



Effect of Beetroot on Hemoglobin Level in Pregnant Women: a Systematic Review

Kusmayra Ambarwati *, Fitria Sari, Asyifa Robiatul Adawiyah, Yuna Trisuci Aprillia, Atik Kridawati

Public Health Program Study, Faculty of Health Sciences, Universitas Respati Indonesia, Indonesia

*Email (corresponding author): mayra@urindo.ac.id

Abstract. Background: Anemia is a very large public health problem all over the world during pregnancy, and is a component of maternal and fetal morbidity. Recently, attention has focused on certain natural-source nutrients with high iron or folate content, such as beetroot (*Beta vulgaris* L.), as potential therapies for anemia in pregnant women. Purpose: The purpose of this systematic review was to investigate the impact of beetroot supplementation on hemoglobin levels in pregnant women. Methods: The original review was carried out based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guideline. Library searches were performed with PubMed, Scopus, Web of Science, and Google Scholar. The Population, Intervention, Comparison, and Outcome framework was used to develop the review question. Results: Of the identified studies, 19 were included. The majority of studies utilized experimental, quasi-experimental, or randomized controlled trial (RCT) designs; Indonesia is the country where most of the studies were carried out. The interventions primarily were beetroot juice, beet powder, and/or iron supplementation. The results were quite consistent, showing that beetroot supplementation effectively enhances hemoglobin levels in pregnant women with anemia. Improvements in the hematocrit and erythrocyte counts were also reported in several studies. Conclusions: Beetroot appears to be a nutrient-based remedy to consider alongside other nutritional therapies for managing anemia in pregnancy. But more rigorous randomized controlled trials with improved design, larger sample sizes, and standardized intervention protocols are needed.

Keywords: Beetroot; Anemia; Hemoglobin; Pregnancy; Systematic Review

1. Introduction

In addition, it is recognized that anemia in pregnancy is a major public health challenge both nationally and worldwide and is a major cause of maternal and neonatal morbidity and mortality. (WHO, 2023; World Health Organization, 2015). Anemia prevalence was estimated at around 36% in the world for pregnant women, especially in low-middle-income countries (LMIC), where there is a high prevalence of nutritional deficiencies. (WHO, 2023) Iron deficiency, inadequate nutrition, the physiological demands of pregnancy, and poor compliance with iron supplements are typical causes of anemia during pregnancy (Achebe & Gafter-Gvili, 2017).

Several negative consequences have been reported to be associated with maternal anemia: preterm delivery, low birth weight, postpartum hemorrhage, poor fetal development, maternal exhaustion, and maternal mortality. (Achebe & Gafter-Gvili, 2017; De-Regil et al., 2015) Anemia in pregnancy is defined as a hemoglobin level below 11 g/dL (World Health Organization, 2023). Maternal blood volume increases significantly during pregnancy; hence, <https://journal.scitechgrup.com/index.php/jsi>

there is a higher iron need during the 2nd and 3rd trimesters of pregnancy. Oral iron supplementation is a hepatically metabolized drug with gastrointestinal side effects, including nausea, constipation, abdominal pain, and vomiting, which may reduce maternal adherence to treatment for iron deficiency anemia (IDA) during pregnancy. (Achebe & Gafter-Gvili, 2017; Khalid et al., 2024) As a result, over the last decade, natural food therapy methods have become a popular alternative nutrition strategy to boost maternal hemoglobin levels, strengthening alternative ways of nutritional support. In this sense, alternative nutritional approaches based on natural food therapy have gained increasing interest as complementary strategies for boosting maternal hemoglobin, strengthening alternatives (AH), and supporting capacity within food nutrition.

