Relationship between Nutritional Status and Menstrual Cycle with Hemoglobin Levels in Adolescent Girls

Erike Septa Prautami [1*], Fatria Harwanto[2], Deya Silviani[3], Dwi Inda Sari[4], Adelina Irmayani Lubis[5]

[1,2,3,4]Nutrition Study Program, Faculty Of Public Health, Universitas Sriwijaya, Ogan Ilir, Indonesia
[5]Public Health Study Program, Faculty Of Public Health, Universitas Sriwijaya, Ogan Ilir, Indonesia

Corresponding Author: erikeseptaprautami@fkm.unsri.ac.id

ABSTRACT

Purpose: Anemia in adolescent girls is a health problem associated with various factors, including nutritional status and menstrual characteristics. Nutritional status describes anthropometric conditions and the balance of nutrient needs, while menstruation can increase iron loss. This study aims to analyze the relationship between nutritional status and menstrual cycle with hemoglobin levels in adolescent girls.

Design: This study used an observational design with a cross-sectional approach. The respondents were 52 adolescent girls at SMK NU Muara Padang who met the inclusion criteria. Data analysis included univariate and bivariate analysis using the Chi-Square test.

Findings: The Chi-Square test results showed no significant relationship between nutritional status and hemoglobin levels (p=0.238). The analysis showed no significant relationship between menstrual cycle and hemoglobin levels (p=0.167).

Research Implications: Nutritional status and menstrual cycle regularity did not show a significant relationship with hemoglobin levels in adolescent girls in this study.

Practical Implications: The findings indicate that the incidence of anemia is likely influenced by various factors, particularly the adequacy of blood-forming nutrients, food consumption patterns, iron loss, adherence to iron supplement tablet consumption, and other biological factors.

Keywords: anemia; hemoglobin; girls; menstrual; nutritional

1. INTRODUCTION

Anemia is a condition in which the hemoglobin (Hb) level in the blood is below the normal value according to sex and physiological condition. Its causes can include iron deficiency, vitamin B12, folic acid, infectious diseases, congenital factors, or bleeding. This condition can reduce body immunity, cause fatigue and concentration problems, hinder growth, and lower learning achievement. The Indonesian Ministry of Health (2018) stipulates that adolescent girls are categorized as having anemia if the Hb level is <12 g/dL (Kemenkes RI, 2018).

Globally, WHO recorded an anemia prevalence of 30% in women aged 15–49 years. In Indonesia (WHO, 2025), Riskesdas (2018) showed an anemia prevalence of 23.7%, with a prevalence of 26.8% in the 5–14 year age group and 32.0% in the 15–24 year age group. These data indicate that anemia in the adolescent group remains a considerable health problem, so prevention and improvement of adolescent nutrition are still needed (Basic Health Research (Riskesdas), 2018). In South Sumatra Province, the prevalence of anemia in 2023 reached 9.9%, higher than the national average of 9.1%, so anemia remains a health problem that needs attention (Indonesian Health Survey, 2023). Based on the South Sumatra Provincial Health Office, out of 17 regencies/cities, the highest prevalence of anemia was in Muara Enim Regency, Banyuasin, and Palembang City (Dinas Kesehatan Provinsi Sumatera Selatan, 2019).

The incidence of anemia in adolescent girls can be caused by various factors, including nutritional status and menstrual cycle. Nutritional status can influence the incidence of anemia because it reflects the balance between intake and the body's nutritional needs. In adolescents, nutritional status can be assessed using Body Mass Index for Age (BMI/A) (Kemenkes RI, 2022). Adolescent girls with undernutrition status tend to have a higher risk of anemia. However, Muhayati and Ratnawati emphasized that adolescents with normal nutritional status can still experience anemia if their dietary patterns do not meet the principles of balanced nutrition (Muhayati and Ratnawati, 2019). In addition to nutritional status, the menstrual cycle is an important factor because menstruation causes periodic blood loss. Kemenkes RI explains that menstruation is the process of shedding of the uterine lining that occurs every month due to changes in reproductive hormones. A normal menstrual cycle lasts for 21–35 days, counted from the day previous menstruation until the first day of the next menstruation. Adolescent girls who have experienced menstruation experience blood loss so that nutritional needs, especially iron, increase (Kemenkes RI, 2023). Therefore, Yulaeka (2020) as well as Yulianti, Aisyah and Handayani (2024) serve as the basis that research needs to be focused on adolescent girls who have experienced menstruation to analyze the relationship between variations in the menstrual cycle and the incidence of anemia (Yulaeka, 2020; Yulianti, Aisyah and Handayani, 2024) .

