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Original Article

Uncovering Determinant of Anaemia Among Adolescent Girls

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ABSTRACT

Anaemia is a significant global public health issue that primarily affects adolescent girls. Smoking, malaria, and low family income are associated with teenage Anaemia in girls. The purpose of the study was to uncover determinant Anaemia among adolescent girls. This type of research is cross-sectional. The research location was at the high schools in Central Sulawesi from March to September 2023. The study sample was teenage girls, with as many as 384 respondents. Simple random sampling was the method used for the sample. The study's independent variables included the respondents' anthropometrics, sociodemographics, and infectious illnesses. The dependent variable was haemoglobin levels. The research instrument used a Kobotoolbox application questionnaire. They measure weight with digital scales, height with Length board measuring, and arm circumference with mid-upper arm circumstances. Laboratory analysts carried out measurements of haemoglobin levels. Chi-square test analysis of research data with a 95% confidence level. Test of logistic regression in multivariate analysis. The findings indicated that 20.3% of teenage girls suffered from Anaemia. Adolescent girls who smoke (OR=3.2, 95% CI (1.10, 8.70)), have malaria (OR=1.9, 95% CI (0.80, 5.00)), and come from an income family with less than Rp. 2.599.546 (OR=1.7, 95% CI (1.00, 2.90)) are at risk for Anaemia. Adolescent girls' anaemia prevalence was a moderate public health concern. Teenage girls who smoke, have malaria and have a family low income below are determinants for Anaemia.

Keywords: *Determinant, Anaemia, Adolescent Girls, Sigi*

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INTRODUCTION

Anemia in adolescent girls is still a public health problem worldwide, particularly in developing countries [1–3]. The prevalence of Anaemia among teenage girls varies depending on the region, but it is generally high. For example, in Indonesia, the prevalence of Anaemia in adolescent girls was found to be 32% [4,5]. A study of high school girls in South Kalimantan, Indonesia, found 29.3% had Anaemia [6]. In a survey conducted in West Java, Indonesia, 41% of the adolescent girls were anaemic[7]. In a rural area in Indonesia, the prevalence of Anaemia in children and adolescents was reported to be 53.9%, with a higher prevalence of IDA in younger children [8]. Similarly, in a rural area of Tamil Nadu, India, the prevalence of Anaemia among adolescent girls was found to be 48.63% [9]. In conclusion, Anaemia in teenage girls remains a significant public health issue worldwide, particularly in developing countries.

The consequences of Anaemia in

adolescent girls can significantly impact their health and development. Anaemia can lead to heart and lung problems, pregnancy complications, growth and development issues, and difficulty performing daily activities [5,10]. If left unaddressed, Anemia can hinder adolescents' development and ability to become productive, creative, and competitive in the future [5,10]. Several studies have found that Anemia has a significant impact on adolescent girls. Anaemia during adolescence hurts growth, cognitive, and performance abilities, severely impacting overall health [6]. Acute and chronic inflammation, parasitic infection, iron deficiency, folate deficiency, vitamin B12 deficiency, vitamin A deficiency, and inherited or acquired disorders that impact haemoglobin synthesis, red blood cell production, or red blood cell survival are among the causes of Anemia in adolescent girls[11]. Poor academic performance, increased morbidity, absenteeism, and cognitive impairment are just a few of the adverse effects that Anemia can have [11]. Furthermore, a lack of red blood cells, or haemoglobin, is linked to Anemia in teenage females, which may hinder their physical and psychological development as they approach maturity[4]. To address this serious public health concern and lessen its adverse effects on adolescent girls' health and well-being, efforts must be made to prevent and cure Anemia in them.

Numerous reasons, such as poor diet, iron deficiency, excessive blood loss, parasite infections, both acute and chronic illnesses, and the existence of additional micronutrient deficiencies, can lead to Anaemia in adolescent girls[12]. The most prevalent cause of Anemia is iron deficiency, which is brought on by inadequate food intake. Anaemia can also result from dietary deficiencies in essential vitamins, such as C, folic acid, and B_{12} [13]. Due to a period of physical growth, reproductive maturation, and cognitive changes, adolescent girls are more susceptible to Anemia. Socioeconomic issues, inadequate nutrition from insufficient food intake, improper hand cleanliness, irregular eating patterns, and worm infestation can also be caused by teenage girls' Anemia[13]. Also, studies have found that Anemia among adolescent girls is associated with low protein and iron intake [4]. Overall, Anemia in teenage girls is a complex issue that requires a multifaceted approach to address its various causes.

