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Anemia in Rural Teenage Girls in Indonesia: A Cross-Sectional Analysis of Prevalence and Risk Factors in Gowa, South Sulawesi, Indonesia

Muhammad Rachmat¹, Citrakesumasari², Sitti Andriani Anwar³, Yessi Kurniati⁴, and Nasrah¹

¹Department of Health Promotion and Behavioural Sciences, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

²Department of Nutrition, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

³Department of Epidemiology, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

⁴Faculty of Medicine and Health Sciences, Universitas Islam Negeri Alauddin, Makassar, Indonesia

Corresponding author: Muhammad Rachmat (e-mail: rachmat.muh@unhas.ac.id)

ABSTRACT Anemia remains a significant public health concern among adolescent girls in Indonesia, particularly in rural regions where access to nutritional education and healthcare services is limited. National data indicate that approximately 23.4% of adolescent girls are affected by anemia, with those in rural areas facing nearly double the risk compared to their urban counterparts. This study aims to examine the relationship between knowledge, intentions, and behaviors related to anemia and menstrual health among teenage girls in Gowa, South Sulawesi. A cross-sectional design was employed using a structured questionnaire administered through face-to-face interviews. A total of 242 students were recruited via convenience sampling from two senior high schools (grades 10–11) and four junior high schools (grades 7–9). Data were analyzed using Chi-square tests to identify associations between knowledge, intention, and behavioral indicators of anemia, including visible signs such as pallor in the face, eyelids, lips, skin, nails, and palms. The results revealed that although 41.3% of participants demonstrated a positive intention and were able to recognize their menstrual cycles accurately ($p = 0.001$), a significant proportion (50.3%) exhibited inadequate knowledge regarding their menstrual health and its connection to anemia. Behavioral indicators related to anemia symptoms showed statistically significant associations with intention and knowledge variables ($p < 0.05$). These findings highlight a critical gap in adolescents' understanding of anemia and its manifestations. The study underscores the urgent need for targeted educational interventions and public health initiatives to improve awareness and promote early identification of anemia symptoms. Enhanced adolescent health education can contribute to more effective prevention and management strategies, particularly in low-resource settings where anemia prevalence remains high.

INDEX TERMS anaemia, menstrual cycle, adolescent girls, knowledge and behavior, rural students

I. INTRODUCTION

Adolescence is a critical period of human development marked by rapid physiological, psychological, and emotional changes. It spans approximately from the onset of puberty to the mid-twenties, involving complex transformations in cognition, emotion regulation, social roles, and physical health [1]. Physiologically, adolescents experience significant growth spurts, hormonal shifts, and the initiation of reproductive function. These processes increase the demand for key nutrients, especially iron, which is crucial for red blood cell formation and oxygen transport [2], [3]. However, due to dietary inadequacies and menstrual blood loss, adolescent girls are particularly vulnerable to iron deficiency anaemia [4].

Globally, anaemia remains one of the leading nutritional deficiencies affecting adolescents. In 2019, the prevalence of

anaemia in non-pregnant women aged 15–49 years was estimated at 30%, and 37% in pregnant women [5]. Iron deficiency is the primary cause, although other nutritional deficits, chronic diseases, infections, and parasitic infestations may also contribute [6], [7]. The World Health Organization (WHO) has targeted a 50% reduction in anaemia among women of reproductive age by 2025 [8]. In Indonesia, anaemia is a persistent public health problem. According to Riskesdas 2018, the national prevalence among women of reproductive age was 25.3%, with adolescents aged 15–24 years accounting for 48.9%, a significant increase from 37.1% in 2013 [9]–[11].

Adolescents in rural areas are disproportionately affected due to limited access to nutritious foods, health education, and reproductive health services [12]. Studies reveal that young women in these regions are more likely to suffer from

chronic undernutrition and poor dietary patterns, leading to a higher risk of anaemia [13]. Moreover, adolescent knowledge of anaemia, its symptoms, and preventive measures is alarmingly low. Surveys show that only 13.2% of teenage girls in Indonesia could correctly define anaemia, and nearly 24% were unaware of its causes [14], [15].

