

RESEARCH ARTICLES

Mackerel Fish Soup Supplementation on Hemoglobin Levels Among Second-Trimester Pregnant Women with Anemia

Pemberian Sup Ikan Kembung terhadap Kadar Hemoglobin pada Ibu Hamil dengan Anemia pada Trimester Kedua

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Abstract

Several maternal and neonatal health issues can contribute to anemia in pregnant women, which is a significant public health concern, particularly during the second trimester. Iron supplementation should be accompanied by local dietary adjustments focused on dietary intake. As an essential component in hemoglobin production, mackerel (*Rastrelliger kanagurta*) is a good source of animal protein due to its high iron and vitamin B12 content. This study aimed to assess changes in hemoglobin levels following mackerel soup supplementation among second-trimester pregnant women with mild anemia. The study used a pre-experimental one-group pretest-posttest design with a total sampling technique involving 32 participants. The intervention consisted of 200 ml of mackerel soup containing 100 grams of mackerel, administered twice a week for three weeks. Hemoglobin levels were measured before and after the intervention using a digital hemoglobin meter, and data were analyzed using a paired-sample t-test. A significant difference ($p < 0.001$) was observed, indicating that the mean hemoglobin level increased from 9.941 g/dL before the intervention to 11.053 g/dL after the intervention. In conclusion, mackerel soup supplementation may serve as a complementary food-based nutritional intervention to support the improvement of hemoglobin levels among second-trimester pregnant women with mild anemia.

Keywords: anemia, hemoglobin, mackerel fish soup, pregnancy

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Abstrak

Beberapa masalah kesehatan ibu dan bayi baru lahir dapat menyebabkan anemia pada ibu hamil, yang merupakan masalah kesehatan masyarakat yang signifikan, terutama selama trimester kedua. Suplementasi zat besi harus disertai dengan penyesuaian diet lokal yang berfokus pada asupan makanan. Sebagai komponen penting dalam produksi hemoglobin, ikan mackerel (*Rastrelliger kanagurta*) merupakan sumber protein hewani yang baik karena kandungan zat besi dan vitamin B12-nya yang tinggi. Studi ini bertujuan untuk menilai perubahan kadar hemoglobin setelah suplementasi sup mackerel pada ibu hamil trimester kedua dengan anemia ringan. Studi ini menggunakan desain pra-eksperimental satu kelompok pretest-posttest dengan teknik pengambilan sampel total yang melibatkan 32 peserta. Intervensi terdiri dari 200 ml sup mackerel yang mengandung 100 gram mackerel, diberikan dua kali seminggu selama tiga minggu. Kadar hemoglobin diukur sebelum dan sesudah intervensi menggunakan alat pengukur hemoglobin digital, dan data dianalisis menggunakan uji t sampel berpasangan. Perbedaan signifikan ($p < 0,001$) diamati, menunjukkan bahwa kadar hemoglobin rata-rata meningkat dari 9,941 g/dL sebelum intervensi menjadi 11,053 g/dL setelah intervensi. Kesimpulannya, suplementasi sup ikan mackerel dapat berfungsi sebagai intervensi nutrisi berbasis makanan pelengkap untuk mendukung peningkatan kadar hemoglobin pada ibu hamil trimester kedua dengan anemia ringan.

Kata kunci: anemia, hemoglobin, kehamilan, sup ikan makarel

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Highlight:

- Mackerel serves as an affordable local animal protein source rich in iron and vitamin B12, which play a crucial role in supporting hemoglobin production during pregnancy
- Supplying mackerel fish soup twice weekly over three weeks functions as an effective complementary food-based strategy alongside standard iron tablets for second-trimester pregnant women with mild anemia.
- Following the intervention, all participants experienced a complete transition in hemoglobin status, shifting entirely from mild anemia prior to the study to normal levels.

INTRODUCTION

Anemia in pregnancy is defined as a hemoglobin (Hb) level below 11 g/dL, with 90% of cases caused by iron deficiency, a condition worsened by physiological blood dilution in the second trimester (Retnaningsih et al., 2025). Iron deficiency during pregnancy can lead to anemia, which often occurs in pregnant women due to iron deficiency (Fe) or is referred to as iron deficiency anemia (IDA). The anemia status in second-trimester pregnant women is influenced by several factors, including low iron intake, poor dietary habits, and low adherence to Fe tablet consumption (Retnaningsih et al., 2025).

