



## Role Of *Moringa Oleifera* Leaf Extract In Increasing Hemoglobin Levels In Pregnant Rats With Anemia

Rani Safitri<sup>1</sup>, Reny Retnaningsih<sup>2</sup>

<sup>1,2</sup> Department of Midwifery at Institute of Technology, Science and Health dr. Soepraoen Malang, Indonesia

### ARTICLE INFORMATION

Received: September, 4, 2019

Revised: October, 3, 2019

Available online: February, 2021

### KEYWORDS

*Moringa oleifera* leaf, hemoglobin levels, anemia

### CORRESPONDENCE

E-mail: [raniandriatno@gmail.com](mailto:raniandriatno@gmail.com)

[renyretna87@gmail.com](mailto:renyretna87@gmail.com)

No. Tlp : +6281335566657

### A B S T R A C T

Anemia is one of the epidemic health problems in society and the most common nutritional problem. The *Moringa oleifera* is rich in excellent dietary content and can complement the body's needs. This study aims to determine *Moringa oleifera* leaf extract's effectiveness in increasing hemoglobin levels in pregnant rats (*Ratus norvegicus*) with anemia. This paper used a true experimental research design with a pre-post test randomized control group design. This study utilized female rats (*Ratus norvegicus*), pregnant 8-12 weeks, weighing 200 grams. Experimental procedures were four treatments with three repetitions. Types of treatment were negative control and positive control (administration of *Moringa oleifera* leaf extract) at a dose of 0.18 g / head, 0.36 g / head, and 0.72 g/head. Analysis using one way ANOVA with an error rate of 0.05. The results showed  $p < 0.005$ , which means a significant increase in hemoglobin levels in the group given the treatment of moringa leaf extract at a dose of 0.72 g/head/day. The conclusion and suggestion from this research are public could get information about using natural materials as economically valuable drugs (back to nature).

### INTRODUCTION

Anemia is a condition in which red blood cells or oxygen intake are insufficient to meet the body's physiological needs, which can vary according to age, sex, and pregnancy status. In pregnancy, when the hemoglobin levels are less than 11 g/dl in the first and third trimesters or less than 10.5 g/dl in the second trimester, the pregnant woman is considered anemic. WHO reports that 18% of women from industrialized countries and 35% to 75% (56% on average) of pregnant women in developing countries are anemic. This anemia can disrupt the fetus and increase maternal mortality. Anemia in pregnancy can lead to pre-eclampsia and eclampsia and intrauterine growth restriction (IUGR), low birth weight, and an increased risk of postpartum hemorrhage. Pregnant women with anemia experience premature birth, low APGAR scores, and intrauterine fetal death more than non-anemic pregnant women. Mild anemia usually does not affect pregnancy unless the mother is anemic in subsequent pregnancies due to low iron stores. On the other hand, signs and symptoms of severe anemia – such as tachycardia, dyspnea, and high cardiac output failure – can be fatal. During pregnancy, the need for iron increases, which worsens the prevalence of anemia; there is also a disproportionate increase in plasma volume over red blood cell levels, resulting in a physiological decrease in hemoglobin (Hb) levels in the mid-trimester (Yousry, M. A., et al., 2018)

Moringa plant contains high nutrients and is very useful for improving nutrition. *Moringa oleifera* has successfully prevented the epidemic of malnutrition in several countries in Africa and saved the lives of many children and pregnant women. Adding Moringa to the daily diet of children can quickly improve malnutrition because it contains 40 essential nutrients. Moringa leaf contains complete protein (nine essential amino acids), calcium, iron, potassium, magnesium, and vitamins A, C, E, and B, which have a significant role in the immune system. Research in Indonesia on the clinical effects of moringa leaves also has been done. Based on research on the antibacterial activity test of Moringa leaf extract against *Streptococcus* bacteria's growth, the results reported that the higher the concentration of Moringa leaf extract, the greater the bright zone formed (areas that were not overgrown with bacteria). Bright zone began to create at a concentration of 5% Moringa leaf extract powder (Luthfiyah, 2012).

Based on several studies' analysis, the *Moringa oleifera* leaf's nutritional content can complement the body's needs (Ahmad, 2015). Moringa leaf contains 25 times more iron than spinach, helping the body form hemoglobin and myoglobin, which carry oxygen in the blood and muscles (Madukwe E.U., Ugwuoke A.L., 2013).