The beetroot (*Beta vulgaris* L.) is a functional food with high content of iron, folate, nitrates, which can aid erythropoiesis, vitamin C, which encourages hemoglobin synthesis, betalains, and antioxidants that help to reduce oxidative stress. Beetroot vitamin C could enhance non-heme iron assimilation, and folate stimulates red blood cells production and haemato-formation processes. Beetroot also contains nitriles that may play a beneficial role in vascular circulation and the delivery of oxygen to tissues. Beetroot supplementation has been studied in pregnant women to assess its impact on Hb levels. The study found a significant increase in hemoglobin levels in pregnant women with anemia receiving care at Kotaraja primary health care after receiving beetroot juice, according to Zahyrah, Dondi, and Wijayanti. (Zahyrah et al., 2020) The study by Wahab, Setiyawati, and Hadijah showed that after 7 days of intervention, hemoglobin levels increased in third-trimester pregnant women with anemia. (Wahab et al., 2022). However, the researchers also found that beet juice, when taken by pregnant women, can have a major effect on their hemoglobin levels, with improvements. (Novelia et al., 2025) Among women with anemia, Amini and Nurbaety found that those who took beetroot juice alongside Fe tablets had better outcomes than those who took Fe tablets alone. (Amini & Nurbaety, 2025) Triana et al., Hadisaputro, and Djamil found that supplementation with beet powder and iron was very effective in increasing hemoglobin, hematocrit, and erythrocyte count in pregnant women with anemia. (Triana et al., 2020; Triana & Triana, 2020) A number of studies have reported favorable results of beetroot supplementation in sports, but the evidence is mixed, with many limited to small sample sizes and varying study durations and administration methods.

To date, no systematic reviews specifically focusing on pregnant women have synthesized evidence on the effect of beetroot supplementation on hemoglobin levels. Thus, this study aimed to systematically review the effect of beetroot supplementation on hemoglobin levels in pregnant women. This study aims to systematically review the effect of beetroot supplementation on hemoglobin levels in pregnant women, thereby supporting Sustainable Development Goal 3 of ensuring healthy lives and promoting well-being for all.

2. Methods

The study adopted a systematic review design in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The review protocol was designed based on the acronym "PICO. The review protocol was created using the acronym "PICO". Pregnant women who are anemic or have low hemoglobin were included in the population. The intervention included beetroot supplementation, beetroot juice supplements, beet powder, beetroot extract, and/or iron supplementation. The

comparison groups received either standard care, iron alone, routine nutritional care, or other forms of nutritional supplementation. Hemoglobin level was the primary outcome. Literature research was conducted to identify keywords for publication searches across the four databases: PubMed, Scopus, Web of Science, and Google Scholar. The following words were used in the search strategy: (“pregnant women” OR pregnancy OR maternal) AND (beetroot OR “Beta vulgaris”) AND (hemoglobin OR anemia OR anemia). Of these, 491 records were retrieved from databases and other sources during the search. Nineteen studies met the inclusion criteria after removing title/abstract duplicates and screening titles. The study selection process was described using PRISMA (see in-text literature).

The inclusion criteria were: Research studies of pregnant women:

1. Research comparing beetroot interventions;
2. Research has reported hemoglobin levels;
3. Experimental, quasi-experimental, or randomized controlled trial designs;
4. Full-text articles available in English or Indonesian. Figure 1. Prisma

