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Determinants of Iron Supplementation Adherence in Adolescent Girls: Challenges and Strategies: *Scoping Review*

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ABSTRACT

Background: *Anemia in adolescent girls is a major health problem that affects growth, cognitive development, and productivity. Iron supplementation is a key preventive measure, yet adherence remains low.* ***Objective:*** *This review aimed to identify factors influencing adherence, barriers faced, and strategies to improve compliance with iron supplementation among adolescent girls.* ***Methods:*** *A scoping review was conducted using the PRISMA-ScR framework. Literature searches in PubMed, ScienceDirect, Wiley, and Google Scholar (2015–2025) identified 2,237 records; 14 studies met the inclusion criteria.* ***Results:*** *Adherence rates were very low, ranging from 1.4% in Indonesia (A1) to 26.2% in Ghana (A8), and 4.8% in India (A10). Supervised school programs increased adherence up to 67.7% (A11). Main determinants included knowledge, social support, side effects, and distribution systems. Effective strategies reported were school-based education, teacher and health worker monitoring, community campaigns, and culturally adapted interventions.* ***Conclusions:*** *Adolescent girls' adherence to iron supplementation remains suboptimal. Strengthening school-supervised intake, expanding digital adherence monitoring, and implementing community-based education are recommended to accelerate anemia reduction.*

Keywords: *adherence, iron supplementation, adolescent girls, barriers, strategies*

ABSTRAK

Latar Belakang: *Anemia pada remaja putri merupakan masalah kesehatan serius yang berdampak pada pertumbuhan, perkembangan kognitif, dan produktivitas. Suplementasi zat besi menjadi strategi utama pencegahan, namun tingkat kepatuhan masih rendah.* ***Tujuan:*** *Kajian ini bertujuan untuk mengidentifikasi faktor yang memengaruhi kepatuhan remaja putri dalam mengonsumsi suplementasi zat besi, hambatan yang dihadapi, serta strategi untuk meningkatkannya.* ***Metode:*** *Scoping review dilakukan dengan pendekatan PRISMA-ScR. Pencarian literatur pada PubMed, ScienceDirect, Wiley, dan Google Scholar (2015–2025) menghasilkan 2.237 artikel; 14 artikel memenuhi kriteria inklusi.* ***Hasil:*** *Tingkat kepatuhan sangat rendah, mulai dari 1,4% di Indonesia, 26,2% di Ghana, hingga 4,8% di India. Program sekolah dengan pengawasan guru meningkatkan kepatuhan hingga 67,7%. Faktor utama yang memengaruhi meliputi pengetahuan, dukungan sosial, efek samping, dan sistem distribusi. Strategi efektif yang dilaporkan adalah edukasi berbasis sekolah, pemantauan oleh guru dan tenaga kesehatan, kampanye komunitas, serta intervensi berbasis budaya.* ***Kesimpulan:*** *Kepatuhan remaja putri terhadap suplementasi zat besi masih rendah. Penguatan program sekolah dengan pengawasan konsumsi, pengembangan monitoring digital, dan edukasi komunitas berbasis budaya direkomendasikan untuk mempercepat penurunan anemia.*

Kata Kunci: *kepatuhan, suplementasi zat besi, remaja putri, hambatan, strategi*

INTRODUCTION

Micronutrient deficiencies remain a global health problem, especially among vulnerable populations such as young children, adolescent girls, menstruating women, and pregnant or postpartum women. Dessie et al (2024) showed that vitamin A deficiency affected 16.3% of children, iodine deficiency 43.4%, anemia due to deficiency 5.4%, and anemia-related stunting 19.5%. Stunting was associated with vitamin A deficiency (aOR: 1.54; 95% CI: 1.01–2.37), while iron deficiency anemia was linked to the absence of vitamin A supplementation. According to WHO (2022, 2023) anemia affects about 40% of children aged 6–59 months, 37% of pregnant women, and 30% of women aged 15–49 years.

In Indonesia, anemia is a significant public health issue affecting all age groups, with adolescent girls being particularly vulnerable due to blood loss during menstruation. If left unaddressed, anemia during adolescence can persist into pregnancy, increasing the risk of adverse fetal outcomes and pregnancy complications (Ministry of Health, 2024) .The Indonesian government has integrated anemia prevention into the National Movement for the

Acceleration of Nutrition Improvement under Presidential Regulation No. 42 of 2013 (WHO, 2011).