One type of vegetable that has not been widely used but has a high nutritional content is Moringa leaf. Moringa leaf is a mother's best friend and the magic tree because it has high nutritional content and many benefits. Moringa leaf is a nutrition source; even WHO has introduced Moringa leaf since 1988 as an alternative food to overcome malnutrition. Moringa leaf contains many micronutrients needed by pregnant women, such as beta carotene, thiamine (B1), riboflavin (B2), niacin (B3), calcium, iron, phosphorus, magnesium, zinc, and vitamin C (Sitohang, P. C., et al., 2018)

Based on the previous study of anemia and the effect of *Moringa oleifera* leaf, the authors are interested in examining the effectiveness of *Moringa oleifera* leaf extract on increasing hemoglobin levels and the number of erythrocytes in pregnant rats (*Ratus norvegicus*). This research can be a reference in overcoming and treating anemia.

## **METHOD**

The research was a true experimental. The study design used a pre-posttest randomized control group design – experimental procedures with four treatments and three repetitions. This study's sample was white rats (*Ratus norvegicus*), female, pregnant, 8-12 weeks, weighing 200 grams, obtained from the Pharmacology Laboratory of the Health Polytechnic of Dr. Soepraoen Hospital. The sample size was 24 tails.

The authors did pretreatment of pregnant rats for one week. There were four groups – control, experiment with doses of 0.18 g/head, 0.36 g/head, and 0.72 g/head – each group consisting of 6 pregnant rats.

Laboratory of Pharmacy, Dr. Soepraoen Hospital, Poltekkes, made Moringa leaf extract with maceration

process. Hemoglobin levels were measured by the spectrophotometric method at a wavelength of 540 nm. Pathological treatment (anemia), namely by giving sodium nitrite (NaNO<sub>2</sub>) as much as 1 ml/head/day for treatment 2, 3, and 4 for 18 days.

Research at the Pharmacology Laboratory of the Health Polytechnic of Dr. Soepraoen Hospital to manufacture Moringa oliefera leaf extract. Laboratory of Pharmacology Health Polytechnic of Dr. Soepraoen Hospital for treatment and care of experimental animals and Laboratory of Clinical Pathology, Faculty of Medicine, Universitas Brawijaya for reading research results. After 24 days of passing the ethical test, the authors started the method described above.

## RESULTS

### Description of Hemoglobin Levels (g/dl) in Pregnant White Rats (*Rattus norvegicus*)

Table 1 Data on Hemoglobin Levels (g/dl) before being given NaOH<sub>2</sub> and Moringa leaf extract

Dosage (g/head)	Group						Average
	X1	X2	X3	X4	X5	X6	
Control	18	14	14	15	18	16	15.8
P1 0,18	14	12	18	14	13	18	14.8
P2 0,36	14	15	13	11	14	13	13.3
P3 0,72	18	15	15	12	18	12	15.0
Total	64	56	60	52	63	59	59.0

Table 1 shows that the average hemoglobin levels of pregnant rats before being given NaOH<sub>2</sub> and Moringa leaf extract is 59.0 g / dl.

Table 2 Data on Hemoglobin Levels (g/dl) after being given NaOH<sub>2</sub> and before being given Moringa leaf extract

Dosage (g/head)	Group						Average
	X1	X2	X3	X4	X5	X6	
Control	11	12	10	10	10	12	10.8
P1 0,18	9	7	11	11	10	13	10.2
P2 0,36	10	13	10	8	10	9	10.0
P3 0,72	11	14	10	10	9	10	10.7
Total	41	46	41	39	39	44	41.7

Table 2 describes that the average hemoglobin level of pregnant rats after being given NaOH<sub>2</sub> and before being given Moringa leaf extract is 41.7 g/dl.

Table 3 Data on hemoglobin levels (g/dl) of anemic rats and after being given Moringa leaf extract

Dosage (g/head)	Group						Average
	X1	X2	X3	X4	X5	X6	
Control	13	13	12	12	12	13	12.5
P1 0,18	16	11	13	17	14	18	14.8
P2 0,36	17	18	14	16	14	13	15.3
P3 0,72	18	17	16	18	17	18	17.3
Total	64	59	55	63	57	62	60.0

Table 3 explains that the average hemoglobin levels of anemic pregnant rats and after being given Moringa leaf extract is 60.0 g / dl.

