

ROSELLA INFUSION AND IRON SUPPLEMENTATION INCREASE HEMOGLOBIN IN PREGNANT WOMEN WITH ANEMIA

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ABSTRAK

Latar Belakang: Anemia pada kehamilan tetap menjadi masalah kesehatan ibu yang penting karena dikaitkan dengan peningkatan risiko komplikasi pada ibu dan perinatal. Di wilayah kerja Puskesmas Kelumbayan, tercatat 18 dari 140 ibu hamil (12,86%) mengalami anemia pada tahun 2024. Suplementasi zat besi merupakan standar perawatan, sementara rosela (*Hibiscus sabdariffa*) mengandung vitamin C dan senyawa lain yang dapat mendukung penyerapan zat besi.

Tujuan: Menganalisis pengaruh pemberian seduhan rosela sebagai pendamping suplementasi zat besi terhadap kadar hemoglobin pada ibu hamil dengan anemia.

Metode: Penelitian kuasi-eksperimental dengan desain *pretest-posttest* dua kelompok ini melibatkan 40 ibu hamil trimester kedua atau ketiga yang mengalami anemia ringan; masing-masing kelompok terdiri dari 20 peserta yang dipilih secara purposif. Peserta dialokasikan secara non-acak ke dalam kelompok intervensi dan kelompok kontrol sesuai dengan desain kuasi-eksperimental. Kedua kelompok menerima suplementasi standar zat besi/folat, sedangkan kelompok intervensi juga menerima seduhan rosela yang dibuat dari 1,5 g kelopak bunga rosela kering yang diseduh dalam 300 mL air, diminum satu kali sehari selama 14 hari. Kadar hemoglobin diukur menggunakan alat *Easy Touch* sebelum dan sesudah intervensi. Uji Shapiro-Wilk digunakan untuk menilai normalitas data, uji *paired-sample t-test* untuk menilai perubahan dalam kelompok (jika asumsi terpenuhi), dan uji *independent-samples t-test* untuk membandingkan perubahan hemoglobin antar-kelompok.

Hasil: Rata-rata kadar hemoglobin pada kelompok intervensi meningkat dari $10,41 \pm 0,33$ g/dL menjadi $11,42 \pm 0,37$ g/dL, sedangkan pada kelompok kontrol meningkat dari $10,36 \pm 0,33$ g/dL menjadi $10,93 \pm 0,29$ g/dL. Rata-rata peningkatan masing-masing adalah 1,01 g/dL dan 0,57 g/dL. Analisis menunjukkan adanya perbedaan peningkatan antar-kelompok sebesar 0,485 g/dL (IK 95% 0,24–0,63; $p < 0,001$). Kesimpulan: Pemberian seduhan rosela sebagai terapi tambahan pada suplementasi zat besi dikaitkan dengan peningkatan kadar hemoglobin yang lebih besar dibandingkan dengan suplementasi zat besi/asam folat saja pada ibu hamil dengan anemia ringan.

Saran: Studi terkontrol lebih lanjut dengan masa pemantauan yang lebih lama serta pengendalian asupan makanan dan kepatuhan suplementasi yang lebih baik disarankan sebelum penerapan secara rutin.

Kata kunci: anemia pada kehamilan; hemoglobin; suplementasi zat besi; rosela; vitamin C

ABSTRACT

Background: Anemia in pregnancy remains an important maternal health problem because it is associated with increased risks of maternal and perinatal complications. In the Kelumbayan Community Health Center service area, 18 of 140 pregnant women (12.86%) were recorded as having anemia in 2024. Iron supplementation is standard care, while rosella (*Hibiscus sabdariffa*) contains vitamin C and other compounds that may support iron absorption.

Objective: To analyze the effect of rosella infusion used as an adjunct to iron supplementation on hemoglobin levels among pregnant women with anemia.