Globally, anemia affects around 40% of pregnant women during the second and

third trimesters (Zulkifal *et al.*, 2021). In Indonesia, the prevalence of anemia among pregnant women increased from 48.9% in 2019 to 78% in 2021, according to the Ministry of Health (Kementerian, 2021). In East Java Province, anemia affects approximately 49.9% of pregnant women (Dinkes, 2021). Local data from Malang Regency also indicate a considerable number of anemia cases among pregnant women, with 2.317 reported cases and 92 classified as severe anemia (Jawa Pos, 2025). Preliminary data obtained from TPMB Bd. Ratna Bantur showed 93 cases of anemia among pregnant women, with 48 cases (48%) categorized as mild anemia during the second trimester.

Several factors contribute to the high prevalence of anemia in pregnant women, including limited knowledge regarding nutrition, inadequate dietary intake, skipping breakfast, and consumption of beverages such as tea and coffee that inhibit iron absorption (Sari *et al.*, 2024). Anemia during pregnancy may increase the risk of maternal and fetal complications, including preeclampsia, placental abruption, heart failure, low birth weight (LBW), and preterm birth (Sa'idah and Keswara, 2025). Management of anemia can be carried out pharmacologically through iron supplementation and non-pharmacologically through nutritional improvement (Trilupi, 2021).

Anemia prevention efforts include increasing nutrient intake from animal and plant sources, such as eggs, milk, meat, fish, tofu, tempeh, and nuts. The government has also implemented iron supplementation programs for pregnant women; however, adherence to iron tablet consumption remains relatively low, resulting in suboptimal outcomes without additional nutritional support. Therefore, nutritional interventions through iron- and protein-rich supplementary foods (PMT) may serve as a potential strategy (Soleha, 2024). In this study, mackerel fish soup was used as a form of locally based supplementary feeding (PMT) for second-trimester pregnant women with mild anemia. The use of mackerel soup as a food-based nutritional intervention remains limited in previous studies, particularly at the primary healthcare level, thereby highlighting the novelty of this research (Soleha, 2024).

Mackerel is an affordable source of animal protein and rich in iron, vitamins, and omega-3s. Its nutritional content is quite high, with fresh mackerel containing approximately 18.54% protein, 0.59% fat, 2.91% carbohydrates, 76.47% moisture, and 1.48% ash (Andira *et al.*, 2022). The advantages of mackerel have been supported by several studies, one of which was conducted by Sa'idah and Keswara (2025) and found a statistically significant difference ($p < 0.05$) in hemoglobin levels before and after mackerel consumption. This discovery suggests that pregnant women with anemia who eat mackerel have higher hemoglobin levels. One viable and long-term nutritional intervention option for pregnant women with anemia is the use of mackerel as a supplemental meal (PMT) in soup form (Alfitri and Retnaningsih, 2019).

Based on preliminary studies at the research site, pregnant women in their second trimester still had hemoglobin levels lower than normal, indicating mild anemia. This situation indicates that anemia among pregnant women is still an ongoing problem and requires additional interventions beyond iron supplementation. However, the use of mackerel as a PMT (food supplement) in the form of soup for pregnant women with anemia remains rarely studied, particularly at the primary healthcare level.

In this study, women with mild anemia in their second trimester of pregnancy were studied to see how supplementing their diet with mackerel fish soup affected their hemoglobin levels. One potential alternate method for preventing and managing anemia in pregnant women is to use locally accessible foods, and this research aims to give scientific proof for this claim.

METHODS

This study used a quantitative method with a pre-experimental one-group pretest-posttest design. The purpose of this study was to assess changes in hemoglobin levels following mackerel fish soup supplementation among second-trimester pregnant women with mild anemia. The study, including research planning, data collection, and analysis, was conducted at TPMB Bd. Ratna Kurnianingtyas in Bantur District, Malang Regency. The study was carried out over a three-week period, from December 1st to December 21st, 2025.

The population of this study consisted of all second-trimester pregnant women with mild anemia at TPMB Bd. Ratna Kurnianingtyas. Mild anemia was defined as a hemoglobin level between 10.0–10.9 g/dL. The total population also served as the research sample, consisting of 32 subjects selected using a total sampling technique, in which all eligible members of the population were included as research subjects. The inclusion criteria in this study were second-trimester pregnant women with mild anemia, willing to participate as research subjects, willing to undergo hemoglobin level examination, and willing to consume mackerel fish soup supplementary feeding (PMT) according to the study protocol. The independent variable in this study was the administration of mackerel fish soup as supplementary feeding (PMT), while the dependent variable was the change in hemoglobin levels among second-trimester pregnant women with mild anemia.