Adolescence (ages 10–18 years) is a critical stage for developing health habits that influence future well-being. Iron deficiency anemia during this period negatively affects growth, cognition, immunity, and productivity (Widyawati, 2018). However, adherence to iron supplementation among adolescent girls remains a challenge. Reported barriers include lack of knowledge, side effects, discomfort, and insufficient family or community support Conversely, factors such as effective health education, school-based monitoring, and strong family involvement have been shown to improve adherence (Unairnews, 2022).

Despite the growing body of research, few reviews have systematically synthesized barriers and strategies to improve iron supplementation adherence, particularly in Indonesia's cultural and educational context. This study therefore aims to map existing evidence, identify determinants of adherence, and provide actionable recommendations for strengthening adolescent girls' compliance with iron supplementation programs.

METHODS

This review explores the factors influencing adolescent girls' adherence to iron supplementation, the challenges they encounter, and strategies to enhance adherence using a scoping review approach. As a type of systematic knowledge synthesis, a scoping review employs a structured methodology to map existing evidence on a specific topic, identify key concepts, theories, sources, and highlight knowledge gaps. While scoping reviews are widely conducted, there remains a need to enhance their methodological rigor and improve the quality of reporting. This document introduces the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) guidelines and provides an explanation of their application (Tricco et al., 2018) . This scoping review method adopts the approach developed by Arksey & O'Malley (2005) steps taken in this scoping review include: (1) identifying research questions, (2) identifying relevant studies, (3) selecting relevant studies, (4) extracting and compiling data from the selected studies, and (5) systematically compiling, summarizing, and reporting the results

Identifying Research Questions

The research question for this scoping literature review, structured using the PCC framework in Table 1, is: "What are the key factors affecting adolescent girls' adherence to iron supplementation?"

Table 1. PCC *Framework*

P ***(Population)***	***C*** ***(Exposure)***	***C*** ***(Outcome)***
Teenage girl	Determinants of adherence in iron supplementation	Challenges and strategies

A comprehensive literature search was conducted in four major databases: PubMed, ScienceDirect, Wiley Online Library, and Google Scholar. The search covered articles published from January 2015 to January 2025. The following Boolean operators and keywords

were applied: *adolescent OR female teenagers AND determinants OR factors AND adherence OR compliance AND iron supplementation AND strategies OR barriers OR challenges*. Specific keywords were used in each database.

The inclusion and exclusion criteria used in this review are as follows:

Table 2: Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Full text and open access articles.	Editorial Articles, Opinions, Commentaries or articles that are not the result of original research.
Suitable relevant articles that discuss "Barriers and Supporters of Iron Supplementation Adherence in Adolescent Girls: Insights and Recommendations".	*Book review* / article *review*
Articles published in the last 10 years 2015 - 2025	Publication manuscript
Articles published in English	
Primary research or *original articles*	

Identifying Relevant Studies

After performing a literature search using predefined keywords across multiple databases and manual search engines, researchers initially identified 2,237 articles. These articles were then screened to determine their relevance to the review topic. Following the screening process, 14 articles met the established criteria. At this stage, the PRISMA Flow Chart was utilized to systematically visualize the article selection process.