The Government of the Republic of Indonesia has tried to prevent and treat Anemia in adolescent girls through various strategies and collaborations. Some of these efforts include balanced nutrition education, food fortification, school-based health checks, weekly Iron and Folic Acid Supplementation (WIFAS) program, multisectoral collaboration, and community awareness and socialization [5,14–16]. The frequency of Anemia in Indonesian teenage females persists despite these attempts. Thus, we must maintain and expand these activities to treat and further lessen the burden of Anemia in this age group. Another measure taken by the government to stop teenage girls from becoming anaemic is the distribution of pills with blood added. Around 2018, the Ministry of Health of the Republic of Indonesia simultaneously pushed for giving adolescent girls pills with blood added. According to a study conducted at one of the East Kalimantan Public Health clinics in Indonesia, 97.1% of recipients received tablets that add blood over a year. However, Anemia affects three out of ten teenage girls. [17]. Similarly, 3 out of 11 adolescent females at one of the Sigi Regency Community Health Centers showed Anemia when anaemia screening was performed [18].

Different countries and areas have various risk factors for Anemia in adolescent girls. Food intake habits, low socioeconomic level, malaria, aging, menstruation, smoking, and low educational attainment have all been found to be significant risk factors for iron deficiency anaemia (IDA) in female adolescents in developing nations [19–21]. Low iron intake was identified as a potential risk factor for IDA in an Indonesian investigation that revealed the frequency of nonanemic iron insufficiency to be higher than that of IDA [22]. Furthermore, a Korean study revealed that a family history of the disease was an independent risk factor for IDA in teenagers[23]. It has also been shown that low iron intake and absorption, blood loss during menstruation, and higher iron requirements are all associated with a higher risk of Anemia in female teenagers[24]. These findings underscore the importance of considering regional and country-specific factors when addressing

Anemia in adolescent girls.

Research on risk factors for Anemia in Sigi Regency, Central Sulawesi, has never been conducted. This research is helpful for local governments, especially the health and education offices of Sigi Regency, Central Sulawesi, to determine the right strategy for preventing and managing Anaemia. The purpose of the study was to uncover determinants of Anemia: A Study on Adolescent Girls in Sigi District, Central Sulawesi, Indonesia.

METHOD

This research uses a cross-sectional design and observational analytics to examine the anaemia risk factors in teenage girls in Sigi Regency, Central Sulawesi, Indonesia. From March to September 2023, a Senior High School (SMA) in the Sigi Regency, Central Sulawesi, served as the study's site. The teenage girls at Sigi Regency's challenging high schools in Central Sulawesi made up the study population. The study sample consisted of 384 individuals. Simple random sampling is the method used for sampling.

The independent variables were the occupation of mother with measuring results work and not work, family income by calculating results <Rp.2.599.546 dan ≥Rp.2.599.546, class rank with measuring results 1-5, 6-10 and >10, upper arm circumference with the measuring results of less caloric energy and no less caloric energy, length of menstruation by measuring results <7 days and ≥7 days, iron supplementation with measuring results given and not given, anemia education with measuring results provided and not given, infectious diseases with the results of measuring the sick and not sick of sickness, smoking with measuring results smoking and non-smoking, malaria with malaria and no malaria measurement results, exercise habits with measuring results of do or not do, knowledge of nutrition with measuring results are good, enough and less, frequency of eating fish with measuring results are rare and frequent, eggs with measuring results are occasional and regular, meat and drinking milk every day with measuring results are rare and frequent. The dependent variable is haemoglobin levels, with the measuring results being Anemia and not Anemia.

