

Effectiveness of Education-Based Interventions and Supplementation in the Management of Anemia in Pregnant Women: A Systematic Literature Review

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ABSTRACT

Anemia during pregnancy remains a global public health problem that seriously affects both mothers and fetuses. Addressing this issue requires intervention strategies that not only rely on iron supplementation but also effective education tailored to the socio-cultural context. This article aims to examine the effectiveness of various education-based and iron/folate supplementation interventions in managing anemia among pregnant women through a systematic literature review approach. The review was conducted using a Systematic Literature Review method on 11 quasi-experimental studies published between 2015 and 2025. Inclusion criteria included studies investigating nutritional education and/or iron/folate supplementation interventions in pregnant women. Data were thematically analyzed to assess intervention types and outcomes achieved, including changes in hemoglobin levels, nutritional knowledge, and supplement adherence. The review indicated that interventions combining theory-based education such as the Health Belief Model, use of visual media, family and community approaches, as well as empowerment of local health cadres consistently improved hemoglobin levels, knowledge, and adherence among pregnant women. The success of interventions was strongly influenced by contextual factors such as local culture, social structure, and health literacy. Contextual, participatory, and community-based education and supplementation interventions proved to be more effective in preventing and managing anemia in pregnant women. A multidimensional strategy involving the health sector, families, and communities needs to be adopted to support program sustainability.

Keywords: pregnancy anemia, nutritional education, iron supplementation, adherence, theory-based intervention, systematic literature review

1. Introduction

Anemia during pregnancy is one of the most common public health problems and has serious impacts on the health of both mother and baby. Anemia is defined as a condition in which the level of hemoglobin in the blood is lower than normal, thereby reducing the blood's ability to carry oxygen to body tissues. In pregnant women, anemia is generally caused by iron deficiency (iron deficiency anemia), but it can also be due to a deficiency of folic acid, vitamin B12, or chronic infections (Priyanto & Irawati, 2020).

The World Health Organization (WHO) estimates that more than 40% of pregnant women worldwide suffer from anemia, and this figure may be much higher in low- and middle-income countries. In South Asia and Sub-Saharan Africa, the prevalence can even reach more than 50%. In Indonesia, the 2022 Indonesia Nutritional Status Survey (SSGI) reported that around 48.9% of pregnant women experience anemia, making it an urgent national health issue (Magfirah, 2023).

The impact of anemia during pregnancy should not be underestimated. In mothers, anemia increases the risk of pregnancy complications such as extreme fatigue, preeclampsia, infections, labor difficulties, and postpartum hemorrhage. In fetuses, anemia can lead to intrauterine growth restriction (IUGR), low birth weight, preterm birth, and even neonatal death. This condition also contributes to the high maternal and infant mortality rates in many developing countries (Pratiwi et al., 2022).

Governments in various countries have responded to this issue with intervention policies, such as providing free iron and folic acid supplements (commonly known as IFA tablets) to pregnant women during antenatal care. However, adherence to supplement consumption remains low. Studies in various regions have shown that lack of understanding, unmanaged side effects, limited social support, and cultural misconceptions are the main barriers to the prevention and management of anemia (Nur Arifah, 2025). In response to the complexity of this issue, a variety of intervention approaches have been developed. These approaches not only focus on supplement distribution but also integrate nutrition education, health promotion based on behavioral theories, and family and community engagement.

Theory-based approaches such as the Health Belief Model (HBM), the Health Promotion Model, and visual media-based interventions such as illustrated guidebooks have been used to enhance the effectiveness of education and strengthen behavioral change among pregnant women in preventing anemia (Neherta & Refnandes, 2024).

However, the effectiveness of each intervention varies significantly depending on socio-cultural context, intervention design, and the level of involvement from families and health workers. Therefore, a systematic review of global interventions is needed to determine which approaches are most effective in improving hemoglobin levels, nutritional knowledge, and adherence to iron supplement consumption.

This literature review aims to identify, compare, and analyze various education- and supplementation-based intervention strategies for addressing anemia in pregnant women. The results of this review are expected to serve as a foundation for designing more contextual, evidence-based, and sustainable intervention programs to reduce the prevalence of anemia in pregnancy across different settings.

