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Review Article

Effectiveness of health belief model-based prenatal education on anemia prevention behaviors among pregnant women: A systematic review

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Abstract

Background: Anemia during pregnancy remains a major public health concern because it contributes to adverse maternal and fetal outcomes and is strongly influenced by modifiable health behaviors. Prenatal education grounded in behavioral theory has gained increasing attention as a strategy to improve preventive practices, particularly in primary care and community settings. The Health Belief Model offers a relevant framework because it addresses women's perceptions of risk, benefits, barriers, and cues to action related to anemia prevention.
Objective: This systematic review aimed to evaluate the effectiveness of Health Belief Model-based prenatal education on anemia prevention behaviors among pregnant women in community health centers and other primary care settings.
Methods: This study applied a systematic review design. Literature searches were conducted across major electronic databases using combinations of terms related to the Health Belief Model, prenatal education, pregnant women, anemia, iron supplementation, hemoglobin, and primary health care. The main outcomes were hemoglobin level, anemia prevalence, iron-folic acid supplementation adherence, dietary intake, and behavioral determinants. Data were extracted using a structured form and synthesized narratively.
Results: Eight studies were included in the final synthesis. The findings consistently showed that Health Belief Model-based or theory-based prenatal education improved anemia prevention behaviors and related health outcomes. The strongest effects were observed in iron-folic acid supplementation adherence, hemoglobin improvement, anemia reduction, and healthier dietary practices. Several studies also reported gains in maternal knowledge, attitudes, and selected Health Belief Model constructs, especially perceived susceptibility and cues to action. Interventions that combined counseling with educational media, reminder systems, or repeated follow-up produced more consistent benefits across settings.
Conclusion: Health Belief Model-based prenatal education appears to be an effective strategy for improving anemia prevention behaviors among pregnant women in community and primary care settings. Integrating theory-based educational interventions into routine antenatal services may strengthen maternal anemia prevention and support better pregnancy outcomes.

Background

Anemia in pregnancy remains a major maternal health problem because it increases the risk of adverse maternal and fetal outcomes during the antenatal period and around childbirth (Igweonu & Onyeneho, 2019; Pattanaik, 2025). Pregnant women often experience barriers in preventing anemia because they have limited knowledge, inconsistent dietary practices, and poor adherence to iron–folic acid supplementation during pregnancy (Triharini et al., 2023; Anggaraini & Lestari, 2025). Health services therefore require effective educational strategies because routine information delivery often fails to produce sustained preventive behavior among pregnant women (Dewidar et al., 2023; Engidaw et al., 2025). Community health centers hold a strategic role in this context because they provide the first level of maternal care and repeated contact with pregnant women throughout pregnancy (Nahrisah et al., 2020; Yuliana, 2025). Prenatal care programs consequently need behavior-oriented interventions because anemia prevention depends not only on treatment access but also on women's daily decisions regarding diet, supplementation, and self-care (Anato & Reshid, 2025; Wakwoya et al., 2023).

Behavioral theories offer a strong framework for prenatal education because they explain how individual beliefs shape health actions during pregnancy (Araban et al., 2017; Triharini et al., 2023). The Health Belief Model specifically explains preventive behavior through perceived

susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy in a health context (Yari et al., 2024; Gutteres et al., 2026). This model has shown relevance in maternal and family health because belief-based interventions can improve readiness to adopt protective behaviors and reduce resistance to recommended practices (Amita et al., 2026; Astriana et al., 2025). In pregnancy care, these constructs are important because women must recognize the risk of anemia, value the benefits of prevention, and overcome barriers to iron intake and healthy nutrition (Triharini et al., 2023; Araban et al., 2017). Theoretical guidance is therefore necessary because educational content without a behavioral framework may improve knowledge but may not consistently change preventive practices (Khani Jeihooni et al., 2021; Dewidar et al., 2023).

Previous intervention studies have reported promising results because theory-based and nutrition-focused education improved maternal knowledge, supplementation compliance, hemoglobin levels, and related pregnancy outcomes (Abd Rahman et al., 2022; Wakwoya et al., 2023). Quasi-experimental and randomized studies further demonstrated that nutrition education and counseling reduced anemia and strengthened adherence to recommended antenatal practices among pregnant women (Nahrisah et al., 2020; Anato & Reshid, 2025). Other evidence also showed that theory-based education during pregnancy improved nutritional behavior and supported favorable birth-related outcomes in community settings (Tsegaye et al., 2023; Beressa et al., 2025). Systematic reviews additionally confirmed that nutrition counseling can improve behavioral, nutritional, and health outcomes among pregnant women in low- and middle-income countries (Dewidar et al., 2023; Chanie et al., 2025). Meta-analytic evidence also indicated that education during pregnancy can strengthen iron–folic acid supplementation compliance and contribute to anemia reduction across diverse settings (Engidaw et al., 2025; Teede et al., 2022).

Although many studies have examined prenatal education, the available evidence remains fragmented because interventions vary in theoretical basis, delivery format, and measured outcomes (Dewidar et al., 2023; Chanie et al., 2025). Several reviews have focused on general nutrition counseling, gestational weight gain, childbirth fear, exercise, or other antenatal issues rather than specifically on anemia prevention behaviors grounded in the Health Belief Model (Teede et al., 2022; Karaçam et al., 2026; Dong et al., 2026). Existing studies on anemia prevention also often emphasize hemoglobin improvement or supplementation adherence without synthesizing how HBM-based prenatal education influences broader preventive behaviors in community antenatal settings (Abd Rahman et al., 2022; Wakwoya et al., 2023). Evidence from related HBM applications in other health areas suggests that belief-based education can effectively promote preventive behavior, yet the transferability of this mechanism to anemia prevention during pregnancy still requires focused synthesis (Yari et al., 2024; Astriana et al., 2025). A systematic review is therefore important because it can integrate current findings, identify patterns of effectiveness, and clarify the contribution of HBM-based prenatal education in community health centers (Cardona-Arias, 2022; Gutteres et al., 2026).

