Journal of Public Health for Tropical and Coastal Region (JPHTCR)
Journal homepage: https:/ejournal2.undip.ac.id/index.php/jphtr/index
ISSN: 2597- 4378

Factors Associated to the Incidence of Anemia Among Adolescent Girls in Muaragembong District Bekasi Regency

Nisa Fitriyanti[1*], Anhari Achadi[1]
[1]Faculty of Public Health, Universitas Indonesia, Indonesia
*Corresponding Author: Email: nisa.fitriyanti@gmail.com

Abstract

Introduction: Anemia is still a major health problem among adolescent girls. The prevalence of anemia among adolescent girls in Muaragembong District Bekasi Regency in 2022 reached 68.7%, so Muaragembong Health Center triggered intervention through innovation programs in iron supplements. This study aimed to analyze factors related to the incidence of anemia among adolescent girls in Muaragembong District Bekasi Regency.

Methods: This was a quantitative study with a cross-sectional study design. The subjects were 150 adolescent girls of grade XII from 5 schools in Muaragembong District. The sampling method used was probability sampling with clustered random sampling technique. Hemoglobin (Hb) levels was measured by Hemocue Hb meter device. Data on food consumptions were collected through Food Frequency Questionnaires (FFQ). Data analysis was conducted through Chi square tests.

Results: Based on the results, 26% of adolescent girls sufferred from anemia. The factors of anemia incidence were thin nutritional status (p=0.0001), abnormal menstrual patterns (p=0.0001), non hand-washing behavior (0.016), unbalanced food consumption patterns (p=0.002), and iron supplement consumption <4x/ month (p=0.0001). The results of multiple logistic regression tests showed that abnormal menstrual patterns (OR=22.07; 95% CI: 3.24-150.51), iron supplement consumption<4times/mo (OR=10.83, 95% CI: 1.30-89.88), thin nutritional status (OR=4.23, 95%CI: 1.44-12.40), and balanced food consumption patterns (OR=0.27, 95% CI: 0.09-0.84) were related to the incidence of anemia in adolescent girls.

Conclusion: The dominant factor of anemia in adolescent girls was abnormal menstrual pattern. However, other factors: iron supplement consumption and balanced food consumptions were also important factors related to anemia.

Keywords: anemia, adolescent girls, menstrual pattern, iron supplement, hand-washing behavior

Copyright (c) 2024 The authors. Published by Faculty of Public Health, Universitas Diponegoro.
This is an open-access article under the CC BY-SA License (https://creativecommons.org/licenses/by-sa/4.0).
DOI: https://doi.org/10.14710/jphtcr.v7i3.24877

Article History: Received: 31th October 2024, revised: 29th November 2024 accepted: 10th December 2024

Introduction

One of the main health problems in adolescents is nutritional problems, especially micronutrient deficiencies, especially anemia. Anemia is when the level of iron-rich hemoglobin in the blood is lower than normal.[1] During adolescence, the need for iron increases rapidly due to the increase in total blood volume and the increase in body mass caused by changes and development of various body dimensions (weight and height).[2]

Moreover, in adolescent girls, menstruation occurs during this period, which makes adolescent girls more susceptible to anemia compared to boys.[1]

Anemia in adolescent girls has an impact on stunted growth and development, decreased concentration and cognitive abilities, lack of productivity, and lack of resistance to infectious diseases, and can affect reproductive health now and in the future. This impact can be more fatal if it occurs in adolescent girls who are pregnant, some problems that can arise in this condition include problems during childbirth such as increased risk of maternal and child death, Low Birth Weight (LBW), prematurity, and reduced nutritional status of babies born.[3]

From a public health perspective, anemia is caused by a complex etiology with various risk factors. Direct causes of anemia include lack of iron intake, infectious diseases, inflammation, other chronic diseases, and various gynecological and obstetric disorders. These conditions are exacerbated by risk factors such as food insecurity and poor diet, limited access to nutritional interventions, and poor hygiene and sanitation.[1] In this study, they are categorized by biological, hygiene, and socioeconomic factors.