The research instrument uses questionnaires containing the characteristics of respondents., knowledge about balanced nutrition, frequency of use of foodstuffs, anthropometric data, exercise habits, history of infectious diseases, and haemoglobin measurement data. The research data was collected using questionnaires tested on different respondents. Questionnaires have also been tested for validity and reliability. The data collection questionnaire has been tested in one of the other high schools. The data collection questionnaire is carried out by enumerators trained before conducting research data collection activities. Measure weight with digital weight scales, height with Length board measuring, and upper arm circumference using mid-upper arm circumstance (MUAC). Health analysts from the Central Sulawesi Provincial Health Laboratory measured haemoglobin levels. Respondents ' blood samples were taken as much as 1 millilitre. Haemoglobin levels are calculated using the Haemoglobin Hematology Analyzer method. This research has obtained recommendations from the Central Sulawesi Provincial Education Office with letter number 873/1512.SEK/DISDIK and permission from Central Sulawesi province's National and Regional Political Unity Agency with letter number 070/6711/Bid.III-BKBPD/2023. Before collecting research data, respondents were first explained and asked for approval. The Ministry of Health in Palu, Central Sulawesi, and Indonesia's Poltekkes Research Ethics Commission have approved this study. M2A23/0063/IGPK-KPK. At the 95% (α5%) confidence level in the survey, bivariate analysis was performed using the chi-square test, and multivariate analysis was performed using logistic regression analysis.

RESULTS

From June to August of 2023, a high school in Sigi, Central Sulawesi, served as the data collection site for this research. The research sample that was obtained consisted of 384 respondents. The results of the study can be seen in Table 1 below:

Table 1. Sociodemographic characteristics of respondents.

Variable	Sum	%
Age		
Early Adolescence	20	5.2
Mid-teens	336	87.5
Late Adolescence	28	7.3
Mother's Occupation		
Work	104	27.1
Does not work	280	72.9
Family Income		
<Rp. 2.599.546	196	51.0
≥Rp. 2.599.546	188	49.0
Upper Arm Circumference		
Less calorie energy	115	29.9
No Less Energy Calories	269	70.1
Length of Menstruation		
<7 days	207	53.9
≥7 days	177	46.1
Ranking in Class		
Ranks 1-5	152	39.6
Ranks 6-10	130	33.9
Ranks >10	102	26.6
Nutritional Status (IMT/U)		
Underweight	144	37.5
Normal	187	48.7
Overweight+Obecity	53	13.8
Iron Supplementation		
No	328	85.4
Yes	56	14.6
Get Anemia Education		
No	277	72.1
Yes	107	27.9
Kidney Disease		
Yes	3	0.8
No	381	99.2
Tuberculosis		
Yes	1	0.3
No	383	99.7
Malaria		
Yes	22	5.7
No	362	94.3
Smoking		
Yes	17	4.4
No	367	95.6
Exercise		
No	309	80.5
Yes	75	19.5
Knowledge		
Less	66	17.2
Enough	178	46.4
Good	140	36.5
Fish Feeding Frec/See Protein Source		
Infrequently	175	45.6
Often	209	54.4
Frec Eats Eggs		
Infrequently	261	68.0
Often	123	32.0
Frec Eating Meat		
Infrequently	288	75.0
Often	96	25.0
Frec Drink Milk		
Infrequently	243	63.3
Often	141	36.7
Anemia		
Yes	78	20.3
No.	306	79.7

Table 1 shows that most respondents in order are middle adolescence (87.5%), non-working mothers (72.9%), and family income < Rp. 2,599,546 (51%), No Fewer Energy Calories (70.1%), menstrual length <7 days (53.9%), rank 1-5 (39.6%), not taking iron supplementation (85.4%), not receiving anaemia education (72.1%), not suffering from kidney disease (99.2%), not suffering from Tuberculosis (99.7%), not suffering from malaria (94.3%), not smoking (95.6%), not exercising (80.5%), sufficient knowledge (46.4%), often eating fish (54.4%), rarely eating eggs (68%), eating meat (75%), and rarely drinking milk (63.3%). The prevalence of Anemia among respondents was 20.3%.

Table 2. Bivariate Analysis of Determinants of Adolescent Anemia in Sigi Regency, Central Sulawesi (n-384).

Research Variables and Anemia Status	Anemia		Not Anemic		Nilai p*
	n	%	N	%	
Age					
Early Adolescence	5	25.0	15	75.0	0.851
Mid-teens	67	19.9	269	80.1	
Late Adolescence	6	21.4	22	78.6	
Mother's Occupation					
Work	26	25.0	78	75.0	0.164
Does not work	52	18.6	228	81.4	