This review also carries practical significance because community health centers need evidence-based educational models that are feasible, structured, and responsive to pregnant women's behavioral determinants (Nahrisah et al., 2020; Angraeni et al., 2025). Health workers can use theory-driven education more effectively because HBM constructs allow them to tailor messages according to women's perceived risk, motivation, and barriers to anemia prevention (Araban et al., 2017; Triharini et al., 2023). The review may also support policy and program development because antenatal care guidelines increasingly emphasize comprehensive prenatal support that improves maternal behaviors and pregnancy outcomes (Wilson et al., 2026; Teede et al., 2022). For low- and middle-income settings, this evidence is particularly relevant because educational interventions often represent scalable and affordable strategies for strengthening maternal care quality (Dewidar et al., 2023; Engidaw et al., 2025). By synthesizing the available studies, the review can help clinicians and researchers select intervention components that have the greatest potential to improve anemia prevention behavior among pregnant women (Beressa et al., 2025; Abd Rahman et al., 2022).

Based on this rationale, the present study aims to systematically review the effectiveness of Health Belief Model-based prenatal education on anemia prevention behaviors among pregnant women in community health centers.

Methods

Study Design

This study employed a systematic review design to examine the effectiveness of Health Belief Model-based prenatal education on anemia prevention behaviors among pregnant women attending community health centers and other primary care settings. The systematic review design was selected because it enables the structured identification, appraisal, and synthesis of empirical evidence from intervention studies conducted across different contexts, thereby providing a comprehensive understanding of how theory-based prenatal education influences behavioral and health-related outcomes in pregnancy. This approach was considered appropriate because the topic involves a complex intervention that may vary in delivery format, educational content, duration, and outcome measurement across studies. To ensure transparency, methodological rigor, and reproducibility, the review process was designed in accordance with the PRISMA 2020 guideline, which is the reporting standard recommended within the EQUATOR Network for systematic reviews and meta-analyses. The use of PRISMA 2020 strengthened the methodological structure of the review by guiding the reporting of literature identification, screening, eligibility assessment, and inclusion procedures in a clear and replicable manner. In this review, the systematic design also allowed the authors to integrate evidence from both randomized and non-randomized intervention studies, which was important for capturing the breadth of available evidence on prenatal educational interventions in community-based maternal health services.

Research Question

The review was guided by a focused research question formulated to determine whether prenatal education based on the Health Belief Model is effective in improving anemia prevention behaviors among pregnant women in community health center settings. More specifically, the review sought to assess whether such interventions improved adherence to iron supplementation, increased dietary intake of iron-rich foods, enhanced hemoglobin status, reduced anemia prevalence, and promoted positive attitudes and behaviors related to anemia prevention during pregnancy. The question was developed from the recognition that anemia prevention in pregnancy is strongly influenced by behavioral determinants, including perceived susceptibility, perceived severity, perceived benefits, and perceived barriers, which are core constructs of the Health Belief Model. Because primary care and community health center environments serve as key platforms for antenatal education, the review also aimed to determine whether theory-based education delivered in these settings produced measurable behavioral and clinical benefits. The research question therefore focused not only on whether prenatal education worked, but also on whether an HBM-based educational framework offered a meaningful contribution to preventive maternal health behavior in routine community-based antenatal services.

Inclusion and Exclusion Criteria

The review included studies conducted in primary care and community-based maternal health settings, such as community health centers, government clinics, and rural or urban community antenatal care services. The target population consisted of pregnant women in the first, second, or third trimester who received educational interventions grounded in behavioral theory, with particular emphasis on the Health Belief Model. Only randomized controlled trials and quasi-experimental studies were included because these designs provide stronger evidence for intervention effectiveness than descriptive or purely observational designs. Eligible studies were required to evaluate outcomes directly related to anemia prevention, including adherence to iron supplementation, dietary intake of iron-rich foods, hemoglobin level, and anemia prevalence. In addition to these primary outcomes, the review also considered secondary outcomes

such as changes in attitudes toward anemia prevention, reductions in anxiety related to anemia, and improvements in maternal quality of life when these outcomes were reported. The inclusion criteria were further narrowed to studies involving pregnant women with singleton pregnancies, women aged 18 to 40 years, and those without serious medical complications such as hypertension or gestational diabetes, because these factors could substantially influence both intervention delivery and pregnancy outcomes. Studies were excluded if they did not involve an educational intervention, did not apply a theory-based framework, used purely observational methods, or were review articles rather than primary empirical studies. Protocol papers and mixed-methods studies that did not provide extractable intervention effectiveness data consistent with the review objectives were also excluded from the final synthesis.

Search Strategy

The literature search was conducted systematically across several electronic databases to identify relevant studies on prenatal education, the Health Belief Model, and anemia prevention in pregnancy. The search strategy was developed using a combination of controlled vocabulary terms and free-text keywords connected through Boolean operators in order to maximize sensitivity while maintaining conceptual relevance. The main search terms included combinations of "Health Belief Model" OR "theory-based education" AND "pregnant women" AND "anemia" OR "iron supplementation" OR "hemoglobin" AND "primary health care" OR "community health center." The databases reported in the review materials included PubMed, Scopus, ProQuest, Sage Journal, and Oxford Academic, while the study selection process also referred to searches from PubMed, ClinicalKey, ScienceDirect, and ProQuest. Taken together, these sources reflect a broad database strategy aimed at identifying intervention studies from both medical and multidisciplinary literature. The search was limited to articles published between 2015 and 2025 in the English language, and only studies with accessible full text were considered eligible for screening. This time restriction was justified by the intention to capture contemporary evidence on theory-based prenatal education while maintaining relevance to current antenatal care practices and behavioral intervention approaches. The structured and database-based search strategy enhanced the comprehensiveness of the review and reduced the likelihood that relevant intervention studies were missed during the identification stage.