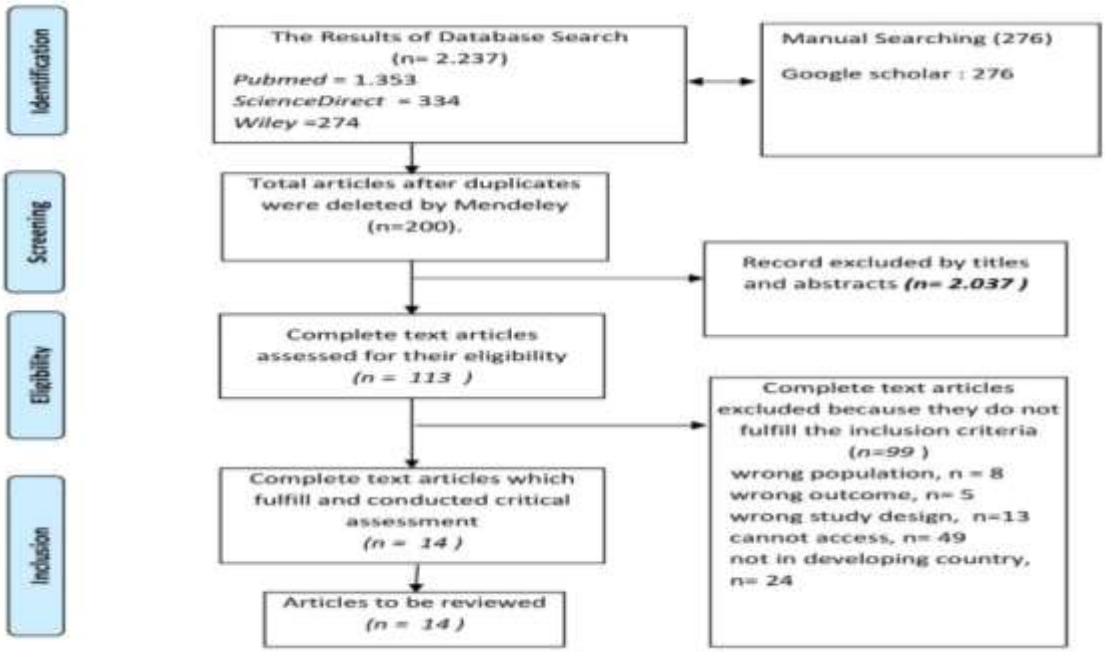

Figure 1. PRISMA flowchart

RESULTS

Choosing Relevant Studies

The extracted data focused on factors influencing adolescent girls' adherence to iron supplementation, the challenges they face, and potential strategies for improvement. Out of the 2,237 articles initially identified, only 14 met the inclusion criteria. These selected articles were published in English between 2015 and 2023. They exhibited various characteristics, including publication year, country of origin, and research methodologies used, as detailed in Table 3.

Table 3: Data Charting

No.	Research Identity	Country	Research Objectives	Research Design	Research Methods	Research Results
1.	The Role of Social Support and Interpersonal Trust to Improve Compliance of Iron Supplementation amongst Adolescent Girls: A Qualitative Approach (Tabita et al., 2023)	Indonesia	Examining adherence and the factors influencing compliance with iron and folic acid supplementation among adolescent girls.	Qualitative research	Data was gathered through online interviews conducted via the Zoom platform, involving a total of 13 participants. An in-depth interview approach was utilized, and the data were analyzed using open coding and thematic analysis.	The study identified several factors affecting adolescent girls' adherence to folic acid supplementation. Key supportive factors included social support from family and teachers, while barriers involved a lack of knowledge and motivation. These findings offer valuable insights into strategies for enhancing adolescent adherence to supplementation programs.
2.	Community approval required	Burkina Faso	Examine factors that influence adolescent	Qualitative research	Interviews were conducted with participants selected based on	Many adolescent girls initially perceive supplements as contraception, thus

No.	Research Identity	Country	Research Objectives	Research Design	Research Methods	Research Results
	for periconceptional adolescent adherence to weekly iron and/or folic acid supplementation: a qualitative study in rural Burkina Faso (Compaoré et al.., 2018)		girls' adherence to iron and folic acid supplementation and understand community perceptions of this supplementation.		adherence levels. Adherence was categorized into "good", "moderate", and "poor" based on recorded supplement consumption. Data analysis techniques were thematic.	reducing their understanding of the importance of supplementation. There were challenges in adherence due to cultural roles that had to be fulfilled, such as domestic obligations that made it difficult to be consistent in taking supplements. High participation in the study persisted despite misconceptions. The study showed the importance of community awareness on the benefits of supplementation to improve adherence.
3.	A Qualitative Study of Factors Influencing Initiation and Adherence to Micronutrient Supplementation Among Women of Reproductive Age in Vietnam (Nechitilo et al.., 2016)	Vietnam	Determine the factors that affect the initiation and adherence to micronutrient supplement consumption.	Qualitative study Qualitative study with approach	Conducting in-depth interviews and focus group discussions with women of reproductive age.	Cultural and social factors strongly influence adherence. The community's misperception of supplements as contraceptives leads to low acceptance. Women's mobility, such as getting married or working outside the city, is also a barrier to adherence.
4.	The acceptability of weekly iron-folic acid supplementation and its influencing factors among adolescent school girls in Yogyakarta city: a mix-methods study (Ansari et al.., 2021)	Indonesia	To evaluate the acceptability of the Weekly Iron-Folic Acid Supplementation (WIFS) program among adolescent girls and identify the factors that influence it.	Mixed-methods	A cross-sectional survey with 211 participants aged 12-18 years from six schools in Yogyakarta. Qualitative data was collected through FGDs and IDIs to explore participants' experiences and perceptions of supplementation.	A total of 22.3% of participants were categorized as having iron deficiency, and 12.4% of them had anemia. Although almost 90% of participants had received supplementation tablets, only 62% reported taking them. Factors that increased the likelihood of tablet consumption were good taste, while inhibiting factors included unpleasant tablet odor, forgetting, lack of support from friends, and side effects such as nausea.