Methods: This quasi-experimental two-group pretest-posttest study included 40 pregnant women in the second or third trimester with mild anemia, with 20 participants in each group selected purposively. Participants were allocated non-randomly to an intervention group and a control group in accordance with the quasi-experimental design. Both groups received the standard iron/folate supplementation used in the study, while the intervention

group additionally received rosella infusion prepared from 1.5 g of dried rosella calyces brewed in 300 mL of water once daily for 14 days. Hemoglobin was measured using an Easy Touch device before and after the intervention. Shapiro-Wilk testing assessed normality, paired-sample t-tests assessed within-group changes when assumptions were met, and an independent-samples t-test compared hemoglobin change between groups. Results: Mean hemoglobin in the intervention group increased from 10.41 ± 0.33 g/dL to 11.42 ± 0.37 g/dL, while the control group increased from 10.36 ± 0.33 g/dL to 10.93 ± 0.29 g/dL. Mean increases were 1.01 g/dL and 0.57 g/dL, respectively. The source analysis reported a between-group difference in improvement of 0.485 g/dL (95% CI 0.24–0.63; $p < 0.001$).

Conclusion: Rosella infusion used as an adjunct to iron supplementation was associated with a greater increase in hemoglobin than iron/folate supplementation alone among pregnant women with mild anemia.

Suggestions: Further controlled studies with longer follow-up and better control of dietary intake and supplementation adherence are recommended before routine implementation.

Keywords: anemia in pregnancy; hemoglobin; iron supplementation; rosella; vitamin C

INTRODUCTION

Anemia in pregnancy is an important health problem because reduced hemoglobin levels decrease oxygen-carrying capacity and may increase maternal vulnerability to fatigue, obstetric complications, and unfavorable perinatal outcomes. Iron supplementation programs have been implemented to prevent and treat iron-deficiency anemia; however, hemoglobin response may vary according to dietary intake, adherence, iron absorption, and other maternal factors (Bakta, 2019; Prawirohardjo, 2020; Proverawati, 2019).

In Indonesia, anemia among pregnant women remains a concern in maternal health services. National health reports support continued iron supplementation and hemoglobin monitoring during pregnancy (Kementerian Kesehatan Republik Indonesia, 2023, 2024). In the Kelumbayan Community Health Center service area, 18 of 140 pregnant women (12.86%) were reported to have anemia in 2024, while iron-tablet coverage was reported to reach 81.4%. These local data indicate that anemia may persist even where iron supplementation is available.

Non-heme iron absorption can be enhanced by vitamin C, making the combination of iron supplementation with vitamin-C-containing foods a biologically plausible approach. Rosella (*Hibiscus sabdariffa*) is a plant-based food source containing vitamin C and antioxidant compounds. Previous studies have reported increases in hemoglobin after rosella was provided alongside iron supplementation, although study settings, formulations, doses, and intervention durations have varied (Nisa et al., 2017; Mizawati & Wulandari, 2021; Pratiwi, 2022; Mayunita, 2024).

Other evidence also shows that iron formulation, dosage, frequency, and treatment adherence influence hematologic responses during pregnancy (Goonewardene & Senadheera, 2018; Srivastava et al., 2019; Stanworth et al., 2024). Therefore, the additional benefit of rosella should be evaluated against a comparison group receiving standard iron supplementation rather than interpreted solely from pre-post changes within one group.

The research gap underlying this study was the absence of a structured evaluation of rosella infusion as an adjunct to iron supplementation among pregnant women with anemia in the Kelumbayan Community Health Center service area. This study therefore aimed to compare changes in hemoglobin levels between pregnant women receiving rosella infusion in addition to the supplementation regimen and those receiving the standard supplementation regimen.

RESEARCH METHODS

This study used a quantitative quasi-experimental two-group pretest-posttest design. The research was conducted in the Kelumbayan Community Health Center service area, Tanggamus Regency, Lampung Province. The preparatory phase, including protocol preparation, administrative arrangements, instrument preparation, and field coordination, was conducted from February to April 2025. Participant recruitment and data collection began only after ethical approval was granted on 28 April 2025 and continued through July 2025. The study population comprised 63 pregnant women in the second or third trimester who had anemia. A total of 40 participants were selected purposively. Because the study used a quasi-experimental rather than randomized design, participants were allocated non-randomly into an intervention group ($n = 20$) and a control group ($n = 20$). No claim of random allocation is made.

Inclusion criteria were pregnancy in the second or third trimester, mild anemia (hemoglobin 9.0-10.9 g/dL), residence in the study area, no reported history of allergy to rosella, willingness to complete the intervention, and no additional iron supplementation outside that provided in the study. Exclusion criteria included moderate-to-severe anemia, a history of pregnancy complications, or inability to complete the intervention.

