

Literature Review: The Effect of Knowledge and Communication, Information, and Education (CIE) on the Incidence of Anemia in Pregnant Women

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Article Info	Abstract
Article History Submitted, 2026-05-11 Accepted, 2026-05-19 Published, 2026-06-30 Keywords: Anemia, pregnant women, knowledge, CIE, health education	Anemia among pregnant women remains a major global public health problem associated with adverse maternal and neonatal outcomes. In addition to biological determinants, maternal knowledge and Communication, Information, and Education (CIE) interventions are considered important factors influencing preventive health behaviors. This literature review aimed to analyze the influence of maternal knowledge and CIE on anemia among pregnant women. Articles were retrieved from PubMed, Google Scholar, and ScienceDirect, covering publications from 2017 to 2025. Eligible studies were published in English or Indonesian, available in full text, and examined maternal knowledge and/or CIE related to anemia in pregnancy. Of the 45 articles initially identified, 9 met the inclusion criteria and were included in the final analysis. The reviewed studies consistently showed that inadequate maternal knowledge was associated with a higher risk of anemia. Educational interventions through CIE effectively improved maternal knowledge; however, current evidence remains insufficient to demonstrate that improved knowledge alone directly reduces anemia incidence because nutritional status, adherence to iron supplementation, antenatal care attendance, and socioeconomic factors also contribute substantially. In conclusion, maternal knowledge and CIE play important roles in promoting preventive behaviors against anemia, although stronger evidence is still needed to confirm their direct effect on reducing anemia incidence.

Introduction

Anemia in pregnant women remains a major public health problem worldwide and continues to contribute substantially to maternal and neonatal morbidity and mortality. According to the World Health Organization, anemia during pregnancy is defined as a hemoglobin concentration below 11 g/dL and is commonly associated with deficiencies in iron, folic acid, and vitamin B12. During pregnancy, physiological changes, including plasma volume expansion and increased fetal iron requirements, substantially increase maternal iron demands, making pregnant women particularly vulnerable to anemia when nutritional intake is inadequate (Rahman, 2024; Zhang, 2022). The prevalence of anemia remains especially high in low- and middle-income countries, including many regions in Asia and Africa. Maternal anemia has been associated with adverse pregnancy outcomes, including preterm birth, low birth weight (LBW), impaired fetal growth, postpartum hemorrhage, and increased maternal and neonatal morbidity and mortality (Karami, 2022; Omotayo, 2021; Wahyuni, 2020).

The occurrence of anemia during pregnancy is multifactorial and involves both biological and non-biological determinants. Biological factors include deficiencies in essential micronutrients, infectious diseases, and chronic medical conditions. However, non-biological factors, particularly maternal knowledge, attitudes, and health behaviors, also contribute significantly to anemia prevention and management (Putri, 2022; Sari, 2023; Zhang, 2022). Pregnant women with inadequate knowledge are less likely to adopt appropriate preventive behaviors, including consuming iron-rich foods, adhering to iron (Fe) supplementation, and attending regular antenatal care (ANC) visits, thereby increasing their risk of developing

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anemia (Huda, 2025; Sun, 2022). Previous studies have consistently shown that adherence to iron supplementation and routine ANC attendance are associated with lower anemia prevalence among pregnant women (Putri, 2022; Rismawati, 2018).

To improve maternal knowledge and encourage positive health behaviors, Communication, Information, and Education (CIE) has been widely implemented as a health promotion strategy. CIE aims to enhance individuals' knowledge, awareness, and capacity to adopt healthy behaviors through educational interventions such as counseling, health education sessions, printed educational materials, animated videos, and digital media (Rohmatika, 2023; Zuliyanti, 2020). Several intervention studies have demonstrated that CIE effectively increases pregnant women's knowledge regarding anemia prevention, iron supplementation, balanced nutrition, and the importance of regular ANC attendance. Nevertheless, improvements in knowledge do not always translate directly into reductions in anemia incidence because behavioral changes are influenced by multiple factors, including nutritional status, socioeconomic conditions, family support, and access to healthcare services (Putri, 2022; Utomo, 2023).

