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Determinants of anemia among adolescents girls in district Banggai, Indonesia

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ABSTRACT

The problem of anemia among adolescent girl in Indonesia is still very high. Many factors cause anemia in adolescent girl. The aim of this study was to assess the prevalence of anemia and its determinants in Banggai district. The research design was cross-sectional, with a sample of adolescent girls aged 12–18 years (n=326). Hemoglobin concentration was measured using a Hemocue hemoglobinometer. The Chi-square test and linear regression analysis were used for data analysis. The results showed that the prevalence of anemia was 48.8%, of which 44.0% had mild anemia and 48.4% had moderate anemia. From the bivariate analysis, anemia was significantly related to adolescent age, father's education, and eating habits ($p<0.05$). Multivariate logistic regression shows that the factors that most influence the occurrence of anemia are age OR=1.7 (95% CI OR=0.20-0.05) and eating habits OR=2.2 (95% CI OR=0.29-0.81). It was concluded that the prevalence of anemia was high in adolescent girls. Intervention steps are needed to improve the anemia status of adolescent girls in Banggai district.

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1. INTRODUCTION

Anemia is a public health problem found throughout the world. There are around a quarter of the world's population in both developed and developing countries who experience anemia [1]. The group of adolescent girls has a higher risk of developing iron deficiency anemia because adolescent girls experience rapid growth, increased nutritional needs [2] and iron loss due to menstruation [3]. Several studies have found a high prevalence of anemia in adolescent girls, including research results in India 42.5% [4], in Europe 32% [3] and in South India 37.7% [5]. In Indonesia, the prevalence of anemia in women of childbearing age (15–24 years) increased from 21.6% in 2018 to 22.3% in 2019 [2]. This data shows that the incidence of anemia in adolescents is a public health problem in the moderate category (20-30%) [6].

The impact of anemia is quite significant on adolescent health. Lack of hemoglobin due to anemia limits oxygen transport in the blood, causing reduced physical and mental capacity and other health risks [5]. Anemia in adolescents is associated with physical disorders, growth and development, decreased immunity, concentration,

learning achievement, fitness and productivity [6]–[8]. Apart from that, anemia also has long-term implications for the future lives of anemic adolescent adults and the lives of anemic adolescent children who become pregnant and give birth. Babies born to anemic teenage girls are at risk of stunting and low birth weight [9].

The incidence of anemia in adolescent girls is influenced by many factors. However, the main factor causing anemia is insufficient iron intake. About two-thirds of the iron in the body is found in red blood cells, hemoglobin [10]. Other influencing factors include lifestyle, breakfast habits, socio-economic and demographics, education, age and region. The factors causing the incidence of anemia in each region vary depending on the geographic and demographic conditions of a region. Several studies have found that the determining factors for anemia include adolescent age, menstrual patterns, diet [11], worm infections and malaria [12]. Apart from that, the causes of anemia, especially in developing countries, are regional factors of residence (rural or urban) [13], diet and family size [14], [15] as well as socio-economic status and educational status of the family [16].

WHO has recommended various programs to reduce the prevalence of anemia, such as iron supplementation, food fortification, health education, and control of parasitic infections [17], [18]. In Indonesia, special interventions have been carried out by providing blood supplement tablets to young women and pregnant women, improving education and balanced nutrition, and adding iron to food [15]. Efforts made to reduce the problem of anemia in Indonesia have not been optimal due to data discrepancies in program implementation.

Considering that the impact that occurs as a result of anemia is very detrimental for the future, preventive and corrective efforts need to be carried out. To carry out optimal prevention and improvement efforts, complete and precise information is needed about the status of anemia in adolescents, as well as the factors that influence it. In Indonesia, data regarding anemia in adolescent girls and the factors causing it are still very limited. Apart from that, it is very important to position adolescent nutritional status as the center of development and mainstream it into health sector plans, strategies and policies. This is what prompted researchers to conduct this research to provide data on anemia in adolescent girls so that it can be the basis for intervention against the problem of anemia in adolescent girls in Banggai Regency. This study aimed to determine the prevalence of anemia and look further at the determinants of anemia in adolescent girls in Banggai Regency, Central Sulawesi, Indonesia

2. METHOD

This research is cross-sectional in nature and was conducted from November to December 2022 in South Batui District and Moilong District, Banggai Regency. The locations of the two sub-districts are next to each other, where South Batui District is located 74 km away and Moilong District is located 89 km away from the center of Luwuk Banggai City. This area is rural, with the majority of the population being farmers. For the Central Sulawesi region, especially Banggai district, there is no data regarding the incidence of anemia in adolescent girls. This research involved 326 teenage girls aged 12–18 from 13 existing Junior High School and Senior High schools.