Several recent studies have examined the role of knowledge, attitude, and practices (KAP) in shaping health behaviors related to anaemia [16]–[18]. While KAP frameworks have demonstrated efficacy in modifying health-related behaviors, evidence on how they relate specifically to anaemia prevention and nutritional outcomes in adolescent populations remains limited. Particularly, few studies have explored how intention and behavior relate to observable anaemia symptoms, such as pallor, fatigue, or irregular menstruation, within the rural adolescent context [19], [20].

This study aims to investigate the level of knowledge, intention, and behavior among adolescent girls in South Sulawesi, Indonesia, regarding anaemia and its prevention. Specifically, it explores their awareness of symptoms, menstrual health, and nutritional habits. The focus is on identifying how knowledge and intention correlate with behavior and symptom recognition. The main contributions of this research are as follows:

1. It provides current data on the knowledge, intention, and behavioral responses of adolescent girls toward anaemia, particularly in underrepresented rural communities.
2. It analyzes the relationship between anaemia symptoms and behavioral indicators using a Chi-square method, contributing to the methodological literature on KAP-based health studies.
3. It supports the development of context-appropriate educational interventions for adolescent health, offering insights for policymakers, educators, and healthcare providers.

II. METHODS

A. STUDY DESIGN

This study applied a quantitative cross-sectional design to explore the associations between adolescent girls' knowledge, intentions, and behaviors regarding anemia and their self-reported symptoms. A cross-sectional design was selected due to its appropriateness for examining the prevalence of specific health-related factors and analyzing their associations at a single point in time without manipulation of variables [23], [24].

B. STUDY SETTING AND PERIOD

The study was conducted in Gowa Regency, South Sulawesi, Indonesia, encompassing both junior and senior high schools. Data collection was carried out over a span of 19 days, from July 23 to August 10, 2022.

C. POPULATION AND SAMPLING

The target population consisted of female students enrolled in six public educational institutions specifically, two senior high schools (grades 10–11) and four junior high schools (grades 7–9). The selection of participants was performed using a non-probability convenience sampling method,

which was deemed appropriate due to accessibility constraints and the exploratory nature of the research [25].

The age range of participants conformed to the Ministry of Health Regulation No. 25 of 2014, which classifies adolescents as individuals aged 10 to 19 years [26]. In total, 242 adolescent girls participated in the study and met the inclusion criteria, which were: (1) being a female student aged 11–17 years; (2) currently enrolled in one of the selected schools; and (3) providing informed consent. Exclusion criteria included any chronic illness that could interfere with the manifestation of anemia-related symptoms.

D. RESEARCH INSTRUMENT

Data were gathered using a structured, interviewer-administered questionnaire. The instrument was developed based on established Knowledge, Attitudes, and Practices (KAP) models and relevant literature on adolescent anemia [27], [28]. The questionnaire was divided into four major sections:

1. Section A: Demographic information (age, grade level)
2. Section B: Knowledge of anemia (causes, symptoms, prevention)
3. Section C: Intention and behavioral practices related to anemia (e.g., dietary habits, menstrual awareness)
4. Section D: Self-reported symptoms of anemia (e.g., facial pallor, pale lips, dizziness, fatigue)

The knowledge section comprised 10 multiple-choice questions. A correct response was scored as 1 point, and incorrect responses were scored as 0. The total score was calculated as a percentage. Participants were categorized as having “high knowledge” if they answered at least 80% of the questions correctly, and “low knowledge” if below 80% [29]. Variables for intention and behavior were derived from a series of Likert-scale items. Responses were summed and categorized into positive or negative intention/behavior based on the mean score as a cut-off point, consistent with previous health behavior research [30].

E. DATA COLLECTION PROCEDURES

Data collection was conducted through face-to-face interviews by trained enumerators who were briefed on the protocol and ethical handling of participant information. Each session lasted approximately 20–30 minutes per participant. This approach helped mitigate literacy barriers and ensured the completeness and consistency of responses. A pilot test was conducted involving 20 students from schools not included in the final sample to ensure clarity, reliability, and validity of the instrument. Minor revisions were made based on pilot results to improve question wording and sequence. Ethical approval for the study was obtained from the institutional ethics review board of Poltekkes Kemenkes Surabaya. Written informed consent was obtained from all participants, and for minors, parental consent was also secured.