No.	Research Identity	Country	Research Objectives	Research Design	Research Methods	Research Results
5.	Barriers to and Facilitators of Iron and Folic Acid Supplementation within a School-Based Integrated Nutrition and Health Promotion Program among Ghanaian Adolescent Girls (Gosdin et al., 2018)	Ghana	Analyze the challenges and facilitating factors influencing adherence to school-based iron and folic acid supplementation programs aimed at reducing anemia in adolescent girls.	longitudinal and cross-sectional	Longitudinal data analysis and generalized linear mixed models were applied to assess the factors affecting adherence to iron and folic acid (IFA) consumption at both the school and student levels. Additionally, bottleneck analysis was conducted to identify obstacles in IFA coverage rates.	Research identified various factors that influence the success of the program, including community support, teacher training, and students' knowledge and attitudes towards anemia and the benefits of IFA.
6.	Knowledge, Attitude And Adherence To Taking Blood Supplement Tablets Against Anemia In Adolescent Girls (Journal et al., 2024)	Indonesia	Assessing the knowledge, attitudes, and adherence of adolescent girls in consuming iron supplement tablets to prevent anemia.	Descriptive analytic with cross-sectional method.	Sampling was done by purposive sampling. Data were collected through questionnaires filled out by 60 female students at SMP Negeri 12 Palembang.	In-depth interviews were conducted with 39 participants, including non-pregnant, pregnant, postpartum women, as well as those who dropped out of the study, while additional data collection was conducted through focus group discussions with 24 village health workers (VHWs). Data analysis was conducted using MAXQDA10 software and processed based on grounded theory principles.
7.	Effect of education through video and packaging modifications of iron tablets on female adolescent behavior in the iron supplementation intake in SMPN 2 and SMPN 1 Parigi □ (Putu et al., 2021)	Indonesia	To evaluate the impact of video-based education and redesigned iron tablet packaging on adolescent girls' adherence to iron supplementation.	Quasi-experimental design	The study was carried out at SMPN 2 and SMPN 1 Parigi using a stratified random sampling method, with each group consisting of 62 respondents. The intervention involved video-based education and modifications to the packaging of iron tablets.	The Wilcoxon Signed Ranks Test analysis revealed a p-value of 0.001 (<0.05) in the intervention group, indicating a significant improvement in adolescent girls' knowledge, attitudes, and intentions before and after the intervention. Similarly, the control group demonstrated comparable results, with a p-value of 0.001 (<0.05).

No.	Research Identity	Country	Research Objectives	Research Design	Research Methods	Research Results
8.	Compliance with Weekly Iron and Folic Acid Supplementation and Its Associated Factors among Adolescent Girls in Tamale Metropolis of Ghana (Dubik et al., 2019)	Ghana	Assess the adherence level to the Iron and Folic Acid Supplementation (IFAS) program and identify the factors influencing adherence among adolescent girls in Tamale Metropolis, Ghana.	Cross-sectional study.	A structured questionnaire administered through interviews was used, with a sample of 424 randomly selected adolescent girls. Analysis was conducted using bivariate and multivariate logistic regression analysis.	Of the 424 respondents, only 26.2% were categorized as compliant with consumption of five or more supplement tablets over the past seven weeks, with the main reason being to prevent anemia and advice from teachers as the main motivations for taking supplements.
9.	Coverage of and compliance to iron supplementation under the National Iron Plus Initiative among reproductive age-group women in urban Puducherry - a cross-sectional study Abstract: (Gayathri et al., 2019)	India (Puducherry)	To estimate the proportion of women of reproductive age who received iron supplementation under the NIPI, assess the adherence rate among those who took the tablets, determine the percentage of women who received information from healthcare providers about anemia symptoms and the benefits of supplementation, and analyze the factors contributing to low acceptance and	cross-sectional	This study was conducted in the JIPMER health service area, Puducherry, using a questionnaire designed based on official program guidelines. The participants were women of reproductive age (15–49 years) who had resided in the service area for over a year. The questionnaire covered various aspects, including demographic information, frequency of home visits by Auxiliary Nurse Midwives (ANMs), the number and source of tablets received, knowledge about anemia, and reasons for non-adherence to tablet consumption.	Only 45.7% of women of reproductive age received iron supplementation, with a significant disparity between pregnant or lactating women (86.7%) and those who were neither pregnant nor lactating (38.7%). The primary sources of supplementation were health facilities and Anganwadi centers, while direct home delivery of tablets was limited. Factors positively influencing supplementation acceptance included being in adolescence, not being employed, receiving home visits from Auxiliary Nurse Midwives (ANMs), pregnancy, and the breastfeeding period.