Study Selection Process

The study selection process followed a staged and systematic procedure based on the PRISMA 2020 framework. After the initial database search, a total of 1,075 records were identified from the selected electronic sources. At the first stage, duplicate records and clearly ineligible publications were removed, and 715 articles were excluded because they did not meet the predetermined inclusion criteria. The remaining 360 articles proceeded to title and abstract screening, during which the reviewers examined their relevance to the research objective, study design, target population, and intervention characteristics. From this stage, 192 articles were excluded because they did not align with the focus of the review. Articles that passed the initial screening were then retrieved for full-text assessment, and 10 studies were examined in depth to determine methodological and conceptual eligibility. During this full-text review, 2 articles were excluded, including one mixed-methods study and several protocol papers that did not provide outcome data appropriate for effectiveness synthesis. After all screening and eligibility steps were completed, 8 studies were included in the final systematic review. To reduce selection bias, the screening and eligibility assessment processes were conducted by two independent reviewers working in parallel, and disagreements were resolved through discussion and consensus. This dual-reviewer process strengthened the credibility of the final study set and improved consistency in the application of inclusion and exclusion criteria (See Figure 1).

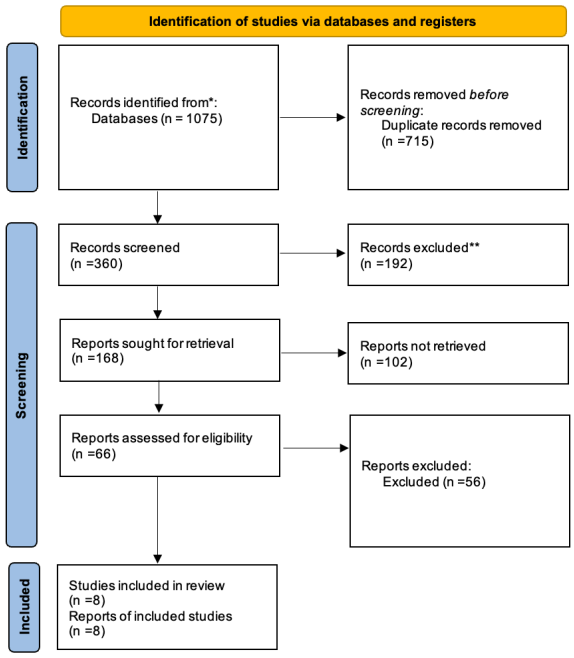

Figure 1. PRISMA flowchart of the article selection process in a systematic review

Quality Appraisal

The methodological quality of the included studies was assessed to determine the trustworthiness of the evidence and to identify the extent to which bias may have influenced reported outcomes. Because the review included both randomized controlled trials and quasi-experimental studies, different appraisal tools were applied according to study design. For randomized controlled trials, the review used the Risk of Bias 2 (RoB 2) tool, which evaluates bias across domains such as randomization procedures, deviations from intended interventions, missing outcome data, outcome measurement, and selection of the reported result. For quasi-experimental studies, the Joanna Briggs Institute Critical Appraisal Checklist for Quasi-Experimental Studies was used to assess methodological rigor, including the clarity of cause-and-effect relationships, similarity of participants, reliability of outcome measurement, completeness of follow-up, and appropriateness of statistical analysis. The use of design-specific appraisal tools was justified because the methodological threats in randomized and non-randomized studies are not identical and therefore require different criteria for accurate evaluation. In addition to study-level appraisal, the review materials indicated that publication bias would be assessed using Egger's test. However, because the final review included only a small number of studies and did not proceed to quantitative meta-analysis, the interpretation of publication bias should be approached with caution. Overall, the quality appraisal process was included to strengthen the validity of the review conclusions, to support critical interpretation of the evidence base, and to distinguish more robust findings from those potentially affected by methodological limitations.

Data Extraction and Synthesis

Data extraction was performed using a structured extraction form developed to ensure consistency and completeness in recording study characteristics and outcomes across all included articles. The extraction form captured key information including the author, year of publication, study design, sample size, participant characteristics, intervention components, duration of intervention, measurement instruments, and primary and secondary outcomes. The review also documented the instruments used in the primary studies, such as questionnaires based on Health Belief Model constructs, laboratory measurement of hemoglobin levels, pill count methods for assessing iron supplementation adherence, and food recall techniques for evaluating iron intake. Data extraction was conducted by two reviewers independently in order to minimize individual bias and reduce the risk of transcription or interpretation errors. When discrepancies arose, the reviewers discussed the extracted information until agreement was reached. The synthesis of findings was conducted through narrative synthesis rather than meta-analysis because the included studies demonstrated substantial heterogeneity in study design, intervention delivery, duration, setting, outcome indicators, and measurement approaches. The narrative synthesis therefore focused on comparing patterns of effectiveness across studies, particularly in relation to changes in anemia prevention behavior, adherence to iron supplementation, consumption of iron-rich foods, hemoglobin improvement, and reductions in anemia prevalence in intervention

groups compared with control or comparison groups. In addition, the synthesis paid attention to which HBM constructs appeared to contribute most strongly to behavioral change, thereby allowing a more conceptually meaningful interpretation of intervention effectiveness across the included literature.

Results

Study selection

The database search identified 1,075 records. After the initial screening, 715 records were excluded because they did not meet the predefined eligibility criteria. The remaining 360 records underwent title and abstract screening, and 192 records were removed due to irrelevance to the review objective. Ten full-text articles were then assessed for eligibility. Two studies were excluded at the full-text stage because they did not match the methodological requirements of this review, including mixed-methods and protocol-based publications. Ultimately, eight studies were included in the final synthesis.

Characteristics of included studies

The eight included studies represented diverse geographical contexts, including Malaysia, Ethiopia, Indonesia, Iran, and multi-country low- and middle-income settings. The body of evidence comprised randomized controlled trials, cluster randomized trials, quasi-experimental studies, one correlational study used to explain key behavioral determinants, and one systematic review with meta-analysis. Most primary studies were conducted in antenatal care, community health centers, government clinics, or community-based maternal health programs, which reflected the practical relevance of Health Belief Model-based prenatal education in primary care settings. Sample sizes varied substantially, ranging from 76 to 403 pregnant women in primary studies, while one meta-analysis synthesized evidence from 53 studies involving 13,475 pregnant women. The interventions generally combined HBM-based education with counseling, printed educational materials, digital media, reminder systems, or supplementation support. The main outcomes assessed across studies were hemoglobin level, anemia prevalence, iron-folic acid supplementation adherence, dietary intake of iron-rich foods, knowledge, attitudes, and HBM-related behavioral constructs. Table 1 summarizes the characteristics and main findings of the included studies.

