Belang District, Southeast Minahasa Regency, North Sulawesi, Indonesia. The research design involved two stages of observation: before the administration of red guava juice (pretest) and after the administration of red guava juice (posttest). The red guava juice was made from 100 g of red guava fruit, 10 g of granulated sugar, and 150 ml of water, blended and strained. The composition included 228 mg of vitamin C, 0.73 mg of vitamin E, 49 µg of folate, 0.26 mg of iron, 0.23 mg of zinc, and 5204 µg of lycopene. The juice was administered for 7 days. The respondents' hemoglobin levels were measured before and after 7 days of consuming the red guava juice. The population in this study consisted of 30 female students, using a total sampling technique, which included the entire population of 30 respondents divided into 2 groups: 15 respondents in the treatment group and 15 respondents in the control group.

The intervention involved administering red guava juice to the treatment group for 7 days, consumed in the morning, while the control group did not receive any treatment. Data analysis was performed using the paired t-test.

Ethical Approval Number: 301/Kepk/Vii/2019 from Health Research Ethics Committee, Manado Health Polytechnic Ministry of Health.

RESULTS

Hemoglobin Levels Pretest and Posttest in the Treatment Group.

Based on Table 1, there were 6 non-anemic respondents in the pretest, which increased to 13 non-anemic respondents in the posttest in the treatment group. In contrast, in the control group, there were 6 non-anemic respondents in the pretest, with no increase in non-anemic respondents in the posttest.

Normality Test

This test was conducted to determine whether there were changes in hemoglobin levels before and after the adminis-

Table 1. Distribution of respondents based on hemoglobin levels in the pretest and posttest of the treatment and control groups at a junior high school of SMP N Belang

Hemoglobin Levels	Category	Treatment Group		Control Group	
		Pretest	*Posttest*	*Pretest*	*Posttest*
≥ 12 g/dl	Non-Anemic	6	13	6	6
< 12 g/dl	Anemic	9	2	9	9
Total		15	15	15	15

tration of red guava juice in the treatment group and in the control group without any treatment. The results of the paired sample t-test for changes in hemoglobin levels before and after treatment in the treatment group are shown in Table 2.

Based on Table 2, the difference in hemoglobin levels between the pretest and posttest in the treatment group was 1.12. The paired sample t-test in the treatment group showed a p-value of 0.002 < 0.05, whereas the difference in hemoglobin levels between the pretest and posttest in the control group was 0.01. The paired sample t-test in the control group showed a p-value of 0.334. It can be concluded that there was a significant change in hemoglobin levels between the pretest and posttest in the treatment group, whereas there was no significant change in hemoglobin levels between the pretest and posttest in the control group.

Table 2. Results of the paired sample t-test for changes in hemoglobin levels before and after treatment in the treatment and control groups

Hemoglobin Levels	Treatment Group			Control Group		
	Mean	Standard Deviation	*P value*	Mean	Standard Deviation	*P value*
Pretest	11.46	0.882	0.02	11.77	1.052	0.334
Posttest	12.58	0.882		11.78	1.050	

DISCUSSION

The characteristics of respondents based on age, as indicated by the research data, show that respondents in both the treatment and control groups fall within the range of 13 years. The research results indicate a significant increase in hemoglobin levels with a p-value of 0.002 < 0.05. The mean pretest hemoglobin level was 11.46 g/dl, which increased to 12.58 g/dl in the posttest for the treatment group. The mean increase in hemoglobin levels from the pretest was 1.12 g/dl, indicating a significant change in hemoglobin levels. In contrast, the control group, which did not receive any treatment, had a p-value of 0.334 > 0.05, with a mean pretest hemoglobin level of 11.77 g/dl, which increased to 12.78 g/dl in the posttest. The mean increase in hemoglobin levels from the pretest was 1.01 g/dl, indicating no significant difference in the control group during the posttest. Univariate analysis showed that 6 respondents were not anemic and 9 respondents were anemic during the pretest, which increased to 13 respondents not anemic and 2 respondents anemic during the posttest. In the control group, 6 respondents were not anemic and 9 were anemic during the pretest, with no increase in non-anemic and anemic respondents during the posttest.

