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The effectiveness of educational media in preventing anemia among adolescent girls

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ABSTRACT

Anemia is a prevalent health issue among adolescent girls, particularly in developing countries, with serious consequences for growth, cognitive function, and overall well-being. As this group undergoes critical physical development and prepares for future reproductive health, effective prevention strategies are essential. Health education has been widely recognized as a key intervention to improve awareness, knowledge, and behavioral changes related to iron intake and nutrition. This study systematically reviews 18 eligible articles published between 2013 and 2024 that examine the effectiveness of various educational media in preventing anemia among adolescent girls. A comprehensive literature search was conducted using Google Scholar and PubMed with relevant keywords in both English and Bahasa Indonesia. The included studies utilize different methodologies, such as quasi-experimental designs, participatory action research (PAR), and media development. Various educational media were analyzed, including leaflets, posters, videos, mobile applications, and interactive tools like educational games. The findings consistently demonstrate that educational interventions, particularly those utilizing digital and interactive media, effectively enhance knowledge, foster positive attitudes, and promote healthier behaviors. Approaches that actively involve participants, such as PAR, further improve engagement and personal responsibility for health. To maximize effectiveness, future programs should expand the use of digital platforms, such as social media and gamified learning tools, which have been shown to sustain attention and motivation. Additionally, integrating culturally relevant and community-based educational strategies can further enhance the long-term impact of anemia prevention efforts among adolescent girls.

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INTRODUCTION

Anemia is a condition characterized by lower levels of red blood cells or hemoglobin (Hb) concentration in the blood than the normal range based on age and sex (Addo et al., 2021;

Domenica Cappellini & Motta, 2015; Gelaw et al., 2019). The normal hemoglobin level for women over 15 years old is >12.0 g/dl (>7.5 mmol) (Ritz et al., 2007; Wouters et al., 2018). Anemia can be classified based on various factors, such as cell size, etiopathogenesis, and causes, including blood loss (Astutik and Ertiana 2018). Symptoms of anemia include weakness, fatigue, lethargy, dizziness, headaches, and blurred vision (Bakta 2018). School-age children and adolescents are among the age groups at high risk for anemia (Briawan 2016). Anemia remains a significant global health issue, particularly among adolescent girls. Although there has been a decline in prevalence in recent years, this challenge still requires serious attention. According to WHO data from 2021, approximately 31.2% of women worldwide experience anemia, with the highest prevalence in reproductive-age women (15–49 years) at 33.7%(Survei Kesehatan Indonesia (SKI) 2023). Anemia in this group is often caused by iron deficiency, which can negatively impact maternal health and child development. According to the 2023 Indonesian Health Survey (SKI), the prevalence of anemia among adolescent girls in Indonesia reached 18%, down from 32% in 2018; however, it remains a public health issue that requires serious attention. Some regions report even higher figures. For instance, in West Java, the prevalence of anemia among adolescent girls has been reported to exceed 40% (Lamuri et al., 2024). This condition not only affects the physical health of adolescents but also impacts their concentration, academic performance, productivity, and health readiness for future pregnancies. One strategic effort to combat anemia among adolescent girls is through educational interventions. Nutrition education delivered in an engaging, easily understandable, and relevant manner has proven effective in increasing their knowledge and awareness of the importance of anemia prevention. Educational media, whether in digital forms (videos, infographics, apps, social media) or conventional formats (leaflets, posters, booklets), can serve as powerful tools in conveying health messages. According to the Indonesian Minister of Health Regulation No. 25 of 2014, adolescents are defined as individuals aged 10 to 18 years. This stage is further divided into three phases: early adolescence (10–13 years), middle adolescence (14–16 years), and late adolescence (17–20 years). Notably, the age range of 10 to 14 years, which is typically about 12 to 18 months before the onset of menarche, is considered the peak growth velocity phase for girls. During this critical developmental period, the body demands higher levels of nutrients, particularly iron. If nutritional intake is inadequate, the risk of developing anemia increases significantly

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areas. This approach aligns with adolescent habits and can improve the effectiveness of health education.

