Efforts to Prevent Anemia in Adolescent Girls through Education: A Sistematic Literature Review

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Abstract: Iron deficiency anemia is one of the leading causes of morbidity and disability in adolescents. The prevalence of anemia among adolescent girls in Indonesia was 37.1%, which increased to 48.9% in 2018, with the proportion of anemia in the age group of 15-24 years and 25-34 years. Low knowledge of anemia and nutrition in adolescents will cause them to not care about daily food intake. To estimate efforts to prevent anemia in adolescent girls through education that can be used as an intervention. This study used a literature review using the Prisma method (2020), searching journals through Scopus and Pubmed, using keywords, and obtaining 7 major international journals, which were reviewed and analyzed by researchers. Efforts to prevent adolescent anemia can improve knowledge and attitudes and influence adolescent behavior. School-based interventions through health education about the causes of iron deficiency anemia are very important to reduce the number of people with iron deficiency anemia in adolescents. There is an influence on the level of knowledge of adolescent girls after being given education, but prevention efforts need monitoring and support from related parties such as family, peers, schools, communities, and governments so that the program's success can be adequately achieved. This literature study can be used as reference material for future researchers to examine anemia-related studies using other concepts and methods.

Keywords: education, prevention, anemia, adolescents.

INTRODUCTION

Iron deficiency anemia is one of the leading causes of morbidity and disability in adolescents in low- and middle-income countries and one of the factors contributing to the global burden of disease. According to WHO, 25% of students suffer from iron deficiency anemia, with a prevalence of 29.2 to 79.6% [3]. An estimated 1.8 billion adolescents worldwide, with 90% living in low- and middle-income countries. The rapid growth of adolescents makes adolescents in Indonesia bear the triple burden of malnutrition, one of which is micronutrients. Adolescents (10-19 years old) are at high risk of iron deficiency anemia. The prevalence of anemia in adolescent girls in Indonesia was 37.1%, increasing to 48.9% in 2018, with the proportion of anemia in the age group of 15-24 years and 25-34 years. Anemia can lead to an increase in pregnancy complications, such as low birth weight (L.B.W.), preterm birth, and neonatal mortality. Anemia also negatively

affects physical ability, development, performance, and immunity and has potential long-term effects on women of childbearing age.

The disease affects 1.62 billion people worldwide, primarily children, adolescents and women. In Indonesia, the Ministry of Health reported an increase in the prevalence of nutrition-related anemia among pregnant women, from 37% in 2013 to 48.9% in 2018. Anemia often occurs simultaneously with malnutrition. Health and health behaviors are closely linked from adolescence to adulthood. WHO recommends iron and folic acid supplementation to prevent anemia in adolescence. In Indonesia, anemia management in pregnant women and adolescents is focused on iron supplementation, often independent of other approaches. These approaches may include understanding sociodemographic and lifestyle characteristics, managing community food systems, optimizing food patterns, food fortification, nutrition education, probiotic administration, menstrual irregularities, comorbidities, and ongoing infections.

Reducing anemia in women of reproductive age is essential in improving women's health, child health, school achievement, work productivity, healthier pregnancy outcomes, and intergenerational benefits for good health and economic and community development. Knowledge related to anemia and low nutrition in adolescents will cause them not to care about daily food intake. Therefore, it is necessary to educate adolescents regarding nutritional knowledge and health.

Therefore, this systematic review aims to estimate efforts to prevent anemia in adolescent girls through education that can be used as an intervention. This review collected reports of recent journal articles on the incidence, prevention, and management of anemia, specifically on the reflection of adolescent girls.