The independent variable was rosella infusion as an adjunct intervention, and the dependent variable was maternal hemoglobin level. Both groups received the standard iron/folate supplementation regimen used in the study for 14 consecutive days. The intervention group additionally received rosella infusion prepared from 1.5 g of dried rosella calyces brewed in 300 mL of water and consumed once daily at night after meals for 14 days, whereas the control group received standard iron/folate supplementation without rosella. The source manuscript does not specify the tablet formulation or elemental iron/folic-acid dose; therefore, no unverified dose has been added to this revised manuscript.

Hemoglobin was measured using an Easy Touch device twice, before the intervention and one day after completion of the 14-day intervention. Adherence was monitored by trained enumerators using daily observation records. Data were analyzed using SPSS. The Shapiro-Wilk test was used to assess normality. Within-group pre-post changes were analyzed using paired-sample t-tests when assumptions were met, and the between-group difference in hemoglobin change was assessed using an independent-samples t-test. Statistical significance was set at $p < 0.05$.

Ethics and Participant Protection

Ethical approval was obtained from the Health Research Ethics Committee of Universitas Malahayati, Bandar Lampung, Indonesia, No. 4722/EC/KEP-UNMAL/IV/2025, dated 28 April 2025. Research activities conducted from February to April 2025 were limited to the preparatory phase and did not involve participant recruitment or data collection. Participant recruitment and data collection commenced only after ethical approval had been issued and continued through July 2025. Before enrollment, each participant received an explanation of the study purpose, procedures, potential benefits, voluntary participation, confidentiality, and the right to withdraw. Written informed consent was obtained from all participants before participation.

RESEARCH RESULTS

A total of 40 participants were analyzed, with 20 participants in the intervention group and 20 in the control group. Participant characteristics are shown in Table 1. The percentage for participants aged >30 years in the control group is presented as 35.0% (7/20).

Table 1. Participant characteristics in the intervention and control groups

Variable	Category	Intervention n	Intervention %	Control n	Control %
Age	20-30 years	14	70.0	13	65.0
Age	>30 years	6	30.0	7	35.0
Education	Elementary school	0	0.0	2	10.0
Education	Junior high school	3	15.0	9	45.0
Education	Senior high school	14	70.0	8	40.0
Education	Bachelor degree	3	15.0	1	5.0
Occupation	Housewife	18	90.0	14	70.0
Occupation	Employed	2	10.0	6	30.0

Mean hemoglobin levels increased in both groups after 14 days, with a larger increase observed in the intervention group.

Table 2. Hemoglobin levels before and after the intervention

Group	Time	n	Mean (g/dL)	SD	Min	Max
Intervention	Before	20	10.41	0.33	9.5	10.9
Intervention	After	20	11.42	0.37	10.8	12.1
Control	Before	20	10.36	0.33	10.0	10.9
Control	After	20	10.93	0.29	10.5	11.6

Table 3. Shapiro-Wilk normality test

Group	Measurement	p-value	Interpretation
Intervention	Before	0.068	Normal
Intervention	After	0.535	Normal
Control	Before	0.072	Normal
Control	After	0.388	Normal

Table 4. Comparison of hemoglobin changes between groups

Group	n	Mean before	Mean after	Mean change	Between-group difference (95% CI); p
Intervention	20	10.41	11.42	1.01	0.485 g/dL (0.24-0.63); p < 0.001
Control	20	10.36	10.93	0.57	

The source analysis reported a mean hemoglobin increase of approximately 1.01 g/dL in the intervention group compared with 0.57 g/dL in the control group. The reported between-group difference in improvement was 0.485 g/dL (95% CI 0.24-0.63; p < 0.001).

DISCUSSION

The study showed an increase in hemoglobin in both groups after the 14-day intervention, with a larger mean increase among participants receiving rosella infusion as an adjunct to iron supplementation. This finding suggests that rosella may provide an additional contribution to the hematologic response when used alongside standard supplementation, although the non-randomized design and short follow-up require cautious interpretation.