Adolescents are in the early to middle adolescent phase, characterized by rapid physical growth, the onset of menstruation, increased iron requirements, and psychological and behavioral changes. At this stage, adolescents begin to search for their identity, develop independence, and make their own decisions, including in choosing food. Eating habits and lifestyle patterns that begin to form during this period can affect nutritional status (Bawono, 2023). Based on the above background, this study aims to determine the relationship between nutritional status and menstrual cycle with the incidence of anemia in adolescent girls.

2. RESEARCH METHOD

This study used an observational quantitative approach with a cross-sectional design, in which data collection was carried out at one time to determine the relationship between dietary patterns,

nutritional status, and menstrual cycle with the incidence of anemia in adolescent girls (Siyoto and Sodik, 2015). The number of respondents in this study was 52 respondents selected based on inclusion criteria. This study was conducted at SMK NU Muara Padang, Banyuasin Regency.

Research data consists of primary and secondary data. Primary data includes respondent characteristics, nutritional status, menstrual cycle, and hemoglobin levels. Nutritional status was obtained through direct measurement of body weight and height using a digital scale with 0.1 kg accuracy and a microtoise, then calculated based on BMI-for-age (z-score). Menstrual cycle was obtained through a questionnaire regarding the interval between menstrual periods over the last three months, while the incidence of anemia was determined through hemoglobin level examination using an Hb meter with the finger prick method.

Data processing was carried out using computer software through the stages of editing, coding, entry, and cleaning. Data analysis consisted of univariate and bivariate analysis. Univariate analysis was used to describe each variable in the form of frequency distribution. Meanwhile, bivariate analysis was used to determine the relationship between dietary patterns, nutritional status, and menstrual cycle with the incidence of anemia using the Chi Square test.

3. RESULTS

Univariate Analysis

The frequency distribution of respondent characteristics can be seen in the following table.

Table 1. Distribution of Respondent Characteristics

Variable	Category	Frequency (n)	Percentage (%)
Father's education	Elementary school	28	53.8
	Junior high school	20	38.5
	Senior high school	4	7.7
Mother's education	No formal education	2	3.8
	Elementary school	33	63.5
	Junior high school	12	23.1
	Senior high school	5	9.6
Father's occupation	Laborer	15	28.8
	Civil servant	2	3.8
	Farmer	35	67.3
Mother's occupation	Housewife	5	9.6
	Laborer	6	11.5
	Civil servant	2	3.8
	Farmer	39	75.0
Nutritional status	Underweight	17	32.7
	Normal	23	44.2
	Overweight	12	23.1
Menstrual cycle	Regular	30	57.7
	Irregular	22	42.3
Hemoglobin level	Normal	35	67.3
	Abnormal	17	32.7
Total		**52**	**100,0**

Sources: Primary research data (2026)

The analysis results show that the majority of fathers' education was junior high school at 28 respondents (53.8%), mothers' education at 33 respondents (63.5%) was elementary school, fathers' occupation at 35 respondents (67.3%) worked as farmers, mothers' occupation at 39 respondents (75%) worked as farmers, respondents' nutritional status at 23 respondents (44.2%) was in normal nutritional status, menstrual cycle at 30 respondents (57.7%) had a normal menstrual cycle, and 35 respondents (67.3%) had normal hemoglobin levels.

