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DETERMINANTS OF ANEMIA IN ADOLESCENT GIRLS: LITERATURE REVIEW

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ABSTRACT
Iron deficiency anemia is anemia that occurs due to a lack of iron in the blood that is prone to occur in adolescent girls. Iron deficiency anemia in adolescents has various consequences, such as impaired physical and mental growth and development and decreased physical fitness, work capacity, and school achievement. The purpose of writing this systematic literature review is to determine the determinants of anemia in adolescent girls. This study was conducted by searching for articles in the Pubmed, BMJ, Coachrane Library, Elvisier databases that have been published with a limitation of 2017 - 2022. The keywords used are determinants, AND anemia AND adolescent girl. Center of Review and Dissemination and The Joana Briggs Institute Guideline as a guide in selecting and determining the quality of the research summarized. The journals selected in writing this systematic literature review are journals that use the Randomized Controlled Trial design. Reporting a systematic literature review uses a checklist from PRISMA. The selection of journals based on the keywords used resulted in 7272 potentially relevant studies totaling 142 duplicates which were then removed until complete articles with titles and abstracts were found in 10 journals. Determinants that influence the incidence of anemia in adolescent girls include education level, family income level, diet, BMI, and activity.

Keywords: adolescent girls; anemia; determinants

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INTRODUCTION

According to (WHO, 2019) adolescents are people aged 10-19 years who constitute 25% of the world's population. Adolescents experience a period of rapid change and development both biologically, psychologically and socio-economically, where the body's need for macronutrients and micronutrients is quite high due to the peak development of puberty, accelerated growth, and physical activity (Zhu et al., 2021). Daily iron requirements increase two-fold to three-fold during adolescence for boys and girls, and after menarche iron requirements continue to remain high among adolescent girls due to blood loss during menstruation, which increases the risk of nutritional anemia in adolescent girls (Habib et al., 2020). Anemia is defined as a condition in which the number of red blood cells (erythrocytes) and their oxygen-carrying capacity are insufficient to meet the physiological needs of the body (Mengistu et al., 2019). Iron deficiency anemia is anemia that occurs due to a lack of iron in the blood.

Iron deficiency is the most common nutritional deficiency and the most common cause of anemia. It is characterized by defects in hemoglobin synthesis, resulting in abnormally small red blood cells (microcytic) and decreased hemoglobin count (hypochromic) (Fentie et al., 2020). According to research (Andriastuti et al., 2020) the early stages of iron deficiency can affect motor and cognitive abilities and cause behavioral disorders in children that may be irreversible. Iron deficiency anemia in adolescence also has various consequences, such as

impaired physical and mental growth and development and decreased physical fitness, work capacity, and school performance.

Globally, almost 2 billion people in the world suffer from anemia or around 29.9% are women aged 15-49 years. Asia and Africa are regions with a fairly high prevalence of anemia. The highest prevalence of anemia, namely 41%, occurs in African countries and 35% in East Africa (WHO, 2022). In addition, in Indonesia itself, according to data (Riskesdas, 2018), the prevalence of anemia in adolescent girls is around 32%, meaning that 3-4 out of 10 adolescent girls experience anemia. Analysis of data from the Demographic and Health Survey conducted during 2010-2019 in 45-47 low- and middle-income countries shows that the average prevalence of anemia in women aged 15-49 years is high, namely more than 35% (WHO, 2022). Risk factors for anemia can be caused by income levels, number of family members, inadequate nutrient absorption, and experiencing disease disorders. Teenage girls who experience anemia if not treated will continue to become pregnant women who are at risk of giving birth to children with Low Birth Weight. This causes the child to grow up stunted and have poor intelligence (Taufiqa et al., 2020)

One of the efforts to prevent and control anemia in adolescent girls can be done by providing iron supplements. The government is also trying to prevent anemia in adolescent girls by implementing a program to provide iron tablets for adolescent girls with the hope that the target achieved is 30% in 2019 (Riskesdas, 2018). In addition, efforts that can be made are to improve education and health status. The purpose of writing this systematic literature review is to determine the determinants of anemia in adolescent girls.

