REVIEW ARTICLE

Antenatal Education in Reducing Risk of Anaemia in Pregnancy: A Scoping Review.

Norazlina Md Jazli[1], Sharifah Shafinaz Sh. Abdullah[1*], Chong Mei Chan[2], Nor Sufaradila Maizura Badrun Sufian @ Ahmad Zaki[1], Aminath Rinzy[3], Jiaqi Zhao[4]

[1]Center for Nursing Studies, Faculty of Health Sciences, Universiti Teknologi MARA, Puncak Alam Campus, Selangor, Malaysia.
[2]Department of Nursing Science, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia.
[3]School of Nursing, Maldives National University, Maldives.
[4]School of Nursing, Jinzhou Medical University, Jinzhou, 121001, China.

Corresponding Author
Sharifah Shafinaz Sh. Abdullah
Center for Nursing Studies, Faculty of Health Sciences, Universiti Teknologi MARA (UiTM), Puncak Alam Campus, Selangor, Malaysia
Email: shasya@uitm.edu.my
DOI: https://doi.org/10.70672/k2148075

Received: 13/04/2026. Revised: 19/05/2026. Accepted: 20/05/2026. Published online: 01/06/2026.

Abstract

Anaemia during pregnancy continues to be a major public health concern worldwide, affecting a substantial proportion of expectant mothers and contributing to adverse maternal and neonatal outcomes. This scoping review explores the role of antenatal education in reducing the risk of anemia by examining the types of educational strategies used, their reported outcomes, and existing gaps in current practice. The review was guided by the Arksey and O'Malley framework and reported in line with PRISMA-ScR recommendations. Relevant experimental studies published between 2000 and 2024 were identified from four electronic databases. Following a rigorous screening process, 11 studies were included. Overall, the findings suggest that antenatal education delivered through approaches such as community-based counseling, digital communication, visual or art-based methods, and home visits can improve maternal knowledge, increase adherence to iron and folic acid supplementation, and raise hemoglobin levels. However, the effectiveness of these interventions appears to vary depending on contextual factors, including cultural background, literacy levels, and the extent to which behavioural theories are applied. In conclusion, while antenatal education shows clear potential in reducing anaemia risk, future interventions should place greater emphasis on theory-driven design, cultural relevance, and long-term evaluation. Digital platforms, in particular, may offer practical opportunities to enhance accessibility and engagement, especially in resource-limited settings.

Keywords: *Anaemia in pregnancy, antenatal education, effectiveness, gestational anaemia, nutritional education.*

Introduction

Anemia during pregnancy continues to represent a substantial global health concern, affecting an estimated 40% of pregnant women and posing serious risks to both maternal and fetal outcomes [1]. It is typically defined as a hemoglobin level below 11 g/dL during pregnancy [2, 3]. Although iron deficiency is recognized as the primary cause, other contributing factors, such as inadequate nutrient intake, infections, and genetic conditions, also play a role [4]. When left unmanaged, anemia can result in adverse outcomes, including preterm delivery, low birth weight, postpartum hemorrhage, and increased risk of maternal and neonatal mortality [5, 6].

In response, global health initiatives such as the Safe Motherhood Initiative (SMI) by the World Health Organization (WHO) have emphasized the need for comprehensive maternal healthcare, particularly through antenatal care (ANC) services [7]. ANC not only supports early identification and management of pregnancy-related risks but also serves as a key platform for delivering health education. This educational component aims to enhance maternal knowledge and encourage positive health behaviours [8]. When such education is provided during pregnancy, it is commonly referred to as antenatal education, with early engagement being particularly important for timely intervention [9].

Previous studies have shown that antenatal education can improve maternal knowledge, dietary behaviour, and adherence to iron–folic acid supplementation [10]. Interventions grounded in behavioural theories, such as the Theory of Planned Behaviour, have been reported to produce more meaningful changes in nutritional practices and may reduce the likelihood of anemia [11]. In addition, community-based and culturally adapted programs appear to be beneficial, particularly in resource-limited settings [12].

However, the effectiveness of antenatal education is not consistent across all contexts. Variations in cultural norms, access to healthcare services, infrastructure, and methods of delivery may influence intervention outcomes [13]. While tailoring educational strategies to women's cultural and socioeconomic backgrounds is often associated with better outcomes, there remains a lack of comprehensive research on how these contextual factors shape effectiveness. For example, a systematic review on culturally adapted community-based education among Black populations with chronic diseases reported some positive outcomes, although the overall evidence remains limited [14]. Similarly, research in other educational contexts has highlighted the influence of structural and cultural factors, yet the application of such insights to antenatal education remains underexplored [15].

Furthermore, practical barriers such as limited access to iron supplements and insufficient follow-up may reduce adherence to recommended interventions. It has been reported that only 56.5% of pregnant women consistently adhere to iron and folic acid supplementation, with accessibility and follow-up identified as key challenges [16]. Therefore, this scoping review aims to map the extent, nature, and characteristics of existing studies to examine the current evidence on the effectiveness of antenatal education interventions for reducing the risk of anaemia in pregnancy, including by identifying commonly used educational approaches, evaluating their reported outcomes, and highlighting existing research gaps.

Materials and methods

This scoping review was undertaken to map and synthesize existing evidence on the role of antenatal education in reducing the risk of anaemia during pregnancy. In addition to examining educational interventions, attention

was also given to how nutritional education is incorporated within antenatal care programs. The review focused on three key areas: identifying the types of educational strategies used, assessing their reported outcomes, and determining gaps that may inform future improvements.

A structured approach was applied based on the five-stage framework introduced by Arksey and O'Malley [17]. To enhance transparency and reporting quality, the review was also guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist [18]. These frameworks supported a systematic process from defining the research question to summarizing the findings.

The literature search was conducted in October 2024 using four electronic databases: PubMed, ScienceDirect, Scopus, and Web of Science via the UiTM Digital Library. These databases were selected for their broad coverage of peer-reviewed research in the health sciences and nursing. A combination of keywords and Boolean operators was used to identify relevant studies. Search terms included "Effectiveness" AND "Antenatal Education" OR "Nutritional Education" AND "Anemia in Pregnancy" OR "Gestational Anemia". Although no initial date restriction was applied, studies published between 2000 and 2024 were selected during the screening phase to ensure relevance.

Study selection was conducted in multiple stages to ensure both relevance and methodological quality. Only primary research articles were included, particularly those employing experimental designs such as randomized controlled trials (RCTs) and quasi-experimental studies. Eligible studies involved pregnant women or women planning pregnancy and focused on antenatal education interventions related to nutrition or iron–folic acid supplementation. Outcomes of interest included maternal knowledge, health practices, adherence to supplementation, and hemoglobin levels. Studies were excluded if they were systematic reviews, meta-analyses, scoping reviews, case reports, or observational studies without educational interventions. In addition, only full-text articles published in English were considered.

The initial database search identified 70,681 records. After applying the inclusion and exclusion criteria, 437 articles were retained for further screening. Titles and abstracts were reviewed to determine relevance, followed by full-text assessment of potentially eligible studies. Duplicate records were removed during this process. Ultimately, 11 studies met all inclusion criteria and were included in the final analysis. The study selection process is presented in Figure 1.