Several factors contribute to the high prevalence of anemia among adolescent girls. Menstruation, which causes regular blood loss, substantially raises iron requirements. Additionally, many teenage girls desire a slim body image, which often leads to restrictive eating habits and insufficient nutrient intake (Elstrott et al., 2020; Percy et al., 2017). Furthermore, Wang et al., (2013)reported that adolescent girls with poor eating habits were 1.2 times more likely to develop anemia than those with balanced diets. Another significant factor is nutritional knowledge. Inadequate understanding of dietary needs, food sources of iron, and anemia prevention strategies can hinder adolescents from making informed health choices. According to Susilowati et al.,(2025)), 84.8% of adolescent girls who experienced anemia had low levels of nutritional knowledge. Infections, both acute and chronic, can also exacerbate anemia, especially in environments where sanitation and healthcare access are limited (WHO, 2011). In response to these multifaceted challenges, educational interventions are increasingly recognized as a vital tool in promoting anemia prevention. Educational media—such as booklets, posters, digital videos, mobile applications, and social media campaigns—offer flexible and scalable platforms to disseminate information effectively. The effectiveness of such media, however, depends on their ability to engage adolescents, enhance their understanding, and encourage behavioral change. Despite existing initiatives, there remains limited research evaluating which forms of educational media are most impactful in reducing the risk of anemia through improved knowledge and dietary behavior. Therefore, this study aims to assess the effectiveness of educational media in increasing awareness and prevention of anemia among adolescent girls.

RESEARCH METHOD

This study employs a systematic review design to analyze and describe the effectiveness of educational media in preventing anemia among adolescent girls. The inclusion criteria for this review are scientific articles published in English or Bahasa Indonesia, available in full-text, and focusing on the use of educational media to improve knowledge, attitudes, or behaviors related to anemia prevention in adolescent females. Both quantitative and qualitative studies were included. A comprehensive literature search was conducted using Google Scholar and PubMed databases. The following keywords were used in both English and Indonesian: “educational media” AND “anemia prevention” AND “adolescent girls” and “media edukasi” AND “pencegahan anemia” AND “remaja putri”. The search was limited to articles published between 2013 and 2024 to ensure data relevance and recency. Retrieved articles were organized using reference management software, and duplicates were excluded. Articles were screened based on titles and abstracts for relevance and reviewed in full to assess eligibility. Data extracted included authorship, year of publication, study location, design, sample characteristics, type of media used, outcome measures, and main findings. Descriptive analysis was used to identify trends and variations in the use of educational media across studies. The findings are presented narratively and highlight how different types of media—such as leaflets, videos, posters, and mobile applications—can influence knowledge levels, attitudes, and preventive practices regarding anemia. This review provides an evidence-based understanding of the role of educational interventions in addressing anemia among adolescent girls and offers recommendations for optimizing health education strategies to support adolescent health.

In preparing this systematic review, the risk of publication bias and the tendency to include studies reporting only positive results were anticipated by implementing comprehensive and systematic search strategies across multiple databases (Google Scholar and PubMed) using broad keywords in both English and Bahasa Indonesia. Screening based on titles, abstracts, and full texts allowed for careful assessment of study relevance and quality before inclusion. Although no formal statistical tests for publication bias (e.g., funnel plots) are mentioned, the narrative and

descriptive analysis approach aimed to transparently present variations and trends, acknowledging potential biases and limitations in the existing literature. This methodological rigor helps mitigate the impact of selective publication and strengthens the validity of the review's conclusions. The review carefully considered the methodological quality of included studies by evaluating instrument validity, use of randomization, and presence of control groups. Studies with rigorous designs like RCTs and well-validated measures were prioritized to ensure reliable results. Both quantitative and qualitative research were included to provide a comprehensive view. This approach ensured that conclusions about the effectiveness of educational media for anemia prevention among adolescent girls are based on strong and credible evidence.

RESULTS AND DISCUSSIONS

A total of 521 articles were obtained from two databases, EBSCO and Google Scholar. These articles were then screened, and 96 duplicate entries were removed. Additionally, 158 articles were excluded due to incomplete information or unclear publication years. Next, eligibility assessment was conducted based on the full text and inclusion criteria. A total of 1 articles did not meet the criteria, leaving 37 articles suitable for inclusion in this review. The article selection process and results are shown in the PRISMA Flow Diagram (Figure 1). A synthesis of the 18 eligible articles was conducted, revealing three main themes: the effectiveness of various educational media in increasing knowledge and awareness about anemia among adolescent girls, the influence of these interventions on attitudes and behavioral changes related to iron supplement intake and nutrition, and the role of digital and interactive media in enhancing engagement and long-term retention of health education messages. These themes highlight the critical role of tailored educational strategies in anemia prevention programs targeting adolescent populations.

