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DETERMINANTS OF ANEMIA AMONG ADOLESCENT GIRLS: IMPLICATIONS FOR STUNTING PREVENTION

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ABSTRACT

Anemia in adolescent girls is a global public health issue that affects nutritional status and future reproductive outcomes. Adolescents with anemia are at higher risk of delivering stunted offspring, making anemia prevention essential in breaking the intergenerational cycle of malnutrition. This study aimed to analyze factors associated with anemia among adolescent girls as an effort to prevent stunting. This cross-sectional study was conducted at SMPTQ Pangeran Diponegoro, Semarang, from August to December 2023. A total of 92 female students aged 10–15 years who met the inclusion criteria were selected using total sampling. Data were collected using questionnaires and physical measurements, including hemoglobin levels, BMI, MUAC, and dietary intake. Data were analyzed using chi-square tests ($\alpha = 0.05$). The prevalence of anemia was 25%. Menstrual duration was significantly related to anemia ($p = 0.041$; RR = 2.188). Other factors (BMI, MUAC, breakfast habits) were not significant. Menstrual duration was significantly associated with anemia among adolescent girls. School-based anemia screening and nutrition education are recommended to prevent anemia and future stunting.

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Keywords: Anemia, Adolescent Girls, Menstruation Duration, Stunting Prevention, Iron Deficiency.

Introduction

Adolescents (aged 10–19 years) constitute over 16% of the global population and play a central role in achieving the 2030 Sustainable Development Goals (SDGs)[1]. Accurate data on adolescent health are essential for setting public health priorities, tracking health trends, and addressing existing inequalities, which impact not only current adolescents but also their future roles as parents. Healthy adolescents experience normal growth and development. Although the rapid growth seen in early childhood decelerates and forms an almost flat curve during the school and early adolescent years, maintaining optimal health during this critical transitional phase is vital for overall development[2].

The rising incidence of stunting among young adolescent girls in Indonesia represents a critical, priority health issue. Anemia is significantly predicted to be a major contributor to stunting in this young female cohort (p-value=0.000)[3]. Adolescent girls are highly

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vulnerable to anemia, primarily due to blood loss during menstruation, which subsequently increases their risk of becoming anemic during future pregnancies. Maternal anemia has severe negative consequences, including impaired fetal growth and development, potential pregnancy and delivery complications, and tragically, increased risks of maternal and child mortality[4].

Stunting prevalence data among children aged 5–18 years reveal a significant gender disparity: boys show a stunting prevalence of 40.2%, considerably higher than that of girls, which stands at 30.7%. Nonetheless, for young adolescent girls, the pressing issue remains anemia, with a high prevalence rate of 26.4% in this specific cohort[5].

Stunting in adolescents is a long-term consequence of consuming poor-quality diets, often combined with high rates of morbidity, infectious diseases, and environmental challenges. The consequences of stunting are severe, including impaired cognitive function, which leads to lower IQ and economic disadvantages. Furthermore, the long-term effects of stunting result in short stature, reduced work capacity, and an increased risk of poor reproductive performance[6]. Recognizing the high risks of both stunting and anemia among females, this study aims to analyze the factors contributing to anemia in adolescents as a crucial effort toward stunting prevention.

Methods

This research utilized a quantitative, cross-sectional design and was conducted over five months, from August to December 2023 at SMPTQ Pangeran Diponegoro in Tembalang area of Semarang City. The target population was all adolescent girls at the school (N=108). We employed a total sampling, enrolling all students who met the inclusion criteria. After screening, the final sample size was 92 respondents.

We gathered primary data through a mix of methods, including questionnaires, anthropometric measurements for BMI and MUAC, and clinical measurement of anemia status (Hb level) using the Easy Touch GCHb Meter Device. An adolescent girl was classified as anemic if her Hb level was < 12 g/dL.

Data underwent standard processing (editing, coding, processing, and cleaning). Univariate analysis was performed to describe the characteristics. The core of our analysis was the Bivariate analysis, using the Chi-Square Test to examine the statistical relationship between each independent factor and the anemia status. We set the threshold for statistical significance at $p < 0.05$. The research was conducted following ethical guidelines, receiving formal approval from the Poltekkes Kemenkes Semarang Ethics Committee in December 2023 (Approval Number: 1802/EA/KEPK/2023).

Results and Discussion

Of the 92 adolescent girls studied, the mean age was 13.26 ± 0.9 years, ranging from 12 to 15 years. The mean body weight was 48.38 ± 10.84 kg, and the mean height was 152.11 ± 5.17 cm, indicating that most respondents had normal growth for their age. Regarding parental education, 81.5% of fathers and 72.8% of mothers had higher education levels (Table 1).

