

Original Research Article

Assessment of knowledge, attitude and practices regarding iron deficiency anemia among adolescent girls in urban Prayagraj, Uttar Pradesh: a cross-sectional study

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ABSTRACT

Background: Iron deficiency anemia remains a major public health problem among adolescent girls, particularly in developing countries. Adequate knowledge, positive attitudes, and healthy dietary practices are necessary for the prevention and control of anemia among adolescent girls. Objective was to assess the Oes (KAP) regarding iron deficiency anemia among adolescent girls and to determine the association between KAP scores and selected demographic variables.

Methods: A cross-sectional study was conducted among 200 adolescent girls aged 10-19 years using a structured pre-tested questionnaire. Data was collected to assess knowledge, attitude, and practices related to iron deficiency anemia. Descriptive statistics were used to summarize the data, and the chi-square test was then applied to determine the association between variables. A $p < 0.05$ was considered statistically significant association.

Results: The findings revealed that the majority of respondents had good knowledge regarding anemia, while attitude and practices varied among participants. Demographic variables such as age, education level, and family type showed varying levels of association with KAP scores. A significant association was found between knowledge and attitude ($\chi^2=23.15$, $p < 0.001$) and between attitude and practice ($\chi^2=16.56$, $p=0.002$). However, no significant association was found between knowledge and practice ($\chi^2=0.55$, $p=0.968$).

Conclusions: Although awareness regarding anemia was quite high among adolescent girls, several gaps were observed in practice measures. Health education programs focused on nutrition, iron-rich diets, and regular health screening are recommended to improve preventive practices and reduce the burden of anemia among adolescent girls.

Keywords: Adolescent girls, Anemia, Hemoglobin, KAP study

INTRODUCTION

Iron deficiency anemia is the most widespread nutritional deficiency globally, which mainly affects the women, adolescents and children in developing nations.¹

Anemia is a blood related condition characterized by a drop in hemoglobin concentration below the age and gender-specific reference range, which impairs the delivery of oxygen to peripheral tissues. Although there

are also other causes for anemia, but iron deficiency anemia is the most common type.² Globally, about 40% of children between the ages of 6 and 59 months, 37% of pregnant women, and 30% of women between the ages of 15 and 49 are affected worldwide.³

India is home to 253 million adolescents between 10-19 years of age.⁴ The National Family Health Survey (NFHS) is a multi-round, extensive survey that is administered to a representative sample of Indian

families. The study collected data on fertility, infant and child mortality, family planning practices, maternal and child health, reproductive health along with nutrition, and anemia at the state and national levels. In India, anemia affects 59.1% of Indian teenage females between the ages of 15 and 19.5

Iron deficiency anemia is caused mainly due to inadequate reserves at birth and aggravation of precarious conditions through-out by poor dietary intake, hookworm infestations, the dietary habits of rice consumption as staple which has high phytate contents, intake of coffee and tea with food which has tannin, which is hinder iron absorption in body, menstruation, malaria and other infections.⁶

Anemia is a significant issue for Indian teenage girls because of their heightened susceptibility brought on by higher nutritional requirements, rapid physical growth, menstrual blood loss, inadequate nutrition, and socioeconomic inequalities.⁷ Despite ongoing national programs such as the weekly iron and folic acid supplementation (WIFS) and the Anemia Mukht Bharat initiative, anemia remains a persistent nutritional challenge in India its long-term impacts on health, cognitive development and reproductive outcomes makes it a critical public health priority.⁸

KAP framework is useful perspective for analyzing health-related behaviors in the Knowledge, Attitude, and Practice (KAP) structure.⁹ These days, cross-sectional studies for public health research frequently employ the KAP framework.¹⁰ According to KAP model, nutrition knowledge may have a direct impact on nutritional labelling practice in addition to having a positive and indirect impact through attitude change.¹¹ In recent research of school-age adolescent girls in urban Uttar Pradesh, the prevalence of anemia was 95.02% which is extremely high.¹² Hence study aimed to assess the knowledge, evaluate the attitude, and assess preventive practices related to iron deficiency anemia in adolescent girls, targets adolescents of 10-19 years age groups. The study also aims to determine the association between socio- demographic factors and KAP scores in Prayagraj.