Results

A total of 70,681 records were initially identified across four databases. Following screening and eligibility assessment, 11 studies were included in this review. The included studies were published between 2013 and 2024 and were predominantly retrieved from PubMed. A summary of the included studies by year and database is presented in Table 1.

The scoping review involved a wide range of participants, primarily pregnant women, with one study including women planning to conceive. Sample sizes varied significantly, ranging from small pilot trials with 44 participants [19] to large-scale studies with over 617 participants [20]. Participants were predominantly from low- and middle-income countries (LMICs), including Ethiopia, Kenya, and Burkina Faso, reflecting a focus on regions with high anaemia prevalence. The demographic characteristics included varying gestational ages, with some studies targeting women in early pregnancy [21] and others focusing on the preconception period [22]. Additionally, literacy and socioeconomic factors were indirectly addressed through the design of

interventions, such as picture-based education for low-literacy populations. Table 2 shows the demographic data for the selected articles.

The included studies employed a range of experimental designs, including quasi-experimental studies [21, 23] randomized controlled trials (19),(24) cluster randomized trials [20], and pilot randomized controlled trials [19], demonstrating methodological diversity in evaluating antenatal education interventions. A variety of outcome measures were used to assess the effectiveness of these interventions in improving maternal health and reducing the risk of anaemia during pregnancy. These included maternal knowledge and attitudes towards iron–folic acid supplementation [23, 25] hemoglobin levels and health literacy [24, 26] and adherence to iron–folic acid supplementation [21, 22]. Additional outcomes encompassed dietary practices, iron–folic acid tablet consumption [19], food selection ability, and anaemia prevalence [20, 27] as well as overall nutritional behaviours related to anemia prevention [11, 28].

In terms of theoretical frameworks, the majority of the included studies (66.67%; n = 8) did not explicitly report using theory in their antenatal education interventions. Among those that did, the Health Belief Model (HBM) was the most commonly applied [23, 28], followed by the COM-B model [19] and the Theory of Planned Behaviour (TPB) [11]. These findings highlight a gap in the application of theory-driven approaches and underscore the importance of integrating established behavioural frameworks to enhance the effectiveness of antenatal education interventions.

This review also identified that only two studies explicitly assessed the prevalence of anemia during pregnancy [20, 24]. A cluster randomized trial conducted in Burkina Faso reported a 19.8% reduction in anaemia prevalence following home-based interventions, with mean haemoglobin levels increasing to 11.63 g/dL after multiple visits. In contrast, the control group demonstrated only minimal improvement, with haemoglobin levels remaining below the recommended threshold.

Similarly, a randomized controlled trial conducted in Nepal demonstrated a statistically significant improvement in haemoglobin levels and health literacy following art-based, face-to-face educational interventions ($p < 0.05$). These findings suggest that targeted antenatal education interventions, particularly those incorporating interactive and visual approaches, may contribute to meaningful improvements in anaemia-related outcomes. Details of the selected studies, following the PRISMA 2020 framework, are presented in Table 4, providing a structured summary of study characteristics, interventions, outcomes, and key findings.

Discussion

The findings of this review indicate that antenatal education plays an important role in improving outcomes related to anaemia in pregnancy, particularly in enhancing maternal knowledge, dietary practices, and adherence to iron–folic acid supplementation. Across the included studies, a variety of educational approaches were implemented, ranging from community-based interventions and home visits to digital messaging and visual-based education. Although these approaches are generally associated with positive outcomes, the extent of their effectiveness varied across settings and intervention designs.

One remarkable finding across the reviewed studies was the considerable variation in intervention delivery methods. Some studies implemented structured and repeated face-to-face educational sessions, whereas others relied on brief counseling, home visits, mobile messaging, or technology-assisted communication approaches. Interventions that incorporated interactive elements, such as discussion, visual aids, demonstrations, and culturally adapted educational materials, appeared to produce more

consistent improvements in maternal knowledge and health-related behaviours. These findings suggest that the mode of delivery and level of participants' engagement may substantially influence the effectiveness of antenatal educational interventions.

The variation in intervention approaches was also reflected in the types of outcomes measured across studies. Intervention focused primarily on educational counseling and awareness, commonly evaluated maternal knowledge, attitudes, and health literacy related to anaemia and iron-folic acid supplementation (IFAS). In contrast, interventions emphasizing adherence to supplementation frequently assessed compliance with iron and folic acid intake, while nutrition-focused educational strategies often evaluated dietary practices, food selection ability, and the frequency of iron-rich food consumption. Only a limited number of studies assessed clinical outcomes such as maternal haemoglobin (Hb) levels and anaemia prevalence, despite anaemia reduction being the primary objective of many interventions. This indicates that most studies focused more on intermediate behavioural and cognitive outcomes than on long-term clinical effectiveness.

Across the reviewed studies, common outcome measures assessing the effectiveness of antenatal educational strategies for anaemia prevention broadly fall into three categories: biochemical, cognitive-psychological, and behavioural. In the biochemical domain, the primary outcomes evaluated across multiple studies were maternal haemoglobin (Hb) levels and the corresponding prevalence of anaemia [20, 24, 26-28]. Cognitive and psychological outcomes, frequently measured changes in maternal knowledge of anaemia and iron-folic acid supplementation (IFAS) [26], attitudes towards IFAS [21], maternal health literacy [24], and constructs related to the Theory of Planned Behaviour [11]. Behavioural outcomes mainly focused on adherence or compliance with IFAS [27], alongside dietary practices such as food selection ability and the frequency of consuming iron-rich foods [19, 26-28].

To evaluate these outcomes, researchers utilized a combination of self-administered questionnaires, interview-administered instruments, and clinical diagnostic tools. Cognitive and psychological outcomes were commonly measured using structured or semi-structured questionnaires administered via face-to-face interviews [22, 23, 25-27] or online forms [19]. Standardized instruments included the Structured Knowledge Interview Schedule (SKIS), which assessed maternal knowledge related to anaemia [27, 28], and the 14-item Health Literacy Scale (HLS-14), which evaluated functional, communicative, and critical health literacy [24]. Dietary behaviours were measured using food selection ability checklists and 7-day food frequency questionnaires [26-28]. Compliance with IFAS was measured using either subjective self-reported recall questionnaires [19, 24, 27] or objective pill counts involving remaining tablets in bottles or blister packs [20-22]. Clinical outcomes were measured using tools such as the HemoCue Hb301 system [20] and laboratory photocolorimeters applying the cyanmethaemoglobin method [28].

Although several studies evaluated similar outcomes, the instruments and operational definitions used were not always consistent across studies. Most studies relied on structured questionnaires with Likert-scale and multiple-choice responses to assess knowledge and attitudes [11, 23, 25]. However, substantial variation was observed in the assessment of behavioural compliance. Some studies used objective pill counts to verify adherence [20-22], whereas others relied entirely on maternal self-report and recall [19, 24, 27]. In addition, the definition of “high compliance” varied across studies, with some researchers using a threshold of at least 70% supplement consumption [21], while others used 75% or higher [27]. Such methodological inconsistencies may affect

comparability across studies and limit the interpretation and synthesis of pooled findings.

