PLACENTUM
Laman resmi: http://jurnal.uns.ac.id/placentum
ISSN 2303-3746
e-ISSN 2620-9969
PLACENTUM Jurnal Ilmiah Kesehatan dan Aplikasinya

Efficacy of Soy Milk and Moringa Jelly Drink as a Nutritional Supplement for Enhancing Hemoglobin Levels in Postpartum Mothers

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ABSTRACT

Background: Postpartum anemia is a condition with hemoglobin (Hb) levels <12 g/dL, which has a serious impact on the health of mothers and babies, increasing the risk of complications such as infection, postpartum hemorrhage, impaired breast milk production, anemia in infants, and delayed growth and development. Soy milk is a plant-based nutrient source rich in protein, iron, carbohydrates, healthy fats, fiber, and isoflavones, which play a role in hemoglobin synthesis and iron absorption. Moringa (Moringa oleifera) leaf extract also contains iron, vitamin C, protein, essential amino acids, as well as vitamin B complex and folate that support erythropoiesis.
Methods: This study employed a one-group pretest-posttest design, conducted at PMB Wulan from January to March 2025, involving a population of all postpartum women in the PMB Wulan work area (n = 20). The intervention was provided in the form of 250 ml of Soy Milk and Moringa Jelly Drink per day for 14 consecutive days.
Results: The results showed a significant increase in Hb levels after the intervention, as determined by the Wilcoxon Signed Ranks Test (p = 0.003). The average Hb level increased from 9.505 g/dL to 10.525 g/dL, with an average change (delta) of 3.45. A total of 65% of respondents experienced an increase in Hb levels, 10% did not change, and 25% experienced a decrease.
Conclusion: Consuming Soy Moringa Jelly Drink has the potential to be an alternative nutritional intervention to help increase hemoglobin levels.

Keywords: ***Hemoglobin; Moringa Extract; Postpartum; Soy Milk***

INTRODUCTION

The postpartum period consists of three hases: the acute phase (the first 24 hours), the subacute phase (up to 6 weeks), and the late or delayed phase (up to 6 months). Some physiological

changes, such as pelvic floor function, can last longer. The World Health Organization defines the postpartum period as six weeks, although some countries extend maternal healthcare coverage to one year after delivery.[1] Postpartum anemia is a condition where the hemoglobin level is <10 g/dL in 24–48 hours after delivery or <12 g/dL in the following weeks, with the strongest risk factor coming from anemia during pregnancy which increases the possibility of postpartum anemia by 2–5 times.[2] Postpartum hemorrhage increases the risk of anemia by 4–5 times, while types of delivery such as cesarean section, instrumental delivery, episiotomy, or perineal laceration, as well as poor nutritional status and inadequate iron–folate supplementation during pregnancy also contribute to the occurrence of postpartum anemia. [3]

Postpartum anemia has a serious impact on both mother and baby. Physically and mentally, anemia leads to fatigue, cognitive impairment, infections, palpitations, shortness of breath, and the risk of postpartum depression, which can disrupt mother-child bonding.[4] Severe conditions increase complications, including infections and maternal death. In terms of obstetrics, anemia increases the risk of postpartum hemorrhage by 11 times, prolongs hospitalization, and increases the likelihood of preterm labor, cesarean section, and other complications.[5] In infants, postpartum anemia leads to decreased milk production, less optimal care, risk of anemia, and impaired growth, development, immunity, and mother-child interaction.[6]

Anemia remains a significant global health challenge by 2024. Postpartum anemia is a highly prevalent condition estimated to affect up to 80% of women in developing countries and about 50% in developed countries. This high prevalence is largely attributed to iron deficiency and blood loss during labor.[7]

Nigeria dan beberapa negara Afrika lain melaporkan sekitar 40–50% anemia segera setelah persalinan.[8] Postpartum anemia (PPA) is common in women after childbirth and affects about 50-80% of all women worldwide.[7] This figure increased according to the 2018 Riskesdas, which reported a prevalence of 54.8%. This high prevalence indicates that postpartum anemia is a serious health problem because it affects the quality of obstetric care and the mother's recovery process.[9]