The most common direct cause of anemia is iron deficiency. Lack of iron intake is often related to general nutrition inadequacy. For adolescents and adults, one indicator that shows that the body's nutritional needs have been met is achieving normal body weight, which is a weight that is by height. To measure this, the Body Mass Index (BMI) measurement is usually used.[4] In a study conducted by Enggardany et al., it was found that there is a relationship between BMI and anemia in adolescent girls in Indonesia. Adolescent girls with a thin BMI tend to be at risk of experiencing anemia compared to the group with a normal BMI.[5] Research conducted by Indriyani et al. also proved a link between iron supplementation and the incidence of anemia. Adolescent girls who are not taking iron supplementation are at risk of experiencing anemia 56.639 times higher.[6]

Another biological factor that causes anemia is gynecological and obstetric disorders. Abnormalities in menstrual patterns such as polymenorrhea and menorrhagia can cause excessive blood loss that directly causes anemia. Research conducted by Ekasanti et al. proved a relationship between menstrual patterns and anemia.

Infectious diseases are also one of the main causes of anemia. This is because infectious diseases can interfere with the absorption and metabolism of nutrients which can ultimately trigger anemia. [1] Research conducted by Ekasanti et al. also proved that parasitic infections such as malaria and worms can increase the potential for anemia by 6.83 times in adolescent girls.[7]

Personal hygiene practices such as hand washing with soap can affect the level of Hb serum ferritin in adolescent girls. This is caused by contamination of harmful microorganisms when we do not wash our hands can cause infectious diseases, which can cause anemia.[8] Research conducted by Pertiwi et al. showed a relationship between personal hygiene and the incidence of anemia in women of childbearing age (WUS).[9]

Socioeconomic factors can also influence the incidence of anemia among adolescent girls. The level of knowledge and education of both adolescent girls and their parents, especially mothers, can affect their behavior in preventing anemia. If adolescent girls don’t know the causes, impacts, and ways to prevent anemia, they tend to be non-compliant in joining anemia prevention programs like iron supplementation and are therefore susceptible to anemia.[10] Also, mothers with low formal education will have difficulty reading nutritional labels on food, while mothers generally are the most responsible ones for preparing food at home, they won’t be able to choose food with balanced nutrition for family consumption, and therefore they will be prone to suffer from anemia.[11]

Family economic status can also increase the incidence of anemia in adolescent girls. Economic status reflected by the level of parental income greatly influences the purchasing power of

Copyright (c) 2024 The authors

households. Households with low socioeconomic status will face food insecurity, which causes a lack of nutritional intake which will then have an impact on overall health, including the incidence of anemia.[11]

Various efforts have been made to overcome anemia. WHO through the 65th *World Health Assembly* that was held in Geneva in 2012 has recommended a global action plan to improve maternal, infant, and child nutrition. One of their commitments is to reduce half of anemia sufferers in women of childbearing age in 2025.[1] The Indonesian government has also taken the initiative to carry out the action plan, one of which is through iron supplementation is known as the provision of iron supplementation which has been given to target adolescent girls in school-age equivalent to middle and high school since 2014 and is included in specific interventions in efforts to accelerate the reduction of stunting.[3]

However, the prevalence of anemia is still relatively high. It is estimated that the prevalence of anemia in adolescents and women of childbearing age in the world will reach 30% in 2023.[1] Meanwhile, in Indonesia, according to the 2018 Riskesdas data, the prevalence of anemia in adolescents aged 15-24 years reached 32%.[12] In West Java, according to a survey by Nutrition International in 2018, cases of anemia in adolescent girls had reached 41.93%.[13] From December 2022 to January 2023, the Muaragembong Health Center has also conducted anemia screening for adolescent girls in junior high and high schools, especially in grades VII and X along with health screening activities for school-age children. As a result, the prevalence rate of anemia in adolescent girls in the Muaragembong Health Center work area reached 68.7%, this prevalence rate is the highest in Bekasi Regency, far exceeding the national and West Java averages.

This condition triggered Muaragembong Health Center to prioritize intervention through an innovative program in iron supplementation that is called "JUBAH MERAH" which is an abbreviation of “Jumat Berkah Minum Tablet Tambah Darah”. Several activities that have been initiated through this program include cross-sector collaboration as an effort to advocate the program, the formation of iron supplementation volunteers in each school, and monitoring iron supplementation using photos and videos sent via WhatsApp groups or links on social media. This program is expected to reduce the prevalence of anemia in adolescent girls in Muaragembong District.[14]

Based on the description above, this study aims to identify and analyze the multifactorial determinants of anemia in adolescent girls in Muaragembong District, Bekasi Regency, to provide evidence for further targeted intervention.

