

Identifying anemia determinant factors in adolescent girls to improve productivity: A systematic review

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ARTICLE INFO

Article history:

Received Jul 9, 2026

Revised Jul 16, 2026

Accepted Aug 1, 2026

Keywords:

Adolescent Girls

Anemia

Literature Review

Nutritional Status

Productivity

ABSTRACT

Anemia has a negative impact on the productivity of adolescent girls. However, adolescents' understanding of risk factors for anemia is still limited. Therefore, a literature study was conducted to provide knowledge about the determinant factors of anemia for adolescent. The purpose of this literature review is to identify determinant factors for the incidence of anemia in adolescent girls. This study was systematically compiled based on a literature search using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method. Data was collected from Google Scholar and PubMed electronic databases from May to June 2024. Articles are disaggregated based on inclusion and exclusion criteria. The criteria for journal inclusion are articles published in the 2019-2024 range, Indonesian and English language journals. The criteria for journal exclusion are incomplete journals. Two reviewers independently assessed the feasibility of the article using the Newcastle Ottawa scale guidelines. A total of 20 articles were considered feasible. Factors related to the incidence of anemia in adolescent girls include dietary patterns, body image, physical activity, nutritional status, iron consumption, disease history, menstruation, and adolescent girls' knowledge. The results of this study have implications for adolescents' understanding of preventable anemia risk factors. In addition, this research contributes to the improvement of adolescent productivity through an understanding of the determinants of anemia in adolescents. Therefore, it is recommended to further research is expected to evaluate effective models of anemia prevention for adolescents to increase adolescent productivity.

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INTRODUCTION

Anemia in adolescents is a preventable global health problem, but prevention efforts have not yet reached the target. Adolescent girls are at high risk of developing anemia due to increased iron

needs during growth and menstruation. WHO estimates that 30% of women aged 15-49 years worldwide experience anemia (WHO, 2024). Meanwhile, several studies in Asian countries report that the incidence of anemia in adolescents varies from 30-60% (Ara et al., 2024; Daniel, K alaivani, et al., 2023). The incidence of anemia in adolescents in Indonesia is reported to range from 14.3-32% (Rosyad et al., 2024; Sari et al., 2022). Meanwhile, from the iron panel analysis, 10 students (47.6%) had abnormal serum iron levels, 6 students (28.6%) had abnormal transferrin saturation levels (Brien & Ru, 2017).

Anemia that occurs in adolescence can have a negative impact on the physical growth and development of adolescents, as well as increase the risk of infection (Febrianti et al., 2023). Anemia also negatively affects concentration and cognitive abilities leading to a decline in academic performance, interfering with motor development and cognitive intelligence (Ekasanti et al., 2020). Anemia can have long-term consequences on reproductive health, potentially affecting pregnancy outcomes such as low birth weight and prematurity (Mulianingsih et al., 2021). If anemia continues, it will have a wide impact on economic productivity, so it needs immediate treatment.

Based on the conceptual framework from WHO, it is known that the causes of anemia are very complex. The cause of anemia refers to the direct cause of anemia and the risk factors include direct risk factors, underlying risk factors, and fundamental driving factors (WHO, 2023). Several studies have successfully confirmed risk factors for anemia in adolescent girls. However, the risk factors for anemia found still vary. Dietary patterns have been found to significantly affect the level of anemia and a vegetarian diet may increase the incidence of anemia (Pavithran & Patil, 2024). Another researcher found that risk factors for anemia consist of menstrual conditions and nutrient intake (Fuadah & Saragih, 2024). Anemia in adolescents is also affected by factors such as age, nutritional status, and the length of the menstrual cycle (Fuadah & Saragih, 2024).

Various studies on anemia in adolescents are widely available, but most studies are still limited to prevalence estimates or analysis of single factors such as nutritional status, menstruation, and infection (Daniel, Kalaivani, et al., 2023; Endang Purwati et al., 2024). Studies that integrate the determinants of anemia in a multidimensional manner are still rare, so the interaction between factors has not been comprehensively described. In addition, the relationship between anemia and adolescent girls' productivity has not been systematically explored. Methodological variations and often contradictory results in previous studies create knowledge gaps, so a systematic review approach is needed to unify evidence, identify key determinants, and provide a stronger scientific basis for health interventions for the prevention of adolescent anaemia.

