

# Analysis of Viral Load Factors in Sweet Potato Leaf (*Ipomoea batatas*) Increases Blood Hemoglobin Levels of Adolescents in Pesantren Ainul Yaqin Jambi City

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## ABSTRACT

Anemia among teenagers occurs when their dietary intake fails to meet their iron requirements, necessitating iron supplementation. Typically, iron supplements are derived from Fe tablets, often inducing symptoms like nausea and dark-colored stools, which are unpopular among teenagers. One alternative local food source rich in iron are sweet potato leaves. However, the iron content in sweet potato leaves is not widely recognized by the public. This study aims to evaluate the efficacy of incorporating sweet potato (*Ipomoea Batatas*) leaves into the diet of teenagers at the Ainul Yaqin Islamic Boarding School in Jambi City, with the objective of increasing their blood iron levels. This research employed a quasi-experimental design utilizing a two-group pre-test-post-test methodology. A sample of 50 individuals was selected based on homogeneity in their daily food consumption at the Ainul Yaqin Islamic boarding school in Jambi City. Hb stick examination instruments and Easy Touch Hb scales were utilized to measure the weight of sweet potato leaves. Participants were administered sweet potato leaves for a period of 10 days. The average Hb level before treatment was 11.828 g/dl for the treatment group and 14.949 g/dl for the

control group. Following treatment, the average Hb level increased to 13.392 g/dl for the treatment group and 14.532 g/dl for the control group. The treatment group exhibited a notable increase of 1.56 g/dl in Hb levels, whereas the control group saw a marginal increase of only 0.04 g/dl. These results indicate a significant effect of sweet potato leaves in elevating blood hemoglobin levels, with a p-value of 0.00. Anemia among teenage girls can be prevented by incorporating sweet potato leaves into their diet as a vegetable twice a week at the Ainul Yaqin Islamic boarding school. This affordable option offers numerous benefits and taps into local wisdom.

**Keywords:** Sweet potato leaf, haemoglobin, Anemia, Adolescent

## INTRODUCTION

Anemia is a condition characterized by a lower than normal count of red blood cells or hemoglobin [1]. It involves a reduction in the number of erythrocytes (red cell mass), typically indicated by a hemoglobin level below 11 g/dl [2,3].

One of the challenges encountered by Indonesian teenagers is the issue of micronutrient deficiency, with approximately 12% of teenage boys and 23% of teenage girls experiencing anemia,

primarily attributable to iron deficiency (iron deficiency anemia) [4].

The findings from the Basic Health Research (BHR) conducted in 2007, 2013, and 2018 indicate a rising trend in the prevalence of anemia among adolescent girls, with rates of 6.9%, 18.4%, and 32%, respectively. To address this issue, the government has implemented initiatives such as distributing blood supplement tablets (TTD), achieving a national coverage of 48.52%, with rates reaching 64.48% in West Papua [4]. However, by 2019, the coverage had declined to 36.29% [5].

In 2018, the Health Department of Jambi City reported that 1169 female teenagers, accounting for 2.25% of the total population, were afflicted with anemia. This marked an increase compared to 2016, when only 395 young women, or 1.03% of the population, suffered from anemia, indicating a persistent prevalence of anemia among young women in the city of Jambi (Jambi Provincial Health Service, 2020). Umi Kalsum's research in 2015 on adolescent anemia at SMA Negeri 8 Muaro Jambi revealed a prevalence of 46.7%, with girls comprising 66.7% and boys 23.8%. These figures underscore the continued high rate of anemia among teenagers in Muaro Jambi Regency.

Adolescent girls are susceptible to anemia due to significant blood loss during menstruation, exacerbated by insufficient iron intake [6]. Iron plays a crucial role in facilitating growth and development. In response, the Jambi city government initiated a program in 2018 aimed at addressing anemia by distributing supplemental iron tablets to young women in Jambi City [7].

Teenage anemia can be mitigated through the consumption of iron-rich foods. However, iron supplement tablets (Fe tablets), commonly prescribed for this purpose, often induce side effects such as nausea, a distinct odor, and dark stools, rendering them unpopular among teenagers [8]. An alternative local source abundant in iron is cassava leaves, a staple in Indonesian

cuisine. Despite its nutritional value, awareness regarding the iron content of cassava leaves remains limited among the populace. Cassava leaves are widely consumed as a vegetable in Indonesia and offer significant nutritional benefits. For instance, 100 grams of cassava leaves contain 10 mg of iron and 22 mg of vitamin C, along with 48 kcal of energy, 3 grams of protein, 10.8 grams of carbohydrates, 81 mg of calcium, and 66 mg of phosphorus [6,9,10].