METHOD

The literature used in this systematic literature review uses a search through 4 (four) electronic databases, namely Pubmed, BMJ, Coachrane Library, Elvisier which have been published with a limitation of 2017 to 2022. The keywords used are "determinants" AND "anemia" AND "adolescent girls". Furthermore, the method chosen is a study using a randomized clinical trial approach/Random Controlled Trial (RCT) to determine the determinants of anemia in adolescent girls. The research design that is the inclusion criteria in this systematic review is the Random Controlled Trial (RCT) design published in English. The literature used in this Systematic Review uses a search through four (6) electronic databases, namely: Pubmed, BMJ, Cochrane Library, and Elsevier which have been published with a limitation of 2017 to 2022. The keywords used are: "Determinants", "Anemia", "Adolescent girls". Furthermore, the method chosen is a study with a cross-sectional approach that examines the determinants of anemia in adolescent girls. The research design that was the inclusion criteria in this systematic review was a randomized controlled trial (RCT) design published in English. A total of 7272 articles were found, then 282 were excluded and inscribed, 142 articles were selected for completeness, and 10 articles were excluded for purpose and topic of the article until the final result was 10 articles used in this study.

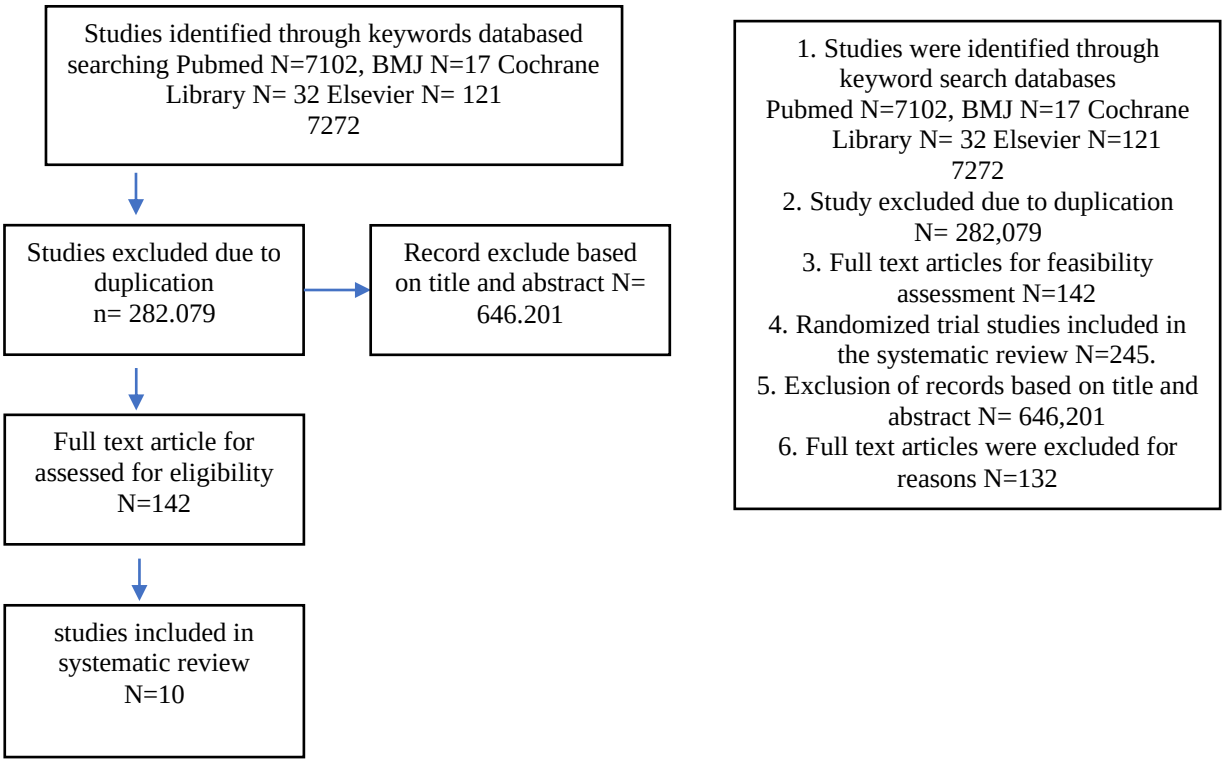

Figure 1. The Study Of Selection Process of Literature Adapted From Prisma

RESULTS

Table 1.
Details of the results of the Preferred Journals for Literature Review

Author/ Year	Tittle	Journal name	Objective	Method	Result
Halala Handiso, 2022	*Anemia and its determinants among adolescent girls in Southern Ethiopia*	*Cogent Public Health*	The aim of this study was to assess anemia status and its determinants in adolescent girls in Southern Ethiopia.	*cross-sectional*	The overall prevalence of anemia was 37.2% among adolescent girls in the study area. Monthly family income, cough and malaria in the last two weeks, missed regular meals, and BMI-for-age were the main predictors of low blood hemoglobin levels among adolescent girls in southern Ethiopia.
Dudi et al., 2020	*Prevalence of anemia among adolescent girls: Severity and determinant factors in Rajasthan, India*	Journal of Pharmaceutical Innovation	Objective: This study was designed to study the prevalence of anemia & associated factors among adolescent girls in Pali District Rajasthan, India.	*cross-sectional*	Respondents were divided into three groups, 98 respondents (54.45%) were in the control group, 49 respondents (27.22%) were in the ID (iron deficiency) group and 33 respondents (18.33%) were in the IDA (iron deficiency anemia) group. There were significant differences between ID, IDA and controls in terms of father's and mother's education (p=0.0403, p=0.0013), eating vegetables and citrus fruits (p=0.012), hard work/exercise (p=0.003), past history of IDA (p=0.001) and paleness as a subjective complaint of girls (p=0.0036).

Author/ Year	Tittle	Journal name	Objective	Method	Result