The reviewed studies also demonstrated several methodological strengths and limitations regarding the instruments used. The inclusion of clinical diagnostic tools to measure haemoglobin levels was a major strength, as it provided objective psychological evidence alongside self-reported behavioural outcomes [20, 27]. Similarly, the use of physical pill counts strengthened adherence assessment by reducing the risk of self-report bias [20, 21]. However, many studies depended heavily on self-reported verbal data to evaluate compliance and dietary practices. Such approaches remain vulnerable to recall bias, response bias, and subjectivity, as participants may over-report adherence to align with perceived expectations from researchers [20, 22, 23, 25, 27].

Despite these limitations, most studies reported substantial efforts to ensure instrument reliability and validity rather than relying solely on self-developed tools. Instruments were frequently pre-tested or piloted in nearby clinics to ensure cultural and linguistic appropriateness [22, 23, 25, 27]. Several studies also demonstrated strong statistical reliability, with Cronbach's alpha values ranging from 0.70 to 0.98 [11, 19, 27], supported by Kuder-Richardson formulas [28], and test-retest reliability using Cohen's kappa statistics [23, 25]. In addition, the HLS-14 instrument underwent forward-backward translation and confirmatory factor analysis before implementation [24]. Content validity was commonly established through expert panel reviews involving obstetricians, nutritionists, and public health professionals [24, 25, 27, 28]. These findings suggest that although considerable heterogeneity existed in outcome measurements and assessment approaches, many studies attempted to maintain methodological rigor.

Another important issue identified in this review was the limited integration of theoretical frameworks to guide the design of educational interventions. A large proportion of the included studies did not explicitly report the use of behavioral theories, while only a few applied models such as the Health Belief Model (HBM) [23, 28], COM-B [19], and the Theory of Planned Behavior (TPB) [11]. The absence of theory-driven frameworks may partly explain the variability observed in intervention design, behavioral outcome measures, and educational strategies across studies. Without a strong theoretical foundation, interventions may fail to adequately address the underlying determinants of behavior change beyond knowledge acquisition alone, thereby limiting sustainability and long-term effectiveness.

The integration of theoretical frameworks is a fundamental determinant of success in complex health interventions. According to the Medical Research Council (MRC) framework for complex interventions, a prospective, theory-driven process is essential for developing educational strategies that are effective, sustainable, and scalable [29]. The lack of theoretical guidance also limits the ability to standardize intervention components and evaluation processes across studies. Theory-driven design provides a framework for making explicit the implicit assumptions about how and why a program is expected to work within a specific context [30]. A previous study had found that without a theoretical foundation, interventions frequently default to a "one size fits all" approach that fails to recognize the underlying complexities of maternal health or the specific contextual barriers women face [30].

The absence of behavioral and psychological theories results in significant heterogeneity in the educational strategies employed across studies. Frameworks such as the COM-B (Capability, Opportunity, Motivation, Behaviour) model and the Health Belief Model (HBM) provide structured guidance on how educational content should be delivered [19]. For example, the COM-B model demonstrates that moving beyond simple reminders to include specific "enablement

strategies" is critical to modifying complex behaviors such as dietary intake. When these theories are omitted, educational strategies often rely on passive, routine counseling that lacks the necessary components to overcome maternal barriers or leverage social support [19]. This results in highly variable educational delivery, where some studies simply dispense information while others actively target perceived susceptibility and severity, leading to vastly different behavioral responses [23].

Theoretical frameworks directly dictate what should be measured along the causal pathway of an intervention [29]. A theory-driven approach ensures that indicators are pre-specified for every precondition, from initial inputs to long-term behavioral impacts [29]. For example, using the Theory of Planned Behavior (TPB) or HBM requires researchers to measure specific psychological constructs, such as perceived behavioral control, subjective norms, and perceived benefits versus barriers [23]. In the absence of a guiding theory, studies tend to measure isolated endpoints that may not adequately reflect the intermediate cognitive and behavioural processes required for sustained change. This lack of standardized, mechanism-based indicators prevents researchers from combining process and effectiveness evaluations into a single coherent analysis, making cross-study comparisons of behavioral outcomes fragmented and highly variable [29]. Ultimately, the lack of theoretical grounding contributes to inconsistent intervention effectiveness across the literature. Interventions anchored in models such as the HBM or TPB have been shown to significantly improve knowledge, foster positive attitudes, and enhance clinical parameters (such as haemoglobin levels) by systematically addressing the determinants of non-adherence and behavioural resistance [23].

Furthermore, despite the generally positive findings regarding knowledge improvement, adherence, and dietary behaviour, only a limited number of studies directly assessed changes in hemoglobin levels or in anemia prevalence [20, 24]. This highlights a significant gap in the measurement of long-term clinical outcomes in antenatal educational research. While educational interventions may improve intermediate cognitive and behavioral outcomes, further evidence is needed to determine whether these improvements consistently translate into meaningful clinical reductions in anemia prevalence during pregnancy.

Overall, antenatal education demonstrates considerable potential in reducing the risk of anaemia in pregnancy. However, its effectiveness appears to be influenced by multiple interacting factors, including intervention design, participant engagement, cultural relevance, accessibility, consistency of outcome measurements, and theoretical integration. Future interventions should therefore adopt more theory-driven and culturally adaptive approaches, while incorporating standardized outcome measures and long-term clinical evaluation to strengthen the evidence base for the effectiveness of antenatal educational strategies for anemia prevention.

Limitations of this review

This scoping review has several limitations that should be considered when interpreting the findings. Only articles published in English and available in full-text format were included, which may have resulted in the exclusion of potentially relevant studies published in other languages or inaccessible databases. Furthermore, although multiple electronic databases were searched, unpublished studies and grey literature were not included, which may limit the comprehensiveness of the evidence identified. In addition, considerable variation was observed across the included studies in terms of intervention design, educational delivery methods, outcome measures, and assessment instruments. This variation made direct comparison between studies difficult and

limited the ability to draw definitive conclusions regarding the most effective antenatal educational approach for the prevention of anaemia. Moreover, most studies focused primarily on cognitive and behavioural outcomes related to pregnant women's knowledge and practices regarding anaemia, while relatively few studies evaluated long-term clinical outcomes such as haemoglobin levels and the prevalence of anaemia.

Another limitation identified in this scoping review concerns the inconsistent use of the theoretical framework. The limited integration of behavioural theories may have influenced the variability in intervention effectiveness and reduced the comparability of findings. Despite these limitations, this review provides valuable insights into current antenatal educational strategies and highlights key gaps to guide future research and practice.

Conclusions

In conclusion, this scoping review highlights the potential of antenatal education as a strategy to reduce the risk of anaemia in pregnancy. The findings suggest that educational interventions can improve maternal knowledge, promote positive health behaviours, and enhance adherence to iron-folic acid supplementation. However, evidence regarding improvements in clinical outcomes, particularly haemoglobin levels and anemia status remain inconsistent across studies. Furthermore, the effectiveness of these interventions varies and is shaped by contextual, cultural, and methodological factors.