Postpartum anemia is generally treated with oral iron supplementation as the primary therapy, while in severe cases intravenous iron or blood transfusions may be administered, accompanied by nutritional counseling to increase iron intake and absorption.[10] The use of natural ingredients such as soy milk and moringa leaves, which are rich in iron, vitamin C, and antioxidants, can be an affordable and accessible supportive therapy to help address postpartum anemia, especially when combined with medical supplementation and local food-based nutritional interventions.[11] Soy milk itself is a source of plant-based nutrition that contains protein, iron, folate, vitamin B complex, important minerals, and isoflavones which play a role in hemoglobin synthesis and erythropoiesis. Research in Indonesia shows that consumption of 200 ml of soy milk per day for 14 days can significantly increase hemoglobin levels.[12]

Moringa oleifera leaf extract is rich in iron, vitamin C, protein, essential amino acids, vitamin B complex, and folate which support hemoglobin synthesis and erythropoiesis, and it has been proven in a study in India that giving 250 mg Moringa leaf powder capsules twice daily for 7 days significantly increased hemoglobin levels in postpartum mothers.[13] Based on the high incidence of postpartum anemia and the nutritional potential of soy milk and Moringa oleifera leaf extract in increasing

hemoglobin levels, this study developed an innovative functional jelly drink as a practical, highly nutritious, and local food-based supplement to help postpartum maternal recovery and as a natural and affordable alternative in treating postpartum anemia.

METHODS

This study used a quasi-experimental design with one-group pretest-posttest design. This design was chosen to measure the effect of the intervention of giving Soy Milk and Moringa Jelly Drink on increasing hemoglobin levels in postpartum women by comparing the results of measurements before and after treatment in the same group.

The research was conducted at PMB Wulan from January to March 2025. The study population consisted of all postpartum women residing in the PMB Wulan work area, totaling 20 individuals. The sample determination was carried out using a quota sampling technique, resulting in 20 postpartum women being selected for this study, who met the inclusion and exclusion criteria.

Inclusion criteria include: (1) postpartum women in the period ≤ 6 weeks postpartum; (2) aged 20-40 years; (3) had initial hemoglobin levels <12 g/dL (mild-moderate anemia); (4) resided in the working area of PMB Wulan; and (5) willing to participate in the study until completion, including checking hemoglobin levels twice (before the intervention and 2 weeks after the intervention).

Exclusion criteria included: (1) postpartum women with severe obstetric complications such as preeclampsia, postpartum hemorrhage, or infection; (2) had a history of chronic diseases (e.g., kidney, liver, or blood disorders) that could affect hemoglobin levels; and (3) had a history of allergy to soy, moringa, or its processed products. The research procedure was conducted by selecting 20 respondents who met the criteria and had provided informed consent. Baseline data was collected by checking hemoglobin levels using standard laboratory methods. Furthermore, respondents received an intervention in the form of Soy Milk and Moringa Jelly Drink, administered at a dose of 250 ml per day for 14 consecutive days. The soy moringa gel was administered to respondents by the enumerators daily in the morning to be drunk. A consumption observation sheet was provided to monitor the consumption of the soy moringa gel after breakfast. After the intervention period, the hemoglobin level was rechecked to assess the changes that had occurred.