Table 1. Characteristics and main findings of included studies

Study	Country	Objective	Population, sample, and setting	Study design and data collection	Main findings
Abd Rahman et al., 2022	Malaysia	To develop and evaluate the effectiveness of the MyPinkMom program based on the Health Belief Model for anemia prevention education among pregnant women, with hemoglobin as the primary outcome and knowledge, attitudes, and dietary intake as secondary outcomes.	Pregnant women with anemia; 120 participants (60 intervention, 60 control); two government antenatal clinics in Selangor.	Cluster-assigned, single-blinded, two-arm randomized controlled trial. The intervention group received six infographic videos delivered through a messaging application, while the control group received routine counseling. Data were collected using hemoglobin measurement, questionnaires, and assessments of knowledge, dietary behavior, and supplementation-related practices.	The intervention improved hemoglobin level, knowledge, attitudes, and scores related to iron tablet adherence and dietary intake, including iron and vitamin C intake, by week 6. Tannin intake decreased, and hemoglobin changes remained significantly different between groups up to week 12.
Anato and Reshid, 2025	Ethiopia	To assess the effect of HBM-construct-	Pregnant women; endline	Quasi-experimental study conducted over	Anemia prevalence declined significantly

Study	Country	Objective	Population, sample, and setting	Study design and data collection	Main findings
		based nutrition education and iron-folic acid supplementation on hemoglobin level and iron-folic acid supplementation adherence.	sample 193 participants (97 intervention, 96 control); community setting in Butajira town.	three months. The intervention consisted of community-based education and counseling grounded in HBM constructs, combined with six weeks of iron-folic acid supplementation. Adherence was assessed using pill count. Data were analyzed using difference-in-difference and generalized estimating equation models.	in the intervention group from 27.8% to 7.2%. Knowledge scores and supplementation adherence improved significantly. Women in the intervention group were more likely to adhere to iron-folic acid supplementation than controls (OR = 2.26).
Triharini et al., 2023	Indonesia	To analyze the relationship between Health Belief Model constructs and anemia prevention behavior among pregnant women.	104 pregnant women; obstetric outpatient clinic and home visits for women who did not attend the clinic.	Cross-sectional correlational study. Data were collected using questionnaires assessing HBM constructs and anemia prevention behavior.	Perceived susceptibility and cues to action were significantly associated with anemia prevention behavior. Other HBM constructs were not statistically significant. The findings suggest that health education should strengthen susceptibility perception and cues to action.
Nahrisah et al., 2020	Indonesia	To evaluate the effect of HBM-based integrated pictorial handbook education and counseling on hemoglobin, knowledge, iron intake, and iron tablet compliance.	140 pregnant women with anemia (70 intervention, 70 control); two municipalities in Indonesia; antenatal care services.	Quasi-experimental pretest-posttest control group design. The intervention consisted of pictorial handbook education and counseling. Data were collected using hemoglobin measurement, HBM questionnaires, and food records.	Hemoglobin and hematocrit increased significantly ($p < 0.001$). Iron tablet compliance and knowledge scores improved. The intervention showed a strong effect on the frequency of consuming iron-rich foods.
Wakwoya et al., 2023	Ethiopia	To examine the effect of trimester-based HBM-focused intensive nutrition education and counseling on hemoglobin level among pregnant women.	326 pregnant women (163 intervention, 163 control); antenatal care setting in East Shoa.	Cluster randomized controlled trial. The intervention combined HBM-based education, SMS reminders, and leaflets. Data were analyzed using a linear mixed-effects model.	Hemoglobin level increased significantly in the intervention group ($\beta = 0.50$, $p < 0.01$). Anemia prevalence decreased from 14.7% to 9.2%.
Araban et al., 2017	Iran	To test the effectiveness of HBM-based education on iron and folic acid intake among pregnant women.	76 pregnant women in four urban health centers.	Quasi-experimental study. The intervention involved two HBM-based educational sessions. Data were collected using a three-day food record and HBM questionnaires.	Iron and folic acid intake increased significantly after the intervention ($p < 0.05$). HBM construct scores also improved significantly.
Engidaw et al., 2024/2025*	Low- and middle-	To meta-analyze the effects of nutrition education during	53 studies involving 13,475	Systematic review and meta-analysis including randomized controlled	Nutrition education improved iron-folic acid supplementation

Study	Country	Objective	Population, sample, and setting	Study design and data collection	Main findings
	income countries	pregnancy on iron-folic acid supplementation compliance and anemia outcomes.	pregnant women from low- and middle-income countries.	trials and quasi-experimental studies. Outcomes were pooled using odds ratios and standardized or mean difference estimates.	compliance (OR = 2.80), increased hemoglobin by a mean of 0.88 g/dL, and reduced anemia risk by 34%.
Tsegaye et al., 2023	Ethiopia	To evaluate the effect of theory-based nutrition education during pregnancy on maternal and neonatal outcomes.	403 pregnant women; community-based setting across 22 kebeles.	Three-arm quasi-experimental community-based study. The intervention involved home visits, dietary recall, and anthropometric assessment.	Birth weight increased and dietary diversity improved after the intervention, indicating broader benefits of theory-based prenatal education.

Effects on iron-folic acid supplementation adherence

Improved adherence to iron-folic acid supplementation emerged as one of the most consistent behavioral outcomes across the included studies. The Malaysian trial reported higher scores related to iron tablet adherence after the intervention period, alongside parallel improvements in knowledge and dietary behavior. The Ethiopian quasi-experimental study showed that women in the intervention group were significantly more likely to adhere to iron-folic acid supplementation than those in the control group, with an odds ratio of 2.26. The Indonesian handbook-based intervention also reported significant improvement in iron tablet compliance after education and counseling. These findings were strongly supported by the meta-analysis, which found that nutrition education increased adherence to iron-folic acid supplementation with a pooled odds ratio of 2.80. Taken together, the evidence suggests that prenatal education grounded in behavioral theory does not only inform pregnant women about anemia prevention, but also supports sustained compliance with supplementation recommendations.