2. Literature Review

Health promotion is a set of strategies designed to increase public awareness about the importance of health and to encourage healthier behavioral changes (Green & Kreuter, 2005). The concept of health promotion refers to a broader approach than just treatment; it includes education, empowerment, and interventions aimed at changing lifestyles to improve the health quality of individuals and communities (Nutbeam, 2000). In the context of preventing anemia in pregnant women, health promotion includes counseling on the importance of iron intake, introducing healthy eating patterns, and conducting regular health check-ups to detect anemia at an early stage.

Behavioral change is central to many health promotion programs, including the prevention of anemia. The Theory of Planned Behavior (Ajzen, 1991) posits that attitudes, subjective norms, and perceived behavioral control are key factors influencing a person's intention to change their behavior. In the context of pregnant women, the expected behavioral changes include increased awareness about the importance of iron intake, adherence to medical advice, and regular health check-ups. A successful health promotion program should stimulate the internal motivation of pregnant women to adopt these changes in their daily lives.

Health education models are approaches used to communicate health information to the public. Commonly used models in health promotion include the Health Belief Model (Rosenstock, 1974) and Social Cognitive Theory (Bandura, 1986). The Health Belief Model suggests that an individual's health behavior is influenced by their perception of susceptibility to disease and the benefits of preventive actions. In preventing anemia in pregnant women, this model emphasizes the importance of raising awareness about the risks of anemia and the benefits of prevention through a balanced diet and iron supplement consumption.

Social Cognitive Theory, on the other hand, highlights the importance of the interaction between individuals, behavior, and the social environment in the process of behavioral

change. This means that in the context of health promotion for pregnant women, support from family, peers, and healthcare workers is crucial in encouraging positive behavioral change.

Social and cultural factors play a significant role in the success of health promotion efforts. Limited access to health information, cultural norms, and dietary habits related to pregnancy can influence the behavior of pregnant women in preventing anemia (Khan et al., 2016). Therefore, more contextual and culturally sensitive approaches are necessary in health promotion programs.

The ecological model of health recognizes that the factors influencing an individual's health do not solely originate within the individual but also stem from their social, economic, and cultural environments (Bronfenbrenner, 1979). In the context of health promotion for anemia prevention among pregnant women, this model highlights that beyond individual education and intervention, factors such as access to healthcare services, economic status, and government policies also play a critical role.

3. Methodology

This study employed a Systematic Literature Review (SLR) approach to identify, collect, and analyze various intervention studies focused on addressing anemia in pregnant women through nutrition education and iron/folic acid supplementation (Suhartono, 2017). This approach enables researchers to synthesize a comprehensive overview of primary research findings that have been published, thereby providing an in-depth understanding of the effectiveness of interventions implemented globally.

The data sources for this literature review were obtained from scientific articles published between 2015 and 2025. The search focused on peer-reviewed international journals that discussed maternal health interventions, particularly those related to anemia. Keywords used in the search process included: *anemia in pregnancy*, *nutrition education*, *iron supplementation*, *health belief model*, and *quasi-experimental intervention*. Although the specific databases used are not explicitly mentioned, SLR typically involves searches from databases such as PubMed, Scopus, Web of Science, and Google Scholar (Listiani et al., 2025).

Inclusion criteria were established to ensure that only relevant and methodologically sound studies were included in the analysis. The selected studies had to meet the following criteria:

1. Use a quasi-experimental design, either with a control group or a pre-post test format;
2. Specifically focus on anemia in pregnant women as the primary issue;
3. Include educational interventions such as counseling, health talks, visual media, and/or iron and folic acid supplementation.
4. Be written in English.

Preference was given to studies using a health behavior theory-based approach, such as the Health Belief Model or the Health Promotion Model (Syamsuni & Ahmad, 2024). Conversely, studies that were merely descriptive, opinion pieces or editorials lacking empirical data, and those that did not present specific outcome measures such as hemoglobin levels, knowledge scores, or supplement adherence rates were excluded from this review. Studies that did not target pregnant women as the population were also excluded from the analysis. The journal search employed Boolean operators with the keywords: "Health Promotion" AND "Anemia" AND "Pregnancy". Literature screening and study selection followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines. Below is a diagram of the Literature Review Flow based on the PRISMA framework.

After a rigorous selection process, 11 articles were identified that met all the inclusion criteria. Data from each article were synthesized into a thematic analysis table, containing

key information such as the title and location of the study, author(s), year of publication, study design, form and approach of the intervention, as well as main outcomes such as changes in hemoglobin levels, improvements in nutritional knowledge, and adherence to iron supplement consumption (Widiana et al., 2025).