Methods

This is quantitative research with a cross-sectional study type, where the measurement of the dependent and independent variables is carried out simultaneously. The research was conducted among adolescent girls at grade XII of the 5 schools in Muaragembong District, that is SMAN 1 Muaragembong, SMK Assa'adatul Abadiyah Muaragembong, MA Assa'adatul Abadiyah Muaragembong, SMA YASMI Muaragembong and SMA Pelita Bangsa Muaragembong in the first week of August 2024.

The calculation of the minimum sample size is carried out using the sample size calculation formula for the different proportion hypothesis tests with a 95% confidence interval (1.96) and 95% power of the test (1,64).[15] The number of samples obtained from the largest N value is 86. Then corrected the design effect of 1.5 due to sampling with cluster technique, so that the size of the research sample becomes 129 people. Furthermore, to prevent respondents who cannot be examined and interviewed (non-response) the number of samples is added by 10% so that the minimum sample for the study is 142 people which is finally added up to 150 people.

Sampling in this study used probability sampling with clustered random sampling technique, a sampling technique that divides the population into several groups (clusters). The clusters/groups in

Copyright (c) 2024 The authors

this study were high schools in the Muaragembong Health Center Working Area, a total of 5 schools/clusters. Then to determine the number of samples in the cluster, proportional sampling was carried out so that there is a balanced comparison. Pick representative samples in high school was done by simple random sampling, which is a method for taking samples randomly from a sample frame that has been sorted. Then the random process is carried out using the SPSS program. This representative sample will be carried out evenly in all schools and classes, using the available attendance list. If the student is absent at the time of the examination, then sampling will be carried out to the next student on the list. The exclusion criteria of this study are adolescent girls who have blood disorders such as thalassemia, hemosiderosis, etc., and who refused to join the study.

This research is quantitative research which uses primary data. Before collecting data, respondents will be asked to fill out a consent form to participate in the study. In this informed consent, participants will be informed about risks that they may have experienced including bleeding, pain, and discomfort, so that they have the right not to participate in the study or leave during the research. They will also be guaranteed data confidentiality, therefore their data will be safe from violation. Data collection primary data used for this study is by examining Hemoglobin (Hb) levels using the Hemocue Hb meter device carried out by analysts from the Muaragembong Health Center, examining nutritional status with an anthropometric device brand Balmed by Muaragembong Health Center officers and structured interviews using questionnaires.

The dependent variable in this study is the occurrence of anemia characterized by Hb below 12gr/dL, normal Hb if the value obtained is 12gr/dL or more. The independent variable in this study is nutritional status which is measured by measuring height and weight, then calculated using the BMI formula. Then BMI is classified as normal if the number obtained is 18.5 or more and thin BMI is if the number obtained is below it. Menstrual patterns are assessed through interviews using questionnaires to evaluate the menstrual cycle, the amount of menstruation, and the duration of menstruation. The history of infectious diseases studied here are pulmonary TB and worms. Personal hygiene studied here is the habit of washing hands with soap. Food consumption patterns are obtained through food frequency questionnaires (FFQ), which evaluate the consumption patterns of several types of food which are sources of iron, enhancers of iron absorption, and inhibitors of iron absorption, categorized as balanced nutrition if a score obtained from the FFQ questionnaire is above the mean score and imbalanced nutrition if the score is below. Compliance with Iron supplement consumption is obtained through interviews on whether adolescent girls routinely consume iron supplements in the last month, according to recommendations, that is 1 time a week. They will be categorized as obedient if they consume iron supplements≥ 4 times a month, whereas if they consume less they will be categorized as disobedient. The level of knowledge of adolescent girls is obtained through questions containing material on anemia and balanced nutrition and will be categorized as good if the score obtained is above the mean score and not good enough if it's below the mean score. The level of maternal education is the level of education that has been completed by the mother of adolescent girls, divided into high if completing school at least equivalent to high school, low education if only completing school up to junior high school and not attending school. If the mother is not involved in the household, it can be replaced by the education level of another primary guardian. The level of parental income is assessed based on the Bekasi Regency UMK in 2024, which is IDR 5,219,263, -, assessed whether the parents' income is below the UMK and equal to or more than the Bekasi Regency UMK. Questionnaires used in this study must be tested first for validity and reliability. The result of the test was that 10 questionnaires were valid and reliable (calculated r>table r = 0,361) with a Cronbach Alpha score of 0,776.