No.	Research Identity	Country	Research Objectives	Research Design	Research Methods	Research Results
			adherence rates of iron supplementation.			
10.	Short Communication Iron-and-folic-acid supplementation among adolescents (aged 10-19 years) in two North Indian States, 2015-2016: a sex-stratified analysis (Rai, 2020)	India (Bihar and Uttar Pradesh)	Evaluating the prevalence and determinants affecting the consumption of iron and folic acid (IFA) supplements among adolescent boys and girls in two states of India.	cross-sectional	Data were gathered from 20,594 respondents aged 10 to 19 years using a multi-stage sampling approach. Statistical analysis was conducted using bivariate and multivariate logistic regression to identify factors influencing the acceptance of iron and folic acid (IFA) supplements.	Only a small percentage of adolescents receive and consume IFA supplements, with significant challenges in terms of acceptance compliance. The report also provides data on rates of anemia among adolescents, which indicates the need for further interventions.
11.	Prevalence of Anaemia and Compliance to Weekly Iron-Folic Acid Supplementation Program amongst Adolescents in Selected Schools of Urban Puducherry , India (Wangaskar et aL., 2021)	India (Puducherry)	Evaluate the prevalence of anemia and compliance with the Weekly Iron and Folic Acid Supplementation (WIFS) program among school-going adolescents. .	cross-sectiona	Data were gathered from schools, involving 499 students, through questionnaires to evaluate sociodemographic status and adherence to supplementation. Additionally, clinical tests were performed to assess the prevalence of anemia among the students.	The findings revealed that over 50% of adolescents were anemic, with a higher prevalence among those who had low adherence to the Weekly Iron and Folic Acid Supplementation (WIFS) program. The analysis also identified various social and demographic factors that influenced adolescents' compliance with the supplementation program.
12.	Factors associated with anaemia among adolescent boys and girls 10-19 years old in Nepal (Padarth et al., 2020)	Nepal	Analyze the factors linked to anemia in adolescent boys and girls aged 10 to 19 years.	cross-sectional	Data were collected through interviews that included biological indicators (hemoglobin levels and other biomarkers) and anthropometric assessments. Blood samples were taken for	The prevalence of anemia is more than 10% among male adolescents and more than 20% among female adolescents; certain factors such as nutritional status, diet, and sanitation that can be enablers or barriers to adolescent health are related to anemia.

No.	Research Identity	Country	Research Objectives	Research Design	Research Methods	Research Results
					nutritional and health status analysis.	
13.	Anaemia in Indians aged 10 - 19 years: Prevalence, burden and associated factors at national and regional levels (Scott et al.., 2022)	India	Assess the prevalence, severity, and impact of anemia among Indian adolescents while examining the factors contributing to anemia at both national and regional levels.	cross-sectional	Data were gathered from the 2016–2018 Comprehensive National Nutrition Survey (CNNS), which utilized a stratified cluster sampling method proportional to population size. A total of 14,673 individuals with valid hemoglobin level measurements were included in the dataset.	Anemia affects approximately 40% of adolescent girls and 18% of adolescent boys, equating to around 72 million anemic adolescents in India. The primary contributing factors include micronutrient deficiencies and dietary-related variables.
14.	Hemoglobin level and common mental disorders among school adolescent girls in Central Ethiopia: Structural Equation Model (Kedir et al.., 2025)	Ethiopia	Examining the association between hemoglobin levels and common mental disorders (CMD) among school-going adolescent girls in Central Ethiopia.	cross-sectional study	Data were collected using structured questionnaires in Amharic and Siltigna. Mental health was assessed with the WHO SRQ-20, and samples were drawn from primary and secondary school students.	Showed an association between hemoglobin level and mental disorders in adolescent girls, and provided estimates of the direct and indirect effects of hemoglobin on CMD.