F. VARIABLES AND OPERATIONAL DEFINITION

1. Dependent Variable: The primary outcome variable was the presence of general anemia symptoms, as self-reported by the participants. Symptoms assessed included facial and palmar pallor, fatigue, dizziness, pale

nail beds, and pale lips. Responses were recorded in binary format (Yes/No).

2. Independent Variables:

- Knowledge: Categorized as high ($\geq 80\%$) or low ($< 80\%$) based on percentage of correct answers.
- Intention: Categorized as positive or negative based on the mean intention score.
- Behavior: Categorized similarly using mean behavioral scores.

Demographic variables such as age and grade level were also recorded and used in further stratified analysis.

G. DATA ANALYSIS

Data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to summarize demographic data and variable distributions. Frequencies and percentages were computed for categorical variables. The Chi-square test (χ^2) was employed to identify associations between independent variables (knowledge, intention, behavior) and the dependent variable (presence of anemia symptoms). A significance level of $p < 0.05$ was applied to determine statistical relevance. This statistical approach allowed for the identification of significant behavioral and cognitive predictors of anemia symptoms in adolescent girls, providing evidence for targeted health education strategies.

H. ETHICAL CONSIDERATIONS

All procedures involving human participants were conducted in accordance with the Declaration of Helsinki. Confidentiality and privacy were maintained throughout the research. Participant responses were anonymized during data processing and analysis.

III. RESULTS

Based on TABLE 1 above, it shows that the dominant respondents came from the category of junior high school students, namely in class 7 a number of 73 people (30.2%), class 8 a number of 62 people (25.6%) and class 9 a number of 62 people (25.6%). Table 2 indicates that the majority of respondents, specifically 149 individuals (61.6%), had a poor degree of knowledge of anaemia. Conversely, only 93 individuals (38.4%) exhibit a high level of knowledge. In addition, the variable representing respondents' desire to prevent anaemia exhibited a similar frequency distribution. Specifically, 126 individuals (52.1%) had excellent intentions, while 116 individuals (47.9%) had unfavourable intentions. The study found that 131 respondents (54.1%) exhibited good behaviour in preventing teenage anaemia, while 111 respondents (45.9%) displayed bad behaviour.

TABLE 1

Characteristics of Respondents (n=242)

Characteristics	n	%
7 th Grade	73	30.2
8 th Grade	62	25.6
9 th Grade	59	24.4
10 th Grade	13	5.4
11 th Grade	35	14.5

As presented in Table 2, 61.6% of respondents exhibited low knowledge about anemia, while only 38.4% demonstrated high knowledge. Regarding intention, 52.1% had a positive

intention to prevent anemia, whereas 47.9% had a negative one. In terms of behavior, 54.1% reported good preventive behavior, while 45.9% displayed poor behavior. These findings reflect varying levels of cognitive and behavioral readiness among rural adolescent girls to address anemia risk factors.

TABLE 2

Distribution of Adolescent Knowledge, Intentions and Behavior of Anaemia (n=242)

Characteristics	n	%
Knowledge		
Low	149	61.6
High	93	38.4
Intentions		
Bad	116	47.9
Good	126	52.1
Behavior		
Bad	111	45.9
Good	131	54.1
Total	242	100

TABLE 3.

Bivariate Analysis of General Symptoms of Anaemia Related to Menstrual Experience

Category	Symptom						p-value
	Have you had your period (menstruation)?						
	Never		Seldom		Always		
	n	%	N	%	n	%	
Knowledge							
Low	19	12.8	90	60.4	40	26.8	0.715
High	14	15.1	58	62.4	21	22.6	
Intention							
Bad	26	22.4	81	69.8	9	7.8	0.001
Good	7	5.6	67	53.2	52	41.3	
Behavior							
Bad	17	15.3	74	66.7	20	18.0	0.056
Good	16	12.2	74	56.5	41	31.1	

TABLE 3 demonstrates that 41.3% of students with predominantly positive intentions are able to accurately identify their menstrual cycle with a significance level of $p=0.001$. Conversely, they predominantly have limited knowledge about their menstrual cycle. TABLE 4 shows that the student exhibited paleness in their face, eyelids, lips, skin, nails, and palms during a significant period, as indicated by the intention and behaviour variable with a p-value of less than 0.05. However, the data also indicates a low occurrence of students who consistently appear pale throughout their menstruation. Conversely, the majority of students in the "never" category have a pale appearance (TABLE 3).

