THE RELATIONSHIP OF KNOWLEDGE, ATTITUDE, BEHAVIOR, AND NUTRITIONAL STATUS WITH THE INCIDENCE OF ANEMIA IN ADOLESCENT GIRLS

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Abstract
Anemia is a common nutritional problem among adolescent girls, primarily due to iron deficiency, which can affect physical growth, academic performance, and daily productivity. This study aimed to examine the relationship between knowledge, attitude, behavior, and nutritional status with the incidence of anemia among adolescent girls at Madrasah Tsanawiyah Nurul Iman Pomalaa. A cross-sectional study was conducted with 146 female students selected through purposive sampling. Data collection included questionnaires, anthropometric measurements for Body Mass Index (BMI), and hemoglobin (Hb) level testing. The results showed no statistically significant associations between knowledge (p = 0.756), attitude (p = 1.000), behavior (p = 0.246), and nutritional status (p = 0.493) with anemia incidence. However, all odds ratios were greater than 1, suggesting a descriptive tendency toward increased anemia risk among participants with poor knowledge, negative attitudes, unhealthy behaviors, or abnormal nutritional status. These findings emphasize the importance of preventive efforts through school- and family-based health education, especially regarding iron-rich dietary intake and compliance with iron supplementation. Further research is recommended to include other contributing factors such as menstruation patterns, psychological stress, and physical activity to better understand the multifactorial nature of anemia in adolescents.
Keywords: adolescent girls, anemia, attitude, knowledge, nutritional status

INTRODUCTION

Adolescents are defined by the World Health Organization (WHO) as individuals aged between 10 and 19 years[1]. This period is categorized into three stages: early adolescence (10–13 years), middle adolescence (14–16 years), and late adolescence (17–20 years). Each stage has unique characteristics related to cognitive, emotional, moral, and social development, all of which contribute to identity formation[2]. Adolescents have higher nutritional needs due to rapid physical growth and development during the transition from childhood to adolescence. They require energy/calories, protein, calcium, iron, zinc, and vitamins to support daily physical activities such as school and other routines[3]. One of the major health issues among adolescent girls associated with nutritional needs is iron deficiency anemia.

Anemia among adolescent girls is a significant health issue, especially in developing countries. The condition, often caused by iron deficiency (iron-deficiency anemia), can affect health, growth, academic performance, and physical activity. It is a serious public health problem that impacts the life cycle of adolescent girls. Those suffering from anemia experience growth limitations, reduced learning capacity, difficulty concentrating on daily activities, increased vulnerability to infections, higher dropout rates, lower physical fitness, and reduced work productivity[4]. Low hemoglobin levels or red blood cell counts are key indicators of

anemia. Iron-deficiency anemia is the most common form. According to hemoglobin levels, anemia in adolescent girls aged 12–14 is classified as non-anemic ($\geq$12 g/dL), mild anemia (11.0–11.9 g/dL), moderate anemia (8.0–10.9 g/dL), and severe anemia (<8 g/dL)[5].

According to the WHO, the prevalence of anemia among women aged 15–49 years reached 29.9% in 2019[6]. In Indonesia, the anemia prevalence in children aged 5–14 years was 16.3%, with 18% among females and 14% among males in 2023[7]. This shows that females are more affected by anemia than males. Women generally have lower iron reserves due to menstrual cycles, which increase iron requirements to replace blood lost during menstruation. Most girls begin menstruation at the age of 11–12, with 34.1% reaching menarche at that age[7].

Adolescent girls are at greater risk of anemia due to monthly menstruation, and low dietary iron intake can trigger the condition[8] The risk increases with age and peaks during adolescence when growth is most rapid. Girls aged 12–15 are at particularly high risk due to increased nutritional demands[9]. The 2023 Nutrition Action campaign in Kolaka Regency found that 84 out of 105 female students (80%) at SMPN 2 Latambaga were anemic—1 with severe anemia, 55 with moderate, and 28 with mild anemia[10]. This suggests a high prevalence of anemia among adolescent girls in the region.

Anemia incidence in adolescent girls is influenced by knowledge about the signs and symptoms. Previous studies show that knowledge is a determinant of anemia in this population. A lack of awareness regarding symptoms, complications, and prevention can lead to poor dietary choices, resulting in insufficient iron intake[11]. However, Utami et al. reported that even girls with good knowledge might have a higher risk of anemia due to poor behavior, such as not consuming iron-rich foods[12]. Behavior in consuming iron-rich foods and iron supplements plays a key role in anemia prevention. Rahayu et al. noted that preventive behavior, including iron supplement intake, affects anemia incidence[13]. These behaviors are, in turn, shaped by attitudes. A positive attitude increases the likelihood of engaging in preventive behaviors[14].