Bivariate Analysis
Nutritional Status with Hemoglobin Levels

Table 2. Relationship between nutritional status and hemoglobin levels in adolescent girls

Nutritional status	Anemia status				Total		P-value
	Anemic		Not anemic		N	%	
	n	%	n	%			
Normal nutritional status	13	56.5	10	43.5	29	100	0.238
Abnormal nutritional status	22	75.9	7	24.1	23	100	
Total	**35**	**67.3**	**17**	**32.7**	**52**	**100**	

Sources: Primary research data (2026)

Based on the table above, it shows that out of 29 respondents with normal nutritional status, 13 respondents (56.5%) experienced anemia. Meanwhile, out of 23 respondents with abnormal nutritional status, 22 respondents (75.9%) experienced anemia. The analysis of the relationship between nutritional status and the incidence of anemia was conducted using the Chi-Square test, which obtained a p-value = 0.238, so it can be concluded that there is no relationship between nutritional status and hemoglobin levels in adolescent girls.

Menstrual Cycle with Hemoglobin Levels

Table 3 Relationship between menstrual cycle and hemoglobin levels in adolescent girls

Menstrual cycle	Hemoglobin level				Total		P-value
	Anemic		Not anemic		N	%	
	n	%	n	%			
Regular	23	76.7	7	23.3	30	100	0,167
Irregular	12	54.5	10	45.5	22	100	
Total	**35**	**67.3**	**17**	**32.7**	**52**	**100**	

Sources: Primary research data (2026)

Based on the table above, it shows that of the 30 respondents who experienced a regular menstrual cycle, as many as 23 respondents (76.7%) had hemoglobin levels in the anemic category. Meanwhile, of the 22 respondents with irregular menstrual cycles, as many as 12 respondents (54.5%) had hemoglobin levels in the anemic category. The analysis of the relationship between nutritional status and the incidence of anemia was carried out using the Chi-Square test, which obtained a p-value = 0.167, so it can be concluded that there is no relationship between menstrual cycle and hemoglobin levels in adolescent girls.

4. DISCUSSION

Relationship Between Nutritional Status and Hemoglobin Levels

The study results showed that there was no significant relationship between nutritional status and hemoglobin levels in adolescent girls. Based on the Chi-Square test results, a p-value of 0.238 (>0.05) was obtained, so statistically nutritional status is not related to hemoglobin levels in the respondents. Nevertheless, descriptively it appears that the proportion of respondents with abnormal nutritional status who experienced anemia was higher compared to respondents with normal nutritional status. In the normal nutritional status group, 13 respondents (56.5%) were recorded as having anemia, while in the abnormal nutritional status group, 22 respondents (75.9%) experienced anemia. These findings indicate a tendency toward differences in proportions, but the difference is not statistically strong enough to state that there is a relationship in the study population.

The absence of a significant relationship in this study is in line with the findings of research conducted on adolescent girls in Zarqa, Jordan. That study involved 420 adolescent girls aged 12–16 years and found that the distribution of anemia did not differ significantly based on body mass index category. Most adolescent girls with anemia were actually in the normal BMI category, while the relationship between BMI-for-age Z-score and hemoglobin levels was also very weak and not significant. These findings indicate that anthropometric measures in general cannot necessarily describe the adequacy of micronutrients, especially iron, which plays a direct role in hemoglobin formation(Al-Momani H, 2026). Another study on 221 adolescent girls aged 14–19 years in India also showed that anemia is closely associated with micronutrient deficiency. A total of 57% of respondents had anemia and 84% had at least one micronutrient deficiency; iron deficiency was found to be a predictor of anemia and its severity. (Dhurde *et al.*, 2024).

Research conducted in Pekanbaru provides a slightly different perspective. Putri et al. reported that poor nutritional status and low mid-upper arm circumference are associated with anemia in adolescent girls, especially after multivariate analysis. Adolescents with low mid-upper arm circumference have approximately 1.95 times higher risk of experiencing anemia, while poor nutritional status also shows an association in the multivariate model (Putri *et al.*, 2025). The differences in these results can be influenced by population characteristics, sample size, methods of measuring nutritional status, as well as other variables controlled in the analysis. Thus, nutritional status remains important in the context of anemia, but its effect on hemoglobin levels does not always appear directly in bivariate analysis.

