SupplementationofMoringa

by Layanan Turniitn

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Supplementation of Moringa (*Moringa oleifera*) leaf capsules on hemoglobin levels in women of reproductive age with iron deficiency anemia in Malaka regency, Nusa Tenggara Timur, Indonesia

Carmen Siagian[1], Maria Fransisca Djogo[2], Maria Martina Nahak[2], Regina Tedjasulaksana[3*], Alfridus Emanuel Manek[2], Elferida Sormin[4], Levina Augusta Geraldine Pieter[5]

[1]Center for Food and Nutrition Studies, Universitas Kristen Indonesia, Jakarta, Indonesia;
[2]Family Welfare Movement, Nusa Tenggara Timur, Indonesia;
[3]Midwifery department, Politeknik Kesehatan Denpasar, Bali, Indonesia;
[4]Department of Chemistry Education, Faculty of Teacher Training and Education, Universitas Kristen Indonesia;
[5]Indonesia National Research and Innovation Agency.

*Corresponding author:
Regina Tedjasulaksana;
Midwifery department, Politeknik Kesehatan Denpasar, Bali, Indonesia;
reginatedjasulaksana@yahoo.co.id

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ABSTRACT

Introduction: Women of reproductive age with anemia are recommended to take iron supplements and increase their intake of iron-rich food. Moringa (*Moringa oleifera*) leaf is a potential plant containing high iron, which is simple to find in Indonesia.
Aims: to determine the effectiveness of Moringa leaves supplementation in women of pro age.
Methods: This type of research is an experiment with experimental research with pre-post test control group design. The sample was 119 subjects collected using purposive sampling according to the inclusion criteria. The study subjects were divided into 3 treatment groups: supplementation of Ferrous sulfate tablets 30 mg per day (Group P0); 3000 mg Moringa leaf capsules three times a day (3 x 1000 mg) (Group P1); and Moringa leaf capsules at a dose of 3000 mg three times a day (3 x 1000 mg) plus 30 mg ferrous sulfate tablets once daily (Group P2) for 60 days, then hemoglobin (Hb) levels were re-evaluated.
Result: The Friedman test showed a mean Hb difference between the three measurement groups, which was statistically significant with $p < 0.05$. The treatment group with P2 had the highest value of 4.74, followed by P1 and P0 of 4.71 and 4.65.
Conclusion: Supplementation of Moringa leaf capsules at a dose of 3000 mg for 60 days may increase Hb levels in women of reproductive age with iron deficiency anemia.

Keywords: Hemoglobin, *Moringa oleifera*, Iron Deficiency Anemia.
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BACKGROUND

Women of reproductive age are defined as women of productive age, ranging from 15 to 49 years, with fully functioned sexual organs with the status of single, married or widowed, and possibly having offspring.[1,2] At this reproductive age, nutritional status may be impaired and thus affect maternal health during pregnancy and breastfeeding. Anemia is one most common nutritional problems during pregnancy and breastfeeding.[3–5]

The causes of iron deficiency anemia in women are menstruation, lack of nutrition and iron intake, and increasing need for iron in pregnant women, lactating women and adolescents. Based on the 2013 Nutritional Adequacy Rate (RDA), the need for iron intake for women of reproductive age aged 15-49 years is 26 mg/day.[6,7]

According to WHO recommendations in 2011, efforts to overcome anemia in adolescents and women of reproductive age are focused on promotion and prevention activities by increasing the intake of iron-rich foods and supplementing iron tablets. Women of reproductive age with anemia have been recommended to be given iron supplements and increasing intake of iron-rich food. Moringa leaves (*Moringa oleifera*) is one of the potential plants which contains high iron, which is easy to find in Indonesia.[7–9]

Moringa is a herbal medicinal plant found in almost all areas in the Province of East Nusa Tenggara (NTT), including the District of Malaka. The results of the phytochemical test on Moringa leaf powder showed that Moringa leaf powder contained macro and micronutrients, including high iron content, which divided into 249.54 mg/kg of powder and amino acids of 24.89% w/w. Moringa leaf powder also contains protein (18.9% w/w), calcium (23,189.95 mg/kg powder), magnesium (2463.48 mg/kg powder), and zinc (<0.75 mg/kg Moringa powder).[10]

Previous Research shows that the consumption of moringa leaf extract in pregnant women in the second and third trimesters can significantly increase Hb levels.[7,11] One study conducted by Hikmah et al. in 2021,[11] showed that supplementing with moringa leaf tea (2500 mg) combined with Fe tablets could significantly increase Hb levels in third-trimester pregnant women at the Pangkajene. Rahmawati research in 2021,[9] showed that supplementing moringa leaves to anemic adolescent girls with activity intolerance increased Hb levels in adolescent girls.[12,13]

METHODS

This type of research is an experiment with a randomized research pre-post-test control group design. This study assessed hemoglobin levels before and after receiving treatment in research subjects. The population in this study were women of reproductive age with iron deficiency anemia in Malaka Regency, Nusa Tenggara Timur Province. This study sample was 19 subjects and was collected using purposive sampling according to the inclusion criteria. The study site was carried out by simple random sampling. Women are eligible to participate if they are between 25 and 45 years old and consent to participate in this study, while loss to follow up more than 20%, either duration or adherence, is excluded.

The study subjects were divided into 3 treatment groups, then given treatment with Firstly Group P0: supplementation of SF tablets 30 mg per day; Group P1: Moringa leaf capsules (*Moringa oleifera*) at a dose of 3000 mg three times a day (1000 mg); and Group P2: Moringa leaf capsules (*Moringa oleifera*) at a dose of 3000 mg three times a day (1000 mg) plus 30 mg SF tablets once daily for 60 days, hemoglobin levels were then re-evaluated in the study subjects, with anemia defined as hemoglobin level below 12 mg/dl.