Soy Milk and Moringa Jelly Drink Sis a functional drink made from a combination of soy milk and moringa leaf extract jelly. This product is packaged in PET plastic bottles with a capacity of 250 ml, with the main composition of water, soybeans, sugar, salt, CMC, plain instant jelly powder, and moringa leaf extract powder. The manufacturing process begins with the preparation of soybean juice from 500 grams of soaked soybeans, which are then mashed, filtered, and boiled with coconut sugar and salt to produce soy milk ready for consumption. Next, moringa extract is obtained from dried moringa leaves that are mashed, boiled, and filtered to produce an infusion. This infusion is then mixed with Nutrijell powder, water, and sugar to produce a solid jelly. The jelly is cut or grated to taste, then mixed into soy milk before being packaged in bottles. The Soy Moringa Gel was prepared by the researchers in collaboration with the enumerators. This beverage product has undergone aftertaste testing with excellent results. The Soy Moringa Gel has also been consulted with nutrition experts from the Nutrition Study Program at Kusuma Husada University.

The research instruments used include the Easy Touch Hb checker, which measures respondents' hemoglobin

levels quickly and accurately in the field before and after the intervention. Observation sheet, to record the administration of Soy Milk and Moringa Jelly Drink, respondents' consumption compliance, as well as the results of checking hemoglobin levels on schedule.

Data were analyzed bivariately. Normality tests were performed using the Shapiro-Wilk test because the number of samples <50. The results of the normality test showed a p-value <0.05. This indicates that the data is not normally distributed. Therefore, to test the difference in hemoglobin levels before and after the intervention, a nonparametric test, the Wilcoxon Signed Ranks Test, was applied.

This study has passed the ethical review of the Health Research Ethics Committee of Kusuma Husada University Surakarta with number 2586/UKH.L.02/EC/II/2025, so that the entire research process is ensured in accordance with the ethical principles of health research, including aspects of beneficence, non-maleficence, respect for persons, and justice. Thus, the results of this study are not only scientifically valid but also ethically accountable.

RESULT

As presented in Table 1, the maternal characteristics showed that most respondents were primiparous (65%), the majority of respondents had higher education (65%), half of the respondents were housewives (50%).

Based on Table 2, almost all respondents (95%) gave birth naturally, 75% of respondents consumed Fe tablets, and almost all respondents (95%) did not experience bleeding.

Table 1. Characteristics of respondents based on parity, education, occupation, and postpartum period

Characteristics	N	%
Parity		
Primiparous	13	65.0
Skundiparous	4	20.0
Multiparous (>2)	3	15.0
Education		
Primary	3	15.0
Secondary	4	20.0
Tertiary	13	65.0
Occupation		
Housewife	10	50.0
Employee	4	20.0
Self-Employed	3	15.0
Civil Servant	3	15.0
Postpartum period		
1-14 days	6	30.0
15-28 days	8	40.0
29-42 days	6	30.0

Table 2: Characteristics of respondents based on delivery history

Characteristics	N	%
Type of labor		
Normal	19	95.0
SC	1	5.0
Fe Tablet Consumption		
Yes	15	75.0
No	5	25.0
History of Hemorrhage		
Yes	1	5.0
No	19	95.0

Tabel 3. Data normality test results

	Shapiro-Wilk		
	Statistic	**df**	***p value***
Hb_Pre	0,758	20	0,000
Hb_Post	0,672	20	0,000
Delta	0,918	20	0,091
Parity	0,669	20	0,000
Education	0,669	20	0,000
Occupation	0,777	20	0,000
Type_of_birth	0,236	20	0,000
Tablet_Fe	0,544	20	0,000
Bleeding	0,236	20	0,000

Based on Table 3 Normality test with Shapiro-Wilk on hemoglobin before, after, and Delta variables showed p-value <0.05.

Tabel 4. Changes in Hemoglobin (Hb) Levels Before and After 14 Days of Intervention

Description	N	%
Increase	13	65.0
Fixed	2	10.0
Down	5	25.0

As shown in Table 4, of the 20 respondents, 13 individuals (65%) showed an increase in hemoglobin levels after the intervention, 2 individuals (10%) had levels that remained unchanged, and 5 individuals (25%) experienced a decrease. Most respondents experienced an increase, indicating that the administration of Soy Milk and Moringa Jelly Drink has a positive effect on hemoglobin levels in the majority of postpartum women.