To strengthen future practice, there is a need to design interventions that are theory-driven, culturally appropriate, and supported by ongoing monitoring and evaluation. In addition, greater emphasis should be placed on measuring clinical outcomes, such as haemoglobin levels and the prevalence of anaemia, to provide stronger evidence of effectiveness. The integration of digital approaches also offers promising opportunities, although further research is required to evaluate their long-term impact and feasibility across different populations.

Financial Assistance

This study was supported by the Fundamentals Research Grant Scheme (FRGS) under the Ministry of Higher Education (KPT) Malaysia, grant number FRGS/1/2024/SS10/UITM/03/3

Declaration of Conflict of Interest

The authors agree that this research was conducted without any self-benefit or commercial or financial conflicts, and declare no conflicts of interest with the funders. The authors declare that this manuscript is an original work and has not been published previously nor is it currently being considered for publication elsewhere. There is no conflict of interest to declare. The authors also confirm that all sources used have been properly acknowledged and cited.

Authors' Contributions

NMJ conceptualized the study, developed the review protocol, conducted the literature search, synthesized the data, and drafted the manuscript. JZ, and NSM served on the review panels and contributed to article screening, methodological quality appraisal, and data extraction. AR provided methodological oversight, contributed to data interpretation, and critically revised the manuscript. SHSA and CMC contributed to data verification, manuscript editing, and final refinement. All authors read, edited, and approved the final manuscript.

Acknowledgement

The authors extend their gratitude to the Fundamental Research Grant Scheme (FRGS) of the Ministry of Higher Education (KPT), Malaysia. Special thanks are extended to Universiti Teknologi MARA for its continuous support, encouragement, and the provision of necessary resources throughout the process. Deeply appreciative of the assistance of the university librarians who helped refine our literature search strategy.

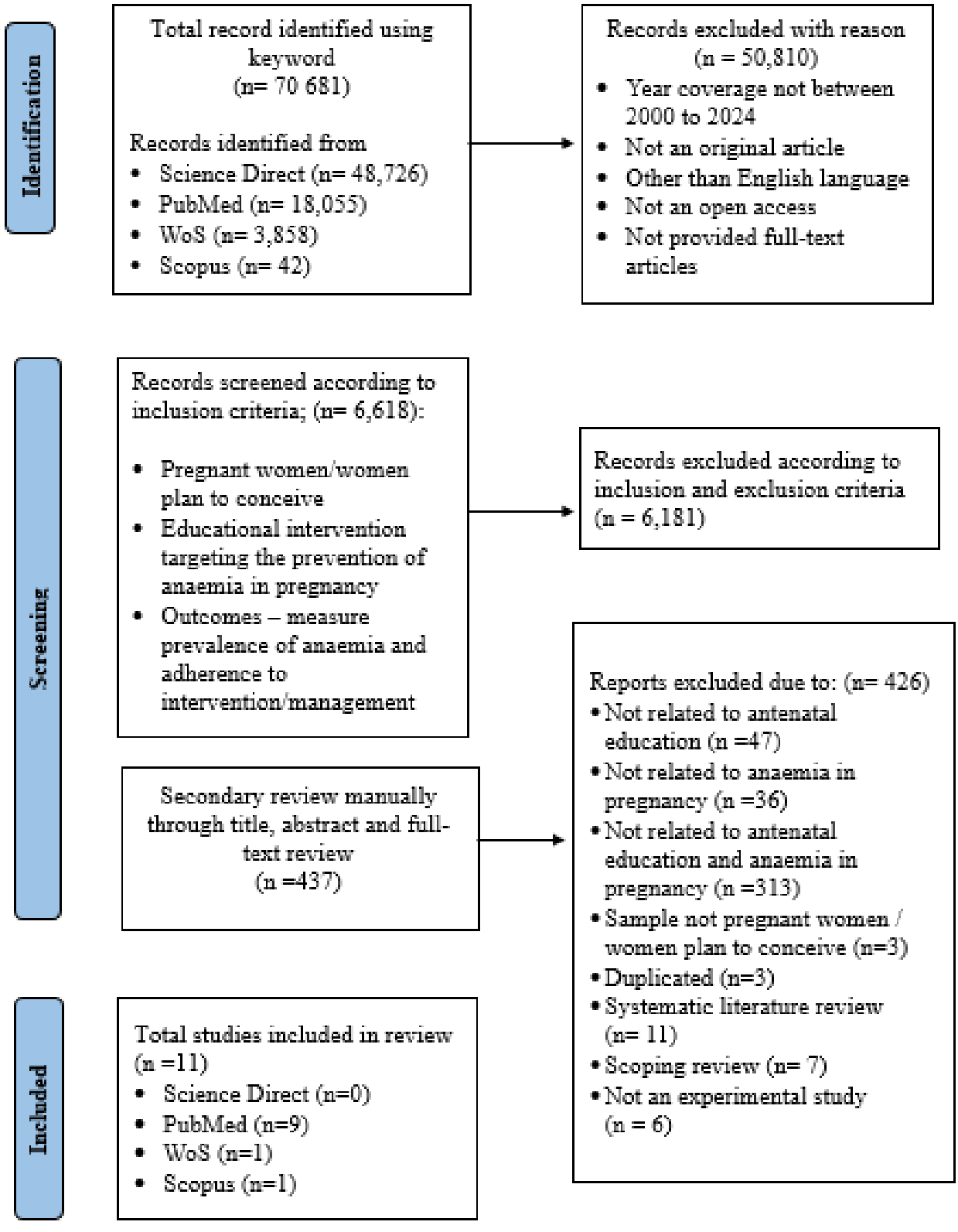

Figure 1. PRISMA 2020 flow diagram

Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

Table 1. Number of Included Articles by Year and Database

Year	Number of Articles	Database
2024	2	PubMed
2023	2	PubMed
2022	2	PubMed
2021	2	1 PubMed 1 WoS
2019	2	PubMed
2013	1	Scopus

Table 2. Demographic data of selected articles

Authors	Sample Size	Study Location
Reshid and Anato (2024)	198 pregnant women	Butajira town, Ethiopia
Sakai et al. (2024)	156 pregnant women	Western Nepal
Abdisa et al. (2023)	472 pregnant women	Rural Ethiopia
Izzatul Arifah et al. (2023)	44 pregnant women	Surakarta, Indonesia
Berhane and Belachew (2022)	244 women planning to get pregnant	Eastern Ethiopia
Elsharkawy et al. (2022)	196 pregnant women	Saudi Arabia
Ilboudo et al. (2021)	617 pregnant women	Burkina Faso
Kamau et al. (2019):	340 pregnant women	Kiambu County, Kenya
Sunuwar et al. (2019)	115 pregnant women	Kathmandu, Nepal
Noronha et al. (2013)	225 pregnant women	Southern India
Khani Jeihooni et al. (2021)	150 pregnant women	Shiraz, Iran

Table 3. Behavioural theories applied in the antenatal education interventions included in the scoping review