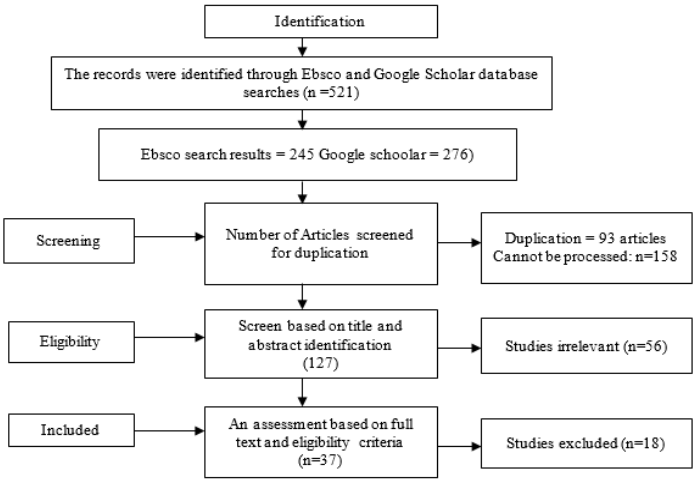

Figure 1. Prism diagram

This review analyzes 18 articles that collectively examine the effectiveness of various educational media in supporting anemia prevention efforts among adolescent girls. These studies employ a range of approaches, including quasi-experiments, pre- and post-tests with control groups, participatory action research (PAR), and the development of educational media. The types of media used vary widely, such as animated videos, e-booklets, posters, printed modules, social media platforms like TikTok, and interactive educational tools like *Truth or Dare* cards. Each study provides valuable insights into how education delivered through different media formats can enhance knowledge, foster positive attitudes, and even influence real behavioral changes, such as increased consumption of iron supplements and healthier dietary choices. Some studies also

demonstrate direct clinical outcomes, including increased hemoglobin levels, as a result of these interventions. By analyzing these 18 studies, this review aims to identify common trends, strengths, and limitations of each approach, and to offer recommendations for the most effective and sustainable educational strategies for preventing anemia among adolescent girls.

Table 1. Selected articles on educational interventions for anemia prevention among adolescent girls

No.	Author(s) & Year	Title	Method	Main Findings
1	(Amalia et al., 2024)	Education on Anemia for Adolescent Girls and Hemoglobin Testing Post Iron Supplementation at SMP Al-Ma'arif Tasikmalaya	Participatory Action Research (PAR)	Education improved the students' understanding of anemia and the importance of consuming iron supplements
2	(Anifah et al., 2020)	The Effect of Health Education Using Video Media on Knowledge about Anemia in Adolescent Girls	Quasi-experiment (pre-post test)	Significant improvement in adolescent girls' knowledge after video-based education
3	(Jabbar et al., 2023)	Education on the Dangers of Anemia and the Use of Iron Supplements (Fe) for Students at SMP Negeri 5 Kendari	Lecture, discussion, and educational video	Education improved students' understanding of the dangers of anemia and the use of iron supplements
4	Widyawati et al. (2022)	Health Promotion Using Video Media for Preventing Anemia in Adolescent Girls at Darussalam Pesantren, Bergas	Health promotion using animated video	Animated video effectively improved adolescent girls' knowledge about anemia prevention
5	(Jadana et al., 2019)	The Effect of Nutritional Education and Iron Supplementation on Hemoglobin Levels in Adolescent Girls	Quasi-experiment	Nutritional education and iron supplementation increased hemoglobin levels and knowledge in adolescent girls
6	(Alaofé et al., 2009)	Effect of a nutrition education program and diet modification in beninese adolescent girls suffering from mild iron deficiency anemia	Quasi-experiment (pre-post test)	Health promotion improved adolescent girls' knowledge about the importance of iron supplementation
7	(Salma Nabila et al., 2023)	The Effect of Education Using TikTok Media on Knowledge and Attitudes toward Anemia Prevention in Adolescent Girls	Pre and posttest with control group design	Education via TikTok improved knowledge and attitudes of adolescent girls towards anemia prevention
8	(Violita & Adimuntja, 2025)	Development of Truth or Dare Cards for Anemia Prevention Education in Adolescent Girls	Educational media development	"Truth or Dare" cards were effective as an educational tool for anemia prevention in adolescent girls
9	(Lende et al., 2024)	Analysis Of The Consumption Behaviour Of Blood Supplement Tablets Among Female Students At Stikes Panakkukang	Pre-experiment (pre-post test)	Health education improved positive attitudes towards the consumption of iron supplements
10	(Ahmalinda et al., 2020a)	The Effect of Nutritional Education on Knowledge of Anemia, Iron Supplementation, and Iron Intake in Adolescent Girls at High Schools in Cimahi	Quasi-experiment (pre-post test with control)	Nutritional education improved knowledge, iron supplement consumption, and iron intake in adolescent girls
11	(Violita & Adimuntja, 2025)	Development of Truth or Dare Cards for Anemia Prevention Education in Adolescent Girls	Educational media development	Truth or Dare" cards were effective as an educational tool for anemia prevention in adolescent girls
12	(Soesilawati et al., 2019)	The Effect of Health Education on Attitudes of Adolescent Girls Regarding the Consumption of Iron Supplements at SMP Negeri 3 Kediri in 2024	Pre-experiment (pre-post test)	Health education improved positive attitudes towards the consumption of iron supplements

