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THE EFFECT OF MORINGA (MORINGA OLEIFERA L.) LEAF EXTRACT CAPSULES IN INCREASING HEMOGLOBIN LEVELS IN ADOLESCENT GIRLS

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ABSTRACT
Moringa leaves can be an alternative to increase hemoglobin (hb) levels because they contain high iron, protein, and vitamin C. Adolescent girls have a higher risk of experiencing anemia due to increased iron requirements resulting from menstruation. Objective: To determine the effect of moringa leaf extract capsules (Moringa Oleifera L) on increasing hemoglobin levels in teenage girls at SMKN 1 Takokak, Cianjur Regency. Method: The research design employed in this study is a pre-experimental approach, utilizing a one-group pretest-posttest design. The sample size consists of 30 adolescent girls selected through purposive sampling technique. Data collection involves measuring hemoglobin levels. Data analysis is conducted through univariate and bivariate analyses using the Wilcoxon Signed Rank Test. Results: The research findings indicate that there was an increase in hemoglobin levels before (10.69) and after (12.78) the intervention, with an average difference of -2.09. Furthermore, there was a significant p-value of 0.001 (<0.05). Conclusions: The moringa leaf extract capsules have shown an influence in increasing the hemoglobin levels of adolescent girls. Moringa Leaf Extract can be recommended as a non-pharmacological alternative to enhance hemoglobin levels.

Keywords: adolescent girls; extract capsules; hemoglobin levels; moringa leaf

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INTRODUCTION

Anemia remains one of the most significant health problems worldwide, especially in developing countries. According to a World Health Organization (WHO) report, about 42% of preschool children and 40% of pregnant women in the world are anemic, with a high prevalence among adolescent girls in developing countries (World Health Organization, 2021). Adolescent girls have a higher risk of anemia compared to adolescent boys, due to an increase in iron demand due to menstruation (Hastuty et al., 2022). Adolescent girls are vulnerable to iron deficiency anemia due to increased iron demand during rapid growth, menstruation, and often accompanied by an unbalanced diet (Kumari et al., 2017). The incidence of anemia in adolescent girls based on Basic Health Research (Riskesdas) in 2013 was 37.1%, which increased to 48.9% in Riskesdas in 2018. The prevalence of anemia in adolescent girls in the West Java region in 2018 was 41.9% in the age group 13-19 years. The intervention carried out by the government to reduce the prevalence of anemia in adolescent girls is by providing iron and folic acid supplementation through the administration of blood supplement tablets (Fe). Blood supplement tablets are tablets that contain at least 60mg of elemental iron and 400mg of folic acid (Kemenkes RI, 2019).

Anemia in adolescent girls can cause several adverse effects, both short and long term. The short-term effects of anemia in adolescent girls include a decrease in concentration while studying, but it can also cause decreased immunity so that they are susceptible to disease and infection. The long-term impact of anemia on adolescent girls is the increased risk of pregnancy anemia. If anemia occurs during pregnancy, it will interfere with the growth and development of the fetus in the womb. In addition, anemia in pregnancy can trigger complications during pregnancy and during childbirth, which will ultimately increase the risk of maternal and infant mortality (Royhanaty et al., 2023).Traditional treatment of anemia often involves iron supplementation. However, there is evidence to suggest that iron supplementation alone may not be sufficient to effectively address anemia, especially without the support of adequate intake of other nutrients (da Silva Lopes et al., 2021; Kumar et al., 2022). In this context, natural ingredients such as Moringa (Moringa oleifera) leaves have gained attention as potential alternatives or additional supplements. Moringa leaves are known for their rich nutritional content, including proteins, vitamins, and essential minerals such as iron (Gopalakrishnan et al., 2016).

The content contained in moringa leaves is a natural compound that is more numerous and diverse compared to other plants. According to the results of research from (Islam et al., 2021) Moringa leaves contain vitamin A, vitamin B, vitamin C, calcium, potassium, iron, protein, thiamine, riboflan, niacin, acampantothenate, biotin, vitamin B6, vitamin B 12 and folate. Various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotenoids are easily digested and assimilated by the body. The high levels of iron found in Moringa leaves can be used as an alternative as a supplement to overcome the problem of anemia in adolescents (Hastuti & Sari, 2022).Moringa oleifera leaves have been shown to effectively increase hemoglobin levels, especially in populations prone to iron deficiency anemia. This effect is attributed to the high iron content and other nutrients present in Moringa leaves, which increase hemoglobin synthesis. Moringa's high content of protein, iron, and vitamins contributes to its anemia-fighting properties (Anwar et al., 2020). A study involving anemic adolescent girls showed that Moringa oleifera leaf capsules significantly increased hemoglobin levels. Participants who took these capsules showed a greater increase in hemoglobin compared to those who only took iron supplements, with an average increase of 1.82 g/dL versus 1.40 g/dL, respectively (Yulastini et al., 2023).