The research procedure began with the collection of initial data (pretest) through the examination of hemoglobin levels in all subjects. Subsequently, the subjects received an intervention in the form of one serving of mackerel fish soup (200 ml of soup containing 100 grams of mackerel fish) administered twice a week for three weeks. During the intervention period, all subjects continued to receive routine iron (Fe) tablet supplementation according to standard antenatal care recommendations. After the intervention period was completed, posttest hemoglobin measurements were conducted using a digital hemoglobin meter (Hb meter). The instruments used in this study included a hemoglobin meter, observation sheets, and mackerel fish soup as the intervention medium.

The data were analyzed using a paired-sample t-test to determine differences in hemoglobin levels before and after the intervention, with a significance level set at $p < 0.05$. This study was approved by the Health Research Ethics Committee (KEPK-EC) under approval number KEPK-EC/445/XII/2025. Before the study began, all subjects were informed about the objectives, benefits, and procedures of the study to be undertaken. After understanding the explanation, subjects were asked to sign an informed consent form indicating their willingness to participate in the study. The confidentiality and privacy of all subjects were fully protected, and all collected data were used solely for scientific purposes anonymously.

RESULTS AND DISCUSSIONS

Table 1 shows that the majority of subjects ($n=19$, or 59.4% of the total) were between the ages of 26 and 35. Those under the age of 25 made up 31.3% of the total subjects, while those over the age of 36 made up 9.4%. According to these findings, most of the individuals were within the age range typically deemed safe for pregnancy. Based on parity, most of the subjects had experienced one previous birth, with a total of 12 individuals (37.5%), followed by subjects who have given birth twice, totaling 9 people

(28.1%). Subjects who have never given birth number 8 people (25.0%), while those who have given birth more than three times total 3 people (9.4%). These results indicate that the majority of subjects have previous pregnancy experience.

Table 1. Subject characteristics (n = 32)

Characteristics	Category	n	%
Age	<25 years	10	31.3
	26–35 years	19	59.4
	>36 years	3	9.4
Parity	Nullipara	8	25.0
	1 Child	12	37.5
	2 Children	9	28.1
	≥3 children	3	9.4
Dietary Pattern	Good	12	37.5
	Moderate	11	34.4
	Poor	9	28.1
Nutritional Status	Underweight	7	21.9
	Overweight	6	18.8
	Normal	19	59.4
Total		32	100.0

Source: Primary data, 2025

According to the features of their food patterns, 12 subjects (37.5%) have acceptable dietary patterns, 11 have adequate patterns (34.4% of the total), and 9 have bad patterns (28.1% of the total). Even though the majority of subjects eat healthily, a small percentage have an unhealthy eating habit that may impact their hemoglobin levels and nutritional status. The majority of subjects, with 19 individuals (59.4%), fell into the usual group when it comes to nutritional status. Subjects with poor nutritional status number 7 people (21.9%), while those with excess nutritional status number 6 people (18.8%). This indicates that, in general, the nutritional status of subjects is quite good, although there are still groups at risk of anemia due to poor nutritional status.

Table 2. Distribution of anemia status before and after mackerel fish soup PMT intervention (n = 32)

Anemia	Category	n	%
Before Intervention	Mild anemia	32	100
	Total	32	100
After Intervention	Normal	32	100
	Total	32	100

Source: Primary data, 2025

Based on Table 2, all subjects in the pre-intervention stage fell into the mild anemia category, totaling 32 people (100%). These findings indicate that all pregnant women who were subjects of the study had hemoglobin levels below the normal value before receiving the PMT in the form of mackerel fish soup. After the intervention, all subjects experienced an increase in hemoglobin levels, reaching the normal category with 32 individuals (100%). These findings demonstrate a positive change in hemoglobin status after the administration of mackerel fish soup PMT. These results indicate that the PMT

mackerel fish soup has the potential as a nutritional intervention to help increase hemoglobin levels in second-trimester pregnant women with mild anemia.