Copyright (c) 2024 The authors

Data analysis was carried out starting from univariate, bivariate using the chi-square test for independent variables with 2 categories and a simple logistic regression test for variables with more than 2 categories, and a multivariate with multiple logistic regression analysis techniques. If multicollinearity between variables is suspected, then the variables will be combined into a single variable.

The ethics of this study were obtained from the Research Ethics and Public Health Service Committee, Faculty of Public Health, University of Indonesia with the number: Ket- 437 / UN2.F10.D11 / PPM.00.02 / 2024.

Results

Univariate analysis

From the results of the table above, respondents who experienced anemia were 26%. For the nutritional status of the respondents, most were in the normal category, that is 78.7%. From the menstrual pattern, most respondents had a normal menstrual pattern, that is 90%. When viewed from the history of infectious diseases, almost all respondents, that is 94%, were in the normal category. For hand-washing behavior, most respondents implemented hand-washing behavior (96.7%). Food consumption patterns for each category almost had the same percentage, that is unbalanced nutrition (56.7%) and balanced nutrition (43.3%). The Iron supplement consumption variable mostly consumed iron supplement <4 times a month as much as 71.3%. The level of knowledge of the respondents mostly had a good level of knowledge (77.3%). While for maternal education, most were in the low category, that is 85.3%. For parental income, most were below UMK, that is 85.3%.

Bivariate Analysis

The results of the table above show that adolescent girls who experience anemia with normal nutritional status are 16.9% and thin 59.4%. Statistically, the p-value = 0.0001 means that there is a significant relationship between nutritional status and the incidence of anemia in adolescent girls. OR of 7.162 (3.049 - 16.819) means that adolescent girls with thin nutritional status have a risk of 7.162 times higher for anemia compared to adolescent girls with normal nutritional status. From the menstrual pattern variable, 86.7% of adolescent girls with abnormal menstrual patterns experience anemia and 16.9% of adolescent girls with normal menstrual patterns experience anemia. Statistically, the p-value = 0.0001 means that there is a relationship between menstrual patterns and anemia. OR of 27.250 (5.79 - 128.252) means that adolescent girls with abnormal menstrual patterns have a risk of 27.250 times higher for anemia compared to adolescent girls with normal menstrual patterns. Of adolescent girls who have a history of infectious diseases 55.6% have anemia and 19.3% who don't have a history of infectious diseases have anemia. The p-value = 0.052 means that statistically there is no relationship between the history of infectious diseases and the incidence of anemia. From the hand-washing behavior, 80% of adolescent girls who do not implement hand-washing behavior and 24.1% of adolescent girls who implement hand-washing behavior experience anemia with p-value = 0.016, meaning that there is a statistically significant relationship between hand-washing behavior and the incidence of anemia. Or of 12.571 (1.36 - 116.222) means that adolescent girls who do not implement hand-washing behavior have a 12.571 times higher risk of developing anemia compared to adolescent girls who implement hand-washing behavior. In the food consumption pattern variable, 36.5% of adolescent girls who consume unbalanced nutritional food experience anemia, and 12.3% with balanced nutritional consumption experience anemia. P-value = 0.002 means that there is a statistically significant relationship between food consumption patterns and the incidence of anemia. OR of 0.244 (0.103 - 0.579) means that adolescent girls with a balanced nutritional food consumption pattern have a 0.244 lower risk of developing anemia compared to unbalanced food consumption patterns. As many as 35.5% of adolescent girls who consume iron supplements < 4 times experience anemia and only 2.3% of adolescent girls who consume iron

Copyright (c) 2024 The authors

supplements≥ 4 times experience anemia. P-value = 0.002 means that there is a statistically significant relationship between Iron supplement consumption and the incidence of anemia. OR of 23.130 (3.061 - 174.766) means that adolescent girls who consume iron supplements < 4 times have a 23.130 higher risk of developing anemia compared to adolescent girls who consume iron supplements≥ 4 times. When viewed from the level of knowledge, 26.7% have good knowledge who experience anemia and 23.5% have less knowledge who experience anemia. P-value = 0.880 means there is no statistically significant relationship between the level of knowledge of adolescent girls and anemia. Adolescent girls with highly educated mothers 6.7% who experience anemia, 28.1% of mothers with low education who experience anemia, and 28.6% of mothers with no formal education who experience anemia. The P-value of 0.106 low category and 0.196 for no school means there is no significant relationship between the education of adolescent girls' mothers and anemia. For the level of parental income with the category ≥ UMK, 9.1% experience anemia, and < UMK, 28.9% experience anemia. P-value = 0.09 means there is no significant relationship between the level of parental income and the incidence of anemia.