Nutritional status—whether underweight or obese—also contributes to anemia risk. Nurjannah & Putri found that nutritional status significantly affects anemia incidence[15]. nderweight status may stem from economic limitations and poor knowledge about nutrition, while obesity may be due to poor dietary patterns and lack of physical activity[16]. This study aims to analyze the relationship between knowledge, attitudes, behaviors, and nutritional status with anemia incidence among adolescent girls at Madrasah Tsanawiyah Nurul Iman Pomalaa.

MATERIALS AND METHODS

This research is a quantitative study employing a cross-sectional study design. This design was used to describe the characteristics of the population or sample at a specific point in time without any follow-up observations[17]. The study was conducted at Madrasah Tsanawiyah Nurul Iman Pomalaa from December 2025 to January 2025. The study population consisted of female students at Madrasah Tsanawiyah Nurul Iman Pomalaa. The sampling technique used was purposive sampling, resulting in a total sample of 146 participants.

The variables of knowledge, attitude, and behavior were measured using questionnaires. Nutritional status was assessed through measurements of height and

weight, followed by Body Mass Index (BMI) calculations. BMI-for-age was categorized as underweight (-3 SD to < -2 SD), normal (-2 SD to +1 SD), overweight (+1 SD to +2 SD), and obese (> +2 SD)[18]. The variable of anemia was determined based on hemoglobin (Hb) levels, measured using a hemoglobin testing device. According to the WHO classification by age, adolescent girls aged 12–14 years were categorized as non-anemic (≥12 g/dL), mildly anemic (11.0–11.9 g/dL), moderately anemic (8.0–10.9 g/dL), and severely anemic (<8 g/dL).

Data analysis in this study included both descriptive and analytical analysis. Descriptive univariate analysis provided the mean, maximum and minimum values, and standard deviation. Bivariate analysis used the Chi-Square test and Fisher's Exact test based on the significance level using SPSS. If the p-value was <0.05, it indicated a statistically significant relationship.

This study received ethical approval from the Health Research Ethics Committee (KEPK) of the Regional Executive Board of the Indonesian Public Health Expert Association (IAKMI) of Southeast Sulawesi Province with the approval number: No. 13/KEPK-IAKMI/II/2025.

RESULTS AND DISCUSSION

The data analysis concerning respondents' demographics, knowledge, attitudes, behaviors, nutritional status, and anemia status are presented as follows.

Table 1. Characteristics of Respondents, Knowledge, Attitude, Behavior, and Nutritional Status in Adolescent Girls at Madrasah Tsanawiyah Nurul Iman Pomalaa

Characteristic	Frequency (%)
Age	
12 years	31(21,9)
13 years	48(32,9)
14 years	56(38,4)
15 years	9(6,2)
16 years	1(0,7)
Father's Education	
No formal education	1(0,7)
Primary	15(10,3)
Secondary	78(53,4)
Higher Education	52(35,6)
Mother's Education	
No formal education	3(2,1)
Primary	19(13)
Secondary	72(49,3)
Higher Education	52(35,6)
Father's Occupation	
Civil servant	14(9,6)
Private employee	48(32,9)
Entrepreneur	49(33,6)
Other	35(24)
Mother's Occupation	

Civil servant	21(14,4)
Private employee	9(6,2)
Entrepreneur	19(13)
Unemployed	97(66,4)
Menstruation Status	
Matured	128(87,7)
Not yet	18(12,3)
Nutritional Status	
Underweight	2(1,4)
Normal	93(63,7)
Overweight	23(15,8)
Obese	28(19,2)
Anemia Status	
Non-Anemic	122(83,6)
Mild anemia	18(12,3)
Moderate anemia	3(2,05)
Severe anemia	3(2,05)
Knowledge	
Good	32(21,9)
Poor	114(78,1)
Attitude	
Positive	72(49,3)
Negative	74(50,7)
Behavior	
Good	75(51,4)
Poor	71(48,6)

Table 1 shows that among 146 respondents, the majority were aged 13–14 years. Most fathers and mothers had completed secondary education. The predominant occupations were private-sector employment for fathers and unemployment for mothers. A large majority (87.7%) of the girls had experienced menstruation. Nutritional status was mostly normal (63.7%), and most respondents were non-anemic (83.6%). However, 78.1% demonstrated poor knowledge about anemia, 50.7% held negative attitudes toward its prevention, and 48.6% exhibited poor preventive behaviors.