Physiologically, adolescence is a period of accelerated growth that leads to increased requirements for energy, protein, iron, and various micronutrients. Iron plays an important role in hemoglobin synthesis and erythrocyte formation. Iron deficiency that persists over a certain period can lead to reduced iron reserves, then decrease the availability of iron for erythropoiesis and in the next stage cause a decline in hemoglobin levels. However, nutritional status measured through anthropometric indicators such as BMI-for-age mainly describes body size conditions and energy balance, not directly describing iron reserves or diet quality. Cohen and Powers emphasized that the risk of iron deficiency in adolescents is influenced by iron requirements during growth, dietary patterns, iron loss, activity, and menstrual blood loss (Cohen and Powers, 2024).

The findings were reinforced by the study by Dhurde et al., which showed that anemia in adolescent girls is not only related to anthropometric status but also to micronutrient status. In that study, iron deficiency and vitamin B12 deficiency were found in a fairly large proportion, and iron deficiency became a predictor of anemia (Dhurde et al., 2024). This means that two adolescent girls

with the same anthropometric nutritional status category can have different hemoglobin levels if there are differences in iron intake, iron bioavailability, protein consumption, vitamin B12, folate, adherence to iron supplement tablet consumption, as well as the presence of infection and inflammatory conditions.

The results of this study can also be understood through the research by Prautami et al. regarding the relationship between nutritional status and knowledge with Hb levels in adolescent girls. That study was conducted on 52 adolescent girls and had a population context aligned with this study. These findings reinforce the importance of viewing adolescent anemia not only through anthropometric indicators, but also through aspects of knowledge and other nutritional factors related to hemoglobin formation (Sripratiwi et al., 2026). In the context of anemia prevention, Prautami et al. also emphasized the importance of nutrition and anemia education for adolescent girls, because understanding balanced nutrition is one of the components that supports anemia prevention efforts (Prautami et al., 2025).

According to the researchers, the absence of a significant relationship between nutritional status and hemoglobin levels in this study may indicate that anemia in the respondents is a multifactorial condition. Nutritional status based on anthropometry cannot be used as the sole indicator to explain hemoglobin levels. Hemoglobin levels are more closely related to the adequacy of hematopoietic nutrients, especially iron, vitamin B12, folate, protein, as well as factors that affect iron absorption and loss. In addition, the relatively small sample size, namely 52 respondents, may also limit the study's ability to detect statistical relationships. Therefore, the result of p=0.238 should not be interpreted as meaning that nutritional status plays no role at all in anemia, but rather indicates that in this study's population and conditions, sufficient statistical evidence has not yet been found to state that there is a relationship between the two variables.

Thus, efforts to prevent anemia in adolescent girls should not only be directed at improving nutritional status anthropometrically, but also at improving the quality and diversity of food consumption, the adequacy of iron and blood-forming micronutrients, adherence to iron supplement tablet consumption, and monitoring of menstrual factors. A more comprehensive approach is needed because anemia is a condition influenced by the interaction between biological factors, diet, menstruation, behavior, and the environment.

Relationship between Menstrual Cycle and Hemoglobin Levels in Adolescent Girls

The study results showed that there was no significant relationship between the menstrual cycle and hemoglobin levels in adolescent girls. Based on the Chi-Square test, a p-value of 0.167 (>0.05) was obtained, so statistically the menstrual cycle is not related to hemoglobin levels. Descriptively, of the 30 respondents with regular menstrual cycles, 23 respondents (76.7%) were recorded as having anemia, while of the 22 respondents with irregular menstrual cycles, 12 respondents (54.5%) had anemia. This pattern shows that the proportion of anemia in this study was actually higher in the group with regular menstrual cycles, so cycle regularity alone cannot be used to explain the occurrence of anemia.