Based on this, this literature study was conducted to increase adolescents' understanding of the determinants of anemia. This study is novel in that it systematically synthesizes the determinants of anemia in adolescent girls, and explicitly links them to productivity through systematic review and meta-analysis approaches. These results could be the basis for the development of comprehensive and effective interventions to reduce the burden of anaemia among adolescent girls.

RESEARCH METHOD

This study is a systematic review of factors related to anemia in adolescents. The method used is systematic literature review (SLR). SLR is a research methodology used to systematically collect, identify, and critically analyze available research studies. In addition, systematic literature reviews provide a structured approach to evaluating a wide range of research, aiding in evidence-based decision-making, in areas such as healthcare. This review uses Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA).

Eligibility criteria

The inclusion criteria used to select articles consisted of (1) studies that discussed factors that affect anemia in adolescent girls, (2) written in Indonesian and English, (3) articles published in the 2019-2024 range and (4) complete articles. Studies are excluded if the article is a review article, commentary/perspective article.

Information Sources

The literature search technique is carried out by entering keywords into the search engine which in this literature review uses Google Scholar and PubMed. The conjunction word, using Boolean logic "AND" and "OR" are used to connect phrases or keywords. The keywords used are such as "factors", "determinants", "relationships", "correlations", "influences", "anemia incidence", "low hemoglobin", "adolescent girls", "adolescent girls", and "adolescent girls". Articles that do not meet the inclusion criteria are excluded from the analysis process. The quality evaluation of the articles used was based on the Newcastle-Ottawa Scale for observational studies.

Literature Search and Selection Process

The literature search process that has been carried out on the research engine using appropriate word combinations, found a total of 691 literature in Indonesian and 1361 literature in English. Furthermore, the identification of study selection was carried out by the author. At the time of title screening, the author obtained 391 literature with titles that matched the criteria. The next stage is abstract screening and 58 literature that passed this stage were obtained. The next process is to assess the feasibility of literature by looking at the full text of the literature, 37 literature that meets the criteria was obtained. In the end, the literature selected from this process was 20 literatures which were then used in writing literature reviews. The selection algorithm and assessment of literature quality can be seen in Figure 1. In addition, the author also uses other official sources to support the writing of literature reviews, such as WHO, Riskesdas, and so on.

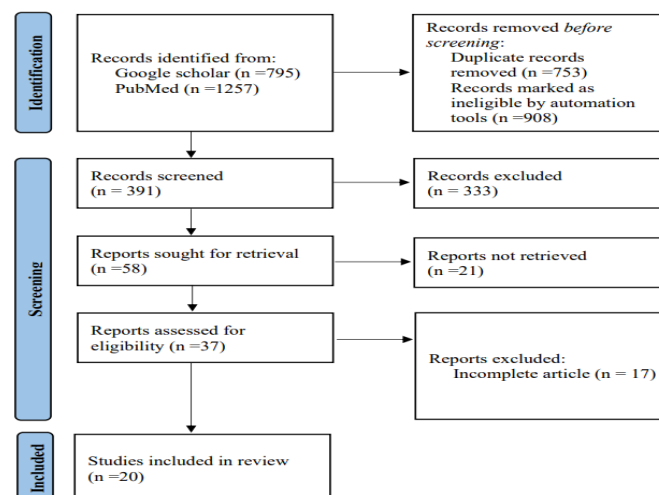


Figure 1. Literature quality selection and assessment algorithm

Data Collection

The process of collecting data for a literature review on factors related to anemia in adolescents begins with the determination of the topic and purpose of the research. The topic of the study was anemia in adolescents, while the purpose of the analysis was to identify factors related to anemia in adolescents. Articles are collected from Google Scholar and PubMed databases. Conjunctions, using Boolean logic "AND" and "OR" are used to connect phrases or keywords. The articles obtained are included in the selection and evaluation process of articles. Articles that do not

meet the inclusion criteria are excluded from the analysis process. Screening is carried out through the selection of article duplication, selection based on title and abstract, and conformity with the criteria of the journal sought. The process continues by extracting and synthesizing data.