The government has undertaken efforts to combat anemia by providing TTD (iron supplements). Additionally, a non-pharmacological approach widely adopted by pregnant women involves consuming boiled sweet potato leaves [11]. Studies conducted on mice have demonstrated that sweet potato leaf juice can enhance the hematological profile of mice with anemia. Moreover, findings from a literature review spanning five journals suggest that the consumption of sweet potatoes and their leaves can elevate hemoglobin levels in pregnant women [12]. Another study corroborated these findings, indicating that boiled sweet potato leaves can effectively increase hemoglobin levels in pregnant women [9].

Teenage girls commonly experience several characteristic symptoms, including fatigue, pale skin, dizziness, headaches, shortness of breath, heart palpitations, dry skin and hair, swollen tongue, and a sore mouth [13].

The consequences of anemia in adolescent girls might not manifest immediately, yet they can persist long-term and significantly impact the individual's future [14]. Anemia in young women can have enduring effects on both their own health and the well-being of their future offspring. The repercussions of anemia include disruptions in growth and development, heightened vulnerability to infections due to a compromised immune system, and an increased susceptibility to poisoning [15].

Iron deficiency or anemia persisting into adulthood and pregnancy can pose risks to the baby. Teenage girls experiencing

pregnancy-related anemia may elevate the risk of premature birth and delivering babies with low birth weight [16].

To prevent anemia, it is highly advisable to ensure the iron needs are met by consuming a balanced, nutritious diet daily. Begin the day with a breakfast comprising iron-rich foods, such as whole-grain bread or green leafy vegetables [10].

In addition, it is essential to consume five portions of fruits and vegetables daily to fulfill the body's vitamin and mineral requirements. Furthermore, it is highly advisable to take Blood Supplement Tablets (TTD) regularly, at least once a week [9].

The research was conducted by the Ainul Yaqin Orphanage, taking into account the homogeneity in the dietary habits of teenage girls.

## MATERIALS & METHODS

This study falls under quasi-experimental research, utilizing a two-group pre-test-post-test design. This design aims to establish cause-and-effect relationships by involving one group of subjects. The research was conducted at the Ainul Yaqin Islamic Boarding School in Jambi City. The population comprised all 60 young women at the Ainul Yaqin Islamic Boarding School in Jambi City. The sample, meeting the criteria, consisted of 50 individuals.

The research employed Hb stick and Easy Touch Hb examination instruments to measure HB levels, along with scales to weigh sweet potato leaves. The research procedure commenced with the selection of respondents, involving the assessment of young women's Hb levels using an Hb stick. Additionally, inquiries were made regarding any illnesses such as malaria, tuberculosis,

diseases related to blood circulation, or the consumption of specific medications.

The respondents are required to consume "pergedel" sweet potato leaves. "Pergedel" is a type of dish made from mashed sweet potatoes mixed with various ingredients and then fried. In this case, the sweet potato leaves are incorporated into the "pergedel" for consumption. The "pergedel" will be provided to the respondents daily for a duration of 10 days.

One crucial consideration is to ensure that the treatment is not administered during the menstruation period of the students. This precaution is taken because menstruation can affect the body's absorption of iron, potentially impacting the effectiveness of the treatment.

It's important to note that adolescent girls require approximately 15 mg of iron per day to meet their dietary needs. Therefore, the provision of "pergedel" sweet potato leaves aims to supplement their iron intake and improve their overall hemoglobin levels.

Research data collection was carried out by researchers and assisted by 2 enumerators. they have been trained to measure hemoglobin levels and provide motivation for respondents to participate during the research.

The research data that has been collected is then processed and analyzed. Data were analyzed using statistical tests using the dependent T-Test or paired samples T-Test. Data analysis using the SPSS version 16.0 application

## RESULT

Research data can be seen in the following table:

**Table 1. Frequency Distribution of Hb Levels before treatment**

Respondent's Hb in g/dl	Hb level before treatment			
	Treatment group		Control group	
	f	%	f	%
7 - 7,9	1	4	0	0
8 - 8,9	0	0	0	0
9 -9,9	1	4	0	0
10 -10,9	5	20	0	0
11-11,9	3	12	0	0
12-12,9	12	48	1	4
13-13,9	3	12	6	24
14-14,9	0	0	9	36
15-15,9	0	0	9	0

This table explains that in the treatment group, 10 students were identified as having anemia, with hemoglobin levels less than 12 g/dl.