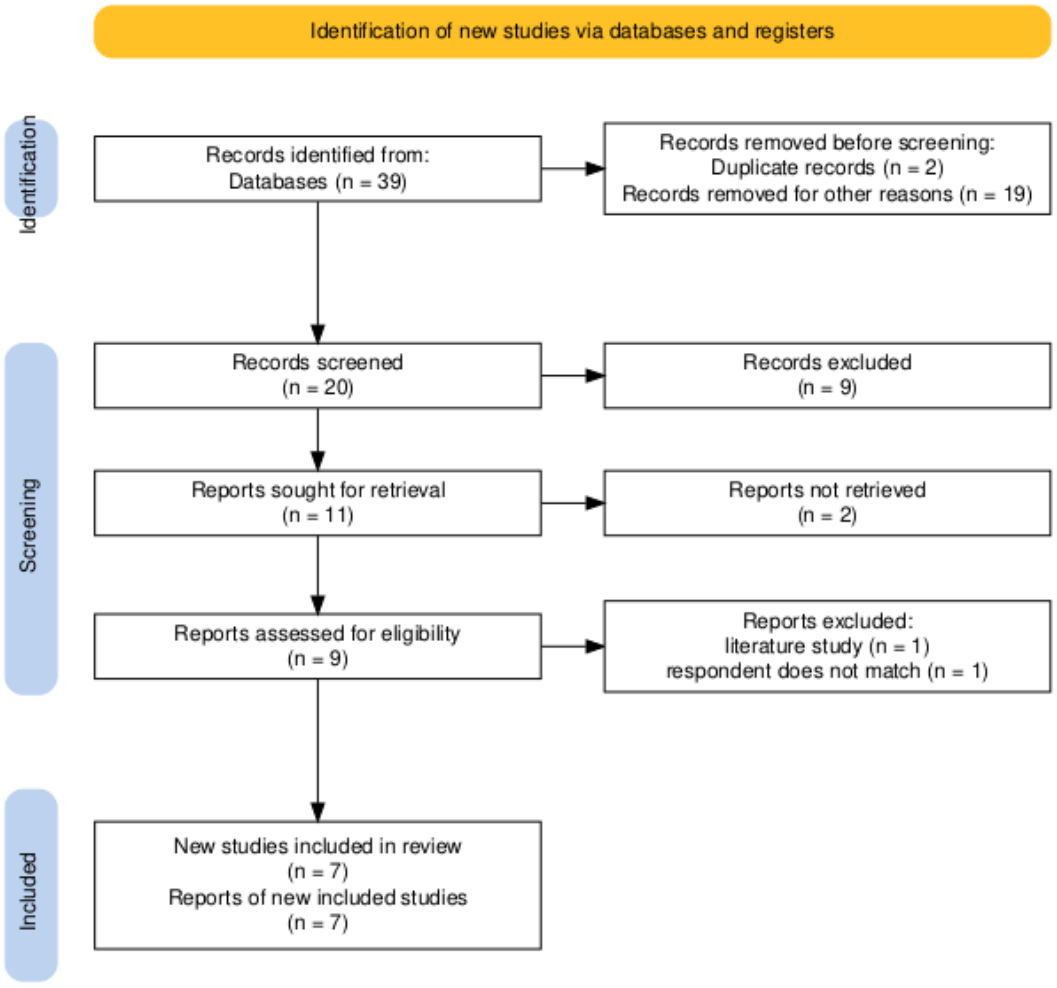
METHOD

This study uses literature review with the Prisma method (2020) as data collection by searching for journals or articles through Scopus, using keywords: (TITLE-ABS-KEY (EDUCATION) AND TITLE-ABS-KEY (PREVENTING) AND TITLE-ABS-KEY (ANEMIA) AND TITLE-ABS-KEY (ADOLESCENTS)) AND (LIMIT-TO (SUBJAREA, “NURS”) OR LIMIT-TO (SUBJAREA, “MEDI”)) AND (LIMIT-TO (DOCTYPE , ‘AR’)) AND (LIMIT-TO (LANGUAGE , ‘ENGLISH’)) AND (LIMIT-TO (EXACTKEYWORD , ‘ADOLESCENT’)) and data collection through Pubmed with keywords: SEARCH: (TITLE-ABS-KEY (EDUCATION) AND TITLE-ABS-

KEY (PREVENTING AND ANEMIA) AND TITLE-ABS-KEY (ADOLESCENTS)) AND PUBYEAR > 2014 AND PUBYEAR < 2025.

In the initial stage of collecting research articles through Scopus and Pubmed, I obtained 22 Scopus journal articles and 17 Pubmed journal articles. The second stage is selecting journal articles using Prisma, and I obtained as many as 4 Scopus journal articles and 5 Pubmed journal articles. In the third stage, researchers conducted a more in-depth selection of international journal articles related to more specific topics. 3 Scopus journal articles were used, and 4 Pubmed journal articles were reviewed and analyzed by researchers.