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13	(Ahmalinda et al., 2020b)	The Effect of Nutritional Education on Knowledge of Anemia, Iron Supplementation, and Iron Intake in Adolescent Girls at High Schools in Cimahi	Quasi-experiment (pre-post test with control)	Nutritional education improved knowledge, iron supplement consumption, and iron intake in adolescent girls
14	(Rosaria et al., 2023)	Effectiveness of Counseling Using Video Media on Knowledge About Anemia Among Adolescent Girls at SMAN 10 Bengkulu City	Quasi-experiment (pre-post test)	Counseling using video media significantly improved adolescent girls' knowledge about anemia
15	(Diana Solang et al., 2023)	Effectiveness of Audio-Visual and Module Media on Knowledge About Anemia Among Adolescent Girls: A Literature Review	Literature review	Audio-visual and module media were effective in increasing knowledge about anemia among adolescent girls
16	ROMANTI et al., 2022)	The Effect of Poster Media on Increasing Anemia Knowledge Among Adolescent Girls at SMAN 1 Kartasura	Quasi-experiment	Poster media effectively increased adolescent girls' knowledge about anemia
17	Firdaus et al. (2021)	The Effect of Nutrition Education Using Anemia E-Booklet Media on Anemia Knowledge and Iron-Rich Food Consumption Behavior Among Adolescent Girls at SMA Negeri 1 Cisarua Bogor	Quasi-experiment	Nutrition education using e-booklets improved knowledge and iron intake behavior among adolescent girls

Methodological Approaches in Educational Interventions

Most of the studies analyzed utilized quasi-experimental research designs (as conducted by Anifah et al., Jabbar et al., Ahmalinda et al., and others), which are suitable for evaluating the effectiveness of educational interventions in specific groups without random assignment. This method allows researchers to observe changes in knowledge or attitudes among respondents before and after the intervention. Additionally, pre-experimental methods are also widely used; although not as robust as quasi-experiments, they still provide initial insights into the effectiveness of education. Some studies employed Participatory Action Research (PAR) approaches (such as Amalia et al., 2024), emphasizing the active involvement of participants in the educational process, which fosters a sense of ownership over the health programs implemented. Interestingly, studies like that of Violita & Adimuntja (2025) applied the development of educational media, combining research with innovative processes to create targeted and engaging media for adolescent audiences. One study utilized a literature review (Diana Solang et al., 2023), offering a broader and integrated perspective of various previous study results, thereby strengthening the evidence for the effectiveness of audio-visual media and learning modules. The variety of methodological approaches enriches the understanding of effective ways to deliver anemia education to adolescent girls.

Variety of Educational Media: From Conventional to Interactive Digital

One notable finding across all studies is the diversity of educational media used. Conventional media such as lectures, discussions, posters, and printed modules are still widely employed and proven effective, as demonstrated in the research by Jabbar et al. and ROMANTI et al. However, digital and interactive media show a trend of increasing effectiveness, particularly among adolescents. For example, animated videos (Widyawati et al., 2022) and other educational videos (Anifah et al., 2020; Rosaria et al., 2023) successfully capture adolescents' attention and enhance their understanding of anemia. A study by Salma Nabila et al. (2023) utilized TikTok, a platform highly popular among teenagers, and showed positive results not only in knowledge but also in attitudes toward anemia prevention. Similarly, the use of educational game media, such as the "Truth or Dare" cards (Violita & Adimuntja, 2025), adds an entertaining element to education and boosts students' active participation. This approach serves as significant evidence that the

selection of appropriate media—especially those that align with adolescents' preferences and learning styles—can be key to the success of health education programs.