Table 1. Characteristics of the respondents

Characteristic	**Mean±SD**	**Min-Max**
Age (year)	13.26±0.9	12 – 15
Weight (Kg)	48.38±10.84	30.50 – 88.90
Height (Cm)	152.11±5.17	141.5 – 164.0
Characteristic		**N(%)**
Father's Education	High	75 (81.5)
	Low	17 (18.5)
Mother's Education	High	67 (72.8)
	Low	25 (27.2)

Table 2 presents the analysis of factors correlated with anemia among 92 adolescent girls. Among the variables examined, menstrual duration was the only factor found to have a statistically significant association with anemia ($p = 0.041$; RR = 2.188). Adolescents with abnormal menstrual duration (<3 or >7 days) showed a 2.19 times higher risk of developing anemia compared to those with normal menstrual duration (3–7 days). This finding suggests that excessive or prolonged menstrual blood loss may contribute substantially to reduced hemoglobin levels and iron deficiency during adolescence.

Other variables—including Body Mass Index (BMI), Mid-Upper Arm Circumference (MUAC), and breakfast habits—did not demonstrate significant associations with anemia status ($p > 0.05$). Although not statistically

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significant, respondents with abnormal MUAC had a higher relative risk (RR = 1.773) of anemia compared to those with normal MUAC, indicating a possible, but inconclusive, relationship between nutritional status and anemia. BMI also showed no meaningful relationship (p = 0.809; RR = 0.916), suggesting that body composition alone may not reliably reflect iron status in adolescents.

Breakfast habits similarly showed no significant association (p = 0.613), although adolescents who skipped breakfast had a slightly higher proportion of anemia cases (9.8%) than those who ate breakfast regularly (15.2%). This pattern may imply that the quality and iron density of meals, rather than the presence or absence of breakfast alone, play a more critical role in anemia prevention.

Table 2. Factors correlated with Anemia among adolescents

Variables	Anemia Status		N	p-value	RR
	Anemia	Non-Anemia			
Menstrual Duration					
Normal	7 (7.6%)	38 (41.3%)	47	0.041*	2.188
Abnormal	16 (17.4%)	31 (33.7%)	45		
BMI					
Normal	13 (14.1%)	37 (40.2%)	50	0.809*	0.916
Abnormal	10 (10.9%)	32 (34.8%)	42		
MUAC					
Normal	9 (8.7%)	34 (33.7%)	49	0.398*	1.773
Abnormal	14 (16.3%)	35 (41.3%)	43		
Breakfast habit					
Yes	14 (15.2%)	46 (50%)	60	0.613*	1.125
No	9 (9.8%)	23 (25%)	32		

*Chi-square test

This study analyzed several factors associated with anemia among adolescent girls as part of efforts to prevent stunting. The findings revealed that menstrual duration was the only factor significantly related to anemia (p = 0.041; RR = 2.188). Adolescent girls with abnormal menstrual duration—defined as less than three days or more than seven days—were more than twice as likely to experience anemia compared to those with normal menstrual duration. This result aligns with earlier studies indicating that prolonged menstrual bleeding increases the likelihood of iron deficiency and iron-deficiency anemia[7–10]. The excessive loss of blood during menstruation can reduce hemoglobin levels and deplete iron stores, especially when not compensated by adequate iron intake[11,12].

The absence of a significant association between anemia and other variables such as BMI, MUAC, breakfast habits, and parental education suggests that anemia among adolescents in this setting is more strongly influenced by physiological factors rather than anthropometric or socioeconomic variables. The nonsignificant relationship between BMI and anemia is consistent with previous research showing that body mass index alone may not reflect the micronutrient status of adolescents[13]. Similarly, MUAC, although a reliable indicator of overall nutritional status, does not directly indicate iron status in the blood[14].

Breakfast habits were not significantly associated with anemia (p = 0.613), although respondents who regularly consumed breakfast had a slightly lower risk of anemia. This finding may indicate that the quality and composition of breakfast meals, rather than the habit itself, are critical determinants of iron intake. Adolescent girls who skip breakfast or consume low-nutrient foods are more likely to experience dietary iron deficiency, as reported by previous study[15].

Overall, the findings emphasize the importance of addressing menstrual health in adolescent girls as a strategy for anemia prevention. Integrating menstrual education, nutritional counseling, and routine hemoglobin screening within school health programs could reduce the burden of anemia and, consequently, the risk of intergenerational stunting. This approach is aligned with the *National Strategy for Anemia Control among Adolescent Girls* by the Indonesian Ministry of Health[4] and supports global efforts to achieve the Sustainable Development Goals (SDGs), particularly Goal 2 (Zero Hunger) and Goal 3 (Good Health and Well-being).

Health programs targeting adolescent girls should incorporate regular screening for anemia, menstrual health education, and promotion of

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iron-rich dietary intake. Schools should serve as key platforms for implementing nutrition and reproductive health education, ensuring that adolescent girls maintain adequate iron stores before entering reproductive age. Policymakers and healthcare providers should collaborate to integrate anemia prevention strategies within existing adolescent health and stunting prevention programs.

Conclusion

Menstrual duration was significantly associated with anemia among adolescent girls. Respondents with abnormal menstrual duration were more than twice as likely to experience anemia compared to those with normal menstruation. Other variables—including BMI, MUAC, breakfast habits, parental education, and consumption of inhibitor and enhancer foods—showed no significant relationship. Health education programs focusing on menstrual health and adequate iron intake should be strengthened at schools and community levels to prevent anemia and future stunting in adolescent girls.

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