This study aligns with research conducted at the Rusdi et al. (2018)[14] Orphanage in Padang Panjang City on 34 anemic adolescents selected through simple random sampling. Subjects were divided into two groups: control and treatment. The treatment group was given 100 grams of red guava processed into juice for 7 days. Data analysis used the dependent t-test with a significance level of α=0.05. The mean pretest Hb level was 10.26 g/dl (control) and 10.50 g/dl (intervention), and the mean serum ferritin level was 33.63 µg/L (control) and 36.63 µg/L (intervention). The mean posttest Hb level was 10.98 g/dl (control) and 12.48 g/dl (intervention), and the mean serum ferritin level was 40.35 µg/L (control) and 57.40 µg/L (intervention). Statistical tests showed that red guava juice significantly affected hemoglobin and serum ferritin levels in anemic adolescent girls, with a p-value of <0.001.

This study is consistent with the research by Winarni et al. (2020)[15], which found that the increase in hemoglobin levels after administering red guava juice with Fe tablets was 2.96 g/dl, red guava alone was 2.89 g/dl, red guava juice with honey was 1.21 g/dl, a combination of spinach and red guava juice was 0.96 g/dl, Fe tablets with orange juice was 0.40 g/dl, orange juice alone was 0.63 g/dl, and Fe-Folate with orange juice was 0.47 g/dl. Thus, among all these studies, the combination of red guava juice with Fe tablets was the most effective in increasing hemoglobin levels in anemic pregnant women compared to orange juice.

This study is also consistent with the research by Yuviska & Armiyanti (2019)[16], which found that the average hemoglobin (Hb) level in adolescents before consuming mung bean juice was 10.107 with a standard deviation of 1.0278. The average Hb level in mothers after consuming mung bean juice was 10.813, with a standard deviation of 1.0460. The average Hb level in mothers before consuming guava juice was 10.040, with a standard deviation of 1.2403. The average Hb level in mothers after consuming guava juice was 10.507, with a standard deviation of 1.3456. There is a difference in the effect of mung bean juice and red guava juice on the increase in hemoglobin levels in RISMA in Desa Maja. This study is in line with the research by Carolin et al. (2021)[17], which found a difference in the effect of red guava juice and beet juice on hemoglobin levels in pregnant women. The average hemoglobin level before and after consuming red guava juice was 8.4 g/dl and 11.5 g/dl, respectively, and the average hemoglobin level before and after consuming beet juice was 8.5 g/dl and 10.2 g/dl, respectively, with a p-value of 0.001.

Red guava juice has shown promising effects on increasing hemoglobin levels in female adolescents, according to several studies. In one study, the mean hemoglobin level in the treatment group receiving Fe tablets and guava juice increased from 10.7 g/dL to 11.4 g/dL, while the control group receiving only Fe tablets increased from 10.2 g/dL to 10.6 g/dL[18]. Another study found a significant effect of red guava juice on hemoglobin levels during menstruation in adolescent girls ($p=0.000$)[19]. Interestingly, the combination of red guava pudding and green bean juice showed an even greater increase in hemoglobin levels, with an average increase of 3.6 g/dL ($p<0.05$) compared to green bean juice alone (2.2 g/dL increase)[20]. This suggests that combining red guava with other iron-rich foods may enhance its effectiveness in increasing hemoglobin levels. Red guava juice is an effective non-pharmacological intervention for increasing hemoglobin levels in female adolescents. Its high vitamin C content likely plays a crucial role in enhancing iron absorption[18,19].

The limitations of this study include a small sample size and a lack of information regarding the participants' previous dietary patterns and physiological conditions. Additionally, the relatively short duration of the study may have limited the ability to observe long-term effects of red guava juice intervention on hemoglobin levels in adolescent girls. These implications highlight the need for future studies with larger sample sizes, longer durations, and more comprehensive data collection to address these limitations and provide more robust evidence on the effects of red guava juice on hemoglobin levels in adolescent girls.

CONCLUSION AND RECOMMENDATIONS

This study suggests that red guava juice may have a positive effect on hemoglobin levels in adolescent females. Daily consumption of red guava juice for 7 consecutive days was associated with a significant increase in hemoglobin levels in the treatment group, while no significant changes were observed in the control group. These findings indicate the potential of red guava juice as a natural alternative for addressing anemia in adolescent females. Further research with larger sample sizes and longer durations is recommended to confirm the long-term effectiveness of red guava juice in improving hemoglobin levels.

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