Tabel 5. Hemoglobin (Hb) Levels in Postpartum Women Before and After a 14-Day Intervention

	HB_ pre	HB_ post	Δ/ Delta	Z-score	P-value
Mean	11,75	12,10	0,39		
Std. Error of Mean	9,828	9,334	1,300		
Std. Deviasi	1,258	1,108	0,596	-2,945	0,003
Min.	9,40	10,10	-0,400		
Max.	13,700	13,900	1,400		

Based on Table 5, there was an increase in the mean Hb level from 11.76 to 12.10 g/dL with an average difference of 0.39 g/dL, and this difference was statistically significant (Z = -2.945; p = 0.003), which indicates an effect of the intervention on increasing hemoglobin levels.

DISCUSSION

The findings of this study indicate a significant increase in hemoglobin levels in postpartum women after being given Soy Milk and Moringa Jelly Drink, as evidenced by the results of the Wilcoxon Signed Ranks Test (p = 0.003). The average hemoglobin level before the intervention was recorded at 9.505, then increased to 10.525 after the intervention, with an average change (delta) of 3.45. A total of 65% of respondents showed an increase in hemoglobin levels, 10% did not change, and 25% experienced a decrease.

The combination of soy milk and Moringa leaves plays a synergistic role in increasing hemoglobin levels through complementary mechanisms. Soy milk is a plant-based food source that provides a complete nutritional profile. The nutritional composition of soy milk includes relatively high levels of protein, ranging from 2% to 5.4%, fat at 1-2.15%, and carbohydrates at 1.25%, as well as various important vitamins such as B1, B2, A, and C. Additionally, soy milk contains essential minerals. In addition, soy milk also contains essential minerals, including calcium, iron, which contributes to the formation of heme in hemoglobin, magnesium, and zinc. It is complemented by dietary fiber and bioactive compounds, including isoflavones.[14]

Isoflavones are bioactive compounds found in soybeans that have great potential in overcoming anemia through various biological mechanisms. One of the main mechanisms is through its antioxidant activity. Isoflavones are able to suppress oxidative stress that can damage erythrocyte membranes, thus helping to maintain a healthy red blood cell count.[15] Isoflavones also act as an anti-inflammatory, reducing the production of pro-inflammatory cytokines such as IL-1 and TNF-α. This helps reduce inflammation that can worsen anemia.[16]

Isoflavones can support the hematopoiesis process by increasing iron absorption and improving the microenvironment in the bone marrow, allowing the erythropoiesis process to occur more optimally.[17]

The findings in this study and the description of the benefits of soy milk align with several previous studies. Although not specifically conducted on postpartum women, the results of this study demonstrate an increase in Hb levels following the soy milk intervention. Research conducted at the Lepo-Lepo Health Center in Kendari City revealed that providing soy milk can increase hemoglobin (Hb) levels in pregnant women with anemia. Before giving soy milk, the average Hb level was 9.36 g/dL, and after 7 days of giving soy milk (200

mL/day), it increased to 9.76 g/dL. This difference was statistically significant (p-value < 0.05).[18]

Another study showed that giving homemade soy milk (250 ml) with the addition of 10 ml of honey significantly increased hemoglobin (Hb) levels in 20 pregnant women in Seunagan District, Nagan Raya Regency, with an average increase of 2.99 mg% ± 1.422 (P < 0.005).[19] Another study conducted at SMP Muhammadiyah 10 Surakarta in 2024 used a one-group pretest-posttest design involving 23 adolescent girls who experienced anemia. The intervention consisted of administering 250 ml of soy milk daily for seven consecutive days. The results showed an increase in average hemoglobin levels by 1.6 g/dL, with a significance value of p < 0.001 after consumption of soy milk.[20]