Picture 1. Prisma analysis



RESULTS

Table 1. Article Review Results

Researcher	Methods	Problem	Prevention	Results
Lafi Munira, Pramon Viwattanakulvanid	qualitative case study, 9 female students (15-18 years old) from two high schools in Banjarmasin, Indonesia, purposive sampling. tele-interview via video call	Female students admitted that they lacked the initiative to learn about anemia and did not know how to prevent it.	Anemia education programs in schools improve girls' knowledge of iron tablet consumption.	There is a significant relationship between knowledge and attitude. The results showed a statistically significant increase in knowledge, attitude, and knowledge scores.
Puspa Sari, Dewi Marhaeni,Diah Herawati, Meita Dhamayanti, Tisa Layalia Hanifah Ma'ruf, Dany Hilmanto	The quasi-experimental, pretest-posttest study included an intervention group of 162 students with the WANTER app and a control group of 115 students with a booklet.	Based on our previous research, some adolescents have anemia	Providing education to the intervention group (WANTER application) and control group (booklet)	knowledge and attitude adolescents significantly improved in three months after the WANTER intervention and anemia prevention booklet with $p < 0.001$
Ali Khani Jeihooni, Sanaz Hoshyar, Pooyan Afzali Harsini, Tayebeh Rakhshani	This quasi-experimental study was conducted on 160 students (80 experimental and 80 control groups). who were selected using random sampling method	Iron deficiency anemia impairs adolescent girls' concentration, reduces their academic performance, productivity, and physical strength, and increases their risk of infection.	The educational intervention is 45 or 50 minutes long. It consists of two parts; demographic information, and the PRECEDE construct (before and 4 months after the intervention).	The experimental group showed significant improvements in PRECEDE constructs, nutritional behaviors, and ferritin levels seen at 4 months after the intervention in the experimental group.

Researcher	Methods	Problem	Prevention	Results
Puspa Sari, Dewi Marhaeni Diah Herawati, Meita Dhamayanti, Dany Hilmanto	Qualitative research grounded theory approach to build substantive theory. purposive sampling in-depth interviews A total of 41 people	Iron deficiency anemia (I.D.A.) in adolescent girls	Using a grounded theory approach to build substantive theory.	Quasi-experiment (randomized pre-test-post-test control group design) Population 249 adolescent girls simple random sampling 70 respondents
Rusmayanty Rusdin, Andi Zulkifli Abdullah, Wahiduddin, Ansariadi, Hidayanty	Quasi-experiment (randomized pre-test-post-test control group design) Population 249 adolescent girls simple random sampling 70 respondents	Low adherence to Fe tablet consumption in adolescent girls, iron supplementatio n program has not been maximized. maximum, the proportion of anemia in the adolescent group is still high	PAKEM (active, creative, effective, and fun learning) education model on Fe tablet consumption compliance.	There was an increase after PAKEM education intervention on knowledge (10.91-17.88), attitude (56.11-73.60), motivation (38.05-53.49), and action (0.83-7.34). There was a significant difference with p=0.000 (p<0.05).
Ilana R. Cliffer, Ourohir'e Millogo, Yllassa Barry, Idrissa Kouanda, Guillaume Compaore, Dongqing Wang, Ali Sie, Wafaie Fawzi.	Cluster-randomized trial, 3123 high school students aged 10 to 18 years old	Many health challenges among adolescents begin with behavioral choices, and schools have a unique opportunity to use health education programs to influence these choices. behavioral choices	Weekly IFA supplementatio n, daily MMS, or receiving standard nutrition education as control. Supplementatio n for 2 periods (10 weeks, 16 weeks) separated by a 20-week gap without supplementatio n. Hemoglobin	The prevalence of anemia at baseline was 32.7% in IFA, 31.2% in MMS, and 29.5% in the control group. Adolescents given I.F.A. had higher hemoglobin levels than the control group (adjusted ÿ: 0.32; 95% CI: 0.02, 0.62). There was no

