

Family Nutrition Education in Preventing Anemia in Adolescent Girls a Literature Review

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Abstract

Anemia among adolescent girls remains a serious public health concern in Indonesia, affecting quality of life, academic performance, and reproductive health. Although various school-based nutrition programs have been implemented, anemia prevalence remains high, indicating limited family engagement in nutrition management. This study offers a novel perspective by integrating a family-centered approach into nutrition education to enhance sustainable health behavior. The findings are expected to strengthen the evidence base for preventive and promotive roles in community nursing. This study aims to evaluate the effectiveness of family nutrition education in preventing anemia in adolescent girls through a systematic review of literature from 2015–2025. The method used was an integrative literature review with article searches through Google Scholar and ScienceDirect. A total of nine studies, including randomized controlled trials, quasi-experimental designs, pre–post tests, and cross-sectional studies, met the inclusion criteria and were included in the analysis. The results indicate that a family-based educational approach, through direct training, theory-based counseling, multimedia education, virtual education, local food-based interventions, and education for mothers and adolescents, can improve knowledge, attitudes, adherence to iron supplementation, and hemoglobin levels. The role of parents, especially mothers, is a key factor in supporting positive nutritional behaviors. Family nutrition education is a potential strategy and needs to be integrated into adolescent health programs at the community and school levels.

Keywords: Anemia; Adolescent Girls; Family Nutrition Education

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1. Introduction

In adolescent girls, anemia is determined by examining hemoglobin levels, which typically show a value of less than 12.0 g/dl (WHO, 2025). Hemoglobin is a vital component of red blood cells (erythrocytes), responsible for binding and distributing oxygen throughout the body's tissues. When hemoglobin levels decrease, oxygen supply to tissues is reduced, which then triggers symptoms of anemia and inhibits normal tissue function (Kementerian Kesehatan RI, 2023).

Anemia is a pressing global public health problem, particularly among young women in developing countries, including Indonesia. According to data from the (WHO), approximately 30,5% of women aged 15–49 years experience anemia, largely due to iron deficiency. In Indonesia, the prevalence of anemia among adolescents aged 15–24 years reaches 15.5% (Kemenkes RI & BKPK, 2023). This suggests that

prevention should begin in adolescence. Prolonged anemia can significantly impact the health of adolescent girls, including impaired physical growth, reduced cognitive function, and reduced immunity (Norris et al., 2022). As they enter adulthood and experience anemia during pregnancy, this condition can weaken the immune system, making them more susceptible to infection and can trigger bleeding complications, leading to an increased risk of maternal death. According to the 2023 Indonesian Health Profile, 357 maternal deaths during pregnancy, childbirth, and the postpartum period were recorded as being due to obstetric hemorrhage (Kemenkes RI, 2024). Beyond health implications, anemia also carries substantial economic costs. It reduces work capacity, lowers educational attainment, and increases healthcare expenditures. Studies estimate that iron-deficiency anemia can reduce productivity by up to 17%, leading to significant long-term

economic losses both for individuals and at the national level.

The Sustainable Development Goals (SDGs), particularly point three, emphasize the importance of ensuring healthy lives and promoting well-being for all age groups. In this context, anemia prevention is a crucial indicator in achieving the SDGs, particularly through nutrition interventions that target families as the primary actors. Families play a central role in making decisions about nutritious food consumption and adolescent adherence to medication, including the use of iron tablets. In this review, the term "family" refers not only to parents—especially mothers—but also includes fathers, siblings, and, where relevant, extended family members such as grandparents. This broader definition highlights the potential for shared responsibility within households and underlines the importance of involving both female and male figures in shaping adolescent nutritional behaviors. In addition to SDG 3 (Good Health and Well-being), anemia prevention is also linked to SDG 4 (Quality Education), since anemia impairs cognitive function and academic achievement, and SDG 5 (Gender Equality), as anemia disproportionately affects adolescent girls and women.

A family-based approach plays a strategic role in preventing anemia in adolescent girls, as stipulated in Minister of Health Regulation No. 39 of 2016 concerning the Healthy Indonesia Program. This policy emphasizes four main priorities, including reducing maternal and infant mortality, stunting in toddlers, and combating infectious and non-communicable diseases. Interventions for adolescents include the provision of iron supplements, health education in schools, youth-friendly health services, and delaying the age of marriage. Efforts to prevent stunting in toddlers also involve providing adolescents with education about clean living and balanced nutrition (Kemenkes RI, 2016).