METHODS

Study design and selection of respondents

A school based cross-sectional study was conducted in the Naini, an urban area of Prayagraj district, Uttar Pradesh over a period of three months from January 2024 to March 2024. The study aimed to assess the knowledge, attitude and practices related to anemia. The total sample size was 200. Four schools were selected for convenience sampling. From each school 50 adolescent girls aged 10-19 years were selected using simple random sampling among those who consented to participate. Girls suffering from any chronic illness and unwilling to participate were excluded from the study.

Study tool

Data was collected through a pre-tested structured questionnaire for interview schedule developed after reviewing relevant literature and similar KAP studies. The questions were administered in both English and Hindi to ensure better understanding among adolescents. The questionnaire consisted of four sections: socio demographic details, knowledge (8 questions), attitude (8 questions) and practice (6 questions). The anthropometric measurements including height and weight were recorded using standard procedures.

Consent

Consent was taken from subjects under study.

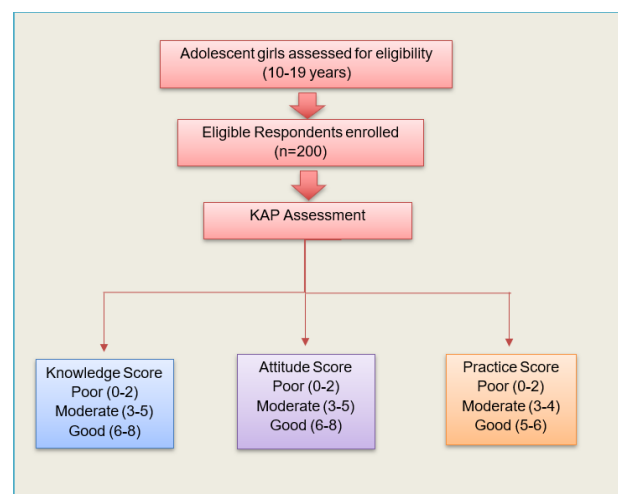


Figure 1: Presentation of study flow.

Data analysis

The collected data was coded and analyzed using descriptive statistical methods such as frequency with percentage for categorical variables and mean±standard deviation. Chi-square test was used to assess associations between categorical variables by using the statistical package for social sciences (IBM SPSS version 22.0). A p value <0.05 was considered statistically significant.

RESULTS

In our study, 200 participants were included. The mean age of the study population was 15.28±1.21 years. The mean height was 144.24±6.76 cm and the mean weight was 35.11±6.1 kg. Among all participants mostly were aged 14-16 years (40%) followed by 17-19 years (35%) and 10-13 years (25%). In the caste distribution, the majority of participants (65%) belonged to the other backward classes (OBC) category. Participants from the general category were 24% while 11% belonged to the SC/ST category. In terms of educational status, it was categorized into group where 46% of participants were classified under lower-level education (primary and

secondary), whereas 54% are from under higher level education (high school and intermediate). A significant majority (61%) of participants belonged to joint families, while 39% were from nuclear families. The socio-economic status assessed through BG Prasad socio economic scale 2025, where 58% of respondents were from upper middle class, followed by 48% respondents are from lower middle class, 46% respondents were from middle class, 26% respondents were from lower class and 22% percent respondents were from upper class (Table 1).¹³

Table 1: Socio demographic characteristics of respondents.

Variables	Category	Frequency (n=200)	%
Age (years)	10-13 years	50	25
	14-16 years	80	40
	17-19 years	70	35
Caste	General	48	24
	OBC	130	65
	SC/ST	22	11
Education level	Lower education (primary+ secondary)	92	46
	Higher education (high school + intermediate)	108	54
Family type	Joint Family	122	61
	Nuclear family	78	39
Socio-economic status	Class 1 (upper)	22	11
	Class 2 (upper middle)	58	29
	Class 3 (middle)	46	23
	Class 4 (lower middle)	48	24
	Class 5 (lower)	26	13

Table 2 shows mean age of respondents was 15.28±1.21 years, mean height of respondents is 144.24±6.76 cm and mean weight is 35.11±6.1 kg. This shows that respondents were underweight.