Researcher	Methods	Problem	Prevention	Results
			was evaluated 4 times	significant difference.
Jo-Anna B. Baxter, Yaqub Wasan, Sajid B. Soofi, Zamir Suhag, Zulfiqar A. Bhutta	Cluster-randomized, controlled trial, of adolescent and young women (15–24 years) in Matiari district, Pakistan	Questionnaire, anthropometric measurements, and Haemoglobin	Empowering adolescents and young women with the right knowledge to make informed and healthy decisions will be key to sustainable behavior change throughout life.	culturally tailored education aimed at empowering participants' ability to make informed decisions about their health, wellbeing and nutrition will be key to sustainable behavior change they will be key to sustainable behavior change throughout the life course

Research conducted by Lafi Munira & Pramon Viwattanakulvanid (2021) with a qualitative case study method, 9 female students (15-18 years old) from two high schools in Banjarmasin, Indonesia, sampling technique using purposive sampling conducted tele-interviews via video call examining the problem Female students admitted that they lacked the initiative to find out about anemia, prevention efforts with anemia education programs in schools increased female students' knowledge about iron tablet consumption. The results of this study show that There is a significant relationship between knowledge and attitude. The results showed a statistically significant increase in female students' average knowledge and attitude scores.

Puspa Sari et al. (2022) conducted research using quasi-experimental research methods, pretest-posttest, and the number of intervention groups of 162 schoolgirls and control groups of 115 schoolgirls. Research conducted previously found that some adolescents experienced anemia. Prevention efforts are carried out by educating the intervention group through the WANTER application media and the control group through booklet media. The results obtained from this study were that adolescents' knowledge and attitudes increased significantly in three months after the intervention of WANTER and anemia prevention booklets with $p < 0.001$.

With this quasi-experimental method, Ali Khani Jeihooni et al. (2021) research was conducted on 160 students (80 experimental groups and 80 control groups selected using the random sampling method). The problem in this study is that iron deficiency anemia interferes with adolescent girls' concentration, reduces their academic performance, productivity, and physical strength, and increases the risk of infection. Prevention efforts are carried out 45 or 50 minutes of educational intervention. demographic information and PRECEDE construction (before and 4 months after the intervention) consist of two parts. The study results in the experimental group showed significant improvements in PRECEDE construction, nutritional behavior, and ferritin levels seen in the 4 months after the intervention.

Research Puspa Sari et al., using qualitative methods and a grounded theory approach to build substantive theory. purposive sampling in-depth interviews A total of 41 people, the problem found Iron deficiency anemia (I.D.A.) in adolescent girls. Prevention efforts were made using a grounded theory approach to build substantive theory. The investigation resulted in 22 categories, 7 themes related to policymaker commitment, stakeholder governance, quality, adolescent lifestyle, adolescent self-factors, adolescent access to health services, and social support.

Research by Rusmayanty Rusdin et al. (2021), with the Quasi-experimental method (randomized pre-test-post-test control group design) Population of 249 adolescent girls with a simple random sampling of 70 respondents, the research problem is the low compliance of Fe tablet consumption in adolescent girls, the iron supplementation program is not optimal, the proportion of anemia in the adolescent group is still high. Prevention efforts with the PAKEM education model (active, creative, effective, and fun learning) on compliance with Fe tablet consumption. There was an increase after PAKEM education intervention on knowledge (10.91-17.88), attitude (56.11-73.60), motivation (38.05-53.49), and action (0.83-7.34). There was a significant difference with $p=0.000$ ($p<0.05$).

Research by Ilana R. Cliffer, et al (2023) In a study comparing MMS with IFA among adolescents, and to the best of our knowledge, this is the first study to compare boys and girls with a school-based supplementation program. We found that students who were supplemented had higher hemoglobin levels compared to students who did not receive supplementation, who showed lower hemoglobin levels than students who did not receive supplementation. We saw a dose-response relationship where the effect was greater (though not significant) when anemia was moderate or severe compared to no anemia. The prevalence of anemia at the start of the study was similar across the study groups, with 32.7% in IFA, 31.2% in MMS, and 29.5% in the control

group. During the entire study period, adolescents administered IFA had higher hemoglobin levels than the control group (adjusted ÿ: 0.32; 95% CI: 0.02, 0.62). No significant associations were found in MMS or anemia outcomes. However, the direction and magnitude of the non-significant associations suggest a potential protective effect of IFA and MMS against anemia.