Table 2. Relationship of Knowledge, Attitude, Behavior, and Nutritional Status with Anemia Incidence in Adolescent Girls

Variable	Anemia Incidence		OR	p value
	Non-anemic	Anemia		
Knowledge				
Good	27(18,5%)	5(3,4%)	1,22	0,756*
Poor	95(65,1%)	19(13%)		
Attitude				
Positive	58(39,7%)	14(9,6%)	1,12	1,000*
Negative	64(43,8%)	10(6,8%)		
Behaviour				
Good	64(43,8%)	11(7,5%)	2,17	0,246*
Poor	58(39,7%)	13(8,9%)		

Nutritional Status				
Normal	76(52,1%)	17(11,6%)	1,47	0,493**
Not normal	46 (31.5%)	7 (4.8%)		

* Chi-Square test;** Fisher's Exact test

Table 2 indicates no statistically significant associations between knowledge (p = 0.756), attitude (p = 1.000), behavior (p = 0.246), or nutritional status (p = 0.493) and anemia incidence. Nevertheless, all odds ratios exceeded 1, suggesting a descriptive trend of increased anemia risk among those with poor knowledge, negative attitudes, unhealthy behaviors, or abnormal nutritional status.

Respondent Characteristics

The respondents in this study were 146 adolescent girls, the majority of whom were aged 13 and 14 years (71.3%). This age falls within early adolescence, a stage marked by rapid biological development. Early adolescence is characterized by hormonal changes that significantly affect nutritional needs, particularly iron, due to the onset of menstruation[6]. This aligns with the study finding that most respondents (87.7%) had already experienced menstruation. Menstrual blood loss is one of the primary causes of iron deficiency anemia in adolescent girls. A study by Rini et al. indicated that the duration and cycle of menstruation were significantly correlated with hemoglobin levels[19].

Most respondents came from families with a middle-level educational background. Maternal education in particular can influence a child's nutritional behavior. Rachmawati suggested that higher maternal education enhances knowledge and skills in choosing balanced diets, contributing to anemia prevention in adolescent girls [20]. This is also supported by Alvia et al., who found that higher maternal education can reduce the risk of anemia [21].

The majority of fathers worked as entrepreneurs (33.6%) or private employees (32.9%), while most mothers were unemployed (66.4%). This suggests that most households relied on a single income source—typically the father—with informal or private sector jobs that tend to offer unstable income. This economic vulnerability may affect a family's ability to meet nutritional needs, especially for adolescent girls whose iron requirements are higher due to menstruation. Research by Gore et al. found that anemia was more prevalent in low-income families and among those with unemployed members[22]. Stable employment provides more reliable income, which is crucial for ensuring adequate nutrition for children.

Relationship Between Knowledge and Anemia Incidence

Knowledge is a cognitive factor that plays a vital role in shaping healthy behaviors, including those related to anemia prevention among adolescent girls. In this study, most respondents (78.1%) had low levels of knowledge about anemia. Among this group, 13% experienced anemia, compared to only 3.4% in the group with good knowledge. Despite this trend, statistical analysis showed no significant relationship between knowledge level and anemia incidence (p = 0.756; OR = 1.22).

This finding suggests that a lack of knowledge may increase the risk of anemia, even if not statistically significant. It aligns with Handayani and Sugiarsih's study, which showed that adolescents with low knowledge were more likely to experience anemia[23]. Knowledge serves as a predisposing factor, influencing disease risk depending on how well the information is internalized and translated

into action[24]. Therefore, even if the statistical association is weak, educational strategies remain essential in adolescent health interventions. Nutrition education is expected to increase awareness and lead to long-term behavioral changes.

Relationship Between Attitude and Anemia Incidence

Attitude represents an individual's evaluation of an object, idea, or behavior, and theoretically acts as a predisposing factor in forming health behaviors. This study found that 50.7% of respondents had a negative attitude toward anemia prevention. However, statistical analysis revealed no significant relationship between attitude and anemia incidence (p = 1.000). This suggests that while attitude influences behavior, it does not always directly affect anemia status, especially without support from other factors such as resources, family involvement, and access to information.

This finding is consistent with Normalia et al., who reported that adolescents with negative attitudes—such as feeling reluctant to take iron supplements or lacking concern about iron-rich foods—were more at risk of anemia[25]. On the other hand, other studies found that although adolescents often have positive attitudes toward anemia prevention, their implementation of preventive actions remains suboptimal[26]. A positive attitude alone may not be sufficient to reduce anemia prevalence without consistent preventive behaviors.