**Table 2. Frequency Distribution of Hb Levels after treatment**

Respondent's Hb in g/dl	Hb level before treatment			
	Treatment group		Treatment group	
	f	%	f	%
10 -10,9	1	4	0	0
11-11,9	5	20	1	4
12-12,9	4	16	2	8
13-13,9	4	16	4	16
14-14,9	6	24	6	24
15-19,9	5	20	9	36
16- 16,9	0	0	3	12

After consuming 100 grams of "pergedel" sweet potato leaves daily for 10 days, each student ingested a total of 1 kg of sweet potato leaves over the treatment period. Following the treatment, the average hemoglobin level was 13.392 g/dl in the treatment group, compared to 14.532 g/dl in the control group. While the average

hemoglobin levels appeared to increase in the treatment group, upon closer examination of individual cases, it was observed that some students experienced a slight decrease in hemoglobin levels. For instance, levels dropped from 11.5 to 11.1 g/dl and from 11.8 to 11.2 g/dl.

**Table 3. Results of analysis of differences in Hb levels in the treatment and control groups**

Groups	Mean	SD	Sig.
Treatment Before	11.828	1.4890	0.0001
After	13,392	1.5806	
Control Before	14.492	0.9242	0.888
After	14.532	1.4465	

Table 3 indicates that the p-value in the treatment group was <0.001, whereas in the control group, the p-value was >0.888. These results signify a notable difference in the hemoglobin levels of young women after consuming sweet potato leaves for 10 days.

## DISCUSSION

The research involved 25 students who received treatment by consuming sweet potato "pergedel" leaves, while another 25 students served as controls and were provided with potato "pergedel" only. The sweet potato "pergedel" contained 11 mg of iron per 100 grams (comprising sweet cassava leaves: 10 mg, egg: 0.3 mg, potato: 0.7 mg), whereas the potato "pergedel" contained 1 mg of iron per 100 grams (comprising egg: 0.3 mg, potato: 0.7 mg). Each group received 10 "pergedel" treatments.

The research findings reveal that 10 students in the treatment group experienced anemia, with hemoglobin levels below 12 g/dl. This aligns with Minister of Health Regulation Number 37 of 2012 concerning the Implementation of Public Health Central Laboratories, which defines anemia in females if the blood hemoglobin level is less than 12 g/dl.

After consuming 100 grams of sweet potato leaves "pergedel" daily for 10 days, each student ingested a total of 1 kg of sweet potato leaves over the treatment period. Subsequently, the average hemoglobin level after treatment was 13.392 g/dl in the treatment group, while the control group had an average hemoglobin of 14.532 g/dl. Based on the average values, there was an increase in hemoglobin levels in the treatment group. However, upon closer examination of individual cases, it was observed that hemoglobin levels had

slightly decreased from 11.5 to 11.1 g/dl and from 11.8 to 11.2 g/dl.

This phenomenon occurred among students who were menstruating at the time of the final measurement. According to theory, a woman's hemoglobin levels typically decrease during menstruation. It's estimated that 10 percent of women experience bleeding of around 27 ml during each 28-day menstrual cycle, while another 10 percent lose more than 80 ml of blood per month. The quantity of blood lost significantly impacts the incidence of anemia because women often lack sufficient iron supplies, and the body's absorption of iron cannot adequately compensate for the iron loss during menstruation [17,18].

Teenagers need 15 mg of iron/day, by consuming yam leaves you can meet your iron needs of 11 mg/day because the iron content in cassava leaves is 11 mg (sweet cassava leaves: 10 mg, eggs: 0.3 mg, potatoes : 0.7 mg per 100 grams) [19]. The average increase in hemoglobin (Hb) in the treatment group was 1.56, indicating that consuming 1 kg of sweet potato leaves over 10 days could potentially raise Hb levels by 1.56 g/dl. In contrast, potato fritters provide only 1 mg of iron per day (comprising eggs: 0.3 mg, potatoes: 0.7 mg). Consequently, the increase in hemoglobin levels in the control group was a mere 0.04.

To mitigate the prevalence of anemia among adolescent girls, it's crucial to ensure the availability of blood supplement tablets in schools or Islamic boarding schools. However, since teenagers often perceive these tablets as medicine, they may be reluctant to consume them [20,21].

Anemia among young women must be prevented due to its adverse effects, including reduced concentration during learning, increased susceptibility to diseases due to compromised immune function, and the potential for adverse pregnancy outcomes such as stunting or low birth weight (LBW) in infants. These conditions arise from inadequate oxygen and nutrient supply to the fetus during pregnancy [22,23]. As an alternative to blood-boosting

tablets, sweet potato leaves serve as a high-iron food source.

## CONCLUSION

Anemia among adolescent girls can be prevented by incorporating sweet potato leaves into their diet as a vegetable twice a week at the Ainul Yaqin Islamic boarding school. This affordable option offers numerous benefits and leverages local wisdom.

### *Declaration by Authors*

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