The data collected consisted of author data, publication year, place of study, title, objectives, research methods, and findings. All selected articles are then manually extracted to get the key points. A critical review is also conducted for each article to assess the quality of the article. The types of data used in this systematic study are quantitative and qualitative data related to factors that affect anemia in adolescents.

Analysis Methods

The following data were taken from the eligible studies: author data, year of publication, place of study, title, objectives, research methods, results and recommendations. A shared spreadsheet was used to enter the data, which was independently extracted by 2 authors for analysis. Reviewers are in charge of breaking up differences in data extraction and reaching consensus in case of disagreements. The quality assessment was carried out by the authors, who independently assessed the factors related to anemia in adolescents. The quality assessment was conducted using the Newcastle Ottawa scale (NOS) guidelines. The study only reported results from the number of articles that met the criteria, so there may be important results from omitted articles that were not reported. The risk of bias is possible because article searches are carried out only from 2 data bases which allows for limitations in the discovery of a wider range of articles.

RESULTS AND DISCUSSIONS

Of the 20 articles analyzed, all came from Indonesia. Most of the articles used a crosssectional study design, with the sample size ranging from 63 to 1375 respondents. The table 1 illustrates that all articles analyzed have a NOS value of 7-9, which is of very good quality.

Tabel 1. Quality assessment of studies using newcastle ottawa scale (NOS) assessment

Author (Year)	Selection			Comparability		Outcome		
	Representativeness of the sample	Sample size	Nonrespondents	Ascertainment of the exposure (risk factor)	Comparability of subjects in different outcome groups on the basis of design or analysis	Assessment of outcome	Statistical test	NOS score
Hadijah, Hasnawati and Hafid, 2019	☆	☆	☆	☆☆	-	☆☆	☆	8
Widya Indina Zulfa (2023)	☆☆	☆	☆	☆☆	-	☆☆	☆	9
Puspa Sari, et al. 2022	☆	☆		☆☆	-	☆☆	☆	7
Ema Yulita, et al., (2022)	☆	☆		☆☆	-	☆☆	☆	7
Siti Nunung Nurjannah dan Ega Anggita Putri (2021)	☆	☆	☆	☆☆	-	☆☆	☆	8
Desi Fadia Syabani Ridwan dan Inne Indraaryani Suryaalamshah	☆	☆	-	☆☆	-	☆☆	☆	7

	Selection			Comparability		Outcome		
(2023)								
Anastasya A. Soekardy	☆	☆	☆☆	☆☆	-	☆	☆	8
(2023)								
Kadek Agus Dwija Putra et.al., 2020	☆	☆	☆	☆	-	☆☆	☆	7
Abdullah Aedh, et al., (2019)	☆	☆☆	☆	☆☆	-	☆☆	☆	9
Shinta Novelia, Rukmaini, dan Indah Purnama Sari (2022)	☆☆	☆	☆	☆☆	-	☆☆	☆	8
Nurhayati, Nurul Indah Qariati, dan Agus Jalpi (2020)	☆	☆	☆	☆☆	-	☆☆	☆	8
Nita Ike Dwi Kurniasih, et al., (2021)	☆	☆	☆	☆	☆	☆☆	☆	8
Claudia, Arif and Anggraini (2023)	☆	☆	☆	☆☆	-	☆☆	☆	8
Desy Qomarasari dan Ana Mufidaturrosida (2022)	☆	☆	-	☆☆	-	☆☆	☆	7
Novan Hariyanto, et al (2022)	☆	☆	☆	☆☆	-	☆	☆	7
Rina Marlina Hutasuhut and Supriati (2022)	☆	☆	☆	☆☆	-	☆	☆	7
Anisa, Rr. Et al., (2023)	☆	-	☆	☆☆	-	☆☆	☆	7
Haniyyah Prastia Putri dan A'immatul Fauziyah (2023)	☆	☆	-	☆☆	☆	☆☆	☆	8
Gebby Memorisa, et al (2020)	☆	☆	☆	☆☆	-	☆	☆	7
Khalilah Adiyani, Farida Heriyani, dan Lena Rosida (2020)	☆	☆	☆	☆☆	-	☆☆	☆	8