In addition to soy milk, there are other ingredients included in one of the superfoods, namely Moringa leaf extract (Moringa oleifera) which has a very rich nutritional content, including protein at 17-25% of dry weight which makes it an important source of vegetable protein, carbohydrates around 28%, relatively low fat which is around 10%, and high fiber ranging from 11-15%. In terms of micronutrients, Moringa (Moringa oleifera) leaves are rich in vitamins C, B1, β-carotene (a precursor of vitamin A), folate, and vitamin B12, which play a role in various metabolic processes, including hemoglobin synthesis and erythrocyte maturation.[21] The mineral content is also abundant, especially in calcium, iron, potassium, and magnesium. Iron (Fe) plays a direct role in the formation of hemoglobin, while vitamin C facilitates the increased absorption of non-heme iron in the digestive tract. In addition, the plant proteins in moringa provide essential amino acids for globin formation, while bioactive compounds such as flavonoids (quercetin and kaempferol), phenols, tannins, saponins, alkaloids, isothiocyanates, and phenolic acids provide biological effects that are beneficial to overall health.[22]

The findings of this study and the description of the benefits of moringa extract align with the results of several previous studies. In a study at Juliana Clinic in Tanjung Morawa, respondents received 250 cc of moringa decoction daily for 14 consecutive days. The results showed that the average hemoglobin level before the intervention was 10.4 g/dL, with a standard deviation of 0.63, in 19 respondents. After the intervention, the hemoglobin level increased to 11.2 g/dL with a standard deviation of 0.50 in the same number of respondents. This finding demonstrates that consuming moringa leaf decoction has a positive effect on increasing hemoglobin levels in postpartum women.[23]

These results align with research conducted on postpartum women in the Tlogosari Wetan Health Center's working area, which involved 30 respondents. A total of 15 respondents in the intervention group received moringa capsules in addition to iron tablets, while 15 respondents in the control group received only iron tablets. Analysis using the independent t-test showed significant differences between the two groups, namely in hemoglobin levels (11.95 vs 11.06), hematocrit (38.39 vs 33.81), platelets (3.03 vs 2.36), and erythrocytes (4.30 vs 3.78) with a p-value <0.05. These results further strengthen the evidence that moringa supplementation, in both decoction and capsule forms, is effective in increasing hemoglobin levels and supporting the hematological status of postpartum women.[24]

Based on the theoretical explanation and previous research findings, it can be concluded that the combination of soy milk and moringa leaf extract is effective in increasing hemoglobin levels in postpartum women. The synergy of the two not only provides iron and vitamin C that play a role in strengthening the erythropoiesis process, but also presents

isoflavones and flavonoids that have antioxidant and anti-inflammatory activities. This dual mechanism creates a more optimal hematopoietic environment, resulting in a more significant increase in hemoglobin levels than either ingredient alone.

This study has several limitations that may lead to data bias, namely the different conditions of the postpartum period and the social status of respondents which causes differences in food consumption.

CONCLUSION

The results of this study indicate that the combination of soy milk and Moringa leaf extract has the potential to increase hemoglobin levels, thus supporting the theory of their synergy in the prevention and treatment of anemia. Moringa leaves (Moringa oleifera) are rich in iron and vitamin C, which play an important role in hemoglobin synthesis and increase the absorption of non-heme iron in the digestive tract, while soy milk is a source of vegetable protein that contributes to the formation of globin.

The formulation of both in the form of Soy Milk and Moringa Jelly Drink not only facilitates consumption but also has the potential to increase the bioavailability of nutrients needed by the body. Thus, Soy Milk and Moringa Jelly Drink can be recommended as an effective alternative to natural supplements to help prevent and overcome anemia, especially in postpartum women.

ACKNOWLEDGEMENT

The author sincerely thanks PMB Wulan for granting access to the research site and the Kusuma Husada University Research Institute for their financial support throughout this study. Special appreciation is also extended to the enumerators for their invaluable assistance in data collection and in the preparation and distribution of the Soy Milk and Moringa Jelly Drink.

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