Gupta, 2020	*A study on Socio-demographic determinants causing anemia in adolescent girls*	*Journal of Medical Science And Clinical Research*	to study the prevalence of anemia and its relationship with socio-demographic factors among adolescent girls.	*cross-sectional study*	Majority of the girls i.e. 970 (97%) belonged to socio-economic class II, III, IV. The association between SES and anemia was found to be statistically significant. The association between maternal education and anemia was also found to be statistically significant but the association between family type and anemia was also found to be statistically insignificant.
Puttaraju, 2018	*Anemia among women Karnataka state, India: Disparities and Determinants*	*International journal of basic and applied research*	This study aims to explore rural-urban disparities and to study the factors associated with anemia among women in Karnataka.	*Random sampling*	The study found that Out of 248 women analyzed, 35.4% women were found to be anaemic and 64.6% were normal. Anaemia was more prevalent in urban areas than in rural areas, Hindu women were more affected than Muslim women, SC, ST were more affected than OBC and others. There was a significant association between place of residence (p=0.000) Community or caste of women (p=0.036) education level of women (p=0.004), toilet facility (p=0.067) and Birth interval (p=0.016) and anaemia. The study implies that prevalence of anaemia decreases with increasing education level and birth interval.
Hassan et al., 2017	*Prevalence and Determinants of Iron Deficiency Anemia in Adolescents Girls of Low Income Communities in Lahore*	*ANNALS*	To assess the prevalence and determinants of iron deficiency anemia in adolescent girls from low-income families living in a semi-urban community of Lahore, Pakistan.	Cross-sectional analytical research	IDA occurred in 68.8% of adolescent girls, of which 40.2% had moderate anemia (8 – 10 gm/dl) and 28.8% had mild anemia (10.9 – 11.9 gm/dl). Employment status ($p < 0.041$), food sources of iron ($p < 0.001$), frequency of heme iron consumption ($p < 0.001$), protein consumption/day ($p < 0.001$) and HEI score ($p < 0.001$) showed a statistically significant relationship. relationship with IDA.
Regasa & Haidar, 2019	*Anemia and its determinant of in-school adolescent girls from rural Ethiopia: a school based cross-sectional study*	*BMC Women's Health*	To evaluate anemia status and anthropometric, dietary and socio-demographic determinants in adolescent girls, western Ethiopia.	*cross-sectional*	The overall prevalence of anemia was 27% (95% CI: 22.9-31%) of which 23 and 4% had mild and moderate anemia, respectively. The proportion of underweight and overweight girls based on BMI for age z-score was 33 and 3.6%, respectively. The odds of anemia were almost four times more likely in late adolescents compared to early adolescents (AOR = 3.8 95% CI = 2.3 to 8.5). Adolescents from rural areas were 3.4 times more likely to have anemia compared to urban adolescents. (AOR = 3.4 95% CI = 1.9 to7) and adolescents who reached menarche were twice as likely to have anemia compared to those who did not (AOR = 2.3 95% CI = 1.34-