Based on the findings from the analyzed article, it was found that factors related to anemia in adolescents are nutritional status, protein intake, diet, physical activity, consumption of bezi tables, Body image, tea drinking habits, knowledge, menstruation, frequency of drinking soda, milk, economic status, maternal education level, family income, breakfast habits, disease history, and diet status, while unrelated factors are Body image, Eating habits, knowledge, nutritional status and menstrual duration. This finding also illustrates several controversial factors including body image factors, eating habits, gisi status and menstrual duration so it needs to be retraced. More fully is shown in table 2.

Table 2. Analysis of factors associated with the incidence of anemia in adolescent women

No	Study	Title	Location	Sample	Study design	Findings
1	Hadijah, Hasnawati and Hafid, 2019	Effect of Menstrual Timing on Hemoglobin Levels and Erythrocyte Morphology	Sulawesi Selatan, Indonesia	20	Quasi experimental	Menstrual period affects erythrocyte morphology
2	Widya Indina Zulfa (2023)	The Relationship between Body Image, Eating Habits, and Nutritional Status with Nutritional Anemia in Adolescent Girls at SMA Negeri 1 Sampang		77	Cross sectional	There was a relationship between nutritional status and anemia problems in high school students, while body image and eating habits were not related
3	Puspa Sari, et al. 2022	Iron deficiency anemia and related factors among adolescent girls and women in rural areas of Jatinangor, Indonesia	Jatinangor Indonesia	67	Cross sectional	Adequate protein intake cannot prevent anemia
4	Ema Yulita, et al., (2022)	The Relationship Between Diet and Physical Activity and the Incidence of Anemia in Adolescent Girls at the Assalam Naga Switching Islamic Boarding School, North Kampar District in 2021	Kampar Utara Indonesia	180	Cross sectional	There is a significant relationship between diet and physical activity and the incidence of anemia in adolescent girls.
5	Siti Nunung Nurjannah dan Ega Anggita Putri (2021)	The Relationship between Nutritional Status and the Incidence of Anemia in Adolescent Girls at SMP Negeri 2 Garawangi Kuningan Regency	Kuningan Indonesia	110	Cross sectional	There is a relationship between nutritional status and the incidence of anemia in adolescent girls.
6	Desi Fadia Syabani Ridwan dan Inne Indraaryani Suryaalamasah (2023)	The Relationship between Nutritional Status and Nutritional Knowledge with the Incidence of Anemia in Adolescent Girls at Triyasa Ujung Berung Junior High School Bandung	Bandung, Indoneisa	93	Cross sectional	There was a significant relationship between nutritional status and the incidence of anemia in adolescent girls, while Unrelated knowledge
7	Anastasya A. Soekardy (2023)	The Relationship between Knowledge, Consumption of FE Tablets and Nutritional Status in the Treatment of Anemia in Adolescent Girls in Nania Village, Ambon City in 2022	Ambon, Indonesia	63	Cross sectional	There was no relationship between knowledge and nutritional status and anemia in adolescent girls.
8	Kadek Agus Dwija Putra et.al., 2020	The Relationship between Body Image and Tea Drinking Habits and Anemia in	Bali Indonesia	1.375	Cross sectional	There is a relationship between negative body image and tea drinking habits while