Family Income					
<Rp.2.599.546	48	24.5	148	75.5	0.038**
≥Rp.2.599.546	30	16.0	158	84.0	
Upper Arm Circumference					
Less calorie energy	19	16.5	96	83.5	0.227
No less energy calories	59	21.9	210	78.1	
Length of Menstruation					
>7 days	46	22.2	161	77.8	0.314
≥7 days	32	18.1	145	81.9	
Achievement					
Level 1-5	30	19.7	122	80.3	0.239
Level 6-10	32	24.6	98	75.4	
Level 10	16	15.7	86	84.3	
Nutritional Status (IMT/U)					
Underweight	34	23.6	110	76.4	0.087
Normal	39	20.9	148	79.1	
Overweight+Obecity	5	9.4	48	90.6	
Iron Supplementation					
No.	69	21.0	259	79.0	0.393
Yes	9	16.1	47	83.9	
Get Anemia Education					
No.	54	19.5	223	80.5	0.522
Yes	24	22.4	83	77.6	
Kidney Disease					
Yes	1	33.3	2	66.7	0.574
No.	77	20.2	304	79.8	
Tuberculosis					
Yes	1	100.0	0	0.0	0.047**
No.	77	20.1	306	79.9	
Malaria					
Yes	7	31.8	15	68.2	0.167
No.	71	19.6	291	80.4	
Smoking					
Yes	7	41.2	10	58.8	0.029**
No.	71	19.3	296	80.7	
Exercise					
No.	62	20.1	247	79.9	0.806
Yes	16	21.3	59	78.7	
Knowledge					
Less	12	18.2	54	81.8	0.757
Enough	39	21.9	139	78.1	
Good	27	19.3	113	80.7	
Fish Feeding Frec/See Protein Source					
Infrequently	36	20.6	139	79.4	0.908
Often	42	20.1	167	79.9	
Frec Eats Eggs					
Infrequently	56	21.5	205	78.5	0.417
Often	22	17.9	101	82.1	
Frec Eating Meat					

Infrequently	60	20.8	228	79.2	0.660
Often	18	18.8	78	81.3	
Frec Drink Milk					
Infrequently	45	18.5	198	81.5	0.251
Often	33	23.4	108	76.6	

**Chi-Square Test*
***Significant p<0.05 (95% CI)*

Table 2 shows that the p values of variables associated with Anemia were family income <Rp.2,599,546 (0.038), Tuberculosis (0.047), and smoking (0.029).

Table 3. Multivariate Analysis of Anemia Determinant (Logistic Regression Test).

Variable	OR	Nilai p	95% CI	
			Lower	Upper
Smoking				
Yes	3.2	0.025	1.1	8.7
No.	1.0			
Malaria				
Yes	1.9	0.157	0.8	5.0
No.	1.0			
Family Income				
<Rp. 2.599.546	1.7	0.039	1.0	2.9
≥Rp. 2.599.546	1.0			

Table 3 shows that adolescent girls who smoke have a 3.2 times determinant of Anemia, malaria 1.9 times, and family income <Rp. 2,599,546 1.7 times.

DISCUSSION

According to the findings, 20.3% of teenage girls in Sigi, Central Sulawesi, were anaemic. This number is lower than the 32% prevalence of Anemia among those in the 15–24 age group in 2018. The prevalence of Anaemia is still high but is falling compared to Southeast Asian nations like Malaysia and Thailand. According to a study on high school-aged girls, 8.3%, or 19 out of 227 respondents, had Anemia[25]. In Malaysia, teenage girls between the ages of 13 and 17 have an average 12.5% anaemia prevalence [26]. Therefore, efforts from various parties and multisector handling are still needed to reduce the prevalence of Anemia from year to year.

According to the findings, teenage girls who smoked had a 3.2 times higher chance of developing Anemia. This study is consistent with a survey by Vivek al. (2023) that indicates there is a high correlation between smoking and adolescent girls' iron deficiency anaemia[19]. Smoking hurts haematological parameters such as haemoglobin, average haemoglobin concentration, red blood cell count, and hematocrit [27]. The adverse effects of smoking on serum ferritin and other haematological markers are corroborated by additional research. One of the best markers of iron status is serum ferritin[28]. Smoking can decrease iron absorption and reduce the body's ability to absorb essential nutrients that maintain blood haemoglobin levels. Smokers have lower haemoglobin levels [29]. Therefore, it is essential to prevent adolescent girls from smoking because it has an impact on haematological parameters.