Behavioral Theory	Key Components	Application in Antenatal Education	Expected outcomes
Health Belief Model (HBM)	Perceived susceptibility, perceived severity, perceived benefits, perceived barriers	Improve awareness of the risk of anaemia and encourage adherence to iron-folic acid supplementation (IFAS)	Improved maternal knowledge and preventive health behaviours
Theory of Planned Behaviour (TPB)	Attitudes, subjective norms, perceived behavioural control	Strengthen behavioural intention towards healthy dietary intake and supplementation practices	Positive maternal behavioural change
COM-B (Capability, Opportunity, Motivation, Behaviour) Model	Capability, opportunity, motivation	Support sustainable behaviour change through education, motivation, and social support	Enhanced adherence and long-term maternal health practices

Table 4. PRISMA 2020 flow diagram for updated systematic reviews which included searches of databases and registers only

No	Author, year, database & title	Study design	Subject & Sample size	Aim of study	Theory used	Antenatal education method used	Variables measured	Results	Conclusions	Recommendations
1.	Reshid & Anato, (2024) **Database:** PubMed **Journal:** Journal of Nutritional Science **Title:** Community-based nutrition education and counselling provided during pregnancy: effects on knowledge and attitude towards iron-folic acid supplemen-tation	Quasi-Experimental utilizing pre-post-test consisting of an intervention and control group	198 Pregnant women attending ANC in Butajira town (99 intervention and 99 control group)	Examined how community-delivered nutrition education on iron-folic acid supplementation (IFAS) influenced pregnant women's knowledge and attitudes toward its use.	Health Belief Model (HBM)	• Participants received nutrition education biweekly over a three-month period, totaling six sessions, each lasting approximately 30 to 45 minutes. • The sessions incorporated a variety of teaching methods, including interactive discussions, visual demonstrations, presentations, and image-based learning activities.	Knowledge and attitude towards iron-folic acid supplementation (IFAS)	The intervention group showed a substantial 35-percentage-point increase in maternal knowledge regarding IFAS ($P < 0.001$), with participants being 2.6 times more likely to demonstrate adequate understanding compared to baseline levels (OR = 2.67). Moreover, there was a significant positive shift in attitudes toward IFAS throughout the intervention period ($P = 0.001$).	The community-focused nutrition education program effectively improved pregnant women's understanding and attitudes toward IFAS. Utilizing the Health Belief Model (HBM), the intervention demonstrated its value in fostering greater awareness and encouraging more positive perceptions within the target group.	This study strongly recommended using HBM-based nutrition interventions, but there is a need to ensure health workers are well-trained and supported through close supervision.
No	**Author, year, database & title**	**Study design**	**Subject & Sample size**	**Aim of study**	**Theory used**	**Antenatal education method used**	**Variables measured**	**Results**	**Conclusions**	**Recommendations**
2.	Sakai et al. (2024) **Database:** PubMed	Randomized Controlled Trial (RCT) using parallel-group	A total of 156 pregnant women in Nepal were initially enrolled from	To evaluate the impact of in-person health education delivered	Not explicitly mentioned	• The education group had three short sessions, led by trained Nepalese nurses. Sessions were	• Haemoglobin levels • Health literacy scores	The intervention group demonstrated a meaningful increase in average	Consistent in-person health education using simplified visual materials led to a notable	Integrate visual-based health education into antenatal care programs for

	Journal: PLoS One **Title:** Effectiveness of art-based health education on anaemia and health literacy among pregnant women in Western Nepal: A randomized controlled trial	comparison design (utilizing three groups)	the Western Regional Hospital for prenatal care. However, only 138 completed the study, as 18 participants dropped out during the follow-up period. The final sample consisted of 49 in the education group, 44 in the distribution group, and 45 in the control group.	through visual tools such as illustrations, photographs, and nomograms on lowering anemia rates and enhancing health literacy.		held at 8–12 weeks, 20–24 weeks, and 30–34 weeks, session lasted about 10 minutes and was conducted face-to-face, using simple, original materials like pictures, photographs, and nomograms to make the information easy to understand. • The distribution group was provided with the original educational materials but did not participate in any personalized health education sessions. • Control – general antenatal care	(functional, communicative, critical)	hemoglobin levels ($p < 0.042$), with a statistically significant distinction observed between the education and control groups ($p < 0.044$). Overall health literacy scores improved among all participants ($p < 0.001$), with the education group achieving marked progress across functional, communicative, and critical literacy domains.	reduction in anaemia and enhanced health literacy among pregnant women in Nepal.	pregnant women.
3.	Abdisa et al. (2023) **Database:** PubMed **Journal:** BMC Public Health **Title:** Effect of community-based nutritional education on knowledge,	Quasi-Experimental study	472 pregnant women pregnant women with gestational ages less than 20 weeks from 16 kebeles in two districts (236 participants for each control and experimental group)	To determine the effect of community-based nutritional education on knowledge, attitude, and compliance to iron folic acid (IFA) supplementation in Ilu Aba Bor zone of southwest Ethiopia.	Not explicitly stated	• Participants in the intervention group attended monthly nutrition education sessions over a three-month period, with each session lasting between 45 and 60 minutes. The sessions were conducted in the local language, Afan Oromo, to ensure better understanding and engagement. • Those in the control group continued to receive standard	Knowledge, attitude, and compliance with IFA •	Community-led nutrition education led to a 15.2% improvement in IFAS knowledge among the intervention group, whereas the control group saw only a 5.1% increase. Participants who received the intervention were 5.6 times more likely to adopt a positive attitude toward IFAS and 3.9 times more	Community- based education improves IFA compliance, knowledge, and attitude, addressing poor compliance issues	Authors not mentioned in the article.

	attitude and compliance to IFA Supplementation among pregnant women in rural areas of southwest Ethiopia: A quasi-experimental study.					antenatal care without additional educational input.		likely to adhere to supplementation compared to those who did not participate in the educational sessions.		
4.	Izzatul Arifah et al. (2023) **Database:** PubMed **Journal:** Journal of Education and Health Promotion Published by Wolters Kluwer - Medknow **Title:** Effectiveness of daily educational message on pregnancy anaemia prevention behaviour and knowledge: A pilot randomized controlled trial	Pilot Randomi-zed Controlled Trial	44 pregnant women who attended Antenatal Care at Primary Healthcare Centers in Surakarta in April to September 2022 (22 participants in each group)	To analyze the effectiveness of daily educational messages on pregnancy anemia prevention behaviour and knowledge among pregnant women in Surakarta City, Central Java Province, Indonesia	Capability, Opportunity, Motivation, Behaviour (COM-B) model	• The intervention group received daily WhatsApp messages with visuals. Each message had one sentence about preventing anaemia in pregnancy and another with motivational support, which based on the COM-B model, were designed to inspire behavior change, not just act as reminders.	Knowledge, diet, IFA tablet consumption	The intervention significantly increased IFA tablet consumption in the last 42 days, with the intervention group averaging 39.54 tablets compared to 34.86 in the control group (p = 0.003). It also significantly improved knowledge (p = 0.007). However, there was no significant difference in anaemia prevention diets between the groups.	Regular educational messages contributed to increased knowledge and enhanced adherence to iron and folic acid (IFA) tablet intake among pregnant women.	Implementing a large-scale randomized controlled trial is considered practical to validate the impact of daily educational messages as an intervention for preventing anemia during pregnancy, while also addressing areas identified for improvement.