In this study, statistical analysis was performed using Statistical Package for Social Sciences v. 23 software (IBM Corp., Armonk, NY, USA). Univariate and bivariate analysis was used. Statistical analysis was performed with the Friedman test to compare the variables in the two groups. All tests were two-tailed α=0.05.

RESULT

Descriptive test results show that in the P0 group, the average Hb before treatment was 11.24; after treatment, it increased to 12.43. In Group P1, before treatment, the average Hb was 11.05; after treatment, it increased to 12.30. In group P2, before treatment, the average Hb was 11.45; after treatment, it increased to 12.50 (Table 1).

The Friedman test showed a difference mean of hemoglobin between the three measurement groups statistically significant statistically with p-value = 0.000. The treatment group with P2 had the highest ranking of 4.74, followed by P1 and P0 of 4.71 and 4.65 (Table 2).

Table 1. Descriptive Test Results Supplementation of Moringa Leaf Capsules (*Moringa oleifera*) for Women Reproductive age with Iron Deficiency Anemia in Malaka District

No	Group	Lowest Hb	Highest Hb	Average Hb	sd	Amount (N)
1	Before Treatment with P0	9.90	11.90	11.24	.51438	39
2	After Treatment with P0	10.50	14.50	12.43	.89329	39
3	Before Treatment with P1	6.80	11.90	11.05	1.12053	44
4	After Treatment with P1	9.90	13.70	12.29	.81936	44
5	Before Treatment with P2	10.50	11.90	11.45	.37682	36
6	After Treatment with P2	10.10	14.70	12.50	1.01107	36

Table 2. Friedman Test Results of Moringa (*Moringa oleifera)* Leaf Capsule Supplementation on Hb in reproductive women with Iron Deficiency Anemia in Malaka District

Group	Mean Ranking	Chi-square	df	p-value
Before Treatment with P0	2.10			
After Treatment with P0	4.65			
Before Treatment with P1	2.32	90,703	5	0.000
After Treatment with P1	4.71			
Before Treatment with P2	2.49			
After Treatment with P2	4.74			

DISCUSSION

The results of this study indicate that the group of women of reproductive age with iron deficiency anemia who received intervention with SF 30 mg tablets (P0), Moringa leaf capsules (*Moringa oleifera*) 3000 mg per day (P1) or who received both the supplement (P2) have increased hemoglobin level. The baseline mean of Hb Group P0 was 11.24 and increased to 12.43. The baseline mean of Hb Group P1 was 11.05 and increased to 12.29. While for Group P2 average Hb was 11.45 before treatment, then it increased to 12.5. These results indicated that there was an increase in Hb levels in the three groups after consuming 30 mg SF tablets (group P0), 3000 mg Moringa leaf capsules (*Moringa oleifera*) per day (P1 group) and 30 mg Fe tablets plus 3000 mg Moringa leaf capsules (group P1). P2) for 60 days.

Friedman test results showed a difference in the average Hb increase in the three treatment groups, and the difference was significant at a value of p=0.000 or p≤0.05. The highest average increase in Hb was found in group P2 (Mean Rank = 4.74), followed by group P1 (Mean Rank = 4.71), and the lowest was group P0 (Mean Rank = 4.65). This study showed that subjects who were given supplemented with SF tablets and Moringa leaf capsules (group P2) had the highest in increasing Hb levels. This study's results align with the previous research by Rahmawati and Daryanti in 2017, which showed that consuming Moringa leaf extract in second and third-trimester pregnant women can significantly increase Hb levels.[13] Another study conducted by Hikmah et al. in 2021, showed that supplementing with moringa leaf tea (2500 mg) combined with SF tablets could significantly increase Hb levels in third-trimester pregnant women at the Pangkajene.[11]

Based on the results of laboratory tests on the active substance content in Moringa leaf powder of 1000 grams of dry Moringa powder, there are 249.54 mg of Fe[10], in this study using 3000 mg of Moringa leaf capsule equal to 0.75 mg Fe. This is possible because of the results of the phytochemical

test on Moringa leaf powder originating from Nusa Tenggara Timur Province aside from having a high Fe content, there are also amino acids of 24.89% w/w, protein (18.9% w/w), calcium (23,189.95 mg/kg powder), magnesium (2463.48 mg/kg powder), and a little zinc (<0.75 mg/kg moringa powder). The protein in Moringa leaf powder forms erythrocytes, which are used to transport iron. Iron binds protein to form transferrin which carries iron into the bone marrow to combine to form hemoglobin.[14]

Several studies have also shown that Moringa leaves contain high vitamin C, which is seven times that of Vitamin C in oranges. Vitamin C can help better absorption of Fe.[6,15] Vitamin C can increase the absorption of non-heme iron fourfold. Vitamin C combines with iron to form a soluble and easily absorbed iron ascorbate complex.[15] The macro and micronutrient content in Moringa powder is thought to work synergistically to increase Hb levels in research subjects significantly.

This study has several limitations, including short follow-up duration and not assessing factors such as physical activity, intake, and comorbidities that may have influenced the hemoglobin level.

CONCLUSION

This study showed that supplementation with Moringa leaf capsules at a dose of 2000 mg for 60 days may increase Hb levels in women of reproductive age with iron deficiency anemia.

DISCLOSURE

Funding

This study did not receive any third-party support or funding.

Conflict of Interest

The author declares no conflict of interest related to material presented in this article.

Ethical Consideration

Ethical research has approved by Research Ethics Committee of Politeknik Kesehatan Denpasar, with letter number: LB.02.03/EA/KEPK/ 0618 /2022.

Author Contribution

All authors contributed equally contribute to the study.

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