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Understanding Gender Patterns in Knowledge, Attitudes, and Practices of Anemia Prevention Among Junior High School Students

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Abstract

Background: Anemia remains a prevalent nutritional problem among adolescents, influenced by rapid growth, dietary patterns, and in females menstrual blood loss. Understanding whether gender differences exist in anemia-related knowledge, attitudes, and preventive practices is essential for designing effective school-based interventions.
Objective: To describe and compare knowledge, attitudes, and preventive practices related to anemia among male and female junior high school students.
Methods: A descriptive comparative study was conducted among 134 junior high school students (grades 7–9) in West Bandung, Indonesia. Participants were selected through random selection within classes at a single school. Knowledge, attitudes, and preventive practices were assessed using structured questionnaires. Gender differences were analyzed using the Mann–Whitney U test due to non-normal data distribution.
Results: Female students demonstrated higher proportions in the high-knowledge category compared with males; however, the difference in knowledge scores between genders did not reach statistical significance ($p = 0.060$). No statistically significant gender differences were observed in attitudes ($p = 0.160$) or preventive practices ($p = 0.285$). Most students of both genders exhibited moderate attitudes and moderate anemia prevention practices.
Conclusion: No statistically significant gender differences were identified in knowledge, attitudes, or preventive practices related to anemia among junior high school students. Although female students tended to show higher knowledge levels, this pattern represents a non-significant trend rather than a confirmed difference. These findings suggest that anemia prevention programs should target both male and female adolescents equally, with emphasis on translating knowledge into consistent preventive behaviors through comprehensive school-based interventions.

Keywords: anemia prevention; adolescents; gender differences; knowledge attitude practice; school health

INTRODUCTION

Anemia is one of the most common nutritional disorders globally, disproportionately affecting adolescents due to increased nutritional demands during rapid growth, poor dietary habits, and, particularly for females, menstrual blood loss. The adolescent period is characterized by accelerated physical, psychological, and cognitive development, requiring adequate nutritional support, particularly micronutrients such as iron. However, current trends among

adolescents show poor dietary behaviors, including frequent consumption of fast food, low intake of vegetables and fruits, and insufficient iron consumption, which directly contribute to iron-deficiency anemia (1,2).

Several studies conducted in both Indonesia and internationally have highlighted the role of poor dietary patterns as a critical determinant of anemia prevalence among adolescents (3). Adolescents frequently consume highly processed, low-nutrient food items that lack essential micronutrients, including iron. According to Syah (4), adolescents in urban settings have shown a marked preference for Western-style fast foods, which are calorie-dense but nutritionally poor, especially in terms of iron content. Similarly, (5) reported that adolescent students in several Indonesian provinces showed low intake of iron-rich foods such as meat, legumes, and green leafy vegetables, indicating a systemic gap in nutrition education and access.

Furthermore, adolescent females face a heightened risk of anemia compared to their male counterparts due to regular menstrual cycles. Menstruation results in monthly blood loss, which increases iron requirements and exacerbates existing deficiencies if dietary intake is insufficient. Despite this gender-based biological risk, adolescent males are not exempt from anemia, particularly when compounded by poor dietary practices and lack of health awareness.

The 2023 Indonesian Health Survey revealed that 15.5% of individuals aged 15–24 years experience anemia, with a higher proportion in females compared to males. This trend is consistent with previous national health data. The Riskesdas survey from 2007 to 2018 indicated a steady increase in anemia prevalence among the 15–24 age group, raising public health concerns regarding the nutritional well-being of the country's youth. If left unaddressed, adolescent anemia can have far-reaching consequences, including impaired concentration, reduced academic achievement, suboptimal physical growth, and increased risk during pregnancy (6).

Adolescents with anemia are more likely to experience cognitive fatigue, poor memory retention, and reduced learning capacity, which may contribute to poor educational outcomes. Moreover, long-term iron deficiency can affect immune function and physical endurance, further limiting adolescents' potential. In females, untreated anemia may pose serious risks during pregnancy, including premature birth and low birth weight in future offspring.