The results of a preliminary study conducted at the Takokak Health Center, Cianjur Regency and obtained the results of interviews that they always distribute blood supplement tablets to adolescent girls in schools in Takokak Cianjur Regency according to a predetermined schedule. In November 2023 Puskesmas officers distributed blood supplement tablets to three schools in Takokak Cianjur Regency, namely SMA PGRI Takokak from 121 adolescent girls who were screened there were 80 adolescent girls (60.1%) experiencing anemia, SMKN 1 Takokak from 180 adolescent girls screened who experienced anemia 112 adolescent girls (62.2%), and Madrasah Aliyah from 80 screened there were 50 adolescent girls (16%) who experienced anemia. Of the three schools that have the most female adolescent students is SMKN 1 Takokak, Cianjur Regency.Based on the existing problems and also there are two ways to overcome these problems, namely with pharmacological and nonpharmacological therapies. So the researcher is interested in taking the topic of handling anemia in adolescent girls who are reluctant to take blood supplement tablets (Fe) because of the side effects received by providing nonpharmacological supplementation, namely moringa leaf extract capsules. This study aims to determine the effect of giving moringa leaf extract capsules in increasing the hemoglobin levels of adolescent girls at SMK Negeri 1 Takokak.

METHOD

This study employed pre-experimental, with a one group pretest-postest design. In this research approach begins with a pre-test checking the initial hemoglobin level using a Portable Digital Hemoglobinometer, then given treatment or intervention of moringa leaf extract capsules (Moringa Oleifera L.) will be given to adolescent girls with a dose of 500mg 2x1 consumed for 14 days. After that, for the post-test rechecking hemoglobin levels after being given intervention for 14 days. Monitoring compliance with moringa leaf extract capsule consumption using WhatsApp media where each respondent must share a video when taking moringa leaf extract capsules, then the researcher will check the observation sheet. Measurement of hemoglobin levels using a calibrated Portable Digital Hemoglobinometer. Sampling in this study using non-probability sampling techniques with purposive sampling techniques where sampling is based on certain considerations that have been made by researchers. Taking the number of sample sizes in this study using a minimum sample technique is 30 adolescent girls who are in SMKN 1 Takokak Cianjur Regency, samples in this study must meet the inclusion and exclusion criteria. The inclusion criteria in this study were adolescent girls who were already menstruating and willing to receive intervention for 14 days. While the exclusion criteria are adolescent girls who are menstruating and have a history of systemic disease.Data analysis using univariate and bivariate, normality test using Shapiro Wilk test, Wilcoxon Signed Rank Test to analyze analyze the difference in hemoglobin before and after treatment.

RESULTS

Categories are used to assess the severity of anemia and are usually based on standards set by the World Health Organization (WHO). Not Anemic if hemoglobin level ≥ 12 g/dl, Mild Anemia if hemoglobin level 11.0 - 11.9 gr/dl, moderate nnemia if hemoglobin level 8.0 - 10.0 gr/dl and severe Anemia if hemoglobin level < 8.0 gr/dl.The intervention of moringa leaf extract capsules significantly improved the anemia status of the respondents. Before the intervention, 56.7% had moderate anemia, 30% had mild anemia, and 13.3% had no anemia. After the intervention, 73.3% of the respondents no longer had anemia, while 26.7% still had mild anemia, indicating a positive effect of the moringa leaf extract on reducing anemia. (Table 1).

Table 1.

Overview of anemia before and after intervention

Anemia category	Before intervention (Pretest)	After intervention (Postest)
No Anemia	4 (13,3%)	22 (73,3%)
Mild	9 (30%)	8 (26,7%)
Moderate	17 (56,7%)	0
Severe	0	0

It was found that the average hemoglobin level of adolescent girls before the intervention was 10.69 while the average hemoglobin level of adolescent girls after the intervention was 12.78. There is an increase in Hb levels by 2.69. The statistical test results of further analysis using the Wilcoxon test obtained a significant p value of 0.001 (<0.05) which means that there is an effect of giving capsule extracts of Moringa leaf (Moringa Oleifera L) on hemoglobin levels (Table 2).

Table 2.

Effect of Giving Moringa Leaf Extract Capsules (Moringa Oleifera L) in Increasing the Hemoglobin Level of Adolescent Girls

Hemoglobin Level	f	Mean	Difference	SD	*P Value*
Pretest	30	10,69	2,69	1,2461	0,001
Postest	30	12,78		1,4141	