This study collected sociodemographic data, eating habits, nutritional status, and anemia status. Sociodemographics include the characteristics of the sample and the sample's parents, as well as eating habits collected using a questionnaire. Anthropometrics are measured to determine body weight, height, and nutritional status (BW/U). Body weight was measured with an OMRON digital scale with an accuracy of 0.1 kg. Body height was measured with a Secca Stadiometer with an accuracy of 0.1 cm. The determination of student hemoglobin is carried out by health workers at the school health center by taking blood samples through a finger prick using HemoCue (HemoCue Hb 301+) [19]. Based on the WHO classification, hemoglobin levels of 12 g/dL and above are classified as non-anemic or normal, 11–11.9 g/dL as mild anemia, 8–10.99 g/dL as moderate anemia, and >8 g/dL are classified as severe anemia [20].

Descriptive statistics were used to describe the participants' characteristics. Bivariate logistic regression analyses were then performed to look for correlations between each independent variable and the outcome variable (anemia). All variables with a p-value <0.5 in the bivariate analysis were entered into a multivariable logistic regression analysis. This study received ethical approval from the Ethics Commission of the Faculty of Public Health, Hasanuddin University, with Protocol Number: 1816/UN4.14.1/TP.01.02/2023.

3. RESULTS AND DISCUSSION

3.1. Result

3.1.1. Characteristics of respondents

Table 1 presents the socio-economic characteristics of the respondents. Most of the adolescent girls (71.5%) were 12–15 years old. The majority of fathers and mothers have primary education (35.6% and 44.2%), and more than half of the fathers are farmers (69.6%), and 64.7% of mothers do not work. The prevalence of undernutrition is 6.1%, overnutrition is 13.5%, and the remainder is normal nutrition (80.4%). Most young women have a height of >150 cm (57.4%) and have the habit of eating three times a day (68.4%). The mean hemoglobin

concentration was 11.2±1.23 g/dl. The prevalence of anemia was found to be 159 (48.4%). Of the anemic adolescent girls, 12 (7.5%) had severe anemia, 77 (48.4%) had moderate anemia, and 70 (44.1%) had mild anemia.

Table 1. Characteristics of adolescent girl

Characteristic		N	%
Age	12-15 y	233	71.5
	16-18 y	93	28.5
Height	140-150 cm	139	42,6
	>150 cm	187	57.4
Eating habit	Two times	103	31.6
	Three times	223	68.4
Nutritional status (BAZ)	Underweight	20	6.1
	Normal weight	262	80.4
	Overweight	44	13.5
Father's education	None	36	11.0
	Primary school	190	58.0
	Secondary school	92	28.5
	University	8	2.4
Mother's education	None	27	8.3
	Primary school	224	68.7
	Secondary school	68	20.9
	University	5	1.5
Father's occupation	Farmer	227	69.6
	Fisherman	16	4.9
	Self employed	38	11.7
	Employee	17	5.2
	Other	26	8.5
Mother's occupation	Farmer	79	24.2
	Fisherman	1	0.3
	Self employed	17	5.2
	Employee	8	1.5
	Not working	211	64.7
	Other	10	3.0
Anemia status	No anemia	167	51.2
	Anemia	159	48.8
Anemia classification	Mild anemia	70	44.1
	Moderate anemia	77	48.4
	Severa anemia	12	7.5

3.1.2. Bivariate analysis

Table 2 shows that there is a significant relationship between adolescent age (p=0.001 OR=2.5), father's education (p=0.03 OR=0.6), and eating habits (p=0.00 and OR=0.5) and the incidence of anemia in adolescent girls. From the results of the analysis of adolescent age, the value of OR=2.5 means that adolescent girls aged over 15 years have a 2.5 times higher risk of developing anemia compared to adolescent girls under 15 years of age. Furthermore, there was no significant relationship between maternal education, maternal employment status, nutritional status, and height and the incidence of anemia (p>0.05).