Author/ Year	Tittle	Journal name	Objective	Method	Result
					4.2).
Fentie et al., 2020	*Prevalence of Anemia and Associated Factors among Secondary School Adolescent Girls in Jimma Town, Oromia Regional State, Southwest Ethiopia*	Anemia	To evaluate anemia status and anthropometric, dietary and socio-demographic determinants in adolescent girls, western Ethiopia.	*cross-sectional*	A total of 528 adolescent girls were included in the study resulting in a response rate of 95.8%. The prevalence of anemia was found to be 26.7%, 95% CI (22.7, 30.50). In multivariate logistic regression analysis, those living apart from their families (AOR = 4.430, 95% CI (2.20, 8.90)), low dietary diversity score (AOR = 3.57, 95% CI (1.88, 6.75)), menstrual bleeding more than 5 days (AOR = 2.25, 95% CI (1.17, 4.33), and low economic status (AOR = 2.16, 95% CI (1.17, 4.33)) were factors positively associated with anemia and only having at least high school in maternal education status AOR = 0.43, 95% CI (0.18, 0.97) was negatively associated with anemia in the study area.
Subramanian et al., 2022	*Prevalence of Anemia Among Adolescent Girls Residing in Rural Haryana: A Community-Based Cross-Sectional Study*	*Cureus*	This study was conducted to assess the prevalence of anemia in rural adolescent girls who had reached menarche..	*Cross-sectional*	A total of 272 participants were enrolled in the study. The mean (SD) age at menarche was 13.2 (1.2) years. The prevalence of anemia among adolescent girls who had reached menarche was observed to be 71.7% (95% CI: 66.3 - 77.1) according to the WHO classification. Among 195 anemic adolescent girls, severe, moderate, and mild anemia were observed in 4.8%, 41.2%, and 25.7%, respectively. In multivariable analysis, after adjusting for age, maternal education was significantly associated with anemia (Adjusted Odds Ratio = 0.46, 95% CI: 0.22 - 0.96, p-value = 0.04).
Ahmed & Mohammed, 2022	*Anemia and its associated factor among adolescent school girls in GODEY and DEGEHABUR council Somali region, eastern Ethiopi*	*BMC Nutrition*	to estimate the prevalence of anemia among school-going adolescent girls and to identify associated factors.	*cross-sectional*	The prevalence of anemia was found to be 31.5% among adolescent girls. Family size of 5 people and lack of knowledge about anemia were independent predictors of anemia.
(Kamble et al., 2021)	*Prevalence of anaemia among school going adolescent girls attending Primary Treat and Talk (T-3) camp under Anaemia Mukt Bharat in Delhi*	*Journal of Family Medicine and Care,*	to assess the prevalence of anemia and factors associated with it among school going adolescent girls attending T-3 camp in Delhi	*cross-sectional*	The prevalence of anemia was found to be 59% with a mean (±SD) Hb of 11.3 gm/dl (±1.55) among 203 participants. The majority (48%, n = 119) of anemic girls had mild anemia. Among 203 girls, 65% of participants were aged 14-15 years with a mean (±SD) age of 14.6 years (±1.18). There was a significant association between anemia and dietary patterns, worm status, and BMI ($P < 0.05$).

DISCUSSION

Based on Dudi that there is a significant difference between the iron deficiency (ID) group, the iron definition anemia (IDA) group, and the control group in terms of the education of the father and mother. This study was conducted in Rajasthan India and the examination of hemoglobin levels using a Sahli hemoglobinometer. The data showed that the respondent's father, 43.88 percent of the control group and 12.24 percent of the ID group were educated up to high school, while 42.86 percent of the respondent's father from the control group, 24.49 percent of the ID group and 15.15 percent of the IDA group. have basic education. Some respondent fathers from the control group (09.18%) while most of the respondent fathers from the ID group (63.27%) and the IDA group (87.76%) are illiterate. Only 4.08 percent of the respondent fathers from the control group were educated above high school. Most of the respondent mothers, 62.24 percent of the control group and only 12.24 percent of the ID group had basic education while 13.27 percent of the respondent mothers from the control group were educated up to high school (Dudi et al., 2020). In Gupta's study the relationship between maternal education and anemia was found to be statistically significant, the subjects in the study were girls 20 years and those suffering from chronic diseases were not included in the study. A total of 1000 girls were interviewed and investigated for their hemoglobin concentration. The study of hemoglobin levels used the Cyanmethaemoglobin method.