Although previous studies have demonstrated the effectiveness of CIE in improving maternal knowledge, evidence regarding its direct impact on reducing anemia among pregnant women remains limited and inconsistent. Furthermore, studies investigating the relationship between maternal knowledge and anemia have reported varying findings, suggesting that knowledge alone may not sufficiently explain anemia occurrence. Therefore, a comprehensive synthesis of the available evidence is needed to clarify the contribution of maternal knowledge and CIE to anemia prevention. Accordingly, this literature review aimed to analyze the influence of maternal knowledge and Communication, Information, and Education (CIE) on the incidence of anemia among pregnant women.

Methods

This study employed a literature review approach aimed at obtaining information regarding the influence of maternal knowledge and Communication, Information, and Education (CIE) on the incidence of anemia in pregnant women. Data sources were obtained from electronic databases, including PubMed, Google Scholar, and ScienceDirect. The inclusion criteria consisted of articles published between 2017 and 2025, written in either Indonesian or English, available in full text, and discussing anemia in pregnant women in relation to knowledge or educational interventions (CIE). The exclusion criteria included articles that were not available in full text, duplicate articles, and those that were not relevant to the study variables. The literature search was conducted using the following keywords: “anemia in pregnant women,” “maternal knowledge of anemia,” “health education anemia pregnancy,” “CIE anemia,” and “risk factors of anemia in pregnancy.” The initial search yielded 45 articles. During the screening process, 15 articles were excluded because their full-text versions could not be accessed through the databases used in this review. Consequently, these studies could not be assessed for eligibility and methodological quality and were therefore excluded, leaving 30 articles for further screening. In the eligibility stage, 21 articles were further excluded because they did not match the research topic, did not address the variables of knowledge and CIE, or were duplicates. As a result, a total of nine articles met the inclusion criteria and were included in this literature review.

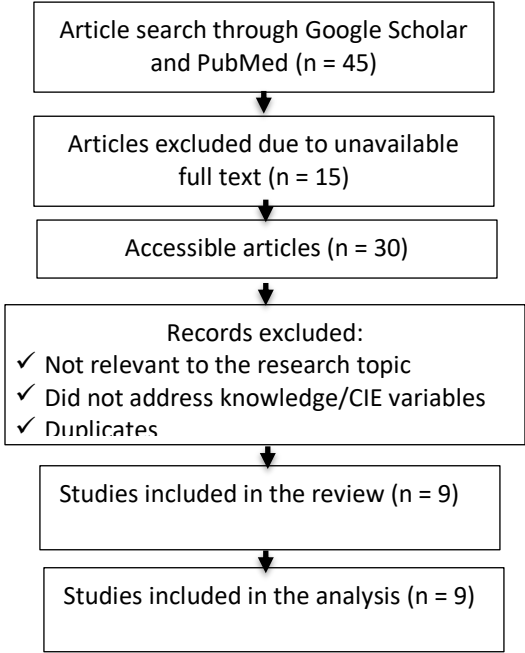


Figure 1. Literature Selection Flow Diagram

Results and Discussion

Based on the literature screening and selection process, nine studies met the inclusion criteria and were included in this review. The included studies comprised various research designs, including cross-sectional, observational, experimental studies, as well as systematic reviews and meta-analyses. These studies were analyzed to explore the relationship between maternal knowledge, Communication, Information, and Education (CIE) interventions, and the incidence of anemia among pregnant women.

