



Education through Mobile Applications on Anemia Knowledge Among Adolescent Girls: A Scoping Review

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ABSTRACT

Anemia is a prevalent public health issue affecting adolescent girls globally, significantly impacting their physical health and development. Mobile applications have emerged as a promising tool for health education, potentially improving knowledge and management of anemia. To systematically review and summarize the available literature on mobile applications designed for anemia education among adolescent girls. The review employed the PRISMA-ScR guidelines for scoping reviews to ensure a systematic approach. A total of six articles were reviewed showing that intervention using mobile phone significantly increased the knowledge of adolescent girls compared to the control group ($p < 0.005$) and was effective in preventing anemia. Anemia education use mobile phone applications is effective for increasing nutritional knowledge and preventing anemia in adolescent girls.

INTRODUCTION

According to WHO anemia is a global health issue that affects various age groups, including adolescents approximately 47.4% of adolescent girls and 25.4% of adolescent boys worldwide suffer from anemia (WHO, 2021). This prevalence reflects a significant health burden, particularly in developing countries. Anemia was prevalent in Indonesia in 2018, according to the Basic Health Research (Riskesdas), with 27.2% of patients aged 5 to 14 years and 37.1% of patients aged 15 to 24 years affected. Riskesdas also concluded that females, particularly adolescent girls, are at a higher risk of anemia.

Anemia in adolescents is a health condition where individuals aged 10 to 19 years experience a decrease in the number of red blood cells or hemoglobin concentration in the blood, resulting in reduced capacity for oxygen transport throughout the body. Adolescent anemia can be caused by various factors, including iron deficiency, vitamin deficiencies (such as vitamin B12 and folic acid), chronic infections, and other underlying health disorders (Ramakrishnan, et.al., 2018).

Knowledge about anemia among adolescent girls is crucial for effectively preventing and managing this condition. This knowledge includes an understanding of the definition of anemia, its causes, symptoms, and consequences, as well as appropriate prevention and treatment measures (Sari, 2021). A lack of knowledge can lead to delays in the detection and management of anemia, which can, in turn, impact their physical health, cognitive development, and overall quality of life (Kusuma and Rahayu, 2023).

Health education via mobile application refers to the use of smartphone or tablet applications to deliver information, resources, and interactive tools designed to promote health awareness and knowledge among users (Nugroho et.al 2021). These applications aim to provide accessible, convenient, and personalized education on various health topics, including disease prevention, management of chronic conditions, healthy lifestyle choices, and health behavior changes (Yuliana et.al 2019).

LITERATURE REVIEW

Adolescent girls are among the most vulnerable groups to anemia due to rapid growth, menstrual blood loss, and often inadequate nutritional intake. Anemia in this population can negatively affect physical development, cognitive performance, and overall quality of life. Recent studies highlight the importance of educational interventions to improve awareness and preventive behaviors regarding anemia. With the increasing penetration of smartphones and internet access, mobile applications have emerged as a promising tool for health education. Mobile health (mHealth) applications provide interactive, accessible, and user-friendly platforms that can deliver tailored information, reminders, and self-monitoring features to enhance knowledge and behavior change.

METHODOLOGY

This study is a scoping review conducted using the PRISMA-ScR checklist (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) (Tricco et al., 2018). The search was performed using the

Google Scholar, Pubmed, and Science Direct database with the Boolean search terms ("Anemia Education OR Education via Mobile Apps" AND ("Adolescents Girl" OR "Girl Teenagers"))).

Data screening was carried out by selecting articles that matched the research title and met the inclusion criteria, which were: 1. the article had been published in an international journal; 2. the keywords matched the Boolean search terms; 3. the article was published within the last 5 years; 4. The article was available in full text. Eligibility was assessed against the exclusion criteria, which were: 1. inaccessible articles; 2. duplicate articles; and 3. articles that were not research studies. The review was also aligned with the PICOS criteria: Population (female adolescents aged 13-18 years), Intervention (anemia education), Comparison (no anemia education), and Study (experimental and observational studies).