Effects on dietary behavior and nutritional intake

Several studies demonstrated that the educational interventions improved maternal dietary practices relevant to anemia prevention. The Malaysian intervention increased dietary intake scores related to iron and vitamin C while reducing tannin intake, which is important because tannin may inhibit iron absorption. The Iranian quasi-experimental study found significant post-intervention increases in iron and folic acid intake after two HBM-based educational sessions. The Indonesian pictorial handbook intervention also reported stronger effects on the frequency of consuming iron-rich foods. In Ethiopia, theory-based nutrition education contributed to improved dietary diversity and better pregnancy-related nutritional outcomes. These results indicate that HBM-based prenatal education can translate abstract health beliefs into measurable nutritional behavior change, especially when education is delivered in a structured and context-sensitive format.

Effects on knowledge, attitudes, and HBM constructs

The included studies also suggested that HBM-based prenatal education improves proximal behavioral determinants that may facilitate anemia prevention. The Malaysian trial demonstrated gains in maternal knowledge and attitudes in addition to biological improvements. The Iranian study reported significant improvements in HBM constructs after intervention, suggesting that educational exposure altered the cognitive and motivational basis for nutrition-related behavior. The Indonesian correlational study identified perceived susceptibility and cues to action as the only HBM constructs significantly associated with anemia prevention behavior, while perceived severity, perceived benefits, perceived barriers, and self-efficacy were not statistically significant in that sample. These

findings imply that not all HBM dimensions exert equal influence across settings, and that susceptibility perception and external prompting may be particularly important targets for intervention among pregnant women. Collectively, the evidence indicates that HBM-based prenatal education affects both behavioral outcomes and the underlying belief structures that shape preventive action.

Effects on broader pregnancy-related outcomes

Although anemia prevention was the central focus of this review, some studies also reported broader maternal and neonatal outcomes. The three-arm quasi-experimental study from Ethiopia found that theory-based prenatal nutrition education improved birth weight and dietary diversity, indicating that the benefits of behavioral education may extend beyond maternal anemia indicators. This pattern suggests that effective prenatal education can generate downstream benefits for fetal growth and overall pregnancy outcomes when implemented consistently in community settings. While such findings were less frequently reported than anemia-specific outcomes, they support the wider relevance of theory-based prenatal education within maternal health promotion.

Discussion

This systematic review showed that Health Belief Model-based prenatal education generally improved anemia prevention behaviors among pregnant women in community and primary care settings. The synthesis indicated that the strongest effects appeared in iron-folic acid supplementation adherence, hemoglobin improvement, anemia reduction, and healthier dietary practices. The included studies also showed that educational interventions influenced knowledge, attitudes, and selected behavioral determinants that support preventive action during pregnancy. The overall pattern suggested that theory-informed education produced benefits not only at the cognitive level but also at the clinical and behavioral levels. The review further demonstrated that community health centers and antenatal care services can serve as effective platforms for delivering structured prenatal education. These findings confirm that behaviorally grounded prenatal education has practical relevance for maternal health promotion in diverse settings.

The improvement in hemoglobin level and the reduction in anemia prevalence suggest that HBM-based prenatal education can support measurable biological benefits during pregnancy (Abd Rahman et al., 2022; Wakwoya et al., 2023). The intervention appears to work because education strengthens women's understanding of anemia risk and encourages repeated preventive actions in daily life (Triharini et al., 2023; Yari et al., 2024). This pattern aligns with previous evidence showing that theory-based maternal interventions can translate health messages into improved nutrition-related practices and better physiological outcomes (Araban et al., 2017; Beressa et al., 2025). The present findings also correspond with broader evidence indicating that nutrition counseling in low- and middle-income countries contributes to improved maternal nutritional and health outcomes (Dewidar et al., 2023; Chanie et al., 2025). In this review, the consistency of hemoglobin improvement across several intervention studies indicates that prenatal education should be positioned as an active preventive strategy rather than as a supplementary educational activity only (Engidaw et al., 2025; Anato & Reshid, 2025). This interpretation is important because maternal anemia remains influenced by modifiable factors that can be addressed through repeated, structured education in routine antenatal care (Igweonu & Onyeneho, 2019; Pattanaik, 2025).

The strong effect on iron-folic acid supplementation adherence indicates that educational interventions can modify one of the most critical preventive behaviors in pregnancy (Anato & Reshid, 2025; Engidaw et al., 2025). This result is coherent with the Health Belief Model because women are more likely to comply with supplementation when they perceive anemia as serious, understand the benefits of tablets, and receive cues that reduce

forgetfulness or resistance (Triharini et al., 2023; Gutteres et al., 2026). Educational approaches that combine counseling with reminders, supportive materials, or structured follow-up appear especially effective because they address both cognitive and practical barriers to adherence (Nahrisah et al., 2020; Wakwoya et al., 2023). This mechanism is supported by studies showing that theory-based health education improves preventive compliance in different maternal and family health contexts (Astriana et al., 2025; Amita et al., 2026). The finding also reinforces the argument that adherence is not solely a matter of availability of supplements, but also a function of motivation, understanding, and reinforcement during pregnancy (Khani Jeihooni et al., 2021; Dewidar et al., 2023). Therefore, health workers in community health centers need to integrate behavior-change components into supplementation counseling in order to obtain better preventive outcomes (Yuliana, 2025; Angraeni et al., 2025).