Several previous studies have shown that nutrition education-based interventions have positive benefits in improving adolescent nutritional awareness and behavior. For example, school-based education programs have been shown to improve adherence to iron supplement consumption and knowledge about anemia (Christiansi, Indriani, Salsabilla, Oktaviana, & Afianto, 2025). However, most of these programs still focus on an individual approach and do not involve the closest social unit, namely the family. Implementing a family approach in nutrition education has the advantage of strengthening social support and improving daily eating patterns. Education involving parents, especially mothers, has been shown to improve adolescent adherence to

iron supplement consumption and their understanding of the importance of a balanced diet (Apriningsih et al., 2019; Zhao & Yu, 2020). Studies by Apriningsih & Sufyan, (2021) and Christiansi et al. (2025) indicate that nutrition education for parents has a significant impact on improving children's attitudes and knowledge. This is in line with findings in several developing countries, where healthy eating practices at home are heavily influenced by family norms, parental eating patterns, and uneven nutritional knowledge (Elohu et al., 2023).

Furthermore, household-based intervention approaches have been shown to be effective in improving dietary diversity and hemoglobin status in children and adolescents (Piennaah et al., 2025; Zhao & Yu, 2020). However, the effectiveness of these interventions is highly dependent on the cultural context, gender roles within the household, and access to health information (Piennaah et al., 2025). Furthermore, innovative media approaches such as educational videos, interactive games, and digital print media are also beginning to be used to convey health messages. These media are effective in increasing student engagement, but challenges arise in terms of consistent use and evaluating their sustainability (Oddo et al., 2022; Wulandari et al., 2023). Several studies also highlight the persistent gap between nutritional knowledge and actual practice in anemia prevention, caused by economic barriers, social norms, and the lack of integrated educational programs in public policy (Efendi & Supinganto, 2023; Elohu et al., 2023). Various educational media innovations such as interactive games and animated videos have shown potential in increasing adolescent interest and understanding, especially if they involve families in their use (Wulandari et al., 2023).

Unlike previous, fragmented studies, this article offers a systematic synthesis of various family and community approaches to nutrition education, identifying consistent trends and research gaps as a basis for evidence-based health policy. Therefore, this study aims to systematically review the literature published between 2015 and 2025 regarding the effectiveness of family nutrition education in preventing anemia in adolescent girls. The main focus of this review is to identify the various educational approaches used, the effect of interventions on knowledge, attitudes, nutritional behavior change, the involvement of family members, and the consistent trends and research gaps in the context of family education. This research provides a conceptual and empirical foundation for the development of family-centered health promotion programs aimed at preventing anemia in adolescent girls. The novelty of this study lies in integrating family engagement

particularly the active role of parents into nutrition education as a key determinant of behavioral change and anemia prevention outcomes. From a nursing perspective, this study contributes to strengthening the preventive and promotive functions of community and family nurses by offering evidence-based strategies to design and implement effective, culturally relevant family-based interventions. The findings are also expected to serve as a reference for researchers and policymakers in developing more contextual and sustainable programs for adolescent health.

2. Method

This study employed an integrative literature review approach to synthesize scientific evidence on the effectiveness of family-based nutrition education in preventing anemia among adolescent girls (Dhollande et al., 2021). This method was chosen because it allows the inclusion and integration of diverse research designs such as quantitative, qualitative, and mixed methods, providing a comprehensive understanding of complex health promotion phenomena. The approach offers the advantage of identifying patterns, gaps, and innovative practices across studies, which is essential for developing evidence-based nursing interventions related to family nutrition education. All studies included in this review had obtained approval from relevant ethics committees and adhered to the principles of informed consent and data confidentiality. This synthesis relied solely on ethically published data and did not involve the collection of new primary data; therefore, no additional ethics approval was required.

Search Strategy and Selection Criteria

The literature search was conducted systematically in Google Scholar and ScienceDirect. While these two databases provided broad coverage of relevant literature, relying on them represents a limitation that should be acknowledged. To ensure reproducibility, the search strategy applied a combination of specific keywords and Boolean operators. The main search strings included: ("family nutrition education" OR "parental nutrition education") AND "anemia" AND "adolescent girls", ("nutrition education" AND "iron supplementation") AND ("teenagers" OR "female adolescents"), and ("family-based intervention") AND ("hemoglobin" OR "iron tablet adherence").

Search limits were applied to restrict results to articles published between 2015 and 2025, written in English or Indonesian, and available in full text. In ScienceDirect, additional subject filters

were applied to health sciences, nutrition, and public health.

The inclusion criteria for this review were as follows: articles must be written in Indonesian or English; focus on family- or community-based nutrition education interventions targeting adolescent girls aged 10–19 years; use a quantitative or mixed methods approach; report outcomes such as knowledge, attitudes, iron supplement consumption behavior, or hemoglobin levels; and be available in full text and published in an accredited or reputable scientific journal.