Multivariate Analysis

Multivariate analysis in the study used multivariate determinant modeling. This modeling aims to obtain a model consisting of several independent variables. Before entering the multivariate modeling, bivariate selection was carried out by looking at the p-value <0.25. Then the variables that entered the multivariate stage were obtained, that is nutritional status, menstrual patterns, history of infectious diseases, hand-washing behavior, food consumption patterns, iron supplement consumption, maternal education, and parental income level. The next stage includes all independent variables that are by the bivariate selection to carry out multivariate analysis using multiple logistic regression tests.

Based on the results of the multiple logistic regression test shown in the table above, it can be seen that the variables that are statistically related to the incidence of anemia are nutritional status, menstrual patterns, food consumption patterns, and iron supplement consumption (p-value <0.05). While the variables of hand-washing behavior, maternal education, and parental income are confounded. The most dominant variable related to anemia in adolescents is menstrual patterns with OR of 22.07(3.236 – 150.506) which means that female adolescents who have an abnormal menstrual pattern have a 22.068 higher risk of experiencing anemia compared to adolescents who have a normal menstrual pattern after controlling for the variables of nutritional status, HAND-WASHING behavior, food consumption patterns, maternal education and parental income.

Table 1. Univariate Analysis Result

Variables	N (150)	%
Anemia		
Normal	111	74
Anemia	39	26
Nutritional status		
Normal	118	78.7
Thin	32	21.3
Menstrual Pattern		
Normal	135	90
Abnormal	15	10
History of Infectious Diseases		
Normal	141	94
Abnormal	9	6
Hand-washing Behavior		
Yes	145	96.7
No	5	3.3
Food Consumption Patterns		
Unbalanced nutrition	85	56.7
Balanced nutrition	65	43.3
Iron suplement consumption		
≥ 4 times	43	28.7
< 4 times	107	71.3
Level of Knowledge		
Good	116	77.3
Not enough	34	22.7
Mother's Education		
High ≥ High School	15	10
Low < SMA	128	85.3
No school	7	4.7
Parental Income Level		
≥ UMK	22	14.7
< UMK	128	85.3

Copyright (c) 2024 The authors

Table 2. Bivariate Analysis Result

Variables	Anemia		p-value	COR	95% CI
	Normal	Anemia			
Nutritional status					
Normal	98 (83.1%)	20 (16.9%)	0.0001*	7.162	3.049 – 16.819
Thin	13 (40.6%)	19 (59.4%)			
Menstrual Pattern					
Normal	109 (80.7%)	26 (19.3%)			
Abnormal	2 (13.3%)	13 (86.7%)	0.0001*	27.250	5.79 – 128.252
History of Infectious Diseases					
Normal	107 (75.9%)	34 (24.1%)			
Abnormal	4 (44.4%)	5 (55.6%)	0.052	3.934	0.999 – 15.485
Hand-Washing Behavior					
Yes	110 (75.9%)	35 (24.1%)			
No	1 (20%)	4 (80%)	0.016*	12.571	1.36 – 116.222
Food Consumption Patterns					
Unbalanced nutrition	54 (63.5%)	31 (36.5%)			
Balanced nutrition	57 (87.7%)	8 (12.3%)	0.002*	0.244	0.103 – 0.579
Iron supplements consumption					
≥ 4 times	42 (97.7%)	1 (2.3%)			
< 4 times	69 (64.5%)	38 (35.5%)	0.0001*	23.130	3.061 – 174.766
Level of Knowledge					
Good	85 (73.3%)	31 (26.7%)	0.880	0.844	0.345 – 2.060
Not enough	26 (76.5%)	8 (23.5%)			
Mother's Education					
High ≥ High School	14 (93.3%)	1 (6.7%)	1		1
Low < SMA	92 (71.9%)	36 (28.1%)	0.106	5.478	0.695 – 43.199
No school	5 (71.4%)	2 (28.6%)	0.196	5,600	0.412 – 76.049
Parental Income Level					
≥ UMK	20 (90.9%)	2 (9.1%)			
< UMK	91 (71.1%)	37 (28.9%)	0.09	4,066	0.905 – 18.276