RESULTS AND DISCUSSION

Overview of Studies

Based on the search results, 322 articles were found through the Google Scholar, Pubmed and Science Direct databases. A total of 52 articles were excluded due to duplication, screening was carried out on 270 articles, then 219 articles were excluded because they did not meet the inclusion criteria. There were 47 articles that met the requirements, then 32 articles were excluded because they were not original articles and 9 articles were not open access. So a review was carried out on 10 articles that met the inclusion criteria.

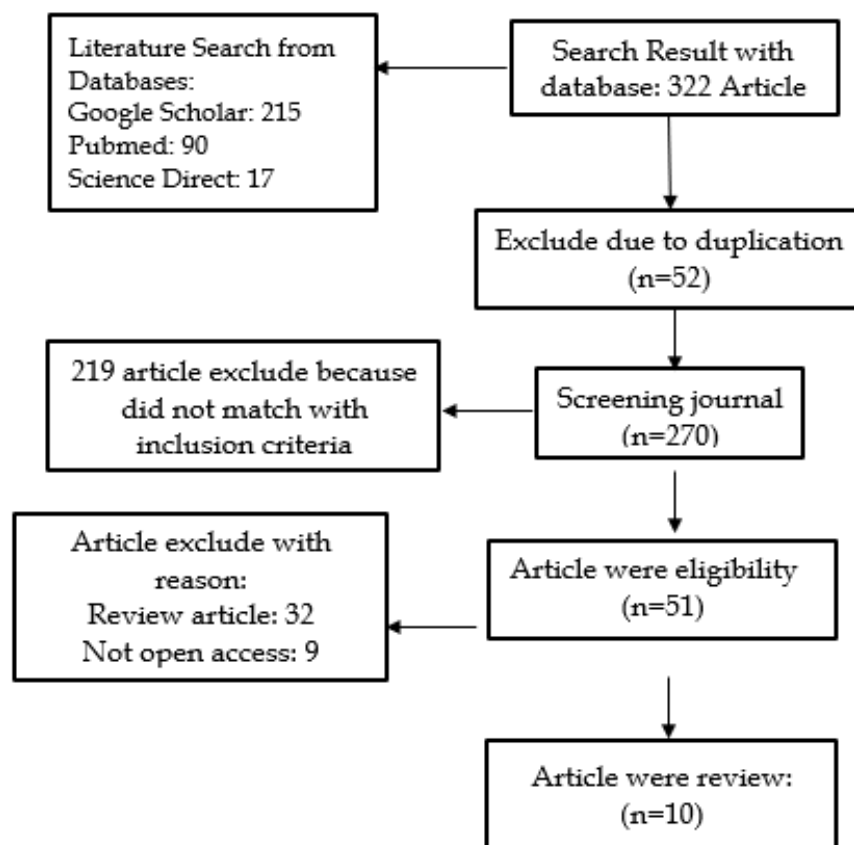


Figure 1. Flowchart study selection

Data Synthesis

The articles that have been found are then grouped based on title, design, intervention sample and the following research results.

Table 1. Synthesis and analysis Data

Authors , year	Title	Design	Sample	Intervention	Findings
Ernawati et.al (2022)	The Effects Of Anemia Education Using Web-Based Smart To Improve Knowledge, Attitudes, And Practice In Adolescent Girls	Pre-experimental One group pretest and posttest	47 female adolescents, 17-18 years	Education using web-based smart	Anemia education using web-based smart can improve knowledge, attitudes, and practice before and after an intervention.
Jeihooni et.al (2021)	The Effect Of Nutrition Education Based On PRECEDE Model On Iron Deficiency Anemia Among Female Students	Quasi-experimental design with pretest-posttest	160 female adolescents, 13-14 years	The educational intervention included six sessions based PRECEDE model for 45 or 50 min	The nutrition intervention education base on PRECEDE model has a positive effect to improve iron deficiency anemia preventive behaviors in female students.
Rohani et.al, (2020)	Youth Health Smartphone Application "Teenfit" In Increasing Adolescent Knowledge About Anemia, In Bantul, Yogyakarta	Quasi-experimental with pretest-posttest	95 female adolescents	health smartphone application "TEENFIT"	Knowledge about anemia in adolescents increases with the using of youth health smartphone application "TEENFIT", but it is not statistically significant.
Sari et.al. (2020)	The Effect Of Mobile Health (M-Health)	Quasi-experimental	277 female adolescents	Mobile applications namely the	Knowledge, attitudes, and practices to