The Jo-Anna B. et al. (2018) trial was conducted in a two-arm, cluster-randomized population controlled by bi-monthly life skills development education and twice-weekly dual micronutrient supplementation (UNIMMAP composition). In addition, several nutrition-related secondary objectives will be assessed, such as anthropometry (including height, weight, mid-upper arm circumference (LILA), nutritional status (including iron, vitamin A, and vitamin D), general health (including morbidity and mortality), and empowerment (including age at marriage, completion of grade 10, and use of personal hygiene items during menstruation). For a maximum of two years, participants will be enrolled in the study.

DISCUSSION

The research results of 7 journal articles mention programs that can be carried out as an effort to prevent anemia in adolescent girls through providing education to increase knowledge, attitudes, and behavior so that it is easy to understand that it can prevent the incidence of anemia in adolescents. Health education effectively improves knowledge, attitudes, and practices in sufficient time. Although most studies reveal that sufficient time is six months or more, a three-month intervention improves knowledge and attitudes, except practices. Counseling programs for healthy adolescents at school or in the community are essential. Health education through WANTER, as well as m-health education and booklets, is needed now. In another study, it is possible to explore education through m-Health.

WANTER will help adolescents monitor their health, nutrition intake, and health information sources. Besides WANTER, another medium that can be used to educate adolescents is booklets to gain knowledge about anemia. Booklets can encourage adolescent girls to learn about nutritious foods, body mass index (BMI) calculation methods, and health. Another study concluded that booklets have a significant effect on improving knowledge, attitudes, and hemoglobin levels. There was no practical improvement over the three months of intervention. The reasons for behavior change toward anemia are multifactorial and complex. Many possible factors influence success in changing behavior, such as self-motivation, understanding in applying habits, and timing of intervention. In addition, the ideal time to improve behavior is six months or more.

The educational intervention improved the experimental group's self-perception. It is considered a powerful source of inspiration and assesses one's organizing ability to achieve a specific goal. When problems arise, effective people will be more determined and spend more time and effort. The influence of knowledge, attitude, self-efficacy, reinforcing factors, and enabling factors in encouraging nutritional behavior to prevent iron deficiency anemia is indicated by the increase in behavior scores and ferritin levels in the experimental.

Several other studies reported that involving the community in improving adolescents' adherence to iron supplements is essential. In addition to support from parents or family, most adolescents mentioned that they received information about iron deficiency anemia and its prevention from teachers at school. School-based interventions through health education on the causes of iron deficiency anemia are essential to reduce the number of adolescents with iron deficiency anemia. Implementing iron deficiency anemia prevention efforts requires continuous monitoring and evaluation, and conducting nutrition education and changing the eating habits of adolescents are the best ways to prevent iron deficiency anemia.

Existing WHO guidelines on iron supplementation for adolescents, Including a culturally tailored education section aimed at empowering participants to make informed decisions about their health, well-being, and nutrition, will be key to sustained behavior change across the life course. guidelines on adolescent-specific antenatal nutrition counseling are unknown, although addressing adolescent nutritional needs will be critical in addressing intergenerational undernutrition, chronic disease, and poverty. Appropriate preconception care can enable adolescents to enter reproductive adulthood with better health and nutritional status before conception.

CONCLUSION

The author's discussion of literature studies from several references related to anemia prevention through education states that providing anemia prevention education to adolescents can increase knowledge and attitudes and affect adolescent behavior, which greatly impacts their decision-making in carrying out anemia prevention.

The results showed that education influences adolescent girls' knowledge level. However, prevention efforts still require monitoring and support from related parties such as family, peers, schools, communities, and governments.

Culturally tailored educational outcomes that empower participants to make informed decisions about their health, well-being, and nutrition will be critical to sustainable behavior change throughout life.

This literature study can be used as literature for future researchers to conduct research related to anemia by applying other methods following the development of science and technology.

Conflict of Interest

The authors declare that they have no conflict of interest.