5.	Berhane and Belachew, (2022) **Database:** PubMed **Journal:** Journal of Nutritional Science **Title:** Effect of Picture-based health education and counselling on knowledge and adherence to preconception Iron-folic acid supplementation among women planning to be pregnant in Eastern Ethiopia: a randomized controlled trial	Parallel Randomi-zed Controlled Trial	244 women in the age group of 18–45 years who planned to conceive and took iron folic acid supplement	To examine the effect of picture-based nutrition education on knowledge and adherence to pre-conception iron–folic acid supplement (IFAS) on the importance of adherence to the IFAS intake during pregnancy in Ethiopia	Not explicitly mentioned	• The intervention group (n=122) was provided with picture-assisted preconception nutrition education and counseling in addition to iron-folic acid supplementation (IFAS), while the control group (n=122) received only the IFAS without any educational component.	Knowledge and compliance with iron-folic acid supplementation (IFAS) throughout the three-month intervention period.	Approximately 42.6% of participants in the intervention group followed the IFAS regimen, in contrast to only 3.3% in the control group ($P < 0.0001$). Further regression analysis revealed that previous experiences of spontaneous abortion and awareness of neural tube defects (NTDs) were significantly associated with higher adherence to IFAS ($p < 0.05$).	Picture-based nutrition education, combined with routine home visits, led to significant improvements in both knowledge and adherence to IFAS among women preparing for pregnancy. This approach enhanced understanding of anemia, neural tube defects, and healthy dietary habits, contributing to the reduction of maternal and neonatal health risks.	This simple, cost-effective intervention should be adopted nationwide, focusing on educating women planning pregnancy about IFAS intake and integrating it into healthcare systems. Expanding it into a national strategy can reduce pregnancy risks, address side effects like nausea, and support food fortification. Larger studies are needed to confirm its cost-effectiveness.
6.	Elsharkawy et al. (2022) **Database:** PubMed	A single-blind randomi-zed controlled trial with two	A total of 196 anaemic pregnant women	To evaluate the effectiveness of the Health Information	Not explicitly mentioned	• Participants in the intervention group attended a one-on-one 30-minute	• Knowledge scores • Food selection ability	Following the three-month intervention, participants in the intervention	The Health Information Package Program (HIPP),	It is recommended that policymakers consider

	Journal: International Journal of Environmental Research and Public Health **Title:** Effectiveness of Health Information Package Program on Knowledge and Compliance among Pregnant Women with Anaemia: A Randomized Controlled Trial	parallel groups	receiving antenatal care at a primary healthcare facility in the Sakaka Al-Jouf region of Saudi Arabia were enrolled between January and May 2021, with 98 participants assigned to the intervention group and 98 to the control group.	Package Program on the knowledge about anaemia, their compliance with iron and folic acid supplementation, and their haemoglobin levels among anemic pregnant women		educational session focused on anaemia and iron supplementation, supported by PowerPoint slides and informational brochures. They also received weekly reminders via WhatsApp and monthly iron supplements provided through the "Wasfaty" service. • Meanwhile, the control group was given standard antenatal care and was granted access to the educational materials post-study for ethical considerations.	• Compliance with iron and folic acid supplementation • Hemoglobin levels	group demonstrated marked improvements in knowledge, ability to choose iron-rich foods, hemoglobin levels, and adherence to iron tablet intake ($p < 0.001$). Compliance with IFA supplementation was notably higher in this group (90.8%) compared to the control group (66.4%).	combined with WhatsApp reminders, effectively improved knowledge about anemia, promoted better food choices, enhanced iron supplementation compliance, and increased Hb levels among anemic pregnant women in Saudi Arabia.	implementing the Health Information Package Program (HIPP) as part of a nationwide strategy to combat anemia in pregnancy. The program has proven effective particularly through its impact on hemoglobin improvement and can serve as a valuable educational resource for nurses, midwives, and obstetricians. Additional research is needed to explore anemia-related factors across more diverse populations to strengthen generalizability.
7.	Ilboudo et al. (2021) **Database:** PubMed **Journal:** American Journal of Tropical Medicine and Hygiene	A cluster randomized trial took place between January 2015 and August 2016 in the Sindou health district of Burkina Faso.	A total of 617 pregnant women receiving antenatal services in the Sindou health district, located in Burkina	To test the effects of personalized support for pregnant women at home on the trend of anaemia prevalence in pregnancy	Not explicitly mentioned	• The intervention group received monthly home visits from community health workers, who offered counseling on nutrition, iron supplementation, hygiene practices, and malaria prevention, with	• Prevalence of anaemia and mean haemoglobin levels during pregnancy	The intervention group experienced a notable decline in anemia prevalence, with a 19.8% reduction observed after receiving at least four home visits. Haemoglobin levels in this	Personalized home support when integrated with standard antenatal care, has been shown to substantially lower the	Implement individualized home-based care for pregnant women emphasizing nutrition, iron and folic acid supplementation, and the prevention of

	Title: Effect of Personalized Support at Home on the Prevalence of Anaemia in Pregnancy in Burkina Faso: A Cluster Randomized Trial		Faso's Cascades region, participated in the study. 440 were assigned to the intervention group and 177 to the control group.			involvement from spouses to enhance support. Participants' progress was regularly tracked, and severe anemia cases were referred to healthcare facilities. In contrast, the control group continued with standard antenatal care and did not receive any supplementary interventions.		group increased to an average of 11.63 g/dL by the seventh visit. In comparison, the control group showed only a marginal improvement, reaching 10.60 g/dL, which remained below the recommended threshold of 11 g/dL.	prevalence of anaemia among pregnant women.	malaria and intestinal parasites alongside routine antenatal services, can significantly decrease anaemia rates among women in rural areas of Burkina Faso.
8.	Kamau et al. (2019) **Database:** PubMed **Journal:** PLoS ONE **Title:** Effect of community-based health education on knowledge and attitude towards iron and folic acid Supplementa-tion among pregnant women in Kiambu County, Kenya: A quasi-	Quasi-Experimental study design, consisting of intervention and control group	A total of 340 pregnant women, aged between 18 and 49 years, were recruited from five designated health facilities located in Lari Sub-County, Kiambu County, Kenya.	To determine the impact of community-driven health education delivered through community health volunteers (CHVs) on pregnant women's knowledge of iron-folic acid supplementation (IFAS), the extent of counseling received on related topics, and their attitudes toward IFAS	Not explicitly mentioned	Pregnant women in experimental group received community- based health education which is home-based counseling, supplements, and encouragement for clinic visits from trained CHVs meanwhile control group received routine IFAS education during antenatal care from healthcare providers. •	Knowledge and attitude towards iron and folic acid Supplementa-tion (IFAS) •	• Overall maternal knowledge of IFAS rose by 13%, with the intervention group demonstrating the largest gain—an increase of 35 percentage points—indicating they were three times more likely to be knowledgeable than at the study's outset. A significant improvement in attitudes toward IFAS was observed ($p <$ 0.001), with endline	Health education delivered at the community level led to substantial enhancements in both knowledge and attitudes regarding iron-folic acid supplementation (IFAS).	• Incorporate community-driven strategies into antenatal IFAS distribution efforts. Community health volunteers (CHVs) should be adequately trained and consistently supervised. Policy revisions are recommended to authorize CHVs to both deliver IFAS