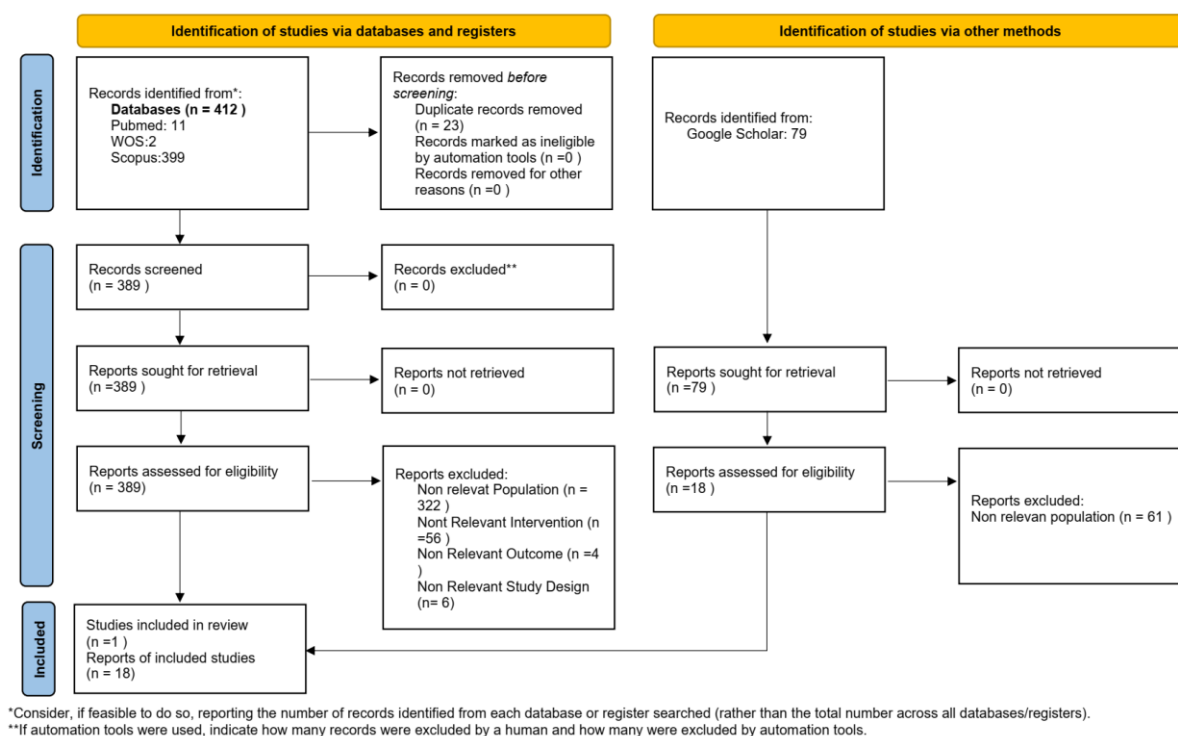


Figure 1. Flow diagram for new systematic reviews which included searches of databases, registers and other sources

Table 1. Quality Assessment Table Joanna Briggs Institute (JBI Checklist)

No	Author	Randomization	Similar Baseline	Similar Treatment Other Than Intervention	Control Group	Multiple Outcome Measurement	Complete Follow-up	Reliable Outcome Measurement	Appropriate Statistical Analysis	Overall Quality
1	(Zahyrah et al., 2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
2	(Wintarsih et al., 2025)	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
3	(Wahab et al., 2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
4	(Novelia et al., 2025).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
5	(Amini & Nurbaety, 2025)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
6	(Triana et al., 2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
7	(Suzanna et al., 2022)	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
8	(Siwi et al., 2025)	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
9	(Wulandari & Susiloningtyas, 2020).	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
10	(Azkiya & Fairuza, 2025)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
11	(Dewita & Henniwati, 2020)	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
12	(Hanum & Rahmah, 2023)	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
13	Istiqomah, W.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
14	(Januarti & Carolin, 2025)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
15	(Zakiyah & Setyaningsih, 2019).	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes	Moderate
16	(Pratiwi & Sulastri, 2025)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
17	(Rifni et al., 2020).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
18	(Sakdah & Idiana, 2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
19	(Yanti, 2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High

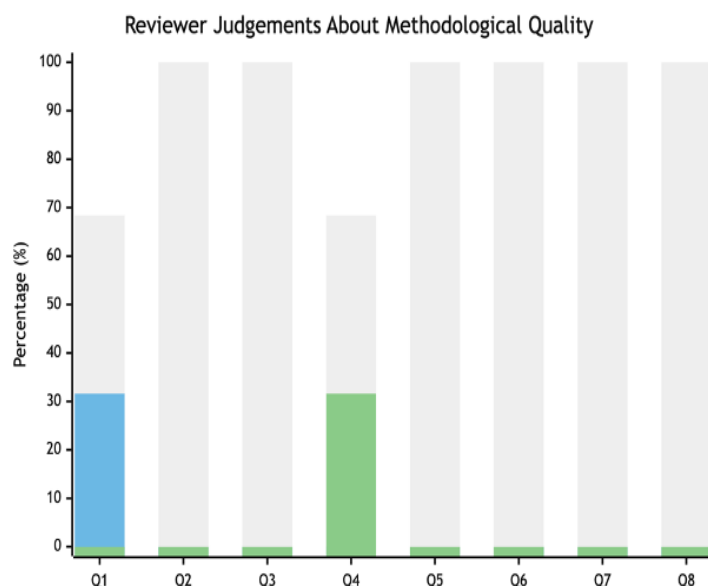


Figure 2. Overall Risk of Bias Graph (JBI Assessment)

3. Results and Discussion

Table 2. Data Extraction Table

No	Author, Year	Country	Study Design	Sample Size	Population	Intervention	Comparison	Duration	Outcomes	Main Findings
1	(Zahrah et al., 2020)	Indonesia	Quasi experimental	30 pregnant women	Pregnant women with anemia	Beetroot juice	Standard care	3 months	Hemoglobin level	Beetroot juice increased Hb level
2	(Wintarsih et al., 2025)	Indonesia	Educational intervention study	150 pregnant women	Pregnant women	Beetroot juice	Routine nutrition education	14 days	Hemoglobin level	Improved hemoglobin after intervention
3	(Wahab et al., 2022)	Indonesia	Experimental study	10 pregnant woman	Third trimester pregnant women	Beetroot juice	Standard care	7 days	Hemoglobin level	Significant increase in Hb
4	(Novelia et al., 2025).	Indonesia	Experimental study	234 pregnant women	Pregnant women	Beetroot juice	Control group	14 days	Hemoglobin level	Beetroot improved Hb levels