Exclusion criteria included studies involving adolescents with complex medical conditions such as sickle cell anemia, thalassemia, hereditary hemoglobin disorders, or other chronic diseases; articles in the form of editorials, opinion pieces, or publications that had not undergone peer review; and interventions that focused solely on clinical aspects without an educational component or family involvement.

The selection of studies through the stages of identification, screening, eligibility, and inclusion is depicted in *Figure 1*, which presents the PRISMA 2020 flow diagram.

Assessed Results

This review assesses the effect of family-based nutrition education on anemia prevention in adolescent girls. The primary focus includes the type of educational approach used and its impact on knowledge, attitudes, iron supplement consumption behavior, and hemoglobin levels. It also analyzes the role of family members in supporting the intervention, and identifies patterns of findings, consistency of results, and research gaps in the context of family education.

Data Extraction and Synthesis

Data extraction was conducted by one principal investigator using a systematic matrix format. Information collected included: author names, year of publication, study location, study design, number of participants, type of intervention, and key findings from each study. Data synthesis was conducted narratively and thematically, grouping study findings into relevant conceptual themes based on similarities in intervention focus and measured outcomes. This approach followed the principles of thematic synthesis as described by Kraus et al., (2022), which allows for the identification of patterns, contextual variations, and gaps in the literature. Of all articles screened, nine studies met the inclusion criteria and were subjected to further analysis. A summary of study characteristics and results is presented in *Table 1*.

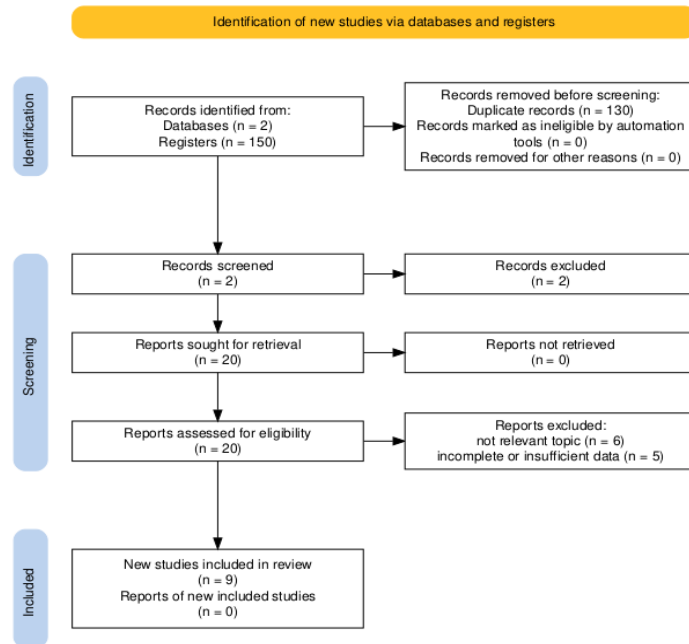


Figure 1. PRISMA 2020 Flow Diagram of Study Selection (Haddaway et al., 2022)

Quality Assessment

The descriptive quality assessment presented in Table 2 was guided by relevant criteria from the Joanna Briggs Institute (JBI) Critical Appraisal Checklists according to study design (e.g., randomized controlled trials, quasi-experimental). Although no formal scoring system was applied, this approach ensured a more rigorous and replicable evaluation of methodological quality. A summary of the quality assessment for the included studies is presented in Table 2.

Some studies in this review used observational designs, such as cross-sectional, so not all aspects of methodological quality could be fully assessed (e.g., the presence of a control group or blinding). Quality assessment was conducted narratively based on design clarity, transparency of reporting, and the relevance of the methods to the study objectives. Terms such as "not reported" or "not applicable" were used to indicate information that was unavailable or irrelevant in the context of a particular study design.

3. Results and Discussion Study Characteristics

The nine studies that met the inclusion criteria for this review exhibited diversity in terms of research design, location, number of participants, and type of intervention used. These studies were conducted in various countries, including China, Ghana, and Indonesia, reflecting the diverse cultural and social contexts in which family-based nutrition education is implemented.

Methodologically, a variety of research designs have been used, including randomized controlled trials (RCTs), quasi-experimental, pre-post tests, cross-sectional, and uncontrolled pre-post tests. The RCT conducted by Zhao and Yu (2020) in China provides strong evidence for the effectiveness of parent-focused nutrition training, showing a 6.1% reduction in childhood anemia prevalence and a 2.8% increase in hemoglobin levels after face-to-face education. In contrast, the cross-sectional study by Pienaaah et al. (2025) in Ghana emphasized the importance of family-based counseling that incorporates gender dynamics and shared meal decision-making, demonstrating that improved dietary diversity can be achieved when families are actively engaged in nutritional planning.