IV. DISCUSSION

A. INTERPRETATION OF FINDINGS

This study revealed no statistically significant association between anemia knowledge and the frequency of anemia-related symptoms among adolescent girls in Gowa Regency ($p = 0.057$). Although 61.6% of participants with low knowledge levels reported symptoms compared to 38.4% in the high-knowledge group, this difference was not significant. These results suggest that possessing knowledge alone does not necessarily correlate with symptom prevalence or effective anemia prevention.

In contrast, intention and behavior showed strong, statistically significant links with symptom occurrence ($p = 0.001$ and $p = 0.014$, respectively). Adolescents with poor intentions toward anemia prevention reported symptoms in

69% of cases, compared to only 43.7% among those with positive intentions. Similarly, 65.8% of those with unfavorable behavior reported symptoms, versus 47.3% in the favorable behavior group. These findings indicate that intention and behavior may be better predictors of anemia symptoms than knowledge alone.

The three key symptoms facial/palmar pallor, general fatigue, and dizziness were more prevalent in participants with lower intention and behavior scores. Importantly, 88.2% of those with strong intention to prevent anemia still reported these symptoms, implying that even positive intent may not be fully realized in protective behaviors.

Sub-chapter A summarizes:

1. Knowledge alone does not significantly predict anemia symptoms.
2. Intention and behavior exhibit stronger correlations with symptom presence.
3. A disconnection exists between intention and effective behavior.

B. COMPARISON WITH EXISTING LITERATURE

1. ROLE OF KNOWLEDGE, INTENTION, AND BEHAVIOR

The Theory of Planned Behavior suggests that intention, influenced by attitude and perceived control, drives actual behavior [31], [33]. Our findings support this model: intention and behavior but not knowledge were significantly related to symptom presence. Similar research among female students has also shown that intention is a stronger predictor of health behavior than knowledge alone [34], [35].

2. DIETARY PRACTICES AND NUTRITIONAL ADEQUENCY

Previous studies found regular consumption of iron-rich foods (e.g., fruits and vegetables) correlated with improved micronutrient intake, especially during adolescence [24]. In the present study, proactive dietary intentions were linked to fewer anemia symptoms, adding credence to earlier observations. However, despite strong intention, many adolescents continued to experience symptoms likely due to inconsistent dietary adherence or limited access to nutritious foods.

3. MENSTRUATION AND PHYSICAL ACTIVITY

Anemia symptoms often intensify during menstruation, influenced by iron loss and reduced physical activity [36], [37]. Among the present cohort, menstrual-related fatigue aligned with symptom reports in Table 3. Most adolescent girls reported sedentary lifestyles academic tasks and commuting via vehicles further exacerbating fatigue and symptom severity [34], [38].

4. RURAL CONTEXT AND CULTURAL BARRIERS

Studies comparing urban and rural environments frequently indicate that rural girls experience higher anemia rates due to poorer health education and limited healthcare access [39]. Cultural beliefs regarding menstruation and diet may hinder knowledge application and dietary practice, which could explain disparities between intention and behavior [40]. Additionally, socioeconomic limitations, food insecurity, and traditional gender roles further exacerbate these

challenges by restricting adolescent girls' autonomy in making health-related decisions. These structural barriers often result in delayed symptom recognition, inadequate nutritional intake, and limited participation in preventive health programs, especially in under-resourced communities.

C. LIMITATIONS, PRACTICAL IMPLICATIONS, AND RECOMMENDATIONS

1. LIMITATIONS

- a. Self-reported data: Reliant on participant recall and perception, potentially introducing bias.
- b. Convenience sampling: May limit the generalizability of findings to the broader adolescent population in Indonesia.
- c. Absence of hemoglobin measurement: Without physiological confirmation, anemia status was inferred from self-reported symptoms, which is less precise [41].
- d. Cross-sectional design: The study cannot determine causality or temporal relationships.