	Education Based On Wanterapplic-ation On Knowledge, Attitude, And Practice (KAP) Regarding Anemia Among Female Students In A Rural Area Of Indonesia	design with pretest-posttest	t, 15-18 years	WANTER application, on increasing KAP	prevent anemia need to be continuously improved. Health education through appropriate media for adolescents is very important to make interventions more effective.
Rahayu et.al (2024)	Usability Of A Mobile Application On Anemia Prevention Among Adolescents	Quasi-experime-ntal design with pretest-posttest	15 female adolescen-ts, 13-14 years	This study investigated the usability of the hybrid application "AneMia-Prev," a mobile application that prevents anemia among adolescents.	The application received an overall usability average of 112.5 points, indicating good usability. The study demonstrates the high usability of the prototype, indicating its effectiveness, efficiency, and satisfaction, suggesting that future research could use TA methods with larger sample sizes.
Nesrin et.al (2021)	The Impact Of Nutrition Education On Knowledge, Attitude, And Practice Regarding Iron Deficiency	Quasi-experime-ntal design with pretest-posttest	363 female adolescen-ts,13-14 years	The intervention was divided into four sessions containing lectures, videos, and brochures,	Structured educational intervention effectively improves knowledge, attitude, and practice regarding IDA

	Anemia Among Female Adolescent Students In Jordan				and each session lasted for approximatel y 45 min.	among Adolescent females.
Adlu et.al (2023)	Effect Of Nutrition Education Using The Podcast Method On Adolescent Girls Knowledge And Attitudes On Anemia In Central Jakarta	Of quasi- experime ntal with a control group design	68 female adolescen t, 16-17 years	The intervention was conducted in four phases over two weeks period. Pretests and posttests were collected using an online questionnaire shared through a messaging platform.	Podcasts could be an alternative education method for adolescents. It shows effectiveness in increasing knowledge but not in attitudes, which needs more study.	
Fitria et.al (2021)	The Effect of Peer Education on Knowledge and Attitudes about Anemia and Chronic Energy Deficiency of Adolescent Girls at Percut Village, Indonesia	Quasi- experime ntal design with pretest- posttest	25 female adolescen ts 16-17 years	The treatment group was given education with content about nutritional problems in adolescent girls including anemia and chronic energy deficiency for two days and repeated the next week, and posttest was carried out again to assess	The peer education method is very effective in increasing knowledge and attitudes about anemia and chronic energy deficiency in adolescent girls in Percut Village, Deli Serdang Regency, Indonesia.	

				knowledge and attitudes in both groups.	
Yulianti et.al (2023)	The Effectiveness of Web-Based E-WoHealth on Compliance with Consumption of Iron Tablets in Young Women	R&D with pretest-posttest	25 female adolescents 13-14 years	This research aims to develop Web-based E-WoHealth media and its effect on the level of adherence to the consumption of blood supplement tablets.	This study recommends the application of WEB-based E-WoHealth media equipped with an iron supplement control card to increase adherence and monitor iron supplement consumption.
Ghaderi et.al (2017)	Effect of Education Based on the Health Belief Model (HBM) on Anemia Preventive Behaviors among Iranian Girl Students	Quasi-experimental design with pretest-posttest	128 female adolescents 16-17 years	The instrument of data collecting was a researcher-made questionnaire including demographic, knowledge, attitude, and behavior questions based on HBM model.	The educational programs based on Health Belief Model had a positive impact on the enhancement of the perceived susceptibility, perceived severity, perceived benefits, cues to action and self efficacy.