Table 1. Results of Journal Analysis

No	Research	Method	Results
1.	Maternal Anemia and Pregnancy Outcomes – Rahman et al., 2024, Public Health Nutrition, Vol. 27(1)	Systematic review and meta-analysis collecting articles from multiple international databases. Article selection was conducted using inclusion and exclusion criteria, and data were analyzed using statistical meta-analysis to examine the relationship between anemia and pregnancy outcomes.	Anemia increases the risk of preterm birth, low birth weight (LBW), and maternal and neonatal morbidity and mortality.
2.	The Effect of Maternal Anemia on Pregnancy Outcomes – Smith et al., 2018, Journal of Obstetrics and Gynaecology, Vol. 38(5)	Observational study with a cohort/analytical design. Hemoglobin (Hb) levels were measured through laboratory examination and followed to assess pregnancy outcomes. Statistical analysis was performed to determine the association between anemia and complications.	Pregnant women with low Hb levels have a higher risk of pregnancy complications.
3.	Factors Associated with Anemia in Pregnant Women – Sari et al., 2023, HIGEIA Journal, Vol. 7(2)	Cross-sectional design involving pregnant women. Knowledge data were collected using questionnaires, while anemia status was determined through Hb examination. Analysis was conducted using chi-square test.	Low knowledge increases the risk of anemia.
4.	Factors Related to the Incidence of Anemia in Pregnant Women – Putri et al., 2022, Journal of Public Health, Vol. 10(2)	Cross-sectional study using interviews, questionnaires, and medical records. Variables included iron (Fe) supplementation, nutritional status, and antenatal care (ANC) visits. Analysis used chi-square and regression tests.	Compliance with Fe supplementation and ANC visits is associated with anemia.
5.	Education on Anemia Prevention in Pregnant Women – Wahyuni et al., 2020, Midwifery Journal, Vol. 12(1)	Experimental study with pre-test and post-test design. Pregnant women received educational intervention (CIE). Knowledge was measured before and after intervention using questionnaires. Data were analyzed using paired t-test.	Education significantly improves knowledge.
6	Nutritional Factors for Anemia in Pregnancy – Zhang et al., 2022, Frontiers in Public Health, Vol. 10	Systematic review using PRISMA method. Articles were collected from multiple databases and analyzed descriptively to identify risk factors of anemia.	Nutritional and social factors influence anemia.
7	Global Prevalence of Anemia in Pregnant Women – Karami et al., 2022, Maternal and Child Health Journal, Vol. 26(10)	Systematic review and meta-analysis of global studies. Statistical analysis was conducted to determine anemia prevalence and its association with pregnancy complications.	The prevalence of anemia remains high globally.
8	Prevalence and Prevention of Iron Deficiency Anemia in Pregnancy in Indonesia – Stevens et al, 2023, Medical and Health Science Journal, Vol. 7(2)	Systematic review using national and international articles. Selection based on inclusion and exclusion criteria, followed by descriptive analysis.	Anemia prevalence in Indonesia is high and requires intervention.
9	The Prevalence of Anemia among Pregnant Women – MDPI, 2022, Nutrients, Vol. 14(15)	Systematic review and meta-analysis with large sample sizes across multiple countries. Statistical analysis was used to determine prevalence and risk factors.	Anemia is influenced by nutritional and social factors.

Based on the analysis of the nine selected articles presented in Table 1, anemia in pregnant women remains a significant and multifactorial public health problem, with substantial impacts on both maternal and fetal health. The findings indicate that anemia is not only associated with biological conditions but is also influenced by behavioral and social determinants. Rahman et al. (2024) reported that anemia in pregnancy is associated with an increased risk of preterm birth, low birth weight (LBW), and higher maternal and neonatal morbidity and mortality. This condition occurs due to impaired oxygen transport capacity resulting from low hemoglobin levels, which subsequently affects fetal growth and placental function (Rahman et al., 2024).

This clinical pathway is further strengthened by Smith et al. (2018), who demonstrated through a cohort analytical design that pregnant women with low hemoglobin levels have a significantly higher risk of developing pregnancy complications compared to those with normal Hb levels. The inclusion of this study is important because, although it does not examine knowledge or educational interventions, it provides strong clinical and epidemiological evidence that anemia has measurable adverse pregnancy outcomes. Therefore, Smith et al. (2018) serves as a foundational reference that justifies the importance of anemia prevention in pregnancy.

In addition, global evidence by Karami et al. (2022) indicates that the prevalence of anemia among pregnant women remains high across various countries, particularly in developing regions. This persistent burden reflects that anemia is still inadequately controlled and requires comprehensive and sustainable prevention strategies (Karami et al., 2022). From a risk factor perspective, maternal knowledge is identified as an important determinant. Sari et al. (2023) found a significant relationship between knowledge level and anemia incidence, where pregnant women with lower knowledge were more likely to experience anemia. This is related to insufficient understanding of iron intake, balanced nutrition, and adherence to iron (Fe) supplementation. Adequate knowledge contributes to the formation of positive health behavior and supports independent prevention practices among pregnant women (Sari et al., 2023).