2. PRACTICAL IMPLICATIONS

- a. Health education interventions: Should emphasize intention-to-action pathways, such as reinforcing self-efficacy and facilitating access to iron-rich foods rather than solely knowledge dissemination.
- b. Menstruation education programs: Should address fatigue and dietary needs linked to the menstrual cycle, promoting proactive behavior during critical periods.
- c. School and community programs: Must incorporate behavior change models (e.g., TPB) and include culturally sensitive components for rural populations.

3. RECOMMENDATIONS FOR FUTURE RESEARCH

- a. Longitudinal designs: To assess causality between intention, behavior, and anemia outcomes over time.
- b. Objective measurements: Incorporating hemoglobin and serum ferritin data to validate symptom-based assessments.
- c. Intervention trials: Testing behavioral interventions (motivational interviewing, peer-led programs) to enhance intention-behavior consistency.
- d. Cultural adaptation: Qualitative studies to explore cultural perceptions of diet and menstruation in rural Indonesian contexts.

V. CONCLUSION

This study aimed to examine the association between knowledge, intention, behavior, and the prevalence of anemia symptoms among adolescent girls in junior and senior high schools in Gowa Regency, South Sulawesi. Using a cross-sectional design with 242 participants, the research found that although 61.6% of respondents demonstrated low knowledge regarding anemia, knowledge was not significantly associated with the presence of anemia symptoms ($p = 0.057$). However, both intention and behavior were found to be significantly associated with symptom prevalence ($p = 0.001$ and $p = 0.014$, respectively), indicating that adolescents with strong preventive intentions and positive behavioral patterns were less likely to experience symptoms such as facial, eyelid, lip, and palmar

pallor. Specifically, only 43.7% of participants with good intention frequently reported pallor symptoms compared to 69% among those with poor intention. Likewise, 47.3% of adolescents with favorable behaviors showed symptom frequency compared to 65.8% among those with poor behaviors. These findings underscore the importance of moving beyond knowledge-based interventions toward strategies that foster meaningful behavior change and positive health intentions. Moreover, the study highlights the role of menstrual awareness, as students with strong intentions were more capable of accurately identifying their menstrual cycles, which may help in early symptom recognition. To mitigate the burden of anemia among adolescents particularly in low- and middle-income countries multisectoral collaboration is essential. Government agencies, educational institutions, NGOs, and international organizations must coordinate efforts to promote anemia education, ensure access to iron-rich foods, and distribute iron and folic acid (IFA) supplements. Future research should explore longitudinal and interventional approaches, incorporate objective health assessments such as hemoglobin testing, and investigate cultural, environmental, and psychosocial determinants of anemia-related behaviors. Furthermore, studies should examine the effectiveness of behavior-change frameworks and culturally tailored educational programs that enhance self-efficacy and translate knowledge into sustainable health actions among adolescent females.

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DATA AVAILABILITY

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTION

Muhammad Rachmat was responsible for conceptualizing the study, leading the overall project administration, supervising the data collection process, and drafting the original manuscript. Citrakesumasari contributed significantly to the development of the study design, particularly in the area of nutritional analysis, and provided critical revisions to the manuscript. Sitti Andriani Anwar played a key role in formulating the epidemiological framework, conducting statistical analysis, and interpreting the data. Yessi Kurniati contributed to the development and validation of the research

instruments, participated in data collection, and supported the revision of the manuscript. Nasrah provided oversight in the area of health promotion, contributed to the coordination of the study, and was actively involved in reviewing and editing the final version of the manuscript. All authors have read and approved the published version of the paper.

DECLARATIONS

ETHICAL APPROVAL

Ethical clearance for this study was obtained from the appropriate institutional ethics committee at Hasanuddin University. All participants provided informed consent prior to data collection, in accordance with ethical standards.

CONSENT FOR PUBLICATION PARTICIPANTS.

All participants in this study were informed about the purpose, procedures, and publication plans of the research. Written informed consent for participation and publication of anonymized data was obtained from each participant or their legal guardians (for those under 18 years old) prior to data collection.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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