Effectiveness of Interventions on Knowledge, Attitudes, and Behaviors

The primary effects measured from these interventions are the increases in knowledge, attitudes, and behaviors related to anemia and iron tablet consumption. Almost all studies indicate a significant improvement in knowledge following the educational interventions. Research by Ahmalinda et al. and Jadana et al. even recorded increases not only in knowledge but also in iron intake and hemoglobin levels, demonstrating a direct educational impact on physiological health aspects. Studies such as those by Lende et al. (2024) and Soesilawati et al. (2019) also highlight positive attitude changes toward iron tablet consumption after receiving education. This is crucial, as one of the main challenges in combating anemia is the low adherence to iron supplement consumption due to a lack of understanding or discomfort. Through appropriate educational approaches, these barriers can be minimized, leading adolescents to become more aware of the importance of anemia prevention.

The effectiveness of popular social media platforms like TikTok compared to traditional media such as booklets or posters was assessed by measuring both short-term knowledge gains and longer-term behavioral outcomes, particularly the sustained consumption of blood supplement tablets. Studies typically employed pre- and post-intervention assessments to evaluate immediate improvements in knowledge and attitudes, followed by follow-up surveys or observations weeks or months later to track retention and actual behavior change. TikTok's engaging, visual, and easily shareable content was found to enhance motivation and recall among adolescents, often leading to higher levels of sustained interest and adherence to recommended behaviors compared to more static formats like booklets or posters. However, some studies also noted that combining social media interventions with conventional media or in-person education tended to yield the best outcomes, suggesting that multimedia approaches reinforce learning and promote more durable behavior changes such as regular tablet intake. Overall, social media platforms like TikTok show promise for reaching adolescent audiences effectively, but ongoing engagement and complementary educational strategies are important to maximize long-term impact.

CONCLUSION

Based on the review of various studies discussing educational interventions for the prevention of anemia among adolescent girls, there is a consistent finding that health education is highly effective in increasing awareness, knowledge, and practices related to anemia prevention. A variety of methodological approaches and educational media, both conventional and digital, provide numerous alternative strategies that can be tailored to local contexts and the characteristics of the target adolescent population. To enhance the effectiveness of future programs, the use of digital and interactive media such as animated videos, social media, and educational games should be expanded, as they have proven more capable of capturing attention and maintaining participant engagement. Additionally, approaches that involve active participation, such as Participatory Action Research (PAR), can encourage a sense of personal responsibility for health. Education should not only focus on increasing knowledge but also aim to foster positive attitudes and behaviors, particularly regarding consistent iron tablet consumption and the selection of nutritious diets. To systematically integrate media-based education programs into adolescent health curricula in junior and senior high schools, it is essential to align these interventions with existing educational frameworks and learning objectives focused on health promotion. First, curriculum developers and health educators should collaborate to incorporate diverse media formats—such as animated videos, social media content, and interactive educational games—that appeal to adolescents and enhance engagement. These tools should complement traditional teaching

methods to reinforce learning effectively. Second, the integration should emphasize active learning approaches, including participatory activities that foster students' ownership of their health behaviors, such as iron tablet adherence and nutritious diet choices. Third, teacher training and resource allocation must support educators in delivering these media-based interventions confidently and consistently. Finally, ongoing monitoring and evaluation mechanisms should be established within the school system to assess knowledge retention, attitude shifts, and behavioral outcomes, enabling continuous program improvement tailored to the local context and adolescent needs. This comprehensive approach ensures that media-based anemia prevention education becomes a sustainable and impactful component of adolescent health curricula. It is recommended to develop and integrate interactive digital educational media, such as animated videos, social media, and educational games, into adolescent health curricula in secondary schools, using participatory approaches to enhance student engagement and personal responsibility. Additionally, training for teachers and health workers should be provided to ensure effective use of these media, along with regular evaluations to keep the content relevant and capable of promoting positive attitudes and healthy behaviors in anemia prevention among adolescents.

The reviewed studies present several limitations, including the predominant use of quasi-experimental designs without control groups, short-term evaluation periods, and a primary focus on knowledge improvement without assessing behavioral changes or clinical outcomes such as hemoglobin levels. Additionally, data duplication in some entries may lead to analytical bias. Future research should employ more robust designs, such as randomized controlled trials (RCTs), and include long-term follow-ups to measure sustained impact. Expanding the use of engaging digital media aligned with adolescents' interests, and integrating education with direct interventions like iron supplementation, are recommended. Furthermore, incorporating culturally relevant and context-specific approaches will enhance the effectiveness and sustainability of anemia prevention programs for adolescent girls.

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