This finding aligns with the Theory of Planned Behavior, which states that attitude influences intention, which in turn influences actual behavior. However, social support and self-efficacy also play important roles in facilitating behavior change[27]. For instance, adolescent girls with positive attitudes but no access to school-based nutrition education or nutritious meals at home may still face anemia risks. Hidayati et al. supported this by finding that, although adolescents showed positive attitudes toward anemia prevention, their high consumption of junk food outweighed their intake of iron-rich foods[28].

Relationship Between Behavior and Anemia Incidence

Health behaviors are shaped by interactions between knowledge, attitude, and the social environment, and are reflected in daily habits. For adolescent girls, regular consumption of nutritious food and iron supplements is crucial for preventing iron deficiency anemia. In this study, there was a difference in anemia incidence between girls with good and poor behaviors, but this difference was not statistically significant (p = 0.246). Still, the odds ratio (OR = 2.17) suggests that girls with poor behaviors may have a higher risk of anemia than those with healthy behaviors.

This result is supported by research from Rahayu et al., who found that irregular iron tablet consumption was significantly associated with increased anemia risk[29]. Additionally, Putera et al. showed that adolescents who did not consume green vegetables or varied sources of dietary iron tended to have lower hemoglobin levels[30]. This highlights how simple dietary behaviors can directly impact anemia status.

Behavior is also influenced by the environment and social norms. Adolescent girls in settings with unhealthy eating patterns or limited nutritional education—whether from school or family—are more likely to develop poor habits. According to the Health Belief Model, health behaviors are influenced not only by perceived threats but also by perceived benefits and barriers to taking action[31]. Although this study did not find a statistically significant relationship between behavior and

anemia, descriptively, girls with poor behaviors were more likely to experience anemia, underscoring the need for sustained health education.

Relationship Between Nutritional Status and Anemia Incidence

Imbalanced and irregular eating behaviors contribute to poor nutritional status, which may in turn increase anemia risk. Nutritional deficiencies, particularly in energy and protein, can disrupt metabolic functions including red blood cell production. In this study, most respondents had normal nutritional status (63.7%), yet some were still anemic. The analysis revealed no statistically significant relationship between nutritional status and anemia (p = 0.493), although the odds ratio (OR = 1.47) indicated a tendency toward greater risk among those with abnormal nutritional status.

his is consistent with Nurazizah et al., who found that adolescent girls with poor nutritional status—whether underweight or overweight—had higher anemia risk[32]. This may be due to imbalances in the intake of micronutrients like iron, folic acid, and vitamin B12, all of which are essential for hemoglobin synthesis. Muhayati and Ratnawati also emphasized that underweight girls tend to have lower iron reserves, which hampers hemoglobin production and increases the risk of iron deficiency anemia[33]. Conversely, overweight or obese girls may lack critical nutrients like iron due to diets high in carbohydrates and fats, which impair iron absorption[34].

Nutritional status is influenced by eating behavior and daily dietary patterns. Girls accustomed to consuming fast food—high in calories but low in micronutrients—often have imbalanced nutrition, whether excessive or deficient, which over time can affect hemoglobin levels. Qomarasari and Mufidaturrosida stated that irregular and iron-deficient eating patterns in adolescent girls may hinder red blood cell production, thus increasing anemia risk[35]. Therefore, girls who follow restrictive diets or eat poorly without professional guidance are at risk for both nutritional deficiencies and anemia.

CONCLUSIONS & RECOMMENDATIONS

Based on the research findings, there was no statistically significant relationship between knowledge, attitude, behavior, and nutritional status with the incidence of anemia among adolescent girls. However, the descriptive data indicated a trend where adolescents with poor knowledge, negative attitudes, unhealthy behaviors, and abnormal nutritional status had a higher likelihood of experiencing anemia. These trends suggest that while not statistically confirmed, these variables still play an important role in the prevention and control of anemia among this population.

Therefore, it is recommended that continuous nutrition education be integrated within both school and family environments to promote healthy eating behaviors among adolescents. Schools should enhance the role of school health units (UKS) in monitoring nutritional status and providing regular health education. Families, on the other hand, should support adolescents in consuming iron-rich foods and adhering to iron supplement programs. Future studies are encouraged to include additional influencing factors such as menstrual history, stress, and physical activity levels to better understand and address the complexity of anemia among adolescent girls.

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