Table 4 Data on Increased Hemoglobin Levels (g/dl) of anemic rats before and after being given Moringa leaf extract

Dosage (g/head)	Hemoglobin Levels (g/dl)	
	Average Before	Average After
Control	10.8	13
P1 0,18	10.2	15
P2 0,36	10.0	15
P3 0,72	10.7	17
Total	41.7	60

The highest hemoglobin levels of anemic pregnant rats after being given Moringa leaf extract for 14 days were an experimental group with a dose of 0.72 g/head/day, 17 gr/dl, while the lowest was at a dose of 0.18 g/head/day and 0.36 g/head/day, which was 15 g/dl. The average range of blood erythrocyte counts of pregnant rats after being given Moringa leaf extract was between 15 - 17 g/dl (Table 4).

Based on the data analysis results, the p-value was less than 0.05 ( $p < 0.05$ ) in group 0.18, 0.36, 0.72 g/head/day. It indicated a significant increase in hemoglobin levels in the treatment group giving Moringa leaf extract at a dose of 0.72 g/head/day.

## DISCUSSION

The mean hemoglobin levels in the treatment group of Moringa oleifera leaf extract at a dose of 0.18 g/head/day and 0.36 g/head/day did not differ significantly – because of the mean  $\pm$  sd values of the P1 and P2 treatment groups containing the same numbers at the standard deviation, namely  $15 \pm 2.6$  and  $15 \pm 2.0$ . In this study, the moringa leaf extract was considered the fastest to increase hemoglobin levels in anemic pregnant rats, which administered moringa leaf extract at a dose of 0.72 g/head/day.

This study showed that the administration of Moringa oleifera extract effectively increased the number of erythrocytes and hemoglobin levels of pregnant rats with anemia. Moringa leaves contain more vitamin A than carrots, more calcium from milk, more iron from spinach, more vitamin C from oranges, more potassium from bananas, and the protein quality of Moringa leaves rivals milk and eggs. On phytochemical examination, Moringa leaves contain sugar, rhamnose, glucosinolates, and isothiocyanates. The phytochemical components of Moringa leaves are known to have the ability to inhibit cancer cells, overcome hypotension, and have antibacterial properties (Fahey, 2005).

Many Moringa leaf properties are used in traditional medicine to treat metabolic diseases, inflammation, infections, parasites, cancer, and water purification. Several studies highlighted the fantastic nutritional qualities of Moringa leaves. Indeed, studies had shown the effectiveness of these leaves in preventing and correcting malnutrition and related diseases, even though they contain anti-nutritional factors such as

phytate and oxalate. Therefore, this leaf can be a dietary supplement for people with malnutrition because it is rich in protein, vitamins (A, B, C, E), and mineral salts (Ca, K, Mg, P, Iron, Zn, Se, Cu, Mn, Na, Cl). Besides, moringa leaf is positioned as a tonic, strengthening, and stimulating the immune system for HIV / AIDS (Coulibaly, A., et al., 2020).

Moringa leaves are useful in treating moderate anemia, compared to cases of severe anemia. In Milman's (2006) research and Thomson's (2011), the reduction of anemia in the intervention group was three times more than in the control group. The decline in cases of severe anemia was not significantly different between the two groups. Children who have severe anemia may have other complications and deficiencies, which can hinder the rapid increase. However, at the end of the intervention, there were no severe anemia cases in the treatment group, which may indicate an increase in dietary knowledge and practice and the effects of strict Hb monitoring and continued provision of nutrition education. The depletion of the body's iron reserves and red blood cell production stimulates iron absorption (Shija, A. E., et al., 2019).

Moringa leaf is a neuroprotectant in cerebral ischemia caused by obstruction of blood flow to the brain. *M. oleifera* leaf causes reperfusion and lipid peroxidation, which in turn results in reactive oxygen species. Moringa, with its antioxidants, can reduce reactive oxygen species, thus protecting the brain. Moringa leaves are the treatment for dementia, as it is a promoter of spatial memory. Leaf extracts can decrease acetylcholine esterase activity, thereby improving cholinergic function and memory. A study conducted by Adeyemi et al. showed that Moringa in mice's diet could increase protein content and reduce urea and creatinine in the blood, preventing kidney dysfunction. Moringa leaves to reduce gastric ulcers' acidity – antiulcer agent – by a percentage of 86.15% and 85.13% at doses of 500 mg and 350 mg. Herbal practitioners prescribe Moringa for people with AIDS. The recommendation of giving Moringa in food can boost the immune system of HIV-positive people (Gopalakrishnan, L., et al., 2016).