No	Study	Title	Location	Sample	Study design	Findings
		Adolescent Girls in Badung District, Bali, Indonesia				eating on the incidence of anemia in adolescent girls.
9	Abdullah Aedh, et al., (2019)	Iron Deficiency Anemia and Associated Risk Factors in Adolescents in Najran, Saudi Arabia	Najran, Arab Saudi	240	Community-based cross-sectional	The level of maternal education has a significant effect on anemia.
10	Shinta Novelia, Rukmaini, dan Indah Purnama Sari (2022)	Analysis of Factors Associated with Anemia Among Adolescent Girls	Tangerang, Indonesia	75	Cross sectional	There was a significant relationship between family income, knowledge, iron-containing foods, nutritional status, and physical activity with the incidence of anemia in adolescent girls
11	Nurhayati, Nurul Indah Qariati, dan Agus Jalpi (2020)	The Relationship of Knowledge, Breakfast Habits and Physical Activity with the Incidence of Anemia in Adolescent Girls at MAN 1 Banjarmasin in 2020	Banjarmasin, Indonesia	183	Cross sectional	There was a relationship between knowledge, breakfast habits, and physical activity to the incidence of anemia in adolescent girls.
12	Nita Ike Dwi Kurniasih, et al., (2021)	The Relationship between Physical Activity Patterns and Disease History with Hemoglobin Levels in Adolescent Girls at SMAN 1 Luragung, Luragung District, Kuningan Regency	Kuningan Indonesia	66	Cross sectional	There was no association between physical activity patterns and disease history and hemoglobin levels in adolescent girls.
13	Claudia, Arif and Anggraini (2023)	The Relationship between Physical Activity, Diet, and Duration of Menstruation with the Incidence of Anemia in Regular Midwifery Students at Kader Bangsa University in 2021	Palembang, Indonesia	51	Cross sectional	There is a relationship between physical activity, diet, and length of menstruation and the incidence of anemia in adolescent girls.
14	Desy Qomarasari dan Ana Mufidaturrosida (2022)	The Relationship Between Nutritional Status, Diet and Menstrual Cycle with the Incidence of Anemia in Adolescent Girls in Grade VIII at SMPN 3 Cibeber	Cibeber, Indonesia	40	Cross sectional	There is a significant relationship between nutritional status, diet, and menstrual cycle and the incidence of anemia in adolescent girls.
15	Novan Hariyanto, et al (2022)	The Relationship between Diet and the Incidence of Anemia in Adolescent Girls at SMA Giki 1 Surabaya	Surabaya, Indonesia	98	Cross sectional	Dietary patterns have a relationship with the incidence of anemia in adolescent girls.
16	Rina Marlina	The Relationship	, Deli	65	Cross	There was a

No	Study	Title	Location	Sample	Study design	Findings
	Hutasuhut and Supriati (2022)	between Body Image and Dietary Status with Anemia in Adolescent Girls in Hamlet III, Bakaran Batu, District, Batang Kuis, Deli Serdang Regency	Serdang, Indonesia		sectional	significant relationship between negative body image and diet status and the incidence of anemia in adolescent girls.
17	Anisa, Rr. Et al.,(2023)	The Relationship between Body Image and Adequate Iron Intake with Hemoglobin Levels in Adolescent Women	Semarang Indonesia	26	Cross sectional	There was no significant relationship between body image and iron intake and the incidence of anemia in adolescent girls.
18	Haniyyah Prastia Putri dan A'immatul Fauziyah (2023)	Knowledge of Anemia and Physical Activity with the Incidence of Anemia in Adolescent Girls	Jawa Barat, Indonesia	49	Cross sectional	There was a significant relationship between knowledge about anemia and the incidence of anemia in adolescent girls. Meanwhile, physical activity is not related.
19	Gebby Memorisa, et al (2020)	The Relationship Between Menstrual Duration and the Incidence of Anemia in Adolescents	Kediri, Indonesia	41	Cross sectional	There was no association between the length of menstruation and the incidence of anemia in adolescent girls
20	Khalilah Adiyani, Farida Heriyani, dan Lena Rosida (2020)	The Relationship between Nutritional Status and the Incidence of Anemia in Adolescent Girls at SMA PGRI 4 Banjarmasin	Banjarmasin, Indonesia	67	Cross sectional	There was no significant relationship between nutritional status and the incidence of anemia in adolescent girls.

The results of the review found that there is no agreement on the determinant factors of anemia in adolescents. Each study evaluated a different determinant factor. Several factors related to anemia in adolescents, including diet, body image, physical activity, nutritional status, iron consumption, disease history, menstruation, and knowledge.