Critical Apprasial

The critical appraisal, conducted using the Joanna Briggs Institute (JBI) tool, revealed that most of the analyzed studies were of high quality, demonstrating strong internal and external validity with well-structured study designs. These included quantitative research utilizing logistic regression and multivariate analysis, qualitative studies based on in-depth interviews, and mixed-method approaches. However, some studies were classified as moderate due to certain biases, such as the misinterpretation of iron and folic acid supplementation as contraception, the absence of longitudinal data, and the impact of social and geographical factors on adherence. None of the studies fell into the low-quality category, as the majority employed sound methodologies and produced reliable results.The key findings indicated that adherence to supplementation was influenced by factors such as social support, awareness of supplement benefits, side effects, and the role of healthcare providers and teachers in monitoring compliance. Implementing school- and community-based interventions with improved education was identified as a crucial strategy to enhance adherence and optimize the effectiveness of supplementation programs in reducing anemia among adolescents.

Table 4. Critical Appraisal

Kode Artikel	Desain Penelitian	Hasil
A1	Qualitative (Tabita et al., 2023)	Baik
A2	Qualitative (Compaoré et al., 2018)	Baik
A3	Qualitative (Nechitilo et al., 2016)	Baik
A4	Mixed Method(Ansari et al., 2021)	Baik
A5	Cross Sectional(Gosdin et al., 2018)	Baik
A6	Qualitative (Rehana et al., 2024)	Baik
A7	Quasi Eksperimental (Putu et al., 2021)	Baik
A8	Cross Sectional (Dubik et al., 2019)	Baik
A9	Cross Sectional (Gayathri et al., 2019)	
A10	Cross Sectional (Rai, 2020)	Baik
A11	Cross Sectional (Wangaskar et al., 2021)	Baik
A12	Cross Sectional (Padarth et al., 2020)	Baik
A13	Cross Sectional (Scott et al., 2022)	Baik
A14	Cross Sectional (Kedir et al., 2025)	Baik

Table 5. Year Classification

No.	Year of Publication	Number of Articles
1	2016	1
2	2018	2
3	2019	2
4	2020	3
5	2021	2
6	2022	1
7	2023	1
8	2024	1
9	2025	1
Total		14

As shown in the table above, the reviewed articles were published between 2015 and 2025. The distribution is as follows: one article from 2016, two articles from 2018, one from 2019, three from 2020, two from 2021, one from 2022, one from 2023, one from 2024, and one from 2025.

Table 6. Classification by Country

No.	Country	Number of Articles
1	Indonesia	4
2	India	4
3	Burkino Faso	1
4	Vietnam	1
5	Ghan	2
6	Ethiopia	1
7	Nepal	1
Total		14

According to the table above, the reviewed articles originated from seven different countries. The distribution includes four articles from Indonesia, four from India, one from Burkina Faso, one from Vietnam, two from Ghana, one from Ethiopia, and one from Nepal.

Table 7. Research Design Classification

No.	Design	Number of Articles
1	Qualitative	3
2	Mixed Method	1
3	Cross Sectional	9
4	Quasi-Experimental	1
Total		14

As shown in the table above, the reviewed articles utilized four different research methods. Specifically, there were three qualitative studies, one mixed-method study, nine cross-sectional studies, and one quasi-experimental study.

Table 8. Theme Analysis

Theme	**Sub-theme**	**Article Code**
Adherence to Iron and Folic Acid Supplementation	Adherence rate among adolescent girls	A1, A8, A10, A11, A13
	Factors Affecting Compliance Social Support	A1, A2, A5, A11, A12
	Perception and Knowledge Barriers and acceptance of supplementation and social support.	A1, A8, A11, A12 A6, A7, A11, A13 A2, A5, A12, A13
Impact of Supplementation	Adolescent Health Education and Intervention	A3, A9, A11, A12 A4, A7, A11, A13
Community Role in Supplementation	Awareness and Education	A1, A6, A11, A12
	The Importance of Community Awareness	A5, A13
	Education Program	A4, A11, A12
Effectiveness of Supplementation Program	Health education and promotion program	A7, A4. A11, A13
	Analysis of program effectiveness in schools	A5, A8, A11, A12
Relationship between Health and Mental Outcomes	The impact of hemoglobin on mental health	A9, A12, A14
	Research on anemia-related mental disorders	A6, A12, A14