In Indonesia, most studies adopted quasi-experimental and pre-post test designs to evaluate knowledge and behavioral changes following educational interventions. Studies by Christiansi et al. (2025) and Suciyanti et al. (2025) confirmed that visual media-based education and local food-centered approaches effectively improved nutritional knowledge, eating behavior, and hemoglobin levels among adolescent girls. Meanwhile, Apriningsih and Sufyan (2021), Oddo et al. (2022), and Wahyuningsih et al. (2022) implemented online interventions—such as virtual focus group discussions and Zoom-based training—that successfully increased family support and parental self-efficacy in encouraging iron supplement (TTD) adherence.

Table 1. Summary of studies included in the review

Study Details	Title	Study Objective	Study Design	Sample Size	Summary of Results
Zhao & Yu, (2020), Tiongkok	Parental Nutrition Knowledge, Iron Deficiency, and Child Anaemia in Rural China	To analyze whether nutritional knowledge training for parents can significantly reduce anemia in their children.	a randomised control trial	2000 parents of fourth and fifth grade students in 42 rural elementary schools	Parental nutrition training has a positive effect on students' hemoglobin levels, through increased knowledge and dietary changes. Specifically, this training can reduce children's anemia by 6.1 percent and increase their average hemoglobin level by 2.8 percent.
Piinaah et al., (2025), Ghana	"The role of child nutrition counselling, gender dynamics, and intra-household feeding decision-making on child dietary diversity in semi-arid northern Ghana"	Examining the relationship between child nutrition counseling, gender dynamics, and household feeding decision-making on child dietary diversity in the semi-arid region of Northern Ghana.	Quantitative study, cross-sectional design with Health Belief Model (HBM) and Gender and Development (GAD) theoretical approaches	517 smallholder households in the Upper West Region, Ghana	Child nutrition counseling was significantly positively associated with children's dietary diversity (OR = 2.682, p < 0.001). - Shared decision-making regarding feeding also had a positive effect (OR = 1.551, p < 0.01).- Female-led households tended to have lower children's dietary diversity. - Other significant factors: good parenting practices, home gardening, household wealth, small household size, geographic location, age of the household head, and ethnicity.
Christiansi et al., (2025), Kabupaten Bangkalan Indonesia	The Effect of Providing Education on Compliance with Iron Tablet Consumption (TTD) on Increasing the Knowledge and Attitudes of Adolescent Girls and Parents in Bangkalan Regency	Analyzing the influence of providing education on increasing the knowledge and attitudes of adolescent girls and parents regarding anemia prevention and TTD consumption.	Quasi-experimental design with one group pre-test and post-test.	89 teenage girls and 40 parents (total 129 respondents), using purposive sampling	- Adolescent knowledge increased from 22.4% to 44.9% (p = 0.00). - Adolescent attitudes increased from 30.0% to 51.6% (p = 0.00). - Parental knowledge increased from 42.5% to 82.5% (p = 0.00). - Parental attitudes increased from 80% to 100% (p = 0.00). - There was no significant effect on parental support for iron tablet consumption (p = 0.45).- Edukasi diberikan menggunakan buku saku, video, jingle, permainan edukatif ("Unonemia"), tote bag
Apringsih & Sufyan, (2021), Tangerang selatan, Indonesia	Education on Anemia Prevention in Adolescent Girls for Parents and Teachers of Madrasah Students	Improving the knowledge, attitudes, and self-efficacy of parents and teachers of Islamic boarding school students in preventing anemia in adolescent girls through online health	Pre-experiment (pre-post test without control) in the form of virtual education-based PKM via Zoom	33 parents and teachers of students at Mumtaza Islamic School, South Tangerang, Indonesia	After the education, there was a significant increase in respondents' knowledge (p=0.000), attitudes (p=0.000), and self-efficacy (p=0.000). The majority of participants had never received any previous education about anemia. The majority obtained their information online; the virtual education was