These results are in line with the study by Putri et al. on 230 adolescent girls in Pekanbaru. The analysis of that study showed that menstrual characteristics, including menstrual cycle length of 21–35 days, cycles of less than 21 days, or more than 35 days, did not show a significant relationship with anemia. Likewise, menstrual duration of more than seven days was not significantly associated with anemia (Putri et al., 2025). These findings provide support that menstrual cycle characteristics alone may not necessarily be sufficient to describe the magnitude of iron loss in adolescent girls.

However, the results of this study differ from the study by Fitriyanti and Achadi on adolescent girls in Muaragembong, Bekasi. That study found that abnormal menstrual patterns were significantly associated with anemia and became one of the dominant factors in multivariate analysis, with an OR of 22.07 (95% CI 3.24–150.51). Being underweight and low consumption of iron supplement tablets were also associated with anemia (Fitriyanti and Achadi, 2024). This difference indicates that the relationship between menstruation and anemia can be strongly influenced by the menstrual characteristics measured. Assessment based solely on cycle regularity may produce a different picture compared to assessment that also takes into account duration of menstruation, amount of bleeding, presence of blood clots, and frequency of menstruation.

Theoretically, menstruation is one of the important biological factors that makes adolescent girls more susceptible to iron deficiency. Each episode of menstrual bleeding causes loss of blood and iron, while during adolescence iron requirements also increase due to blood volume expansion and tissue growth. Cohen and Powers explain that excessive menstrual blood loss is one of the conditions that increases the risk of iron deficiency and iron deficiency anemia in adolescents (16) (Cohen and Powers, 2024). Therefore, menstruation biologically has a plausible relationship with iron status, but this relationship cannot always be captured solely through the variables "regular cycle" and "irregular cycle."

The results of this study can also be linked to the findings of Prautami et al. that education regarding nutrition and anemia in adolescent girls is needed to improve understanding of factors related to anemia (Prautami et al., 2025). In this context, adolescents' knowledge regarding menstruation, iron requirements, consumption of iron-source foods, and adherence to iron supplement tablet consumption can affect the body's ability to maintain iron balance. Therefore, adolescents with the same menstrual cycle can have different hemoglobin levels because they have different dietary patterns, supplementation adherence, iron reserves, and health conditions.

According to researchers, the absence of a relationship between the menstrual cycle and hemoglobin levels in this study may be due to the measurement of the menstrual cycle not yet directly describing the amount of blood loss. A regular menstrual cycle does not necessarily mean little blood loss, while an irregular cycle also does not always mean greater blood loss occurs. Variables that are closer to iron loss are menstrual duration, amount of bleeding, frequency of pad changing, presence of blood clots, and a history of heavy menstrual bleeding. The Pekanbaru study showed that even a menstrual duration of more than seven days did not show a significant relationship with anemia, so menstrual factors need to be analyzed together with other factors that affect iron status (Putri *et al.*, 2025).

In addition, hemoglobin levels are an indicator that can be influenced by various factors other than menstruation, including intake of iron and other micronutrients, infection, inflammation, adherence to iron supplement tablet consumption, and nutritional status. Thus, the p-value of 0.167 in this study is more appropriately interpreted as the absence of a statistical association between menstrual cycle regularity and hemoglobin levels in the study sample, rather than as evidence that menstruation plays no role in the occurrence of anemia. The researchers argue that future studies need to include more detailed menstrual characteristics, especially duration and volume of bleeding, as well as measure iron intake and adherence to iron supplement tablet consumption so that the relationship between menstruation and anemia can be explained more comprehensively.

5. CONCLUSION

Based on the research results, it can be concluded that nutritional status and menstrual cycle characteristics cannot yet be viewed as the sole factors determining hemoglobin levels in adolescent girls. Hemoglobin conditions are likely influenced by the interaction of various factors, primarily the adequacy of blood-forming nutrients, food consumption patterns, iron loss, adherence to blood-supplementing tablet consumption, and other biological factors. Thus, anemia prevention efforts for adolescent girls need to be carried out through a comprehensive approach, not only focusing on improving nutritional status or monitoring menstrual regularity.

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