These findings are further supported by Putri et al. (2022), who demonstrated that adherence to iron supplementation and regular antenatal care (ANC) visits are significantly associated with the incidence of anemia. Non-adherence to iron tablet consumption and irregular ANC visits increase the risk of anemia, indicating that behavioral compliance plays a crucial role in prevention. In efforts to improve maternal knowledge and behavior, Communication, Information, and Education (CIE/IEC) interventions are essential. However, Wahyuni et al. (2020) not only report the effectiveness of education in general, but also specify the IEC methods used, namely structured counseling, leaflet-based education, and audiovisual/video media. Counseling enables interactive two-way communication, leaflets provide repeated written reinforcement, while video-based education enhances visual and auditory understanding, improving retention of information. The combination of these IEC methods significantly improves maternal knowledge regarding anemia, its causes, and prevention strategies (Wahyuni et al., 2020).

However, increased knowledge does not necessarily lead to an immediate reduction in anemia incidence, as behavior change is influenced by multiple factors, including family support, socioeconomic conditions, and access to healthcare services. Furthermore, Zhang et al. (2022) revealed that anemia in pregnant women is influenced by multiple factors such as iron deficiency, folic acid deficiency, nutritional status, and socioeconomic conditions, with nutritional factors identified as the primary contributors. This indicates that interventions focusing solely on knowledge improvement without addressing nutritional status may not yield optimal outcomes (Zhang et al., 2022).

This is further supported by Stevens et al. (2023), who reported that the prevalence of anemia in Indonesia remains high and requires a more comprehensive approach, including improved access to nutritious food, strengthened antenatal services, and continuous health education interventions. It is important to note that in Table 1, this article is correctly attributed to Stevens et al. (2023), while “MHS Journal” refers only to the journal name (Medical and Health Science Journal), not the author. This correction ensures consistency between the narrative and the synthesis table.

Overall, the findings of the reviewed studies indicate that anemia in pregnant women is a complex condition influenced by biological, behavioral, and social factors. Maternal knowledge and CIE/IEC interventions play important roles in improving awareness and promoting healthy behavior; however, these factors alone are not sufficient to reduce anemia incidence. Therefore, a comprehensive and integrated approach is required, including strengthening maternal knowledge through effective IEC strategies, improving nutritional intake, enhancing adherence to iron supplementation, and ensuring accessible and continuous antenatal care services.

Conclusion and Suggestions

Based on the findings of this literature review involving nine selected articles, it can be concluded that maternal knowledge is associated with the incidence of anemia in pregnant

women. Lower levels of knowledge are consistently linked to a higher risk of anemia, whereas adequate knowledge contributes to the formation of positive health behaviors, including adherence to iron supplementation, appropriate dietary intake, and regular antenatal care (ANC) attendance. Communication, Information, and Education (CIE/IEC) interventions have been shown to be effective in improving maternal knowledge; however, their impact on anemia is predominantly indirect, as most studies focus on behavioral outcomes rather than physiological outcomes such as hemoglobin (Hb) levels. Anemia in pregnancy remains a multifactorial condition influenced by nutritional status, socioeconomic factors, and access to healthcare services, indicating that knowledge improvement alone is not sufficient to directly reduce anemia incidence. Importantly, this literature review identifies a gap in evidence regarding the direct effect of IEC interventions on hemoglobin (Hb) levels in pregnant women, as existing studies primarily evaluate knowledge and behavioral changes rather than clinical outcomes.

Therefore, for healthcare services, Communication, Information, and Education (CIE/IEC) interventions should be implemented in a more structured and outcome-oriented manner by integrating health education with clinical monitoring. IEC delivery should be linked with routine hemoglobin (Hb) screening so that pregnant women with low Hb levels receive targeted counseling and individualized follow-up, particularly regarding adherence to iron supplementation. Standardization of IEC materials within antenatal care services is also necessary to ensure consistency of anemia prevention messages and to strengthen the effectiveness of education. For pregnant women, it is recommended to not only increase knowledge but also consistently apply preventive behaviors such as regular iron tablet consumption, improved dietary iron intake, and adherence to ANC visits, with greater awareness of hemoglobin status as an important indicator of maternal health. For future research, studies should focus on primary analytical designs or systematic reviews that specifically examine the direct effect of CIE/IEC interventions on hemoglobin (Hb) levels in pregnant women. Considering the identified research gap, future studies need to move beyond knowledge and behavioral outcomes and measure objective clinical outcomes such as changes in Hb levels before and after IEC interventions, using stronger designs such as randomized controlled trials (RCTs) or longitudinal cohort studies to establish causal relationships.

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