	experimental study			in Kiambu County.				participants being nine times more likely to express a positive attitude compared to baseline.		supplements and offer health education to expectant mothers within their household s.
9.	Sunuwar et al. (2019) **Database:** PubMed **Journal:** PLoS ONE **Title:** Effect of nutrition education on haemoglobin level in pregnant women: A quasi-experimental study	Quasi-experimental study	115 pregnant women with mild to moderate anaemia attending antenatal clinics at Tribhuvan University Teaching Hospital (TUTH) in Kathmandu, Nepal (Intervention: 58, Control: 57)	To assess the effect of nutrition education on nutritional knowledge, hemoglobin level and dietary intake of anemic pregnant women	Not explicitly mentioned	The experimental group was provided with nutrition-focused education sessions along with guidance on iron-rich dietary planning, whereas the control group received only standard educational content.	• Haemoglobin levels • maternal nutritional knowledge, dietary intake	• Compared to the control group, the intervention group demonstrated significantly greater gains, including a larger rise in haemoglobin levels (0.56 vs. 0.16 g/dL, $p = 0.002$), improved knowledge about anemia and iron-rich foods (8.26 vs. 1.05, $p < 0.001$), and increased intake of iron-rich foods ($p < 0.05$).	Providing nutrition education alongside an iron-enriched dietary plan led to marked improvements in haemoglob in concentrations, dietary habits, and understanding of anemia and iron-rich food sources.	To increase the sample size as to improve generalizability and assessing compliance with nutrition education and diet plans. Future studies should measure additional markers to differentiate types of anaemia and use randomization to reduce potential bias.
10.	Noronha et al. (2013) **Database:** Scopus **Journal:** Midwifery	Quasi-experimental design with three groups (one experiment and two control groups)	225 anaemic pregnant women below 20 weeks of gestation in Udupi district,	To determine the effectiveness of a health information package in terms of empowering the pregnant	Health Belief Model (Rosenstock and Becker's model)	Health Information Package (HIP) that included planned educational programs with visual aids, iron and folic acid supplementation,	• Knowledge about anaemia, food selection ability, haemog-lobin levels, compliance to iron	• Significant improvement in: i. Knowledge scores ii. Food selecti	The health information package proved effective in increasing pregnant women's understanding of anaemia, improving their	• Strengthen health promotion activities in all health sectors. • Develop planned health education programs for antenatal clinics and maternal

	Title: Interventional study to strengthen the health promoting behaviours of pregnant women to prevent anaemia in southern India		Karnataka, India (75 in experimental group, 75 in control group A, and 75 in control group B)	women to modify their health-care behaviour and take appropriate action to combat anaemia in pregnancy.		and deworming if required	supplementation, and pregnancy outcomes	on ability iii. Haemoglobin levels • In the experimental group, 61.2% of participants transitioned out of anaemia status, compared to 46.77% in control group A and 75% in control group B. .	dietary choices particularly for foods rich in iron, protein, and vitamin C and boosting hemoglobin levels, thereby contributing significantly to anemia prevention.	health centers despite challenges like increased patient load. • Incorporate dietary counseling and emphasize compliance to iron supplementation during health programs.
11.	Khani Jeihooni et al. (2021) **Database:** Web of Science **Journal:** BMC Public Health **Title:** Effect of educational program based on theory of planned behavior on promoting nutritional behaviours	Quasi-experimental study	150 pregnant women (70 in Shiraz, Iran experimental group, 72 in control group after dropouts)	To determine the effect of educational program based on Theory of Planned Behaviour (TPB) on promoting nutritional behaviours preventing anemia in a pregnant woman in Shiraz city, Iran	Theory of Planned Behaviour (TPB)	Six educational sessions (50-55 minutes each) using lectures, Q&A, group discussions, educational posters and pamphlets, videos, and PowerPoint presentations. Sessions covered anaemia prevention, misconceptions, barriers, and strategies for improving nutrition. Spouses and health officials also participated.	Knowledge, attitude, perceived behavioral control, subjective norms, behavioural intention, and nutritional performance •	• Prior to the intervention, there were no notable differences between groups in terms of knowledge, attitudes, or behaviors. • After three months, the intervention group demonstrated significant advancements	Educational interventions grounded in TPB significantly enhanced understanding, positive attitudes, and dietary practices aimed at preventing anemia during pregnancy.	• Expand the use of TPB-based frameworks for broader populations. • Focus on health education programs integrating theory-based strategies to enhance behavior change. •

	preventing anaemia in a sample of Iranian pregnant women							across all measured domains, with increased behavioral intention (25.57 ± 1.66, *p* = 0.001) and improved performance outcomes (31.03 ± 2.19, P = 0.001).		

References

[1]. World Health Organization. World Health Organization. 2025. p. 1–5 Anaemia: Key facts. Available from: https://www.who.int/news-room/fact-sheets/detail/anaemia

[2]. Florence A. Kanu, Heather C. Hamner, Kelley S. Scanlon AJS. Anemia Among Pregnant Women Participating in the Special Supplemental Nutrition Program for Women , Infants , and Children — United States , 2008 – 2018 [Internet]. 2022. p. 813–9. Available from: https://www.cdc.gov/mmwr/volumes/71/wr/mm7125a1.htm

[3]. Malaysia M of H. Perinatal Care Manual (4th edition) [Internet]. 2023. Available from: https://efaidnbmnnnibpcajpcglclefindmkaj/https://hq.moh.gov.my/bpkk/images/PERINATAL_CARE_MANUAL_4th_Edition_2020_11Mei2023.pdf

[4]. Rahman RA, Badilla I, Id I, Isa Z, Rahman RA. The effectiveness of a theory-based intervention program for pregnant women with anemia : A randomized control trial. 2022;1–16. Available from: http://dx.doi.org/10.1371/journal.pone.0278192

[5]. Shi H, Chen L, Wang Y, Sun M, Guo Y, Ma S, et al. Severity of Anemia During Pregnancy and Adverse Maternal and Fetal Outcomes. JAMA Networl Open [Internet]. 2022;5(2):1–13. Available from: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2788631

[6]. Dominika Skolmowska, Dominika Gł ˛abska, Aleksandra Kołota DG. Effectiveness of Dietary Interventions in Prevention and Treatment of Iron-Deficiency Anemia in Pregnant Women : A Systematic Review of Randomized Controlled Trials. Nutrients [Internet]. 2022;1–15. Available from: https://doi.org/10.3390/nu14153023

[7]. Yadav H, Chan CM, Lan ST. Community Health Nursing. 2nd ed. Kuala Lumpur: Oxford University Press; 2019.