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REFERENCES

Lafi Munira, Pramon Viwattanakulvanid. Influencing factors and knowledge gaps on anemia prevention among female students in Indonesia. International Journal of Evaluation and Research in Education (IJERE). Vol. 10, No. 1, March 2021, pp. 215~221. ISSN: 2252-8822, DOI: 10.11591/ijere.v10i1.20749. http://ijere.iaescore.com

Puspa Sari, Dewi Marhaeni Diah Herawati, Meita Dhamayanti, Tisa Layalia Hanifah Ma'ruf, Dany Hilmanto. The Effect of Mobile Health (m-Health) Education Based on WANTER Application on Knowledge, Attitude, and Practice (KAP) Regarding Anemia among Female Students in a Rural Area of Indonesia. Healthcare 2022, 10, 1933. https://doi.org/10.3390/healthcare10101933https

Ali Khani Jeihooni, Sanaz Hoshyar, Pooyan Afzali Harsini, Tayebeh Rakhshani. The efect of nutrition education based on PRECEDE model on iron deiciency anemia among female students. BMC Women's Health (2021) 21:256 https://doi.org/10.1186/s12905-021-01394-2

Mohammad Juffrie MD, Siti Helmyati DCN, Mohammad Hakimi MD. Nutritional anemia in Indonesia Children and Adolescents: Diagnostic reliability for Appropriate Management. 2020. *Asia Pacific Journal of Clinical Nutrition*. Volume 29, Pages 18 – 31. 10.6133/APJCN.202012_29(S1).03

Puspa Sari, Dewi Marhaeni Diah Herawati, Meita Dhamayanti, Dany Hilmanto. Fundamental Aspects of the Development of a Model of an Integrated Health Care System for the Prevention of Iron Deficiency Anemia among Adolescent Girls: A Qualitative Study. International Journal of Environmental Research and Public Health. 2022, 19, 13811. https://doi.org/10.3390/ijerph192113811

Puspa Sari, Dewi Marhaeni Diah Herawati, Meita Dhamayanti, Dany Hilmanto. Anemia among Adolescent Girls in West Java, Indonesia: Related Factors and Consequences on the Quality of Life. Nutrients 2022, 14, 3777. https://doi.org/10.3390/nu14183777

Rusmayanty Rusdin, Andi Zulkifli Abdullah, Wahiduddin, Ansariadi, Hidayanty. Educational Model of PAKEM in Compliance with Fe Tablet Consumption of Adolescent Girls. Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia, Open Access Macedonian Journal of Medical Sciences. 2021 Aug 21; 9(E):710-716. https://doi.org/10.3889/oamjms.2021.6576. eISSN: 1857-9655

Ria Purnawian Sulistiani, Addina Rizky Fitriyanti, Luthfia Dewi., 2021. Efektifitas Media Edukasi Gizi Untuk Peningkatan Pengetahuan Gizi Remaja. Jurnal Mahasiswa Bimbingan dan Konseling. DOI:http://dx.doi.org/10.31602/jmbkan.v7i3.5759

Kidanemaryam Berhe, Amaha Kahsay, Freweini Gebrearegay, Hadush Gebreegziabher, Lemlem Weldegerima, Natnael Etsay, Haven Hadush, Brhane Gebremariam, Berhane Fseha, Gebrehiwot Gebremariam and Micheale Hailu. 2020. Magnitude and associated factors of anemia among adolescent girls in Ethiopia: a systematic review and meta-analysis. Berhe et al. Archives of Public Health. 80:189. https://doi.org/10.1186/s13690-022-00942-y

Ilana R. Cliffer, Ourohir'e Millogo, Yllassa Barry, Idrissa Kouanda, Guillaume Compaore, Dongqing Wang, Ali Sie, Wafaie Fawzi. 2023. School-based supplementation with iron-folic acid or multiple micronutrient tablets to address anemia among adolescents in Burkina Faso: a cluster-randomized trial. The American Journal of Clinical Nutrition 118 (2023) 977988. https://ajcn.nutrition.org/

Jo-Anna B. Baxter, Yaqub Wasan, Sajid B. Soofi, Zamir Suhag, Zulfiqar A. Bhutta. 2018. Feasibility and effect of life skills building education and multiple micronutrient supplements versus the standard of care on anemia among non-pregnant adolescent and young Pakistani women (15–24 years): a prospective, populationbased cluster-randomized trial. Baxter et al. Reproductive Health (2018) 15:103 https://doi.org/10.1186/s12978-018-0547-y