DISCUSSION

There is an increase in the hemoglobin level of adolescent girls at SMKN 1 Takokak Cianjur Regency after being given moringa leaf extract capsules at a dose of 500mg 2x1 consumed for 14 days. The results of this study are in line with Hastuty's research (2022) that there is a difference in the average value before being given the intervention which is 10.83 and after being given the intervention the average value of hemoglobin levels of adolescent girls increased to 12.72 with a p value of 0.001 ($p < 0.05$) (Hastuty & Nitia, 2022). The effect of moringa leaf extract on increasing hemoglobin levels in adolescent girls shows the average hemoglobin level before 10.37 is smaller than the average value of hemoglobin levels after the intervention is 13.73 with a dose of 600mg / day (Yulastini et al., 2023). This is also supported by the results of (Anwar et al., 2020) obtained significant results of 0.000, namely there is an effect of moringa leaf extract capsules on increasing the hemoglobin levels of adolescent girls with a difference in the average value of pretest and posttest 1.68. The use of Moringa oleifera leaf extract capsules has been shown to effectively increase hemoglobin levels, especially in populations suffering from anemia. This effect is attributed to the rich nutritional profile of Moringa leaves, which includes iron, vitamins, and amino acids essential for hemoglobin synthesis. Effectiveness in adolescent girls showed that moringa capsules significantly increased hemoglobin levels. The treatment group showed an increase from 10.75±0.94 gr/dl to 12.58±0.99 gr/dl after 21 days of intervention, outperforming the control group who only received iron supplements (Yulastini et al., 2023). Another study with a quasi-experimental design reported an increase in hemoglobin levels from 10.97 gr/dl to a higher mean value after two weeks of keloringa leaf capsule supplementation (Nurhayati et al., 2024).

A study on Moringa tempeh burgers showed that burgers containing higher amounts of Moringa leaf flour (12g) led to a more substantial increase in hemoglobin levels (2.23 g/dl) compared to those with lesser amounts or none, indicating the dose-dependent efficacy of Moringa (Ningrum et al., 2024). The combination of Moringa leaf powder with other nutrient-rich foods, such as red dragon fruit juice, also demonstrated a significant increase in hemoglobin levels, further supporting the synergistic potential of Moringa when combined with other iron-rich foods (Ritonga & Maigoda, 2023). A systematic review of multiple studies confirmed the positive impact of Moringa leaf extract on hemoglobin levels, although some studies did not specify the dosage used.Moringa leaves are rich in iron, vitamins, and amino acids, which are essential for red blood cell production and hemoglobin synthesis. This nutrient profile makes moringa an effective natural supplement for the prevention and treatment of anemia (Balebu et al., 2023; Hadju et al., 2015; I'anah et al., 2023; Iskandar et al., 2015). Moringa leaf extract capsules have excellent potential to complement the nutritional content in the body, increase energy and endurance and to overcome complaints due to mineral deficiencies such as iron deficiency which can lead to anemia. Moringa leaves also have no side effects (Anwar et al., 2020; Putra et al., 2016). The dosage in one capsule contains 500mg of moringa leaf powder which can be consumed twice a day. Processing moringa leaves by drying and powdering will increase the quantity of nutrient content of fresh moringa leaves.

The iron (fe) content in moringa leaf powder per 100 grams contains 28.20 mg of iron, however, this increase in nutrient quantity does not occur in vitamin C. This is because vitamin C is a vitamin that is easily oxidized and cannot withstand the increase in heat temperature and the length of the drying process. The loss of vitamin C content per 100gram in fresh leaf elements is 220mg and after processing into powder is reduced to 17.3 mg (Hardiyanti, 2022). The role of vitamin C in the iron absorption process is to help reduce

ferric iron (Fe3 +) to ferrous (Fe2 +) in the small intestine so that it is easily absorbed, the reduction process will be greater if the pH in the stomach is more acidic. Vitamin C can increase acidity so that it can increase iron absorption by up to 30%. Vitamin C can also improve hemoglobin status by another mechanism, namely reducing inhibitors in plant food components (such as tannin in the). Vitamin C activates enzymes needed to convert folic acid in food into the active form of folic acid, which can prevent megaloblastic anemia. Because vitamin C also functions as an antioxidant, it can protect red blood cells from free radicals (Thamrin & Masnilawati, 2021). Iron (fe) is a micronutrient that is indispensable for the body. Generally, iron from plant-based food sources (non heme), such as nuts and vegetables, has a low proportion of absorption compared to iron from animal-based food sources (heme), such as meat, eggs, and fish. In addition to the formation of hemoglobin in the body, iron also has several essential roles in the body including as a means of transporting oxygen from the lungs of body tissues, electron lifting devices in cells as well as an integrated part of various enzyme reactions in human body tissues (Fitriyaa, 2020;Piskin et al., 2022).

In small or large quantities, moringa leaves can be used as an anemia medication. The erythrocyte and leukocyte counts, which show a significant rise, indicate that moringa leaves can be used as dietary supplements and medications for anemia patients (Samuel et al., 2015). By harnessing the potential of natural materials such as Moringa leaves, it is hoped that more effective and affordable solutions can be found to address anemia, especially in areas with limited access to conventional health services. Therefore, as an alternative to fe tablets in the treatment of anemia consumption of moringa leaf extract can be recommended. In addition, this study supports global efforts to promote nature-based and sustainable approaches to health. Given the high prevalence of anemia among adolescent girls, this study has high relevance in the context of public health. The results of this study are expected to make a significant contribution to science and become a reference in the implementation of public health programs to address anemia in adolescent girls

CONCLUSION

Moringa leaf extract capsules are effective in increasing the hemoglobin level of adolescent girls. Moringa Leaf Extract can be recommended as a non-pharmacological alternative to increase hemoglobin levels.

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