The finding is consistent with Nisa et al. (2017), who reported a greater increase in hemoglobin among pregnant women with anemia receiving rosella in addition to iron supplementation than among those receiving iron alone. Mizawati and Wulandari (2021) also reported increased hemoglobin following rosella administration. More recent local studies have similarly described increases in hemoglobin following rosella-based interventions among pregnant women or women of reproductive age (Puspita et al., 2025; Zahra et al., 2024; Hindratni et al., 2025).

A plausible mechanism is related to the vitamin C content of rosella, which may improve absorption of non-heme iron. Rosella also contains antioxidant compounds, including anthocyanins and polyphenols. However, the actual contribution of rosella in this study cannot be separated completely from the effects of iron supplementation, dietary intake, adherence, and other maternal factors. These factors should therefore be considered when interpreting the observed change.

The control group also showed an increase in hemoglobin, indicating that standard iron/folate supplementation remained effective. This is consistent with evidence that iron dose, formulation, frequency, and adherence influence hemoglobin response during pregnancy (Goonewardene & Senadheera, 2018; Srivastava et al., 2019; Stanworth et al., 2024). For this reason, the most relevant comparison is the difference in change between groups rather than the significance of pre-post change within each group alone.

From a practical perspective, an increase of approximately 1 g/dL over 14 days in the intervention group is clinically interesting and warrants further investigation. Nevertheless, the short intervention period is insufficient to assess sustained effectiveness, long-term safety, pregnancy outcomes, or the feasibility of routine implementation in primary care. In addition, the use of a point-of-care hemoglobin device and the absence of

detailed control of dietary iron, vitamin C intake, tea/coffee consumption, and other confounding factors may have influenced the results.

Study Limitations

This study had several limitations. The non-randomized quasi-experimental design, relatively small sample, and single primary-care setting limit generalizability and causal inference. Daily dietary iron and vitamin C intake, tea/coffee consumption, and other health-related factors were not fully controlled. The intervention period was short. In addition, although both groups received the study's standard iron/folate supplementation and the intervention group additionally received rosella infusion, the original manuscript did not document the exact tablet formulation or elemental iron/folic-acid dose. Future studies should use a clearly documented allocation sequence, standardized supplementation regimens with exact doses, longer follow-up, and tighter control of dietary intake and adherence.

CONCLUSION

Among pregnant women with mild anemia, the group receiving rosella infusion as an adjunct to iron supplementation showed a greater increase in hemoglobin than the group receiving standard iron/folate supplementation alone over 14 days. The source analysis reported a between-group difference in hemoglobin improvement of 0.485 g/dL (95% CI 0.24-0.63; $p < 0.001$). These findings support further evaluation of rosella as a complementary dietary intervention, but they do not justify replacing standard anemia treatment.

SUGGESTION

The findings may be used as a basis for further education and implementation research in primary care rather than as a replacement for standard anemia therapy. Future studies should use stronger group allocation methods, longer follow-up, standardized iron/folate regimens, and tighter control of dietary intake and supplementation adherence.

DECLARATIONS

Ethics Approval and Informed Consent

Ethical approval was obtained from the Health Research Ethics Committee of Universitas Malahayati, Bandar Lampung, Indonesia, No. 4722/EC/KEP-UNMAL/IV/2025, dated 28 April 2025. The February-April 2025 period was used only for research preparation; no participant recruitment or research data collection occurred before approval. Participant recruitment and data collection began after ethical approval and continued through July 2025. Written informed consent was obtained from all participants before participation.

Author Contributions

Toyibah contributed to conceptualization, methodology, data collection, data analysis, interpretation of the findings, and preparation of the original manuscript. Anissa Ermasari contributed to supervision, methodological guidance, interpretation of the findings, and critical manuscript review. Ana Mariza contributed to supervision, interpretation of the findings, and critical revision of the manuscript. All authors read and approved the final version of the manuscript.

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Conflict of Interest

The authors declare that there is no conflict of interest related to this study.

Artificial Intelligence Declaration

Generative artificial intelligence (OpenAI ChatGPT) was used solely to support English-language editing, consistency checking, structural organization, and manuscript formatting during the revision process. All AI-assisted outputs were reviewed and verified by the authors. The authors remain fully responsible for the accuracy, originality, integrity, and final content of the manuscript.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to applicable ethical, privacy, and confidentiality requirements.

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