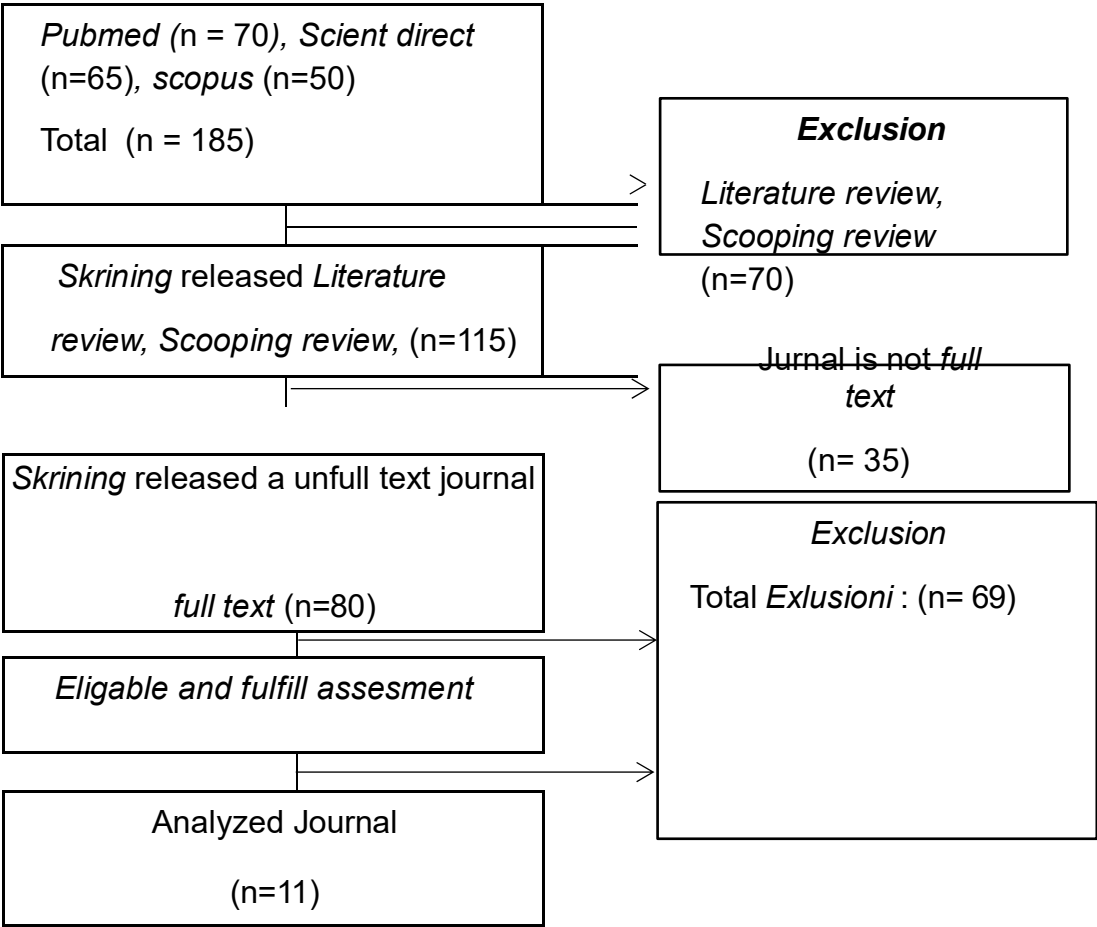


Figure 1. PRISMA framework.

4. Results

Types of Interventions

From the eleven studies analyzed in this review, all employed a quasi-experimental approach, allowing for measurement of changes before and after the intervention within the target group, with or without a control group. This design is commonly chosen due to its flexibility in real-world settings, especially in the context of maternal healthcare in developing countries. The quasi-experimental designs used included pre-test and post-test with control groups, aiming to directly assess the effectiveness of interventions on various indicators such as hemoglobin levels, nutritional knowledge, and adherence to supplement consumption.