DISCUSSION

Adolescent girls' knowledge of anemia becomes a problem that must be solved immediately given the dangers posed by anemia impacting across generations. To reduce the risk of anemia in adolescent girls, an alternative is needed, one of which is education, education is also key because a good understanding of adolescent girls will reduce the incidence of anemia. For the use of educational methods in adolescents, effective it must be packed interestingly and impressively (Styaningrum & Metty, 2021). The source information about anemia could be obtained from teacher, health workers, and friends (Vaezi et.al, 2018). Adolescent health behaviour depends on reliable

sources. The inability to access credible, reliable, and accurate information could impact negatively on the knowledge (Giansanti et.al., 2019).

Education by mobile phone, **or** mobile learning (m-learning), refers to the use of mobile devices such as smartphones and tablets to support the learning process. It includes the use of educational apps, digital materials, and e-learning platforms accessed via mobile phones to expand and enhance the learning experience. Mobile learning enables flexible access to learning resources, interaction with educational content, and participation in learning activities anytime and anywhere (Kumar and Sharma, 2019). Mobile learning leverages mobile technology to provide flexible and accessible access to educational materials and learning experiences. With the advancement of the latest technology, mobile learning continues to evolve, offering a range of tools and methods to enhance education across various contexts (Talan, 2020).

Based on the 6 articles that have been found, the media used for nutrition education is by using application in mobilephone in the intervention group. The results showed that there was an increase in the knowledge score before and after the nutrition education was carried out with this media. There was an increase in knowledge scores in the intervention group compared to the control group that was not given treatment. Research by Anderson et al. (2018) shows that mHealth applications can increase knowledge and provide health education in various health communities. Currently, mHealth applications are widely used as an approach to solving health service problems so that they can reduce costs and improve the quality of health services and change behavior to improve prevention aimed at achieving good services. The use of mhealth can improve health education and behavioral change through changes in knowledge and behavior change for the better (Viljoen et.al, 2015). The mhealth application can be an approach to solving health service problems of limited human resources, distance of health services, expanding target respondents and others (Kosse et.al 2019).

CONCLUSION

This study highlights the significance of mobile application-based nutrition education as an innovative and effective tool for increasing knowledge and awareness about anemia among adolescent girls. The findings indicate that such interventions not only improve understanding of the causes, risks, and prevention of anemia but also have the potential to foster positive changes in attitudes and health-related behaviors. When delivered consistently over a defined period, mobile education can encourage the adoption of healthier lifestyle practices, including regular consumption of iron supplements, balanced diets, and proactive health monitoring. Furthermore, this approach aligns with the growing digital literacy of adolescents, making it a relevant and accessible medium for health promotion in the modern era.

RECOMMENDATION

Based on these findings, it is recommended that healthcare professionals and policymakers integrate mobile application-based education into broader public health strategies aimed at reducing anemia prevalence. Schools and

community health programs can collaborate to implement structured, interactive, and engaging digital modules tailored to adolescents' needs. Future development should focus on enhancing application features, such as reminders for supplement intake, gamified learning, and personalized feedback, to improve user engagement and adherence. In addition, continuous monitoring and evaluation should be conducted to measure the long-term effectiveness of mobile health interventions, ensuring they remain impactful across different social and cultural settings. Expanding this strategy beyond adolescent girls to include parents, teachers, and communities could also strengthen collective awareness and contribute to sustainable anemia prevention efforts.

ADVANCED RESEARCH

Further studies should focus on evaluating the long-term impact of mobile application-based nutrition education on behavior change, adherence to iron supplementation, and actual reduction in anemia prevalence among adolescent girls. Comparative research with other educational methods, as well as assessments across diverse socioeconomic and cultural contexts, would provide deeper insights into its effectiveness and scalability. Additionally, exploring user engagement strategies and integrating interactive features could enhance the sustainability of mobile health interventions.

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