DISCUSSION

Adherence to iron and folic acid supplementation among adolescent girls was consistently low across different countries. In Indonesia, adherence was reported at 1.4% (A1). In Ghana, the rate reached 26.2% (A8). In India, only 4.8% of adolescent girls consumed tablets regularly (A10). However, in schools with strict teacher supervision, adherence increased to 67.7% (A11). A study in East Kalimantan also showed only 4% compliance due to lack of awareness (Citta et al., 2024). In Bogor, supplementation programs were still ineffective in reducing anemia prevalence (Permatasari et al., 2018). These findings demonstrated that program availability alone was not sufficient; structured supervision was crucial.

Several determinants influenced adherence. Knowledge and awareness of anemia increased compliance significantly (A1, A6, A11). Geographic and socioeconomic conditions also affected adherence, with urban adolescents showing better compliance than rural counterparts (A12). Rahmiwati et al (2023) confirmed similar geographic disparities in Indonesia. Social support from teachers, parents, and peers further improved adherence (A1, A8, A11, A12). Apriningsih et al (2020) found that family and health worker involvement enhanced adherence in Depok, while Rahmiwati et al (2023) demonstrated that culture-based school education supported compliance.

Barriers to adherence were also documented. Misconceptions that iron tablets acted as contraceptives discouraged adolescents (A2, A12). Side effects such as nausea and heavy menstruation also reduced compliance (A5, A13). Nurhayati & Fitri (2024) reported that only 23% of adolescent girls adhered in Bengkunat due to discomfort from side effects. Community based education helped overcome fear and misconceptions about supplementation (Zuraida et al., 2023).

The benefits of supplementation were clear. Improved hemoglobin levels and anemia prevention were consistently observed (A3, A11). In India and Nepal, iron deficiency was linked to impaired cognitive growth and academic performance (A9, A12). Feriyanti et al (2022) also reported that iron deficiency correlated with lower academic achievement. In Yogyakarta, adherence stabilized hemoglobin levels (Oktalia et al., 2023). Maternal adherence reduced the risk of anemia in infants (Fatimah et al., 2023). Mental health impacts were significant as well. Anemia increased risks of stress, anxiety, and depression among adolescent girls (A9, A14). Martha & Sulistyaningsih (2022) confirmed that anemia contributed to cognitive decline and fatigue in Indonesia.

Intervention studies emphasized the role of education and program design. School- and community-based education improved outcomes, especially when integrated with teacher supervision (A4, A7, A11, A13). Utami et al (2022) found that education combined with supplementation improved knowledge in Islamic boarding schools. Rahmiwati et al (2023) demonstrated the effectiveness of culturally adapted interventions. The *Getar Thala* program sustained coverage during the COVID-19 pandemic (Wahdah et al., 2023). Digital platforms also enhanced awareness and adherence (Silitonga et al., 2023).

Overall, the evidence showed that adherence was shaped by a combination of knowledge, social support, perceptions, and delivery systems. The novelty of this review lay in its comprehensive synthesis of strategies across different settings. Unlike single studies that addressed only specific factors, this review mapped patterns that consistently appeared: the effectiveness of school-based supervision, the importance of family and community support, and the emerging potential of digital solutions. This integrated perspective provides a foundation for designing scalable, culturally sensitive, and sustainable strategies to reduce anemia among adolescent girls.

LIMITATIONS

This review included only English and open-access studies, potentially excluding relevant literature. Most included studies were cross-sectional, limiting causal inference. Population heterogeneity and contextual differences reduce generalizability of findings.

CONCLUSIONS AND SUGGESTIONS

Adherence to iron supplementation among adolescent girls remains suboptimal, primarily due to limited knowledge, perceived side effects, and weak distribution systems. To address these challenges, effective strategies require multisectoral involvement that integrates various stakeholders. School-based programs with mandatory supervised tablet intake can ensure consistency, while mobile-based monitoring applications provide innovative tools for tracking adherence. Incentive-based programs that reward schools with high compliance rates may also motivate better participation. Furthermore, culturally adapted education and active community engagement play a crucial role in improving acceptance and long-term sustainability. By combining efforts from schools, families, communities, and digital platforms, national targets to reduce anemia among adolescent girls can be achieved more effectively.

ETHICAL CONSIDERATIONS

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