One of the primary strategies to combat adolescent anemia is prevention through knowledge, behavior change, and improved attitudes towards nutrition and health. Knowledge of food sources rich in iron, the importance of balanced diets, and recognition of early symptoms of anemia is crucial in enabling adolescents to make informed health decisions. However, many adolescents lack adequate knowledge of anemia, its causes, and prevention strategies. This limited awareness leads to poor dietary choices, low motivation for iron supplementation, and limited utilization of health services (7).

Health behavior theories suggest that increased awareness and positive attitudes toward healthy eating can translate into preventive behaviors. Attitudes, subjective norms, and perceived behavioral control play an important role in shaping health practices. Therefore, promoting nutritional education and healthy behavior from early adolescence can foster iron-rich eating habits and minimize the incidence of anemia (8).

Despite the growing body of research on adolescent anemia, there remains a significant research gap, especially concerning the comparative analysis of knowledge, attitudes, and preventive practices between male and female adolescents. Most existing studies have primarily focused on adolescent females due to their higher biological vulnerability. However, to design effective school- and community-based interventions, it is essential to understand gender-based differences in anemia-related knowledge and behavior. Such understanding will facilitate the development of gender-responsive health education programs that address the unique needs of both adolescent males and females (9).

Given the serious implications of anemia during adolescence and the rising prevalence in Indonesia, further research is needed to explore the disparities in knowledge, attitude, and preventive practices between genders. A deeper understanding of these factors will support public health authorities in crafting targeted intervention programs, nutritional campaigns, and school-based health education strategies aimed at reducing adolescent anemia prevalence and improving long-term health outcomes. This study aimed to describe levels of knowledge,

attitudes, and preventive practices related to anemia and to examine whether statistically significant differences exist between male and female junior high school students (10,11).

METHODS

Study Design

A quantitative descriptive comparative design was used. The study investigated three main variables: knowledge, attitudes, and preventive practices related to anemia among adolescents.

Participants and Sampling

The study was conducted in one junior high school in West Bandung. Students from grades 7–9 who met the inclusion criteria were eligible. Participants were randomly selected within classrooms using a digital randomization tool. Although random selection was applied, the study represents a single-site sample and does not constitute cluster sampling for inferential purposes.

Sample size was calculated using G*Power; however, because the primary analysis compared two independent groups, the calculation should be interpreted as estimating adequacy for group comparison rather than correlation testing. This limitation is acknowledged. The sample size was calculated using G*Power Software Version 3.1.9.4 with a correlation (ρ) of 0.29, significance level (α) of 0.05, and a power of 0.95, yielding a minimum required sample size of 134 respondents. The sample was evenly distributed between 67 male and 67 female adolescents. To determine the selected respondents, a digital randomization tool (Spinner application) was used in each classroom. The inclusion criteria included: (1) being an active student; and (2) not having any history of hematologic disorders.

Measures

Knowledge was assessed using the Questionnaire (Putri, 2019), which comprises 20 dichotomous (true/false) items covering six indicators: definition, signs and symptoms, causes, consequences, prevention methods, and treatment of anemia. The instrument was previously validated and tested for reliability, with a Cronbach's Alpha score of 0.735, indicating acceptable internal consistency.

Attitudes were measured using the Questionnaire (12), consisting of 10 items across four indicators: willingness to prevent anemia, consumption of fast food, anemia prevention strategies, and attitudes towards anemia management. The questionnaire was validated and found to be highly reliable with a Cronbach's Alpha of 0.979.

Preventive Practices were measured using the Questionnaire, which includes 15 items across three indicators: primary prevention, secondary prevention, and tertiary prevention of anemia. The instrument demonstrated good reliability with a Cronbach's Alpha of 0.861.

Data analysis

Descriptive statistics were used to illustrate the characteristics of each variable, including minimum and maximum values, frequency distributions, mean scores, and standard deviations (±SD). To assess gender-based differences in knowledge, attitudes, and preventive practices, the Mann-Whitney U test was employed due to the non-normal distribution of the data.