Table 3. Multivariate Analysis Result

Variables	p-value	OR	95% CI	
			Lower	Upper
Nutritional status				
Normal		Ref.		
Thin	0.009*	4.225	1.440	12.397
Menstrual Pattern				
Normal		Ref.		
Abnormal	0.002*	22.068	3.236	150.506
Hand-Washing Behavior				
Yes		Ref.		
No	0.060	16.180	0.891	293.711
Food Consumption Patterns				
Unbalanced		Ref.		
Balanced	0.023*	0.268	0.086	0.835
Iron supplements consumption				
≥ 4 times		Ref.		
< 4 times	0.027*	10.826	1.304	89.882
Mother's Education				
High		Ref.		
Low	0.173	5.439	0.475	62,242
No school	0.546	2.677	0.109	65.711
Parental Income				
≥ UMK		Ref.		
< UMK	0.418	2.137	0.340	13.433

*statistically related

Copyright (c) 2024 The authors

Discussion

The results of the univariate analysis in this study obtained data that out of 150 female adolescents who were examined, 26% had anemia. This is in line with WHO which states that the prevalence of anemia in WUS will reach 30% in 2023.[1] From the menstrual pattern, most respondents have a normal menstrual pattern, which is 90%. For a history of infectious diseases, almost all respondents are also in the normal category, which is 94%. For hand-washing behavior, most respondents apply hand-washing behavior (96.7%). The food consumption pattern for each category has almost the same percentage, that is consuming food with unbalanced nutrition (56.7%) and balanced nutrition (43.3%). In the Iron supplement consumption variable, most consume iron supplements less than 4 times a month, which is 71.3%. The level of knowledge of respondents regarding anemia and balanced nutrition mostly has a good level of knowledge (77.3%).

Meanwhile, for maternal education, most are in the low category, that is 85.3%, and there are even a small number who have not attended school at all, that is 4.7%. And for parental income, most are below the UMK, which is 85.3%. Muaragembong District is located in the northernmost part of Bekasi Regency, most of which is coastal land and fishery ponds. The location of Muaragembong District, which is far from the capital of Bekasi Regency, causes a lack of public facilities which also causes various population problems such as minimal business opportunities and low level of community education. This is reflected in the low level of maternal education and parental income of teenage girls.[14]

In the bivariate analysis, data was obtained that the variables that had a statistical effect included nutritional status with a p-value = 0.0001. With an OR of 7.162 (3.049 - 16.819), it means that adolescents with thin nutritional status have a risk of 7.162 times higher for anemia compared to adolescents with normal nutritional status. This is also in line with research conducted by Enggardany et al. which stated that there is a relationship between thin BMI and anemia in adolescent girls in Indonesia, where adolescent girls who have a BMI in the thin category have a risk of 1.198 times greater for anemia when compared to adolescent girls with normal BMI category.[5]

The next variable that is statistically related to anemia in adolescent girls is menstrual pattern. The result obtained is p-value = 0.0001 which means there is a relationship between menstrual pattern and anemia with OR of 27.250 (5.79 - 128.252) which means that adolescent girls with abnormal menstrual patterns, dominantly menorrhagia, have a 27.250 times higher risk of suffering from anemia compared to adolescent girls with normal menstrual patterns. This is by the results of research conducted by Pibriyanti et al. who researched menstrual patterns, that is cycles, frequency, and duration of menstruation with the incidence of anemia. The results obtained from the study stated that there is a relationship between cycles (OR = 5.45), frequency (OR = 2.16), and duration of menstruation (OR = 8.2).[16]

The hand-washing variable also has a statistical effect on the incidence of anemia with a p-value of 0.016. The OR of 12.571 (1.36 - 116.222) can be interpreted that adolescents who do not implement hand-washing behavior have a 12.571 times higher risk of developing anemia compared to adolescents who implement hand-washing behavior. Previous research conducted by Pertiwi et al. also stated the same thing that personal hygiene practices are related to anemia in adolescent girls. Adolescent girls with poor personal hygiene practices are more likely to experience anemia when compared to adolescent girls with good personal hygiene practices.[9]

The next variable that is statistically related to anemia in adolescent girls is food consumption patterns, with a p-value of 0.002 and OR of 0.244 (0.103 - 0.579) meaning that adolescents with food consumption patterns with balanced nutrition have a 0.244 lower risk of anemia compared to food consumption patterns with unbalanced nutrition. In this study, balanced nutrition is obtained when adolescent girls frequently consume food that is rich in iron, enhances iron absorption, and consumes less food that inhibits iron absorption. This is in line with research conducted by Putriwati et al.