The dietary improvements identified in this review further indicate that prenatal education can influence everyday food choices that support anemia prevention (Araban et al., 2017; Abd Rahman et al., 2022). The increase in iron-rich food intake and the reduction in inhibitory consumption patterns show that women can modify nutrition behavior when educational content is practical and belief-oriented (Nahrisah et al., 2020; Wakwoya et al., 2023). This result is consistent with evidence that nutrition education during pregnancy improves maternal dietary practices and contributes to healthier gestational outcomes (Beressa et al., 2025; Teede et al., 2022). The effect is also theoretically plausible because HBM-based interventions frame food choices as purposeful preventive actions against a recognized health threat (Araban et al., 2017; Yari et al., 2024). In low-resource settings, such behavior change is particularly meaningful because dietary improvement can complement supplementation and strengthen long-term maternal health protection (Dewidar et al., 2023; Engidaw et al., 2025). Thus, prenatal education should include clear, culturally appropriate, and actionable nutritional guidance rather than general dietary advice alone (Darmawati et al., 2020; Cardona-Arias, 2022).

The findings on knowledge, attitudes, and HBM constructs indicate that cognitive change remains an important pathway through which prenatal education influences preventive behavior (Abd Rahman et al., 2022; Araban et al., 2017). The significant role of perceived susceptibility and cues to action suggests that women may act more consistently when they recognize personal vulnerability and receive timely prompts from health workers or educational tools (Triharini et al., 2023; Gutteres et al., 2026). This interpretation is supported by HBM applications in other preventive health topics, where risk perception and triggering mechanisms play a central role in behavior adoption (Yari et al., 2024; Astriana et al., 2025). The present review also suggests that not all HBM constructs contribute equally in every context, which means intervention designers should prioritize the constructs that are most sensitive to local behavioral barriers (Khani Jeihooni et al., 2021; Amita et al., 2026). This nuance is important because educational programs that treat all constructs identically may fail to address the dominant motivational deficits experienced by pregnant women in particular communities (Triharini et al., 2023; Beressa et al., 2025). Accordingly, future prenatal education programs should tailor messages around perceived risk, practical cues, and context-specific obstacles to improve effectiveness (Dewidar et al., 2023; Cardona-Arias, 2022).

The broader pregnancy-related benefits found in some included studies suggest that theory-based prenatal education may generate effects beyond anemia prevention alone (Tsegaye et al., 2023; Beressa et al., 2025). Improvements in birth weight and dietary diversity indicate that maternal behavior change can influence downstream maternal and neonatal outcomes when interventions are delivered consistently throughout pregnancy (Tsegaye et al., 2023; Teede et al., 2022). This broader impact aligns with evidence that antenatal education can improve multiple dimensions of maternal well-being, including emotional readiness and

health-related self-management (Karaçam et al., 2026; Dong et al., 2026). The implication is that HBM-based prenatal education should not be viewed narrowly as a single-topic counseling tool, but rather as part of a comprehensive antenatal promotion strategy (Wilson et al., 2026; Dewidar et al., 2023). When community health centers adopt such a perspective, they can integrate anemia prevention with nutrition, self-care, emotional support, and broader maternal health counseling in one structured program (Pratiwi et al., 2025; Yuliana, 2025). This integration would likely increase program efficiency and relevance in primary care contexts where contact opportunities with pregnant women are limited and highly valuable (Angraeni et al., 2025; Cardona-Arias, 2022).

Despite these promising findings, the evidence base also reveals several methodological and contextual limitations that should be interpreted carefully (Chanie et al., 2025; Engidaw et al., 2025). The included studies varied in design, intervention duration, delivery mode, sample size, and outcome indicators, which limited direct comparability across studies and justified the use of narrative synthesis rather than meta-analysis of all primary studies (Dewidar et al., 2023; Cardona-Arias, 2022). The inclusion of one correlational study also means that part of the discussion informs determinants of behavior rather than intervention effectiveness alone, although this evidence remains useful for interpreting the mechanism of change (Triharini et al., 2023; Gutteres et al., 2026). Most studies were conducted in low- and middle-income settings, which strengthens relevance for community health centers but may limit transferability to health systems with different antenatal care structures (Engidaw et al., 2025; Dewidar et al., 2023). The review also suggests that intervention success may depend on implementation quality, reinforcement intensity, and local cultural adaptation, factors that were not reported equally across all studies (Darmawati et al., 2020; Nahrisah et al., 2020). Therefore, future research should develop more standardized intervention reporting, compare delivery formats, and examine longer follow-up periods to clarify the sustainability of HBM-based prenatal education effects (Beressa et al., 2025; Wilson et al., 2026).

Taken together, the present review supports the strategic use of HBM-based prenatal education in community health centers because the approach addresses both behavioral determinants and practical preventive outcomes during pregnancy (Abd Rahman et al., 2022; Wakwoya et al., 2023). The findings indicate that effective prenatal education should combine theory-based counseling with supportive media, repeated contact, and clear behavioral instructions in order to strengthen adherence and dietary change (Nahrisah et al., 2020; Araban et al., 2017). This recommendation is consistent with evidence that theory-driven education is more likely to produce durable preventive behavior than information delivery without a behavioral framework (Khani Jeihooni et al., 2021; Yari et al., 2024). Community health centers are well positioned to implement such interventions because they provide continuity of antenatal care and regular opportunities for maternal education (Yuliana, 2025; Angraeni et al., 2025). In practice, nurses and midwives should focus educational messages on perceived risk, benefits of prevention, reduction of barriers, and regular cues to action that fit women's daily realities (Triharini et al., 2023; Gutteres et al., 2026). With appropriate adaptation and consistent implementation, HBM-based prenatal education has strong potential to become an evidence-informed component of maternal anemia prevention programs in primary care settings (Engidaw et al., 2025; Dewidar et al., 2023).

Conclusion and Recommendation

This systematic review concludes that Health Belief Model-based prenatal education is an effective approach for improving anemia prevention behaviors among pregnant women in community and primary care settings. The intervention contributes to better hemoglobin outcomes, lower anemia prevalence, stronger adherence to iron-folic acid supplementation, improved dietary behavior, and more favorable cognitive and motivational determinants of prevention. The evidence also shows that educational effectiveness becomes stronger

when the intervention is structured, repeated, and supported by counseling media or reminder systems. Community health centers should therefore integrate theory-based prenatal education into routine antenatal services as a practical strategy for maternal anemia prevention. Future studies should use more standardized outcome measures, stronger comparative designs, and longer follow-up periods to evaluate the sustainability of behavioral change and the scalability of intervention models across different health care contexts.