The types of interventions implemented across these studies varied in approach and strategy, but all shared a core focus on nutrition education and iron/folic acid supplementation. One prominent approach was the use of visual media, such as illustrated guidebooks, combined with individual counseling sessions. A study from Indonesia by Nahrisah et al. (2020) showed that this combination was effective in improving mothers' understanding of anemia, enhancing dietary intake, and increasing adherence to iron tablet consumption. The illustrated guidebook facilitated visual and practical understanding of the material, which proved particularly helpful in communities with low literacy levels.

Several studies from Iran, Malaysia, and Ethiopia adopted interventions based on the Health Belief Model (HBM), designed to influence individual perceptions of susceptibility to and severity of anemia, as well as the perceived benefits and barriers of preventive actions like supplement intake and dietary improvements. By applying the HBM, these interventions not only delivered information but also shaped beliefs and motivated pregnant women to change behavior. These studies consistently showed improvements in both hemoglobin levels and preventive behaviors toward anemia.

In India, a family-based intervention approach was used to address social and cultural barriers that often affect pregnant women's decisions regarding nutrition and treatment. A study by Singh et al. (2024) found that involving husbands, mothers-in-law, and other family members in education and monitoring of iron tablet consumption significantly improved adherence. This approach highlighted the importance of the social environment in supporting the success of maternal health programs.

Studies from Kenya and Ethiopia developed community-based interventions, where education and health promotion were carried out through community health workers and local leaders. This approach emphasized community empowerment and the dissemination of information through informal, trusted channels. The results showed significant improvements in knowledge and shifts in attitudes toward iron and folic acid supplementation.

Additionally, a study from Thailand combined a balanced diet approach with iron supplementation, demonstrating that holistic interventions targeting dietary behavior and daily nutrient intake can have broader impacts not only improving hemoglobin levels but also enhancing overall maternal health and reducing the risk of preterm birth.

Through this diversity of approaches, it can be concluded that the effectiveness of interventions is heavily influenced by the method of information delivery, social participation, and the cultural relevance of the approach. Interventions that integrate education, behavioral theories, and social support have proven to be more successful in improving health outcomes among pregnant women with anemia.

Effectiveness of Interventions

The review of the eleven analyzed studies shows that education-based and iron/folic acid supplementation interventions have a significant positive impact in addressing anemia among pregnant women. The three main indicators demonstrating the effectiveness of these interventions are: increased hemoglobin levels, improved nutritional knowledge and attitudes, and enhanced adherence to iron tablet consumption.

Most studies reported a significant increase in hemoglobin (Hb) levels among pregnant women following the intervention. For instance, a study conducted in Indonesia by Nahrisah et al. (2020) showed that the use of illustrated guidebooks combined with personal counseling significantly improved hemoglobin levels compared to the control group. Another study from Malaysia (Hassan et al., 2019) that applied the Health Belief Model (HBM) also found that theory-based health education not only improved pregnant women's perception of anemia risk but also contributed to an increase in Hb levels. Similarly, a study in Palestine (Soliman et al., 2010) demonstrated that nutrition interventions based on the Health Promotion Model improved hemoglobin levels by enhancing dietary habits and awareness of anemia risk.

These findings indicate that education designed using behavioral approaches and tailored to local needs can result in clinically relevant physiological changes. The effectiveness of the interventions is also reflected in the increased knowledge of pregnant women regarding iron, folic acid, and the dangers of anemia, which ultimately fostered positive attitudes toward preventive actions. Studies from Iran, Malaysia, and Ethiopia showed that theory-based educational approaches, such as HBM, effectively influenced both the cognitive and emotional perceptions of pregnant women regarding the importance of maintaining good

nutritional status during pregnancy. Education that emphasizes risk perception, benefits of action, and barrier reduction proved to be more effective than purely informative sessions.

Improved nutritional knowledge also led to behavioral changes, such as increased consumption of iron-rich foods, utilization of nutrient-dense local ingredients, and greater interest in self-directed learning. A more positive attitude toward supplement intake also emerged as a result of deeper understanding of its benefits.

Another key aspect of intervention success was the increased adherence to iron tablet consumption. As is widely known, low compliance is a major challenge in iron supplementation programs, often due to side effects, lack of awareness, or reluctance influenced by cultural and social factors. Personalized interventions, such as counseling (Indonesia), family-based approaches (India), and community-based strategies (Kenya and Ethiopia), significantly improved adherence to iron supplementation.