Diet

A total of 5 out of 20 studies reported that diet was a potent factor in the incidence of anemia in adolescent girls. Eating habits have been proven to affect the incidence of anemia for adolescents (Wiafe et al., 2023; Yanti et al., 2024). However, some other studies have obtained opposite results. Diet was found not to be related to the incidence of anemia in adolescent girls at SMA Negeri 1 Sampang (Anisa et al., 2023). The proportion of anemia in adolescents with a good diet varies from 47.1 to 92.5% (Supriati, 2022; Marcus et al., 2021; Putri & Mangalik, 2022). Adolescents usually eat less varied foods and limit food intake and avoid iron-rich foods (Riskika et al., 2023; Yanti et al., 2024). If this happens for a long time, it will have an impact on decreasing hemoglobin levels and may cause anemia in adolescents (Millaty et al., 2024). An unbalanced adolescent diet low in iron, protein, and vitamin C, and high in fast food can increase the risk of anemia because the body doesn't get enough nutrients to form hemoglobin. In addition, young women are more vulnerable as iron requirements increase due to rapid growth and menstruation (Millaty et al., 2024).

Body Image

Research shows that negative body image perceptions increase the incidence of anemia in adolescents (Putra et al., 2020). These results were found in three studies conducted by (Anisa et al., 2023; Hutasuhut & Supriati, 2022; and Putra et al., 2020). Negative body image perception among adolescent girls is associated with poorer nutritional choices and may contribute to the risk of anemia due to insufficient iron intake (Hutasuhut & Supriati, 2022; Putra et al., 2020). Nonetheless, other studies have found that body image is not related to hemoglobin levels. However, body image problems can affect adolescents' dietary choices so that they do not directly affect blood hemoglobin levels (Anisa et al., 2023).

Body image is a complex psychological feeling and includes various aspects related to a person's body shape and existence (Kehoe et al., 2021). Currently, 40% of adolescents aged 15 to 24 feel that their weight is above the ideal category, but based on the results of the body mass index (BMI) measurement, their weight is in the normal category (Suchdev et al., 2017). This makes most teenagers choose to lose weight in order to get a slimmer and dreamed of body shape. However, it is not uncommon for these teenagers to lose weight in the wrong way, such as reducing food intake which will have an impact on the incidence of anemia in adolescents (Hutasuhut & Supriati, 2022) emotional eating can affect unhealthy food consumption patterns among adolescent girls (Aryani et al., 2024). Physical activity is known to be a risk factor for anemia in adolescent girls (Nurhayati et al., 2023). The proportion of adolescent girls with heavy activity who experience anemia varies between 30-85% (Novelia et al., 2021). However, several other studies have proven that physical activity in adolescent girls is not associated with anemia problems (M. E. Putri et al., 2023; Yunanci et al., 2023).

Physical Activity

Physical activity was found to be associated with the incidence of anemia in adolescents based on the results of four studies (Claudia et al., 2023; Novelia et al., 2022; Putri & Fauziyah, 2023; Yulita et al., 2022). Physical activity is the activity of moving body parts that trigger the release of energy in a simple way (Norris et al., 2022). Strenuous physical activity causes iron metabolism in the body to increase and hemoglobin levels to become abnormal (Yunanci et al., 2023). Physical activity can be categorized as strenuous if it is done for three or more days a week, or it can be a combination of walking for seven days or more with high intensity (Mirzaai Najmabadi et al., 2023). The impact of physical activity on hemoglobin levels is mediated by increased lactic acid levels, increased metabolism, and hydrogen ion levels so that it can result in anemia problems in adolescent girls (Yani et al., 2023).

Nutritional Status

A total of 8 studies reported that nutritional status was a potent factor in the incidence of anemia in adolescent girls. Nutritional status is the state of an individual's body that describes the food consumed and the use of substances in the body (Purwati et al., 2024). Undernutrition status is suspected to increase the risk of anemia in adolescent girls (Oddo et al., 2019). The correlation between the incidence of anemia and nutritional status in adolescents has been supported by research conducted on adolescent girls at SMPN 3 Cibeber, adolescent girls at SMP Negeri 2 Garawangi and at SMP Triyasa Ujung Berung Bandung (Oddo et al., 2019). However, other studies have found that there is no relationship between nutritional status and the incidence of anemia in adolescent girls (Romadhon et al., 2024). This difference in results suggests to reconfirm the relationship between nutritional status and the incidence of anemia, especially in adolescent girls.