Study Details	Title	Study Objective	Study Design	Sample Size	Summary of Results
Apriningsih et al., (2019), Depok	The Role of Parents in Increasing Student Compliance in Taking Iron Supplements in Depok City	Identifying knowledge, attitudes, and the role of parents in increasing student compliance in taking iron tablets (TTD), as well as analyzing the mechanism and schedule for TTD distribution in schools.	Descriptive analytic with cross-sectional design	135 parents of students from 9 high schools (SMA, SMK, and MA), selected using two-stage clustered random sampling.	positively received by both participants and the madrasah institution. - 54.1% of parents have insufficient knowledge. - 42.2% of parents supervise their daughters' iron supplementation at home. - Female students' compliance is higher if parents supervise (p=0.000). - There is a significant relationship between parental knowledge and attitudes and female students' compliance (p=0.000). - The strongest factor influencing compliance is parental supervision ($\beta=0.709$, p=0.000), followed by socialization experience ($\beta=0.551$), distribution mechanism ($\beta=0.435$), and iron supplementation schedule ($\beta=0.429$). - The regression model explains 76.1% of the variation in female students' compliance.
Wahyuningsih et al., (2022), Yogyakarta, Indonesia	Family Empowerment in Assisting Teenagers in Taking Iron Supplements	Analyzing the effectiveness of Focus Group Discussion (FGD) in empowering families to accompany adolescent girls in taking iron tablets.	Pre-test and post-test without control in the form of FGD-based PKM activities	61 families with teenage daughters	The activity was conducted online via Zoom Meeting. - Institutional basis: Poltekkes Kemenkes Yogyakarta Before the FGD: 50.8% of families were supportive, 49.2% were not supportive of TTD assistance. - After the FGD: 83.6% supported, 16.4% did not. - Family attitude scores increased from a mean of 58.77 to 66.47 (+10.6 points). - Education was delivered virtually through materials on the role of midwives and parents in preventing anemia.
Suciyanti et al., (2025), Malang, Jawa timur, Indonesia	Effect of optimized food-based recommendations on nutrient intakes, hemoglobin levels, and memory performance of adolescent girls in	To determine the effect of food-based recommendations (FBR) on nutritional intake, Hb levels, and memory performance in adolescent girls.	Intervensi (quasi-experimental) dengan kelompok kontrol	152 respondents per group, or 304 respondents for the total sample in this study. However, assuming withdrawals, the number of	After 20 weeks, the intervention group experienced significant improvements in: Nutritional intake (protein, fat, iron), Diet (animal protein, liver, vegetables), Hb levels and memory performance (digit span). The control group experienced a decrease.

Study Details	Title	Study Objective	Study Design	Sample Size	Summary of Results
	East Java, Indonesia			participants was increased to 160 per group. Respondents consisted of a mix of healthy and anemic (mild and moderate) adolescent girls for the intervention and control groups, aged 14–18 years.	
Oddo et al., (2022) , Klaten (Jawa Tengah) dan Lombok Barat (NTB), Indonesia	Evidence-Based Nutrition Interventions Improved Adolescents' Knowledge and Behaviors in Indonesia	Evaluating the impact of an evidence-based nutrition intervention package on knowledge, attitudes, and eating behaviors and physical activity of adolescents in Indonesia.	Pre-post study design without control, using a quantitative approach (2019 baseline survey and 2020 endline).	540 students at baseline; 514 students (95%) were successfully traced at endline. Stratified random sampling from 60 schools. Ages 12–18 years, with mean ages: 13.4 years (baseline) and 15.0 years (endline)	Significant improvement in total knowledge score (+3.3 points), including subscores for nutrition, physical activity, and anemia. - Consumption of vitamin A-rich foods increased (OR=1.5), consumption of sweetened beverages decreased (OR=0.4), and physical activity increased (OR=2.3). - Weekly IFA consumption by female students increased significantly (OR=7.0). - No significant improvement in total dietary diversity, but consumption of unhealthy foods decreased.
Agestika & Pratiwi, (2023) , Jakarta timur	The Influence of Knowledge and Attitudes about Anemia in Mothers and Adolescents on Adequate Iron Consumption	Analyzing the relationship between knowledge and attitudes of adolescent girls and mothers regarding adequate iron consumption.	Cross-sectional with random sampling technique	67 pairs of adolescent girls and mothers (134 respondents in total). Adolescent girls aged 15–17 and their mothers	34.2% of adolescents experienced iron deficiency. 47.8% of adolescents and 44.8% of mothers had low knowledge about anemia. Negative attitudes toward anemia were found in 19.4% of adolescents and 38.8% of mothers. High knowledge in adolescents and mothers was significantly correlated with adequate iron intake. Maternal attitudes were not significantly related to iron consumption (p=0.969)