Copyright (c) 2024 The authors

which stated that there is a relationship between food consumption patterns that are rich in iron, rich in protein, and vitamin C as enhancers or strengtheners of iron absorption and inhibitors or inhibitors of iron absorption with the incidence of anemia in adolescent girls.[17]

Iron supplement consumption is also a variable that influences anemia in adolescent girls with a P-value = 0.002 and an OR of 23.130 (3.061 - 174.766) which indicates that adolescent girls who consume iron supplements less than 4 times a month have a 23.130 higher risk of experiencing anemia when compared to adolescent girls who consume iron supplement more than or equal to 4 times a month or in other words routinely consume iron supplement every week. This statement follows research conducted by Joshi and Gumashta which revealed that weekly iron and folic acid supplementation such as in the iron supplementation program for adolescent girls in Indonesia is an effective nutritional intervention and is said to be as effective as daily supplementation with better compliance and fewer side effects. Improvement in anemia status in adolescent girls studied reached 25% in daily supplementation while for weekly supplementation it reached 31.67%.[18]

From the results of multivariate analysis, it can be seen that the variables that are statistically related to the incidence of anemia in adolescent girls include nutritional status, menstrual patterns, food consumption patterns, and Iron supplements consumption (p-value <0.05). While the variables of HAND-WASHING behavior, maternal education, and parental income are confounder variables. The menstrual pattern variable is the most dominant variable related to anemia in adolescent girls with OR 22,068 (3.236 - 150.506). Adolescents with abnormal menstrual patterns are at 22.068 higher risk of experiencing anemia compared to adolescents with normal menstrual patterns after controlling for the variables of nutritional status, hand-washing behavior, food consumption patterns, maternal education, and parental income.

Anemia is a result of physiological mechanisms in which the body experiences blood loss or a lack of red blood cell production. Abnormalities in gynecological and obstetric conditions in adolescent girls can directly cause anemia.[1] Several studies have also revealed a close relationship between abnormal menstrual patterns and the incidence of anemia. Excessive bleeding during menstruation increases the risk of anemia by 2.25 times according to Fentie et al.[19] The duration of menstruation according to Ramzi et al. in their study has a 1.78-fold effect on increasing the risk of anemia.[20] Menstrual cycles that are too short also have a 5.45-fold risk of increasing the incidence of anemia according to Pibriyanti et al.[16]

This study was conducted with the assistance of several health workers from the Muaragembong Health Center so that it could be carried out simultaneously with health screening activities for students in Muaragembong Health Center work area.

The limitations of this study include potential bias in sample selection, this is because the use of an attendance list to select a sample can introduce bias if absent students have different characteristics from those who present at the time of examination. Recall bias can also occur in this study, that is because there are variables that self-reported such as hand-washing behavior and iron supplement consumption. This study also doesn't account for other risk factors such as physical activity, stress levels of adolescent girls, etc. due to limited resources and research time.

Conclusion

Based on the results of this study, it can be concluded that factors related to anemia in adolescent girls in Muaragembong District are thin nutritional status, abnormal menstrual patterns, non hand-washing behavior, unbalanced food consumption patterns, and low compliance with Iron supplement consumption. The most dominant variable was the abnormal menstrual pattern with OR of 22.07 and 95% CI of 3.236 - 150.506. Adolescents who have abnormal menstrual patterns have a 22.07 higher risk of experiencing anemia compared to adolescents who have normal menstrual patterns. Even so, efforts to overcome anemia must be viewed

Copyright (c) 2024 The authors

holistically because this anemia is caused by a complex etiology with various risk factors. Improving health education such as reproductive health, personal hygiene, and nutrition for both adolescent girls and their parents/guardians, along with iron supplement supplementation will be the key success of the anemia reduction program.

Ethics approval

Ethical review of this study was obtained from the Research Ethics Committee and Public Health Service, Faculty of Public Health, University of Indonesia with the number: Ket- 437 / UN2.F10.D11 / PPM.00.02 / 2024.

Acknowledgment

The researchers would like to express their gratitude to the staff and health workers from the Muaragembong Health Center and the Bekasi District Health Office who have granted research permits and helped conduct examinations of adolescent girls in this study.

Funding

This research was self-funded by the researcher.