Based on Table 2, all subjects in this study experienced mild anemia before the intervention (100%), indicating that all pregnant women had hemoglobin levels below the normal range (Naibaho et al., 2023). Worldwide, almost 40% of pregnant women suffer from anemia, and in Indonesia, that number rises to around 27.7% (Hasanah and Liayana, 2024). Low hemoglobin levels are a hallmark of this disorder; they lower the blood's ability to transport oxygen and raise the likelihood of problems during pregnancy (Naibaho et al., 2023; Pratama et al., 2024). Based on Table 3, hemoglobin levels significantly increased from 9.941 g/dL to 11.053 g/dL after the intervention, according to the paired sample t-test findings ($p < 0.001$), indicating that the dietary intervention effectively improved anemia in pregnant women (Sari et al., 2025). This increase also suggests that a nutrition-based approach can be an effective strategy in managing anemia during pregnancy (Sari et al., 2025; Nisak et al., 2024).

Table 3. Changes in hemoglobin levels before and after mackerel fish soup supplementation (n = 32)

Variable	Pretest Mean ± SD	Posttest Mean ± SD	Mean Difference	95% CI	t	df	p-value
Hemoglobin Levels	9.941 ± 0.091	11.053 ± 0.091	-1.112	-1.145 to - 1.080	- 69.388	31	<0.001*

Note: *Paired sample t-test, significant if p-value < 0.05

Furthermore, the high correlation value ($r = 0.925$) indicates that the increase in Hb levels occurred consistently among subjects, thus ensuring a stable effect of the intervention (Nisak et al., 2024). This confirms that the success of increasing Hb levels is influenced not only by the intervention but also by adherence to iron consumption and the pregnant woman's diet (Nisak et al., 2023).

Mackerel, used as an intervention ingredient, is an animal-based food source rich in iron, protein, and essential fatty acids, which play a role in hemoglobin formation (Hasanah and Liayana, 2024). A diet containing iron, protein, and supporting vitamins has been shown to contribute to increasing Hb levels (Hasanah and Liayana, 2024). Furthermore, iron from animal sources has a higher absorption rate than non-animal iron from plant sources, making it more effective in increasing hemoglobin levels (Naibaho et al., 2023).

The findings of this study are also supported by other research showing that supplemental food-based interventions, such as natural iron sources, can significantly increase hemoglobin levels in pregnant women (Sari et al., 2025). This suggests that nutritional approaches can be an effective alternative to pharmacological supplementation (Sari et al., 2023; Nisak et al., 2023).

Physiologically, during pregnancy, plasma volume increases, causing hemodilution, resulting in a tendency for hemoglobin levels to decrease (Mujahadatuljannah and Rabiattunnisa, 2024). If not balanced with adequate iron intake, this condition can lead to anemia and increase the risk of complications such as low birth weight and preterm birth (Pratama et al., 2024).

Compared to other studies, animal-based food interventions, such as fish, are more effective than plant-based sources due to better iron bioavailability (Hasanah and

Liayana, 2024; Naibaho *et al.*, 2023). In addition, anemia in pregnant women is also influenced by other factors such as knowledge, compliance with consuming Fe tablets, and nutritional status (Nisak *et al.*, 2023).

On the other hand, although iron supplementation programs have been widely implemented, compliance among pregnant women remains a major obstacle due to perceived side effects (Nisak *et al.*, 2023). Anemia in pregnant women is more common in those who do not take their iron tablets as prescribed (Nisak *et al.*, 2023). Therefore, food-based interventions such as mackerel soup may be a more acceptable and sustainable alternative (Sari *et al.*, 2025).

Mackerel soup as an intervention has the advantages of being easy to consume, highly nutritious, and can increase appetite in pregnant women (Hasanah and Liayana, 2024). Furthermore, food-based interventions also provide additional benefits for the overall health of the mother and fetus (Pratama *et al.*, 2024). Therefore, this intervention is not only effective in increasing hemoglobin levels but also has the potential to improve pregnancy quality (Sari *et al.*, 2025).

However, this study has limitations because it did not use a control group, so its relative effectiveness compared to other interventions cannot be definitively determined (Mujahadatuljannah and Rabiattunnisa, 2024). Therefore, further research is recommended using a randomized controlled trial design to generate stronger evidence (Nisak *et al.*, 2023).

CONCLUSIONS

Mackerel fish soup supplementation showed a statistically significant increase in hemoglobin levels before and after the intervention among second-trimester pregnant women with mild anemia. The intervention, administered twice a week for three weeks, was associated with an improvement in hemoglobin levels from mild anemia to normal levels across all subjects. Therefore, mackerel fish soup shows potential as a complementary food-based nutritional strategy to support the management of anemia in pregnant women alongside standard iron supplementation.

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