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References

Abd Rahman, R., Idris, I. B., Md Isa, Z., & Abd Rahman, R. (2022). The effectiveness of a theory-based intervention program for pregnant women with anemia: A randomized control trial. PLOS ONE, 17(12), e0278192. https://doi.org/10.1371/journal.pone.0278192

Amita, D. F., Risdianti, H., Firstania, A., Zaharany, T. A., Rajagukguk, S., Khoirot, R. M., … Pitora, T. (2026). Perceived susceptibility and vaccine hesitancy among mothers in completing basic immunization: A qualitative study. Lentera Perawat, 7(1), 159–168. https://doi.org/10.52235/lp.v7i1.705

Anato, A., & Reshid, M. (2025). Effect of nutrition education and iron-folic acid supplementation on anemia among pregnant women in Ethiopia: a quasi-experimental study. Scientific Reports, 15(1), 3556. https://doi.org/10.1038/s41598-025-87957-x

Anggaraini, N. D., & Lestari, D. (2025). Relationship between knowledge of anemia and attitudes toward adherence to iron supplementation among high school students: A cross-sectional study. Indonesian Journal of Health Services, 2(3), 88-95. https://doi.org/10.63202/ijhs.v2i3.108

Angraeni, D. F. A., Manalu, L. O., & Purwati, P. (2025). Edukasi media leaflet terhadap pengetahuan ibu balita dengan ISPA di Puskesmas Curugkembar Kabupaten Sukabumi. Bakti Nusantara Pengabdian Masyarakat Indonesia, 2(2), 32-38. https://doi.org/10.63202/bnpmi.v2i2.78

Araban, M., Baharzadeh, K., & Karimy, M. (2017). Nutrition modification aimed at enhancing dietary iron and folic acid intake: an application of health belief model in practice. The European Journal of Public Health, ckw238. https://doi.org/10.1093/eurpub/ckw238

Astriana, W., Zahra, T., & Wulandari, P. (2025). Effect of health belief model–based education on the prevention of pathological vaginal discharge: A pre-experimental study. Lentera Perawat, 6(4), 804–812. https://doi.org/10.52235/lp.v6i4.637

Beressa, G., Whiting, S. J., & Belachew, T. (2025). Effect of nutrition education integrating the health belief model and theory of planned behavior during pregnancy on gestational weight gain and birth weight in Southeast Ethiopia using complex analyses. BMC Pregnancy and Childbirth, 25(1), 196. https://doi.org/10.1186/s12884-025-07284-x

Cardona-Arias, J. A. (2022). Systematic Review of Mixed Studies on Malaria in Pregnancy: Individual, Cultural and Socioeconomic Determinants of Its Treatment and Prevention. Tropical Medicine and Infectious Disease, 7(12), 423. https://doi.org/10.3390/tropicalmed7120423

Chanie, S. D., Tilahun, W. M., Menber, Y., Wasihun, Y., Gebreegziabher, Z. A., Andualem, Z., Alemu, A. T., Geddif, A., Kassie, G. G., Mitiku, K. W., Belay, M. A., & Simegn, M. B. (2025). The effect of nutrition education and counseling on the nutritional status of pregnant women in Ethiopia, 2025: a systematic review and meta-analysis. Journal of Health, Population and Nutrition, 44(1), 334. https://doi.org/10.1186/s41043-025-01047-2

Crider, K. S., Williams, J. L., Qi, Y. P., Gutman, J., Yeung, L. F., Mai, C. T., Finkelstein, J. L., Mehta, S., Pons-Duran, C., Menéndez, C., Moraleda, C., Rogers, L. M., Daniels, K., & Green, P. (2022). Folic acid supplementation and malaria susceptibility and severity among people taking antifolate antimalarial drugs in endemic areas. Cochrane Database of Systematic Reviews, 2022(2). https://doi.org/10.1002/14651858.CD014217

Darmawati, D., Siregar, T. N., Kamil, H., & Tahlil, T. (2020). The effectiveness of local wisdom-based counseling to prevent iron deficiency anemia among pregnant women: a protocol of a randomized controlled trial. Belitung Nursing Journal, 6(3), 91–96. https://doi.org/10.33546/bnj.1080

Dewidar, O., John, J., Baqar, A., Madani, M. T., Saad, A., Riddle, A., Ota, E., Kung'u, J. K., Arabi, M., Raut, M. K., Klobodu, S. S., Rowe, S., Hatchard, J., Busch-Hallen, J., Jalal, C., Wuehler, S., & Welch, V. (2023). Effectiveness of nutrition counseling for pregnant women in low- and middle-income countries to improve maternal and infant behavioral, nutritional, and health outcomes: A systematic review. Campbell Systematic Reviews, 19(4). https://doi.org/10.1002/cl2.1361

Dong J, Chi J, Lei EF. Effects of prenatal exercise on prenatal and postpartum depression and anxiety symptoms: A systematic review and network meta-analysis. J Affect Disord. 2026 Jan 15;393(Pt B):120438. doi: 10.1016/j.jad.2025.120438

Engidaw, M. T., Lee, P., Fekadu, G., Mondal, P., & Ahmed, F. (2025). Effect of Nutrition Education During Pregnancy on Iron–Folic Acid Supplementation Compliance and Anemia in Low- and Middle-Income Countries: A Systematic Review and Meta-analysis. Nutrition Reviews, 83(7), e1472–e1487. https://doi.org/10.1093/nutrit/nuae170

Gutteres, D., Luthfa, I., & Setyowati, W. E. (2026). Factors associated with family adherence to tuberculosis preventive therapy based on the health belief model: A systematic review. Lentera Perawat, 7(1), 196–211. https://doi.org/10.52235/lp.v7i1.709

Igweonu, O. U., & Onyeneho, N. G. (2019). Anemia in Pregnancy: Urban–Rural Comparison of Management and Prevention Among Women of Child-Bearing Age in Anambra State, Nigeria. International Quarterly of Community Health Education, 39(3), 155–161. https://doi.org/10.1177/0272684X18819975

Karaçam Z, Ofei P, Uzunoğlu G, Güneş Öztürk G. The effect of prenatal education on the fear of childbirth: A systematic review and meta-analysis. Arch Womens Ment Health. 2026 Feb 10;29(1):37. doi: 10.1007/s00737-025-01635-5.