Table 2. Analysis bivariate of factors associated with anemia incidence

Characteristic		Anemic (%) = 159	Non anemic (%) = 167	OR	p-value
Age	12-15 y	99 (42.5)	134 (57.5)	2.5	0.001*
	15-18 y	60 (64.5)	33 (35.5)		
Father's education	Primary	120 (53.1)	106 (46.9)	0.6	0.03*
	Secondary	39 (39.0)	61 (61.0)		
Mother's education	Primary	130 (51.4)	123 (48.6)	0.6	0.10
	Secondary	29 (39.7)	44 (60.3)		
Mother's occupation	Employed	52(49.5)	53 (50.5)	1.1	0.85
	Not employed	107 (48.4)	114 (51.6)		
Eating habit	Two times	95 (59.0)	66 (41.0)	0.5	0.000*
	Three times	64 (38.8)	101 (61.2)		
Nutritional status (BAZ)	Underweight	14 (70.0)	6 (30.0)	0.4	0.09
	Normal weight	148 (48.5)	161(51.5)		
Height	140-150 cm	71 (51.5)	68 (48.5)	0.54	0.8
	>150 cm	88 (47.1)	99 (52.9)		

3.1.3. Multivariate analysis

There are four variables with a p value of less than 0.25 included in the logistic regression model: age, father's education, mother's education, and eating habits. Table 3 shows that the factors most associated with the incidence of anemia in adolescent girls are age OR=0.17 (95% CI OR=0.20–0.05) and eating habits OR=0.22 (95% CI OR=0.29–0.81). Father's and mother's education factors showed an insignificant relationship with the incidence of anemia, p-value >0.05. However, father's and mother's education factors show an almost significant relationship with the incidence of anemia in adolescent girls with a p-value of 0.05–0.1 (borderline) Table 3. So, in the multivariate analysis the father's and mother's education factors were still included in the logistic regression analysis variables.

Table 3. Logistic regression analysis of factors affecting anemia among adolescent girl

Variable	p-value	OR	Cl (95%)
Step 1			
Age	0.002	0.17	0.201-0.048
Father's education	0.060	0.11	0.002-0.083
Mother's education	0.078	0.10	0.005-0.092
Eating habit	0.000	0.22	0.287-0.809
Step 2			
Age	0.002	0.17	
Mother education	0.078	0.10	
Eating habit	0.000	0.22	0.201-0.048
Step 3/final			
Age	0.002		0.002
Eating habit	0.000	0.17	0.000

3.2. Discussion

Our study found that the prevalence of anemia in adolescent girls was 159 (48.8%), of which 44.0% were mild cases, 48.4% were moderate cases and 7.5% were several cases. Based on bivariate analysis, we found significant differences between anemia and age, parental education level, and eating habits with a p value of 0.05. The results of the logistic regression analysis that we carried out found that the factors that most influence anemia in adolescent girl are age and eating habits.

According to the WHO, the incidence of anemia in our study is a serious public health problem [8], [21]. The results of this research are in line with a study conducted by Khan [22] that found a 42.5% prevalence of anemia among teenagers in Pakistan. In another study conducted in Morang district, Nepal, the prevalence of anemia among adolescent boys and girls was 47.7% and 52.3%, respectively [17]. This prevalence is higher than the findings of research conducted on school adolescents in the city of Bonga, Southwest Ethiopia, which found a 15.2% prevalence of anemia [13]. This may be due to geographical differences and our research subjects coming from rural areas. According to national data, the prevalence of anemia in rural areas (22.8%) (in Indonesia is greater than in urban areas (20.6%) [2].

This finding is in line with research conducted in Orissa [23] and Campbell in Bhutan [24] and research in Southeast Ethiopia, which found 40.14% of adolescent girls had mild anemia and 54.92% had moderate anemia [25]. However, our study is different from research conducted in Southwest Ethiopia, where the proportion of mild anemia was quite high (83.9%), followed by moderate anemia (12.9%), and severe anemia (3.2%) [13]. The reason for this variation may be due to increasing malnutrition and differences in the nutritional status of research participants, where in our study the majority of respondents had normal nutritional status.