No	Author, Year	Country	Study Design	Sample Size	Population	Intervention	Comparison	Duration	Outcomes	Main Findings
5	(Amirni & Nurbaiti, 2025)	Indonesia	Randomized controlled trial	30 pregnant women; 15 control; 15 intervention	Pregnant women with anemia	Fe table t + beet root juice Beet powder + Fe supplement	Fe table t only	7 days	Hemoglobin level	Combination therapy more effective Significant improvement in hematologic parameters
6	(Triana et al., 2020)	Indonesia	Randomized controlled trial	30 pregnant women; 15 control; 15 intervention	Pregnant women with anemia	Beet root juice + Bitm a juice (beet root + honey)	Fe supplement	14 days	Hb, hematocrit, erythrocytes	Hb increased after combined intervention
7	(Suzanna et al., 2022)	Indonesia	Experimental study	21 pregnant women	Pregnant women with anemia	Beet root adm inist ratio n	Comparison group	8 days	Hemoglobin level	Increased Hb level
8	(Siwi et al., 2025)	Indonesia	Experimental study	32 pregnant women; 16 control and 16 intervention	Pregnant women	Beet root and	Standard care	7 days	Hemoglobin level	Significant increase in Hb
9	(Wulandari & Susiloningtyas, 2020).	Indonesia	Experimental study	30 pregnant women; 15 control; 15 intervention	Anemic pregnant women	Beet root and	Control group	14 days	Hemoglobin level	Phytopharmaceuticals
10	(Azkiya & Fairu	Indonesia	Comparativ	32 pregnant women; 16 control and	Pregnant women	Beet root and	Standard treat	14 days	Hemoglobin	

No	Auth or, Year	Co un try	Study Desig n	Sample Size	Popula tion	Inte rven tion	Com pari son	Dur atio n	Out com es	Main Findin gs
	za, 2025)	esi a	e study	16 interventio n	with anemia	date juice	men t		n level	l interve ntion impro ved anemia
11	(Dewi ta & Henniwati, 2020)	Ind on esi a	Quasi experi mental	30 pregnant women; 15 control; 15 interventio n	Pregna nt women with anemia	Red beet juice	Stan dard care	14 Days	He mog lobi n level	Hb level increas ed
12	(Han um & Rahmah, 2023)	Ind on esi a	Exper imental study	14 pregnant women	Pregna nt women	Red beet juice	Cont rol grou p	7 Days	Preventi on of ane mia	Reduc ed anemia risk
13	Istiqomah, W.	Ind on esi a	Comp arative study	18 Pregnant women	Pregna nt women	Beet root and spinach	Com pari son grou p	NR	He mog lobi n level	Hb impro ved significantly
14	(Janu arti & Carolin, 2025)	Ind on esi a	Comp arative study	44 pregnant women; 22control; 22 interventio n	Pregna nt women	Beet root well ness shot	Red gua va shot	14 Days	He mog lobi n level	Beetro ot impro ved Hb levels
15	(Zaki yah & Setyaningsih, 2019).	Ind on esi a	Exper imental study	20 Pregnant women	Pregna nt women with anemia	Beet root juice	Stan dard treat men t	21 Days	He mog lobi n level	Effecti ve for anemia manag ement
16	(Prati wi & Sulastri, 2025)	Ind on esi a	Exper imental study	31 Pregnant women	Pregna nt women with anemia	Beet root juice	Rout ine care	NR	He mog lobi n level	Signifi cant Hb increas e
17	(Rifni et al., 2020).	Ind on	Rand omize d	30 pregnant women; 15 control; 15	Postpar tum mother	Beet root ice	Fe table	7 days	He mat olog	Impro ved hemat