Ethical considerations

Ethical clearance was obtained from the Health Research Ethics Committee of STIKep PPNI Jawa Barat. Participants were recruited from grades 7, 8, and 9 who met the inclusion criteria. To ensure balanced gender representation, an equal number of male and female students was selected. After identifying eligible students within each classroom, simple random sampling was conducted using a digital randomization tool (Spinner application) to select the final participants.

RESULTS

This study was conducted in January 2024 at a junior high school in West Bandung, Indonesia. Participants had a mean age of 15 years, ranging from 12 to 16 years. Female students demonstrated a higher proportion of high anemia-related knowledge (61.2%) compared with male students (32.8%), whereas male students were more frequently categorized in the low and moderate knowledge groups. Attitudes toward anemia prevention were generally moderate across genders, observed in 94.0% of male students and 98.5% of female students. Likewise, most participants reported moderate anemia prevention practices, including 74.6% of male students and 79.1% of female students. These findings indicate gender-based differences in knowledge levels, while attitudes and preventive practices were largely comparable between male and female students.

Table 1. The levels of knowledge, attitude and practice to prevent anemia

Variable	Knowledge	Attitude	Practice
Males			
Low	35 (52.2%)	2 (3.0%)	10 (14.9%)
Moderate	10 (14.9%)	63 (94.0%)	50 (74.6%)
High	22 (32.8%)	2 (3.0%)	7 (10.4%)
Females			
Low	11 (16.4%)	0 (0%)	7 (10.4%)
Moderate	15 (22.4%)	66 (98.5%)	53 (79.1%)
High	41 (61.2%)	1 (1.5%)	7 (10.4%)

Table 2. the differences knowledge, attitude and practice to prevent anemia between adolescent female and male

	Knowledge	Attitude	Practice
Asymp. Sig (2-tailed)	0.060	0.160	0.285

Female students showed a higher proportion of high knowledge levels compared with males. However, the difference in knowledge scores did not reach statistical significance (p = 0.060). No statistically significant differences were found between genders in attitudes (p = 0.160) or preventive practices (p = 0.285) (Table 2).

DISCUSSION

This study examined gender differences in knowledge, attitudes, and preventive practices related to anemia among junior high school students. Overall, no statistically significant differences were identified between male and female students across all three domains. Although female students demonstrated a higher proportion of high knowledge levels, this difference did not reach statistical significance and should therefore be interpreted as a non-significant trend rather than a confirmed gender gap.

The observed tendency toward higher knowledge among female students is consistent with findings from previous studies reporting greater anemia-related awareness among adolescent females, often attributed to biological vulnerability associated with menstruation and targeted health education (13–15). Regular menstrual blood loss increases iron requirements, rendering adolescent females more susceptible to iron deficiency anemia. National data from Indonesia similarly indicate a higher prevalence of anemia among females aged 15–24 years compared with males.

This epidemiological pattern has informed the prioritization of adolescent females in many school- and community-based anemia prevention programs. As a result, females are often more frequently exposed to information related to menstruation, nutrition, and iron supplementation. However, as demonstrated in the present study, higher female exposure and awareness do not necessarily translate into statistically significant differences in knowledge scores when compared with male students. Similar inconsistencies have been reported in other adolescent health studies conducted in school settings (16). From a behavioral perspective, these findings can be interpreted using the Health Belief Model, which suggests that perceived susceptibility and perceived severity influence motivation to seek information and adopt preventive behaviors (17). Female adolescents may perceive themselves to be at higher risk due to menstruation, potentially increasing their engagement with anemia-related information. Nevertheless, because the observed differences in knowledge were not statistically significant, these interpretations should be viewed as contextual explanations rather than causal conclusions (18).