Table 2. Summary of Study Quality Assessment Based on Evaluation Criteria

Study Details	Research Design	Number of Participants	Clarity of Goals and Results	Accuracy of Method & Instrument	Data Validity	Quality Notes
Zhao & Yu (2020)	RCT	2000 parents of fourth and fifth grade students in 42 rural elementary schools	Clear	Very precise	High	Robust experimental design; significant increase in hemoglobin
Pienaaah et al., (2025)	Cross-sectional (HBM + GAD)	517 households	Clear	Appropriate	Enough	Gender-related nutrition counseling impacts children's dietary diversity
Christiansi et al., (2025)	Quasi-eksperimental	129 respondents	Clear	Good	Medium	Multimedia education is effective in improving knowledge and attitudes
Apriningsih & Sufyan (2021)	Pre-post, online (Zoom)	33 participants	Clear	Enough	Medium	Virtual education increases self-efficacy; no control group
Apriningsih et al. (2019)	Cross-sectional	135 parents	Enough	Good	Enough	Parental supervision is strongly correlated with compliance with TTD consumption
Wahyuningsih et al. (2022)	Pre-post tanpa kontrol (FGD)	61 families	Enough	Enough	Low	FGD improves family attitudes; but no comparison
Suciyanti et al. (2025)	Quasi-eksperimental	304 respondents	Very clear	Very precise	High	FBR intervention increases nutritional intake and Hb levels
Oddo et al. (2022)	Pre-post tanpa kontrol	514 teenagers	Clear	Good	Enough	Evidence-based education improves healthy eating behaviors
Agestika & Pratiwi (2023)	Cross-sectional	134 mothers-children	Enough	Enough	Medium	Knowledge of mothers and adolescents is correlated with iron adequacy

Other observational studies, including those by [Apriningsih et al. \(2019\)](#) and [Agestika and Pratiwi \(2023\)](#), explored the relationship between parental roles, knowledge, and iron supplement compliance. Both studies consistently revealed that parental involvement, particularly supervision and education from mothers, strongly influenced adolescents' adherence to iron supplementation programs.

In terms of participants, the number of respondents varied from 33 to 2,000, including adolescents, parents, teachers, and households. This reflects the diversity of target populations in the implementation of family nutrition interventions. Overall, the characteristics of the studies analyzed indicate that family-based nutrition education approaches can be adapted to local contexts and flexible intervention formats—whether through online, face-to-face, or community-based approaches. The combination of varied designs and consistent results demonstrates the significant potential of household-based educational interventions to support anemia prevention in adolescent girls.

Study Quality Assessment

The methodological quality of each study in this review was evaluated descriptively based on several key aspects, including the clarity of research objectives, appropriateness of the study design to the research question, transparency in data reporting, and suitability of the analytical methods. This evaluation did not employ a formal scoring system but emphasized the methodological rigor and contextual relevance of each study in supporting the synthesized findings.

Most studies demonstrated adequate methodological quality, particularly those using experimental or quasi-experimental designs with well-defined interventions and measurable outcomes. These studies effectively linked family-based education to improvements in knowledge, dietary practices, and hemoglobin levels, providing credible evidence for program effectiveness.

However, several limitations were also identified. Some studies lacked control groups or used small and context-specific samples, which may reduce the generalizability of findings. Additionally, variations in intervention duration, participant demographics, and measurement tools created challenges in comparing results across studies. Despite these limitations, the inclusion of research from diverse cultural settings such as China, Ghana, and Indonesia enhances the ecological validity and provides valuable insights into how family-based nutrition education can be adapted to different sociocultural contexts.

Overall, the methodological strengths lie in the consistency of positive outcomes across designs,

while the main limitations highlight the need for more longitudinal and rigorously controlled studies to establish stronger causal relationships and assess the sustainability of behavioral changes in anemia prevention.

Educational Approaches

Various educational approaches were used in the nine studies analyzed in this review. Generally, the strategies implemented can be grouped into six main categories: direct parent training, theory-based nutrition counseling, multimedia education, virtual education, food-based interventions, and direct education for mothers and adolescents. Direct parent training was implemented in a study by [Zhao & Yu \(2020\)](#), which used a randomized control trial design to provide nutrition training to parents of elementary school students. This intervention demonstrated significant results, including a reduction in the prevalence of anemia in children and an increase in hemoglobin levels through changes in household eating behavior. Theory-based nutrition counseling was developed in a study by [Pienaaah et al. \(2025\)](#), which applied an approach based on the Health Belief Model and Gender and Development. This counseling not only improves nutritional understanding but also changes the dynamics of decision-making within the household, particularly regarding child feeding patterns, thereby increasing dietary diversity. Multimedia and innovative education was the approach in the study by [Christiansi et al. \(2025\)](#), utilizing educational media such as pocket books, videos, jingles, and the educational game "Unonemia." The results showed an increase in knowledge and attitudes among both adolescents and parents regarding the importance of consuming iron supplements (TTD), although the impact on parental support was still limited. Meanwhile, virtual and online educational approaches were developed in studies by ([Apriningsih & Sufyan, 2021](#); [Wahyuningsih et al., 2022](#)), which conducted online education via Zoom. The material presented in the form of lectures, discussions, and focus group discussions (FGDs) proved effective in improving knowledge, self-efficacy, and family attitudes towards supporting iron tablet consumption by adolescents. Food-based interventions and local recommendations were conducted in studies by [Suciyanti et al. \(2025\)](#) and [Oddo et al. \(2022\)](#), which targeted improving nutritional quality through local food recommendations and structured nutrition education in schools. Both studies recorded improvements in adolescents' knowledge and eating habits, as well as improvements in hemoglobin levels. Finally, direct educational approaches for mothers and adolescents were examined in studies