The research data shows that low maternal education levels have a positive effect on anemia, illiterate education is 340 and elementary school is 229 (Gupta, 2020). Puttaraju's research that the prevalence of anemia decreases with increasing levels of education and birth spacing. This study was conducted in urban and rural districts (Puttaraju, 2018). Subramanian et. al's research that age, maternal education are significantly related to the incidence of adolescent anemia. This study was conducted by collecting adolescents who had experienced menarche (Subramanian et al., 2022).

According to Ahmedcorres, knowledge about anemia is an independent predictor of anemia. Adolescent girls aged 15 to 19 years who were willing to participate in the study and gave their consent and who were present on the day of the visit at school were included in the study (Ahmed & Mohammed, 2022). Based on Handiso revealed that the prevalence of adolescent girls of 37.2% is influenced by the monthly family income factor. The research subjects were adolescent girls, aged 10-19 years in two zones of southern Ethiopia, who were willing to give consent (Halala Handiso, 2022). According to Fentie et. al, adolescents with low economic status are a factor that is positively related to anemia (Fentie et al., 2020).

In the study (Fentie et al., 2020) it was stated that there was a significant relationship between anemia and diet. In line with the study (Halala Handiso, 2022) that skipping regular meals was significantly related to hemoglobin levels in adolescent girls. Adolescent girls who skip their regular meals are 2.25 times more likely to experience anemia than those who do not skip their regular meal times. Based on (Kamble et al., 2021) that thin adolescent girls have a higher prevalence of anemia than adolescent girls who have a normal BMI and this difference is statistically significant. In line with the study from (Regasa & Haidar, 2019) that the proportion of thin and overweight girls based on BMI has a four times greater chance of experiencing anemia. This study is in line with (Puspitasari et al., 2022), stating that there is a relationship between attitudes ($p = 0.003$; $r = 0.292$), subjective norms ($p = 0.006$; $r = 0.266$), and perceived behavioral control ($p = 0.002$; $r = 0.299$) with the intention to prevent anemia and perceived behavioral control ($p = 0.003$; $r = 0.292$) and intention ($p = 0.000$; $r = 0.392$) with anemia prevention behavior. Adolescent girls are a group that is susceptible to anemia. Anemia is a condition of morphological changes and a decrease in the number of blood cells

and hemoglobin so that it is not enough to meet the physiological needs of the body. In adolescent girls, iron deficiency anemia is the biggest cause of morbidity and mortality. Several factors such as poor nutritional status, low socioeconomic status, comorbidities (malaria, thalassemia, and others), impaired absorption of nutrients, and irregular menstrual patterns will increase the risk of anemia. According to (Dudi et al., 2020) states that one of the significant risk factors is hard work. In another study by (Hassan et al., 2017) that work status shows a statistically significant relationship with iron deficiency anemia. In addition, studies (Halala Handiso, 2022), (Puttaraju, 2018), (Hassan et al., 2017), (Regasa & Haidar, 2019), (Fentie et al., 2020) state that there are other factors that contribute to the occurrence of anemia, namely disease factors, urban and rural residence factors, and teenage girls who experience menstruation.

CONCLUSION

Adolescent girls are a group that is vulnerable to anemia. Iron deficiency anemia in adolescence has various consequences, such as impaired physical and mental growth and development and decreased physical fitness, work capacity, and school performance. Adolescent girls who experience anemia if not treated will continue to become pregnant women with anemia which will cause various complications during pregnancy and childbirth. Mothers with anemia will be at risk of giving birth to children with Low Birth Weight (LBW). Low Birth Weight babies will grow into stunted children, not only stunted but also have low intelligence. This study examines several determinants of anemia in adolescent girls using a systematic literature review. The results of this study are expected to prevent anemia in adolescent girls and also prepare healthy and quality adolescent girls as prospective mothers in the future. Healthy and quality adolescent girls will later give birth to a healthy, strong generation, have high competitiveness, and can become national assets in the future.

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