In one study, breastfeeding women who were experiencing anemia were randomly selected and given weekly doses of 100 grams of Moringa leaf powder instead of iron and folic acid (120 mg and 0.5 mg) from the control group. After three months of therapy, there was a significant increase in hemoglobin levels ( $p < 0.001$ ), but iron stores did not change. The protein in Moringa leaves prevents weight loss in women. However, the study concluded that Moringa leaves as a locally available food should be utilized more effectively than supplements and fortified foods for essential nutrients (Sindhu, S., Mangala, S., & Sherry, 2013).

## CONCLUSIONS

Moringa oleifera leaf extract administration can increase hemoglobin levels in anemic pregnant rats (*Rattus norvegicus*). There is the effectiveness of Moringa oleifera leaf extract to increase hemoglobin

levels in the blood of anemic pregnant rats (*Rattus norvegicus*) at a dose of 0.72 g/head/day. The conclusion and suggestion from this research are that the public could get information about using natural ingredients as economically valuable drugs (back to nature).

## REFERENCES

- Ahmad, A. A. (2015) *Pengaruh Pemberian Seduhan Daun Kelor (Moringa oleifera Lam) Terhadap Jumlah Leukosit Tikus Putih (Ratus norvegicus) Jantan*. Program Studi Ilmu Gizi. Universitas Diponegoro.
- Coulibaly, A., Gnangoran, B. N., Oussou, J. B. N. G., & Bleyere, M. N. (2020) ‘Evaluation of Moringa oleifera Lam leaves (Moringaceae) diets against induced anemia in Wistar rats’, *J. Nutr. Food Sci*, 2(3), pp. 101–106.
- Fahey, J. . (2005) ‘Moringa Oleifera: A Review of the Medical Evidence for Its Nutritional, Therapeutic and Prophylactic Properties’, *Trees for Life Journal*, 1(5), pp. 82–87.
- Gopalakrishnan, L., Doriya, K., & Kumar, D. S. (2016) ‘Moringa oleifera: A review on nutritive importance and its medicinal application’, *Food science and human wellness*, 5(2), pp. 49–56.
- Luthfiyah, F. (2012) ‘Efek Serbuk Daun Kelor (Moringa Oleifera) Lokal Nusa Tenggara Barat (NTB) Dalam Meningkatkan Performance Profil Darah Lengkap Tikus Model Kurang Energi Protein’, *Jurnal Kesehatan Prima*, 6(1).
- Madukwe E.U., Ugwuoke A.L., E. J. O. (2013) ‘Effectiveness of dry Moringa oleifera leaf powder in the treatment of anemia’, *International Journal of Medicine and Medical Sciences*, 5(5), pp. 226–228.
- Shija, A. E., Rumisha, S. F., Oriyo, N. M., Kilima, S. P., & Massaga, J. J. (2019) ‘Effect of Moringa Oleifera leaf powder supplementation on reducing anemia in children below two years in Kisarawe District, Tanzania’, *Food science & nutrition*, 7(8), pp. 2584–2594.
- Sindhu, S., Mangala, S., & Sherry, B. (2013) ‘Efficacy of Moringa oleifera in treating iron deficiency anemia in women of reproductive age group’, *International Journal of Physiotherapy Research*, 3(4), pp. 15–20.
- Sitohang, P. C., Candriasih, P., & Amdani, S. (2018) ‘Effect of Moringa (Moringa oleifera) biscuit administration on kemoglobin levels of pregnant women’, *International Journal of Sciences: Basic and Applied Research*, 37, pp. 243–252.
- Youssry, M. A., Radwan, A. M., Gebreel, M. A., & Patel, T. A. (2018) ‘Prevalence of maternal anemia in pregnancy: the effect of maternal hemoglobin level on pregnancy and neonatal outcome’, *Open Journal of Obstetrics and Gynecology*, 8(7), pp. 676–687.