No	Author, Year	Country	Study Design	Sample Size	Population	Intervention	Comparison	Duration	Outcomes	Main Findings
		Indonesia	controlled trial	intervention	s with anemia	cream + Fe tablet	t only		statistical	biological profile
18	(Sakdah & Idiana, 2022)	Indonesia	Experimental study	30 pregnant women; 15 control; 15 intervention	Pregnant women	Beetroot juice + iron tablets	Iron tablets only	10 days	Hemoglobin level	Combination intervention more effective
19	(Yanti, 2024)	Indonesia	Comparative study	30 Pregnant women	Pregnant women	Beetroot	Dragon fruit	14 days	Hemoglobin level	Beetroots increased Hb levels

NR: Not Reported

The studies included in the package were those conducted in pregnant women with anemia or low Hgb levels. The number of participants ranged widely (10-234). Behavioral interventions most often included the administration of beetroot juice; in some studies, beetroot-derived fruit and vegetables were used with iron supplementation, in combination with honey, mung bean extract, or other food products. At Kotaraja PHC, Zahyrah, Dondi, and Wijayanti reported that administering beetroot juice for 3 months significantly increased hemoglobin levels in anemic pregnant women. (Zahyrah, 2020; Zahyrah et al., 2020). When comparing hemoglobin levels among pregnant women, Wintarsih et al. found that hemoglobin levels increased after 14 days of intervention with beetroot juice and nutritional education. Their study paved the way for pregnant Indian women in the third trimester with anemia to also see the benefits of beetroot juice over 7 days, as reported by the researchers Wahab, Setiyawati, and Hadijah. Beetroot juice supplementation resulted in significantly higher hemoglobin concentrations during pregnancy. (Novelia et al., 2025)

The study by Amini and Nurbaety demonstrated that the effect of Fe tablets and beetroot juice on increasing hemoglobin levels was superior to that of Fe tablets alone. Beet powder plus Fe supplementation was found to be highly effective in improving hemoglobin, hematocrit, and erythrocyte levels in pregnant women with anemia. (Triana et al., 2020; Triana & Triana, 2020). Suzanna et al. sought to determine the effectiveness of beetroot juice in combination with mung bean extract and found that it increased hemoglobin levels in women with anemia during pregnancy. (Suzanna et al., 2022)

Siwi et al. (2020) studied Bitma juice, a blend of beetroot and honey, and found a benefit for maternal hemoglobin following the intervention. Siwi's group (2020) found improvement in the hemoglobin of mothers after using Bitma juice, which is made from

beetroot and honey. Both products significantly increased hemoglobin levels in anemic pregnant women. Azkiya and Fairuza found that supplementation with beetroot and date juice improved anemia status among pregnant women.(Azkiya & Fairuza, 2025) Red beet juice has significantly increased the Hb level in an anemic pregnant woman. (Dewita & Henniwati, 2020). Hanum and Rahmah demonstrated that in Paya Cut Village, pregnant women who consumed red beet juice had a reduced risk of developing anemia. (Hanum & Rahmah, 2023). Beetroot, along with spinach, was found to significantly increase hemoglobin levels in pregnant women in the Istiqomah study. (Istiqomah & Fauzi, 2022). Januarti and Carolin compared beetroot and red guava wellness shots and found that the mother's hemoglobin levels improved significantly with the beetroot intervention. (Januarti & Carolin, 2025).

The results of the review are consistent with previous evidence supporting the efficacy of nutrition interventions in improving maternal anemia status. It is hypothesized that food-based interventions may improve adherence due to greater acceptability and perceived safety compared with pharmacological interventions. The methodology quality assessment revealed that the majority of included studies had medium to high methodological quality. However, several studies lacked detailed reporting of randomization, allocation concealment, and blinding procedures.

The other study limitations cited in the included studies included small sample sizes and short intervention durations, which can limit the generalizability of the findings. Moreover, the external validity of most studies could only be applied to the Indonesian population as a whole. However, given these restrictions, the data suggest that using β -carotene as a complementary treatment to improve hemoglobin status in pregnant women with anemia may be warranted.

Conclusions

This systematic review found that beetroot supplementation may improve Hemoglobin levels in pregnant women with anemia. The majority of studies on the effect of beetroot juice, beet powder, or nutritional interventions showed significant increases in maternal hemoglobin concentrations. Beetroot may be a complementary nutritional source for other foods due to its iron, folate, vitamin C, and antioxidant content. The intervention is relatively inexpensive, readily available, and may increase adherence compared with conventional iron supplementation alone. The effects and safety of beetroot supplementation during pregnancy require confirmation through further large-scale, long-term RCTs with standardized intervention protocols.

Conflicts of Interest

The authors declare no conflict of interest.

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