References

1. WHO. Accelerating Anemia Reduction A Comprehensive Framework for Action. WHO. Geneva; 2023.
2. S. S. Gropper JLS and TPC. Advanced Nutrition and Human Metabolism 8th Edition. Boston:Cengage Learning,; 2011.
3. Kemenkes RI. Panduan Pemberian Tablet Tambah Darah (IRON SUPPLEMENT) Bagi Remaja Putri. Kementerian Kesehatan. Jakarta; 2020.
4. Kementerian Kesehatan. Peraturan Menteri Kesehatan No. 41 tahun 2014 tentang Pedoman Gizi Seimbang. Kementerian Kesehatan. Jakarta; 2014.
5. Enggardany R, Hendrati LY, Hairi NN. Relationship between Body Mass Index (BMI) and Anemia Among Adolescent Indonesian Girls (Analysis of The Indonesia Family Life Survey 5th Data). Amerta Nutr. 2021;5(4):347.
6. Indriyani S, Kusharisupeni K AA. Determinan Anemia pada Remaja Putri. J Ilmu Kesehat Masy. 2024;13(02):149–157.
7. Ekasanti I, Adi AC, Yono M, Nirmala G F IM. Determinants of Anemia among Early Adolescent Girls in Kendari City. Amerta Nutr. 2020;4(4):271.
8. Amalia S, Marliyati SA, Dewi M UD. Hubungan Perilaku Hidup Bersih dan Sehat dengan Kadar Hemoglobin dan Feritin Serum pada Remaja Putri: The Association of Clean and Healthy Living Behavior along with Hemoglobin and Serum Ferritin Levels among Adolescent Girls. Amerta Nutr. 2023;7(1):54–62.
9. Pertiwi D, Apriningsih, Wahyuningtyas W AMF. Hubungan Karakteristik Sosiodemografi, Pengetahuan, dan Praktik Personal Hygiene dengan Kejadian Anemia pada Remaja Putri di Desa Sirnagalih. J Kesehat Komunitas. 8AD;8(2):161–170.
10. Pagiu HW, Lucia Yogyana Suramas SS. Hubungan Pengetahuan Dan Dukungan Guru Dengan Kepatuhan Mengonsumsi Tablet Tambah Darah (IRON SUPPLEMENT) Pada Remaja Putri Di SMAN 4 Tana Toraja. OBAT J Ris Ilmu Farm dan Kesehat. 2024;2(1):223–236.
11. Wiafe MA, Ayenu J ECD. A Review of the Risk Factors for Iron Deficiency Anaemia among Adolescents in Developing Countries. Anemia. 2023;1–11.
12. Kementerian Kesehatan. Laporan Riskesdas 2018 Nasional. Kementerian Kesehatan. Jakarta; 2018.
13. R. Lestari. , “Kadinkes: IRON SUPPLEMENT Penting Untuk Cegah Stunting.” 2022.
14. Puskesmas Muaragembong. Profil Puskesmas Muaragembong Tahun 2023. Bekasi; 2023.
15. Lemeshow, David W. Hosmer, Janelle Klar SKL. Adequacy of sample size in health studies. 1993;239.

Copyright (c) 2024 The authors

16. Pibriyanti K, Nufus NT LL. The Relationship Of The Menstrual Cycle, Menstrual Length, Frequency Of Menstruation, And Physical Activities With The Incident Of Anemia In Adolescents Girls At Islamic Boarding School. J Nutr Coll. 2021;10(2):112–9.
17. Putriwati AK, Purwaningtyas DR II. Hubungan asupan gizi dan konsumsi pangan inhibitor zat besi dengan kejadian anemia pada remaja putri di SMAN 6 Tambun Selatan. Ilmu Gizi Indones. 2024;7(2):137.
18. Joshi M GR. Weekly Iron Folate Supplementation in Adolescent Girls – An Effective Nutritional Measure for the Management of Iron Deficiency Anaemia. Glob J Heal Sci. 2013;5(3):188.
19. Fentie K, Wakayo T GG. Prevalence of Anemia and Associated Factors among Secondary School Adolescent Girls in Jimma Town, Oromia Regional State, Southwest Ethiopia. Anemia. 2020;1–11.
20. Ramzi M, Haghpanah S, Malekmakan L, Cohan N, Baseri A, Alamdari A et al. Anemia and Iron Deficiency in Adolescent School Girls in Kavar Urban Area, Southern Iran. 2011;13.

Copyright (c) 2024 The authors