[8]. World Health Organization. World Health Organization. 2016. WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience. Available from: https://www.who.int/publications/i/item/9789241549912

[9]. Ambaye E, Regasa ZW, Hailiye G. Early initiation of antenatal care and its associated factors among pregnant women attending antenatal care at public health centres in Bahir Dar Zuria zone , Northwest Ethiopia , 2021 : a cross- - sectional study. BMJ Open [Internet]. 2023;1–7. Available from: https://doi.org/10.1136/bmjopen-2022-065169

[10]. World Health Organization. Health education: theoretical concepts, effective strategies and

core competencies [Internet]. Available from: https://applications.emro.who.int/dsaf/EMRPUB_2012_EN_1362.pdf

[11]. Jeihooni AK, Rakhshani T, Harsini PA, Layeghiasl M. 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 [Internet]. 2021;1–10. Available from: https://doi.org/10.1186/s12889-021-12270-x

[12]. Munyogwa MJ, Gibore NS, Ngowi AF, Mwampagatwa IH. Effect of nutritional education intervention to reduce anaemia during pregnancy in Dodoma City , Tanzania : protocol for a cluster randomized controlled trial. Biol Methods Protoc [Internet]. 2021;(February):1–7. Available from: https://doi.org/10.1093/biomethods/bpab012

[13]. Garg RK, Bala J, Garg P, Subashini SP. Cultural determinants in anemia prevention and management : Insights from women and caregivers. Indian J Obstet Gynecol Res [Internet]. 2024;11(3):308–14. Available from: https://doi.org/10.18231/j.ijogr.2024.060

[14]. Singh H, Iv JF, Mirzazada S, Saragosa M, Uleryk EM, Nelson MLA. Community - Based Culturally Tailored Education Programs for Black Communities with Cardiovascular Disease , Diabetes , Hypertension , and Stroke : Systematic Review Findings. J Racial Ethn Heal Disparities [Internet]. 2023;2986–3006. Available from: https://doi.org/10.1007/s40615-022-01474-5

[15]. Troy D, Anderson J, Jessiman PE, Albers PN, Williams JG, Sheard S, et al. What is the impact of structural and cultural factors and interventions within educational settings on promoting positive mental health and preventing poor mental health : a systematic review. BMC Public Health [Internet]. 2022;1–16. Available from: https://doi.org/10.1186/s12889-022-12894-7

[16]. Tefera AA, Abdurashid N, Id I, Umer AA. Adherence to iron and folate supplementation and associated factors among women attending antenatal care in public health facilities at Covid-19 pandemic in Ethiopia. PLOS Glob PUBLIC Heal [Internet]. 2023;3(1):1–20. Available from: http://dx.doi.org/10.1371/journal.pgph.0000825

[17]. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol [Internet]. 2007 [cited 2026 May 1];19–32. Available from: https://doi.org/10.1080/1364557032000119616

[18]. PRISMA. PRISMA 2020 Flow Diagram [Internet]. 2020 [cited 2025 May 1]. Available from: https://www.prisma-statement.org/prisma-2020-flow-diagram

[19]. Arifah I, Sekar T, Pambarep A, Khoiriyah L. Effectiveness of daily educational message on pregnancy anemia prevention behavior and knowledge : A pilot randomized controlled trial. 2023;1–7. Available from: https://doi.org/10.4103/jehp.jehp_108_23

[20]. Ilboudo B, Savadogo L ´eon GB, Traor ´e I, Meda C 'ement Z, Kinda M, Sombi ´e I, et al. Effect of Personalized Support at Home on the Prevalence of Anemia in Pregnancy in Burkina Faso : A Cluster Randomized Trial. Am Soc Trop Med Hyg [Internet]. 2021;105(1):207–16. Available from: https://doi.org/10.4269/ajtmh.20-1043

[21]. Abdisa DK, Jaleta DD, Tsegaye D, Jarso MH. Effect of community based nutritional education on knowledge , attitude and compliance to IFA supplementation among pregnant women in rural areas of southwest Ethiopia : a quasi experimental study. BMC Public Health [Internet]. 2023;(23):1–10. Available from: https://doi.org/10.1186/s12889-023-16798-y

[22]. Berhane A, Belachew T. Effect of Picture-based health education and counselling on knowledge and adherence to preconception Iron-folic acid supplementation among women planning to be pregnant in Eastern Ethiopia: a randomized controlled trial. J Nutr Sci [Internet]. 2022 Jun [cited 2025 May 1];11(e58):1–11. Available from: https://doi.org/10.1017/jns.2022.51

[23]. Reshid M, Anato A. Community-based nutrition education and counselling provided during pregnancy: effects on knowledge and attitude towards iron-folic acid supplementation. J Nutr Sci [Internet]. 2024 Oct 9;13(e58):e58. Available from: https://doi.org/10.1017/jns.2024.59

[24]. Sakai H, Kawata R, Adhikari R, Thapa YO, Bhandari TR. Effectiveness of art-based health education on anemia and health literacy among pregnant women in Western Nepal : A randomized controlled trial. PLoS One [Internet]. 2024;19(9):1–17. Available from: https://doi.org/10.1371/journal. pone.0281789

[25]. Kamau M, Mirie W, Kimani S, Mugoya I. Effect of community based health education on knowledge and attitude towards iron and folic acid supplementation among pregnant women in Kiambu County , Kenya : A quasi experimental study. PLoS One [Internet]. 2019;14(11):1–21. Available from: https://doi.org/10.1371/journal.pone.0227351

[26]. Sunuwar DR, Sangroula RK, Shakya NS, Yadav R, Chaudhary NK, Pradhan PMS. Effect of nutrition education on hemoglobin level in pregnant women : A quasi- experimental study. PLoS One [Internet]. 2019;14(3):1–12. Available from:

https://doi.org/10.1371/journal.pone.0213982

[27]. Elsharkawy NB, Abdelaziz EM, Ouda MM, Oraby FA. Effectiveness of Health Information Package Program on Knowledge and Compliance among Pregnant Women with Anemia : A Randomized Controlled Trial. Int J Environ Res Public Health [Internet]. 2022;19(2724). Available from: https://doi.org/10.3390/ijerph19052724

[28]. Noronha JA, Bhaduri A, Bhat HV, Kamath A. Interventional study to strengthen the health promoting behaviours of pregnant women to prevent anaemia in southern India. Midwifery [Internet]. 2013;29:35–41. Available from: https://doi.org/10.1016/j.midw.2012.07.014

[29]. de Jersey S, Guthrie T, Callaway L, Tyler J, New K, Nicholson J. A theory driven, pragmatic trial implementing changes to routine antenatal care that supports recommended pregnancy weight gain. BMC Pregnancy Childbirth [Internet]. 2022;22(1):1–11. Available from: https://doi.org/10.1186/s12884-022-04750-8

[30]. M Kabongo E, Mukumbang FC, Delobelle P, Nicol E. Combining the theory of change and realist evaluation approaches to elicit an initial program theory of the MomConnect program in South Africa. BMC Med Res Methodol. 2020;20(1):1–11. https://doi.org/10.1186/s12874-020-01164-y