In contrast to knowledge, attitudes toward anemia prevention did not differ significantly between male and female adolescents. The

majority of students in both groups demonstrated moderate attitudes toward anemia prevention. This finding suggests that adolescents' attitudes may be shaped more strongly by shared educational, social, and environmental influences than by gender-specific factors. School-based health education programs typically provide standardized messages to all students, emphasizing the health, academic, and physical consequences of anemia. Educational institutions play a central role in shaping adolescent health attitudes by delivering structured and repeated health messages (19). Moreover, adolescents commonly associate good nutritional status with improved academic performance and physical stamina, reinforcing similar value systems across genders (20). Peer interactions, family guidance, and media exposure may further contribute to the development of collective norms regarding anemia prevention. Adolescents frequently exchange information and experiences with peers, which can reinforce shared attitudes toward health regardless of gender. In addition, public health campaigns related to anemia prevention often use inclusive messaging targeting adolescents broadly, which may reduce gender-based differences in attitudinal outcomes.

Preventive practices related to anemia were also comparable between male and female adolescents, with no statistically significant differences observed. Most students reported moderate levels of preventive behavior. This finding indicates that gender alone does not appear to be a primary determinant of anemia prevention practices among adolescents. Despite the tendency for female students to demonstrate higher knowledge levels, this did not translate into superior preventive practices. This finding supports previous evidence indicating that knowledge and attitudes do not automatically result in consistent health behaviors. Behavioral science literature emphasizes that the translation of knowledge into practice is influenced by multiple interacting factors, including motivation, access to resources, habitual behaviors, and socioeconomic constraints (21).

Both male and female adolescents face shared barriers to effective anemia prevention, such as limited access to iron-rich foods, inconsistent availability or affordability of iron supplements, and strong preferences for fast food. These challenges are particularly relevant in low- to middle-income settings and have been widely reported in adolescent nutrition studies (. Additionally, while schools may provide theoretical knowledge through health education curricula, they often lack structured behavior change components such as skill-building, goal setting, or habit reinforcement. The similarity in preventive practices across genders underscores the need to move beyond information-based interventions toward structural and behavioral strategies that support sustained dietary and supplementation behaviors among adolescents.

Implications

School-based anemia prevention programs should prioritize interventions that facilitate behavior change, including routine anemia screening, iron supplementation, and improved access to iron-rich foods for all students. Integrating these strategies within the School Health Program (UKS) and strengthening collaboration with families and communities may enhance the translation of knowledge into sustained preventive practices among adolescents of both gender.

Strengths and limitations

This study benefits from balanced inclusion of male and female students and the use of standardized instruments to assess knowledge, attitudes, and practices. However, several limitations should be considered. First, the study was conducted in a single school, which may limit the generalizability of the findings. Second, the cross-sectional design precludes causal inference. Third, preventive practices were self-reported and may be subject to recall or social desirability bias. Finally, the absence of biological measures such as hemoglobin levels limits the ability to directly link reported behaviors with anemia status. Future research should employ multi-site and longitudinal designs and incorporate biological indicators to better elucidate the relationships between knowledge, attitudes, practices, and anemia outcomes among adolescents.

CONCLUSION

This study found no statistically significant gender differences in knowledge, attitudes, or preventive practices related to anemia among junior high school students. Although female students demonstrated a non-significant trend toward higher knowledge, both male and female adolescents exhibited comparable attitudes and

moderate preventive practices. These findings suggest that anemia prevention among adolescents should adopt a gender-inclusive approach, with greater emphasis on addressing behavioral, environmental, and structural barriers that limit the translation of knowledge into sustained preventive action. Anemia prevention programs should prioritize strategies that bridge the gap between knowledge and behavior, including school-based iron supplementation, practical nutrition education, and improved access to iron-rich foods. Interventions should actively involve both male and female students and engage families and communities to reinforce healthy dietary habits. Routine anemia screening within the School Health Program (UKS) should include male students to increase awareness and promote early prevention across genders.

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Author Contributions
SRN: Conceptualization, study design, data collection, data analysis, interpretation of results, and manuscript drafting.
BP: Study supervision, methodology review, statistical analysis guidance, critical manuscript revision, and final approval.

Conflict of Interest
The authors declare no conflict of interest related to this study.

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

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