The study by Singh et al. (2024) in India showed that involving family members in education and monitoring efforts was highly effective in increasing social support, thereby fostering a stronger commitment among mothers to follow health recommendations. On the other hand, the community-based approach implemented by Kamau et al. (2019) in Kenya demonstrated that empowering community health workers as agents of change helped bridge information gaps and encouraged mothers to take supplements regularly and as scheduled.

Interventions that combined theory-based education, social engagement, and community empowerment proved successful in overcoming the multidimensional barriers to preventing maternal anemia. These findings underscore the relevance of such approaches and support their broader adoption in maternal and child health programs.

Contextual Factors

Although education and supplementation interventions generally show strong effectiveness, their successful implementation largely depends on contextual factors, including socio-cultural conditions, family support, community norms, and the capacity of local healthcare workers. The review of eleven studies in this literature review indicates that interventions tailored to local contexts and involving the social environment of pregnant women tend to be more successful than standardized, individual-focused approaches.

One of the most prominent contextual factors is the role of the family in supporting maternal health behaviors, as illustrated in the study from India by Singh et al. (2024). In Indian society, maternal health decisions are often heavily influenced by the husband or senior family members, such as the mother-in-law. As a result, educational interventions targeting only pregnant women without involving their family members often face barriers in understanding, decision-making, and compliance. The study showed that when families were involved in the educational process, there was a significant improvement in women's adherence to iron supplementation and in family attitudes toward the importance of nutrition during pregnancy. This underscores that emotional, logistical, and social support from the immediate family is a crucial component of intervention success.

Cultural factors and social structures within the community also play a key role in mediating intervention effectiveness, as seen in the study from Kenya by Kamau et al. (2019). In rural Kenyan areas, traditional beliefs and community norms often shape maternal attitudes toward pregnancy and medical supplementation. In such contexts, community-based education led by local health volunteers or community leaders proved to be more effective than formal education delivered by external health professionals. The involvement of informal leaders who hold social legitimacy within the community increases the acceptance of health information and accelerates behavioral change. Additionally, this approach helps to bridge information gaps caused by low health literacy among pregnant women.

Geographic context and access to healthcare services also emerge as crucial factors. Several studies indicate that in remote areas or regions with limited healthcare infrastructure, the effectiveness of interventions is strongly determined by their ability to reach pregnant women through non-conventional means, such as home visits, pictorial printed materials, or training of local health workers. Studies from Indonesia and Palestine showed that educational materials adapted to local literacy levels—such as illustrated guidebooks—were able to overcome comprehension barriers commonly found in areas with low levels of formal education.

Moreover, social norms related to pregnancy, dietary taboos, and perceptions about supplements also influence intervention outcomes. In some communities, iron tablet consumption is still considered taboo, due to the belief that it causes the fetus to grow too large or leads to delivery complications. In such situations, a culturally sensitive approach combined with evidence-based education becomes essential so that the information provided is not only understood but also accepted and internalized by pregnant women and their families.

Community-oriented and culturally grounded interventions have been shown to be more effective in encouraging sustained health behavior change. These interventions do not merely educate but also empower individuals and communities to become active participants in the solution to maternal anemia. Therefore, the planning and implementation of future intervention programs must seriously consider contextual factors to ensure that interventions are relevant, impactful, and sustainable.

5. Conclusion

The results of this literature review indicate that nutrition education and iron/folic acid supplementation interventions are proven effective in addressing anemia in pregnant women. The success of these interventions is reflected in increased hemoglobin levels, improved nutritional knowledge, and greater adherence to iron tablet consumption. Approaches that combine the Health Belief Model, illustrated educational materials, and involvement of family and community show more significant impacts than conventional interventions.

However, the effectiveness of such interventions is highly influenced by socio-cultural contexts. Interventions designed without considering local values, social structures, and literacy levels tend to be less successful. Therefore, participatory and community-based approaches should be integral to strategies for addressing anemia during pregnancy. Involving husbands, families, and local community leaders has been shown to enhance the acceptance and sustainability of healthy behaviors among pregnant women.

Moving forward, it is recommended that anemia intervention programs be integrated across sectors, involving education, social development, and community empowerment. Contextual, theory-based education, equitable distribution of supplements, and training of local health workers are critical components that need to be strengthened. Furthermore, long-term program evaluation and research are necessary to ensure that interventions remain effective, sustainable, and responsive to evolving community dynamics.

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