by (Agestika & Pratiwi, 2023; Apriningsih et al., 2019). Both studies emphasized the importance of parents' role in guiding adolescent girls in iron tablet consumption and showed that the greater the parental knowledge, the higher the adolescents' compliance with iron tablet consumption. Overall, these approaches are multicomponent, encompassing media, delivery methods, and the actors involved, such as parents, teachers, health workers, and adolescents themselves. These studies demonstrate that contextual and participatory educational approaches are more effective in improving outcomes in family-based nutrition education and anemia prevention.

Effects of Intervention

Based on Table 3, most studies indicate that nutrition education interventions have a significant impact on improving participants' knowledge and attitudes regarding anemia prevention. Five studies (Apriningsih et al. (2019), Apriningsih & Sufyan (2021), Christiansi et al. (2025), Oddo et al. (2022), Wahyuningsih et al., (2022) explicitly reported improvements in knowledge and attitudes after the intervention, with a significant p-value ($p < 0.05$). Education was provided through various media, such as videos, pocket books, focus group discussions (FGDs), educational games, and virtual

counseling. Three studies (Apriningsih et al. (2019), Wahyuningsih et al. (2022), Christiansi et al. (2025) also reported increased adherence to iron supplementation (TTD) consumption as a result of interventions involving parents and families. This intervention emphasizes the importance of parental supervision and emotional support for the success of the iron supplementation program for adolescents. Furthermore, two studies (Zhao & Yu, (2020) and Suciyananti et al. (2025) assessed the impact of the intervention on participants' biological status, particularly hemoglobin (Hb) levels. Both studies reported significant improvements in Hb levels, both through parent training on healthy eating patterns and through the implementation of local food-based food recommendations (FBR). The increased Hb levels reflect that the nutrition education intervention impacted not only cognitive and behavioral aspects but also physiological aspects, which are key indicators of anemia status. Overall, the findings from these nine studies indicate that an educational approach that actively involves families and communities can increase knowledge, foster positive attitudes, encourage healthy behaviors, and improve biological indicators in adolescent girls at risk of anemia.

Table 3. Summary of educational approaches and their impact on knowledge, sign consumption behavior, and hemoglobin levels

Studies	Educational Approach	Effect on Knowledge & Attitudes	Effect on Iron Tablet (TTD) Adherence	Effect on Dietary Behavior	Effect on Hb Levels	Effect on Anemia Prevalence
Zhao & Yu (2019)	Nutrition education for parents (RCT, 42 schools, >2000 rural students in China)	Knowledge score increased 0.195 SD ($p < 0.01$)	–	Higher frequency of meat/fish and fruit consumption in the intervention group	Hb increased +2.79 g/L (126.3 → 129.1 g/L)	Anemia prevalence decreased by 6.1% points (non-boarding students)
Pienaaah et al. (2025)	Household nutrition counseling	–	–	Households receiving counseling were 2.3 times more likely to have high dietary diversity (OR=2.309; $p < 0.001$)	–	–
Christiansi et al. (2025)	Education for adolescent girls and parents	Adolescent knowledge increased 22.4% → 44.9% ($p = 0.00$); attitude increased	No significant effect on parental support for TTD adherence	–	–	–

	using pocket books, jingles, tote bags, videos, and anemia education games	30.0% → 51.6% (p=0.00); parental knowledge increased 42.5% → 82.5% (p=0.00); parental attitude reached 100% (p=0.00)				
Apriningsih & Supyan (2021)	Virtual health education via Zoom for parents & teachers	Knowledge improved 12.18 ± 4.69 → 17.54 ± 3.77; attitude ± 4.94 → 46.60 ± 4.02; self-efficacy 20.97 ± 3.55 → 24.57 ± 0.87 (p<0.05)	Education was directed to parents/teachers to motivate adolescents in TTD adherence	–	–	–
Apriningsih et al. (2019)	Parental education and supervision	Positive correlation between parental and adolescent TTD adherence (p=0.000). Parental sup		–	–	–

Note: “–” indicates that no quantitative data were reported for the respective variable in the study.