This study found a significant relationship (p-value 0.001) between adolescent age and anemia status. Adolescent girls aged 15–18 years are twice as likely to experience anemia compared to early adolescents aged under 15 years. These findings are in line with research in India, where the prevalence of anemia was higher (78.3%) in the late adolescent age group (17–19 years) compared to the middle adolescent (14–16 years) and early adolescents (10–13 years) age groups and was found to be statistically significant [24]. Another study, also in India, found that the prevalence of anemia was higher in postmenstrual girls (71%) compared to premenstrual girls (29%) [14]. Research in Ethiopia found that late adolescents were significantly more affected by anemia, two times more than early adolescents (10–14 years) (OR: 1.95, 95% CI: 1.09, 3.47) [23].

This is likely because older girls are at greater risk due to accelerated growth and menstruation. It is likely that rapid growth in stature, muscle mass, and fat mass during adolescence results in greater daily requirements for iron and other micronutrients [26], [27]. Excessive blood loss due to heavy or long-lasting menstruation generally causes iron deficiency and iron deficiency anemia in women of childbearing age. Adolescent girls often experience irregular and heavy menstruation, especially in the 2–5 years immediately after menarche [26]. Macronutrient and micronutrient requirements during adolescence increase gradually and correlate more closely with growth patterns and growth rates than with chronological age [28].

In this study, the father's educational status was significantly (p-value 0.03) related to the prevalence of anemia in adolescent girls. Adolescent girls who had fathers with primary education had a greater chance of experiencing anemia compared to adolescent girls whose fathers had high school education. This finding is in accordance with research in Ethiopia, which found father's education to have a significant relationship with anemia; it is also in accordance with research in Nagpur, India [12], and research by Gedefaw in Southwest Ethiopia [13].

This may be because a father with a higher education is able to make mature decisions regarding his own family and also his children, compared to a father with a basic education and illiteracy. Educated fathers are also more likely to make decisions that will improve their children's nutrition and health. An educated father is likely to send all his children to school, thereby breaking the chain of ignorance and independently contributing to long-term child nutrition [17]. Household food consumption decisions that affect the overall nutritional status of household members are often made by men, in this case, fathers [29]. In Indonesia, especially in the Sulawesi region, most family decisions are made by fathers, and when they are educated, they may have the power to take decisions in matters relating to adolescent health and expected costs, which has an impact on the prevalence of anemia.

In our research, we also found that daily eating habits, namely the frequency of eating, were significantly related to anemia (p-value 0.03), meaning that young women who eat twice a day are more at risk of experiencing anemia than young women who eat three times a day. The results of this study are also in accordance with research conducted on adolescents in Ethiopia, where the prevalence of anemia was related to the frequency of daily meals and the source of family food needs. Adolescents who eat two times or less per day are almost five times more likely to experience anemia compared to those who eat three or more times a day [11]. Another study conducted on adolescent boys in the urban slum area of Multan Nagar, India, also found that the frequency of eating twice a day had a major influence on anemia [30], [31].

This happens because adolescent girl who eat only twice a day or less have less energy and are less likely to consume foods that contain iron. This situation may also be caused by the adolescent girl in our study having poor eating habits and often practicing dieting in inappropriate ways, such as practicing taboos, limiting food portions, or reducing the frequency of eating to prevent obesity. Some teenagers, especially adolescent girl, often consume food in quantities that are not balanced compared to their needs because they are afraid of being overweight. They refer to eating not only in the context of consuming staple foods, but snacks are also categorized as eating.

4. CONCLUSION

The prevalence of anemia in this study is a serious public health problem. Where it was found that 159 (48.8%) adolescent girl were suffering from anemia. The severity of anemia in adolescent girls was found to increase in the late adolescent age group, in adolescents with the characteristics of parents with low education, and in the daily eating habits of adolescents with a frequency of eating only twice a day. The findings from this study call for future effective interventions on dietary changes among Indonesian adolescents. These findings emphasize the need for public health policies to integrate treatment and health promotion strategies that contribute to increased understanding of anemia and linear growth among adolescent girls.

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