The results also showed that malaria was a risk factor for Anemia. Malaria is the leading cause of Anemia in tropical areas[30]. Anemia was linked to diseases like bacteremia, hookworm, and HIV, according to a recent study among children from Malawi. Children under the age of six are more likely to develop Anemia when they have clinical malaria. According to different research, Anemia and malaria are both

prevalent illnesses that mainly afflict children in Africa, and there is a direct link between the two[31]. Particularly in young infants, severe malaria can cause Anemia. The effect of the host's iron status on future malaria has been studied. Consequently, it is yet unknown if having better iron status raises the risk of malaria[32]. Because of the intricate relationship between iron and malaria parasites, which can worsen morbidity, there is a need to integrate iron supplementation with malaria control efforts. Because folic acid negates the medication's antimalarial effects, folic acid supplementation should also be restricted [33].

In addition to the two previous risk factors, family income <Rp.2,599,546 was also a risk factor for Anemia in adolescent girls. The minimum wage standard of Sigi Regency is Rp.2,599,546. Family income below this figure can cause Anemia in teenage girls. Low family income will affect the ability to prepare food for the household. Low-income families are more prone to experience food insecurity, which is the limited or erratic availability of healthful, safe foods. Poorer nutrition quality has consistently been linked to lower household income. People with lower incomes tend to eat a worse-quality diet, consuming more sugar-sweetened beverages and fewer fruits and vegetables than those with higher incomes. Lower-income households are less likely to purchase fit-recommended items like veggies and spend a significant portion of their shopping money on less healthful foods like frozen desserts[35]. Low-income people who experience housing instability may face difficulties getting, storing, and cooking wholesome meals for the family[36]. low-income households purchase fewer healthful foods than high-income households.

Healthy and nutritious food can prevent Anemia in adolescent girls. Girls throughout their adolescence are more at risk for malnutrition since they are developing more quickly than at any other point after birth. They require protein, iron, and other minerals to sustain the teenage growth spurt and meet the body's increased need for iron during menstruation. Around age one, infants can develop Anemia, and the most common cause of Anemia globally is iron deficiency, which causes growth spurts in children and adolescents[37,38]. Iron is needed to make haemoglobin, a protein that carries oxygen throughout the body. The bulk of the iron in the body is stored in haemoglobin. Iron deficiency: Anemia is caused by the body's inability to manufacture haemoglobin, which requires iron[37]. Teenagers who suffer from conditions like celiac disease, which impairs the body's ability to absorb iron from food, as well as those who drink tea, consume insufficient amounts of iron-rich foods, and consume more than 500 milliliters of cow's milk per day—especially when they are still toddlers—may develop iron deficiency anaemia[38]. Adolescent girls who have regular, lengthy, or weighty periods run the risk of developing iron deficiency anaemia since blood loss can also lead to an iron shortage [37,38]. To enhance iron absorption and avoid Anemia, adolescent girls should eat vitamin C-rich citrus fruits, drink at least eight glasses of water throughout the day, and have healthy snacks between meals [38].

Furthermore, an Indonesian study found that six food-based recommendations would guarantee dietary adequacy for nine out of twelve nutrients except for iron, folate, and calcium. Milk and liver were selected as two likely nutrient-dense foods to solve the nutrient gaps [37].

Teenage girls' health, general growth, and general well-being are among the many reasons preventing Anaemia in them is crucial. Anemia can impair an adolescent girl's health and well-being by causing weakness, exhaustion, and a lowered immune system[39,40]. Development can negatively impact cognitive development, school performance, and physical growth, especially during adolescence [41]. The consequences of longevity during adolescence can have long-term effects on girls' health and productivity as they transition into adulthood [42]. The socioeconomic impact is that Anemia can perpetuate the cycle of poverty by affecting adolescent girls' ability to participate fully in education and later in the workforce [43]. Various interventions have been studied and implemented to prevent Anemia in teenage girls, including dietary interventions, deworming, micronutrient fortification, and iron-folic acid supplementation[39,41,42]. Adolescent girls' general health has improved,

and the prevalence of Anemia has decreased because of these efforts. Thus, to successfully prevent and cure Anemia in these vulnerable populations, immediate action is required to adopt and scale up these interventions.

CONCLUSION

Adolescent girls' anemia prevalence was a moderate public health concern. Teenage females' Anemia was influenced by smoking, malaria, and a family income of less than 2,599,546. Various variables, including a deficiency in iron, folic acid, protein, and vitamin C, can cause Anemia in adolescent females. For this reason, prevention and management of Anemia require a multisector strategy.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

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