The Role of Family Members and the Community

The involvement of family members, especially parents, is a crucial component in the success of anemia prevention interventions. Five studies ([Agestika & Pratiwi, 2023](#); [Apriningsih et al., 2019](#); [Apriningsih & Sufyan, 2021](#); [Christiansi et al., 2025](#)) confirmed that family support significantly impacts adolescents' knowledge, attitudes, and adherence to iron supplementation. For example, [Apriningsih et al., \(2019\)](#) found that direct parental supervision was the strongest predictor of iron supplement adherence. In addition to supervision, emotional involvement and parental role modeling were also cited as factors contributing to educational success. [Christiansi et al. \(2025\)](#) study showed that even if parental knowledge and attitudes improved, this did not necessarily translate into behavioral support unless the intervention also addressed motivational aspects and family communication. Conversely, [Wahyuningsih et al. \(2022\)](#) study found that the impact of family support on iron supplementation was significant highlighted that through focus group discussions (FGDs), families' attitudes toward iron supplementation (TTD) assistance improved dramatically after education, demonstrating that providing appropriate information can change families' perspectives and priorities. Thus, the family's role is not only as a recipient of information, but also as a primary facilitator,

creating a supportive environment for behavioral change in adolescent girls in anemia prevention. Linking these findings to health behavior theory, parental supervision can be seen as an external cue to action within the Health Belief Model, while supportive family communication reflects elements of perceived behavioral control in the Theory of Planned Behavior, both of which explain why family engagement is so influential in shaping adolescent adherence.

Trends in Consistency and Research Gaps in the Context of Family Education

This review found consistency in the effectiveness of family education interventions on improving cognitive (knowledge and attitudes), behavioral (iron tablet consumption), and physiological (hemoglobin levels) outcomes. Studies such as ([Apriningsih et al., 2019](#); [Christiansi, et al., 2025](#); [Zhao & Yu, 2020](#)) consistently found that family involvement, especially parental involvement, yielded positive outcomes in the context of anemia prevention in adolescent girls.

However, there are several important gaps that need to be addressed. First, most studies emphasize short-term knowledge and attitudes, while evaluation of the sustainability of behavioral changes and physiological impacts, such as hemoglobin levels, remains very limited. Most studies used short-term pre-post intervention designs, and only two studies explicitly evaluated

hemoglobin levels as a biological indicator. The effectiveness of family nutrition education is strongly influenced by consistent home practices and ongoing social support. Therefore, long-term longitudinal or experimental designs are a priority for future research.

Second, few interventions utilize a comprehensive family approach. Engagement still focuses on the mother, without comprehensive integration with other family members, the school, or the household environment in a systemic manner. Future studies should explore the role of fathers in food purchasing decisions, the influence of older siblings as role models in eating behavior, and the impact of inter-spousal communication on dietary practices, as indicated in studies such as Pienaah et al., (2025). In the Indonesian context, these interventions could be integrated into existing institutional frameworks such as the School Health Unit (UKS), Community Health Centers (Puskesmas), and the Family Welfare Empowerment program (PKK), in line with national health policy priorities (Kemenkes RI, 2016). This provides a more concrete and actionable pathway for policymakers.

Third, most studies are quasi-experimental or descriptive in nature, with limitations on the use of control groups, external validity, and sample size. Furthermore, most studies do not include a cost evaluation of the interventions. According to WHO guidelines, cost-effectiveness analysis is a critical component for public health interventions, as it provides policymakers with evidence on scalability and resource allocation (WHO, 2025). Without this component, family nutrition education may face challenges in being adopted into broader health programs.

Finally, although some studies mention the role of schools or health workers, cross-sector collaboration has not been explicitly explored. Yet, synergy between families, schools, health workers, and local governments can strengthen the success of nutrition education at the community level. This collaboration also has the potential to create a broader and more sustainable support ecosystem for adolescents. Therefore, future research directions need to include intersectoral approaches, cost evaluations, and long-term designs as a basis for evidence-based policy decision-making.

5. Conclusions and Suggestions

Family-based nutrition education has been shown to be effective in preventing anemia in adolescent girls, particularly through improved knowledge, attitudes, iron supplement consumption behavior, and, in some studies, hemoglobin levels. Parental involvement, particularly mothers, is a key factor in supporting the intervention's success.

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