Karaçam Z, Ofei P, Uzunoğlu G, Güneş Öztürk G. The effect of prenatal education on the fear of childbirth: A systematic review and meta-analysis. Arch Womens Ment Health. 2026 Feb 10;29(1):37. doi: 10.1007/s00737-025-01635-5

Khani Jeihooni, A., Rakhshani, T., Harsini, P. A., & Layeghiasl, M. (2021). Effect of educational program based on theory of planned behavior on promoting nutritional behaviors preventing Anemia in a sample of Iranian pregnant women. BMC Public Health, 21(1), 2198. https://doi.org/10.1186/s12889-021-12270-x

Mulyasari, W., & Muhtar, T. (2022). Pentingnya Pembentukan Karakter pada Peserta Didik Usia Sekolah Dasar. 4(4), 6250–6257.

Nahrisah, P., Somrongthong, R., Viriyautsahakul, N., Viwattanakulvanid, P., & Plianbangchang, S. (2020). Effect of Integrated Pictorial Handbook Education and Counseling on Improving Anemia Status, Knowledge, Food Intake, and Iron Tablet Compliance Among Anemic Pregnant Women in Indonesia: A Quasi-Experimental Study. Journal of Multidisciplinary Healthcare, Volume 13, 43–52. https://doi.org/10.2147/JMDH.S213550

Pattanaik, M. (2025). A cross sectional study on the knowledge attitudes and practices of pregnant women regarding anemia in gajapati district of odisha. Journal of Applied Bioanalysis, 569–579. https://doi.org/10.53555/jab.v11i3.272

Pratiwi, D. S., Armayani, A., & Poddar, R. (2025). The effect of pregnancy exercise on the sleep quality of pregnant women in the third trimester : A pre-experimental study. Journal of Community Nursing and Primary Care, 2(2), 37-42. https://doi.org/10.63202/jcnpc.v2i2.79

Teede, H. J., Bailey, C., Moran, L. J., Bahri Khomami, M., Enticott, J., Ranasinha, S., Rogozińska, E., Skouteris, H., Boyle, J. A., Thangaratinam, S., & Harrison, C. L. (2022). Association of Antenatal Diet and Physical Activity–Based Interventions With Gestational Weight Gain and Pregnancy Outcomes. JAMA Internal Medicine, 182(2), 106. https://doi.org/10.1001/jamainternmed.2021.6373

Triharini, M., Eka Mishbahatul Mar'ah Has, & Gita Nofita. (2023). Determinant factors of anemia in pregnancy based on health belief model: a correlational study. Jurnal Ners, 18(1), 40–46. https://doi.org/10.20473/jn.v18i1.43704

Tsegaye, D., Tamiru, D., & Belachew, T. (2023). Effect of a theory-based nutrition education intervention during pregnancy through male partner involvement on newborns' birth weights in Southwest Ethiopia. A three-arm community based Quasi-Experimental study. PLOS ONE, 18(1), e0280545. https://doi.org/10.1371/journal.pone.0280545

Tuhalauruw, N. E. (2024). Effectiveness of giving red spinach on increasing hemoglobin levels in pregnant women in the second trimester with anemia: A literature review. Indonesian Journal of Health Services, 1(4), 140-148. https://doi.org/10.63202/ijhs.v1i4.43

Vecchiarelli HA, Baglot SL, Black T, Choi EY, Cupo L, Sandberg C, Siron L, Chakravarty MM, Hill MN, Howland JG, Khokhar JY, Tremblay MÈ. Effects of prenatal cannabis exposure on offspring mental health: A focus on the role of the immune system. Neurosci Biobehav Rev. 2026 Feb;181:106488. doi: 10.1016/j.neubiorev.2025.106488.

Wakwoya, E. B., Belachew, T., & Girma, T. (2023). Effect of intensive nutrition education and counseling on hemoglobin level of pregnant women in East Shoa zone, Ethiopia: randomized controlled trial. BMC

Pregnancy and Childbirth, 23(1), 676. https://doi.org/10.1186/s12884-023-05992-w

Walana W, Odai SA, Tamomh AG. Prevalence, risk factors, diagnosis and outcomes of Toxoplasma gondii infection in pregnancy: A review. Parasitol Int. 2026 Feb;110:103143. doi: 10.1016/j.parint.2025.103143

Wilson RD, Monks DT, Sharawi N, Bamber J, Panelli DM, Sauro KM, Shah PS, Muraca GM, Metcalfe A, Wood SL, Jago CA, Daly S, Blake LEA, Macones GA, Caughey AB, Sultan P, Nelson G. Guidelines for antenatal and preoperative care in cesarean delivery: Enhanced Recovery After Surgery Society recommendations (part 1)-2025 update. Am J Obstet Gynecol. 2026 Jan;233(6S):S153-S169. doi: 10.1016/j.ajog.2025.01.014.

Yari, A., Mohseni, S., Ezati Rad, R., Hosseini, Z., Shahabi, N., & Aghamolaei, T. (2024). The Effectiveness of Educational Intervention in Promoting Preventive Behaviors of Dengue Fever in Southern Iran: Applying Health Belief Model (HBM). Health Science Reports, 7(12). https://doi.org/10.1002/hsr2.70198

Yuliana, Y. (2025). Edukasi Cuci Tangan dalam Mencegah Penyebaran Infeksi bagi Pasien dan Keluarga di Puskesmas. Bakti Nusantara Pengabdian Masyarakat Indonesia, 1(1), 23-28. https://doi.org/10.63202/bnpmi.v1i1.11