Iron Consumption

A total of 5 studies reported that iron consumption was a potent factor in the incidence of anemia in adolescent girls. Iron is an important component in hemoglobin production. If the iron circulating in the body is low, it is possible that hemoglobin levels are low and oxygen circulation is also low, so it is possible to experience anemia which is characterized by weakness, fatigue, and

paleness (Ani et al., 2020; Warda & Fayasari, 2021). Adolescent girls with less iron intake are less likely to experience anemia. As many as 33.3% of adolescent girls who did not receive Fe tablet supplementation were found to have anemia (Putra et al., 2020).

Anemia due to iron deficiency can be overcome by consuming iron supplementation (Permatasari et al., 2020). Anemia can be overcome by giving 200mg iron tablets for 90 days. However, compliance with iron tablet supplementation is still very low, at 35% (Ani et al., 2018). To overcome this, efforts are needed to increase understanding of the importance of consuming iron to prevent anemia in adolescents (Ani et al., 2018).

Adolescent girls have a higher likelihood of developing anemia when compared to adolescent boys. As many as 60% of adolescent girls are found to have anemia (Setyorini et al., 2019). Iron requirements in adolescent girls increase with respect to growth and menstrual events. Menstruation causes hemoglobin contained in red blood cells to also come out (Sari et al., 2022). The proportion of adolescents with anemia with abnormal menstrual cycles ranges from 50-60% of adolescents (Marcus et al., 2021).

Anemia in adolescent girls is also associated with the habit of consuming food from low-quality iron sources, namely non-heme iron sources. Heme iron sources have an absorption rate of 20-30%, are easier to absorb by the body and their absorption does not depend on other nutrients. (Putra et al., 2020). Consuming animal foods containing heme iron is recommended to prevent anemia (Zolton et al., 2022).

To reduce the incidence of anemia in adolescents, it is recommended to increase the supplementation of Blood Supplement Tablets (TTD) for adolescent girls, especially in Indonesia, as part of anemia prevention programs. In addition, nutrition education in schools and families is recommended to provide an understanding of the importance of supplementation every 2 weeks.

Anemia and adolescent productivity

Anemia is known to reduce the physical and cognitive work productivity of adolescents (Marcus et al., 2021). Anemia, especially iron deficiency anemia and oxygen transport can cause fatigue and decreased physical stamina. Studies have shown that adolescents with anemia often experience lower energy levels, which can hinder their ability to perform tasks efficiently. Cognitive function is also affected by anemia, which can lead to difficulties in concentration, decision-making, and overall mental clarity. School performance in adolescents may be affected by iron deficiency anaemia (Kirolos et al., 2022).

Low hemoglobin levels lead to fatigue, weakness, and impaired attention, ultimately affecting their performance in school and daily activities (Yunanci et al., 2023). Hemoglycerin levels can be increased through vitamin B12-Folic Acid supplementation. The physical fitness of the subjects before and after the intervention was found to be higher in subjects who took vitamin B12-Folic Acid supplementation (Gehrich et al., 2023).

CONCLUSION

The results of the literature review showed that factors related to anemia in adolescents included dietary patterns, body image, physical activity, nutritional status, iron consumption, disease history, menstruation, and level of knowledge. However, the relationship between these factors is still inconsistent, so more in-depth analysis is needed to understand the main determinants. This research makes an important contribution in providing a comprehensive synthesis of the determinants of anemia in adolescents, which were previously fragmented. These results recommend strengthening school-based nutrition education, promoting a balanced diet rich in iron and vitamin C, ensuring regular supplementation programs such as folic acid and blood-boosting tablets for adolescent girls, and implementing community-driven campaigns to prevent extreme dietary behaviors

ACKNOWLEDGEMENTS

We would like to thank the teaching staff at the Department of Public Health and Medicine, Faculty of Medicine, Udayana University, who have guided and provided experience in compiling studies with systematic literature review

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