Table 2: Descriptive statistics of study sample.

Characteristics	Mean±SD
Age (years)	15.28±1.21
Height (cm)	144.24±6.76
Weight (Kg)	35.11±6.1

Most respondents reported having heard about anemia and correctly identified anemia as a condition characterized by decreased red blood cells. Respondents were able to recognize nutrient deficiency and menstrual blood loss as major cause of anemia. Most of respondents were aware with symptoms and harmful effects of

anemia, however knowledge regarding personal hemoglobin status and normal range of hemoglobin in females were comparatively low (Table 3).

Table 3: Knowledge regarding questions related to anemia (n=200).

Knowledge regarding questions	N (%)
Heard about anemia	
Yes	184 (92)
No	16 (8)
What is anemia	
Increased red blood cells	16 (8)
Decreased red blood cells	162 (81)
Don't know	22 (11)
Causing factors of anemia	
Nutrient deficiency	78 (39)
Blood loss during menstruation	62 (31)
Worm infestation	44 (22)
Don't know	16 (8)
Identify the symptoms of anemia	
Fatigue	62 (31)
Difficult concentration	32 (16)
Loss of appetite	50 (25)
Pale skin	34 (17)
Don't know	22 (11)
Harmful effects of anemia	
Impact growth and development	44 (22)
Decreased learning ability	62 (31)
Shortness of breath and dizziness	74 (37)
Don't know	20 (10)
Know about your hemoglobin level	
Yes	94 (47)
No	106 (53)
Normal range of hemoglobin in females	
12.0-16.0 gm/dl	94 (47)
8.0-11.0 gm/dl	74 (37)
Don't know	32 (16)
Treatment of anemia	
IFA tablets	66 (33)
Vitamin C tablets	46 (23)
Blood transfusion	44 (22)
Nutritious diet	44 (22)

The attitude toward anemia of respondents was positive where most of the respondent's perceived anemia as a public health concern and believed that it could be prevented through nutritional changes. Majority of respondents agree that regular medical checkups are important and vitamin C enhanced the iron absorption. Positive attitude observed regarding benefits of iron rich food preparation. Respondents have poor attitude toward tea/coffee consumption affects iron absorption (Table 4).

Table 4: Attitude-based questions related to anemia (n=200).

Attitude-based question and responses	N (%)
Anemia is a public health problem	
Likely	140 (70)
Not likely	60 (30)
Think you are to be anemic	
Likely	108 (54)
Not likely	92 (46)
Anemia is preventable with nutritional changes	
Likely	164 (82)
Not likely	36 (18)
Regular medical checkups are important	
Likely	192 (96)
Not likely	8 (4)
Vitamin C enhances iron absorption	
Likely	40 (20)
Not likely	160 (80)
Cook/prepare meals with iron-rich food	
Likely	162 (81)
Not likely	38 (19)
Benefit to prepare meals with iron-rich food	
Beneficial	184 (92)
Not beneficial	16 (8)
Tea/coffee affects iron absorption	
Serious	88 (44)
Not serious	112 (56)

Table 5: Health practice regarding questions related to anemia (n=200).

Practice-based question	N (%)
Eat iron-rich food on a daily basis	
Yes	108 (54)
No	92 (46)
Skip meals frequently	
Yes	82 (41)
No	118 (59)
Observed any symptoms of anemia in the last few months	
Yes	72 (36)
No	124 (64)
Seek medical attention if suspected symptoms of anemia	
Yes	44 (22)
No	156 (78)
Checked your hemoglobin level in the last 6 months	
Yes	20 (10)
No	180 (90)
Taken deworming tablets in the last 6 months?	
Yes	68 (34)
No	132 (66)

Despite relatively good knowledge and favorable attitudes, preventive practices were suboptimal. A less

proportion of respondents reported regular daily consumption of iron rich foods, considerable number are respondents skips meals frequently. Very small percentage of respondents had tested their hemoglobin in previous six months and only 34% of respondents had taken deworming tablets regularly in past 6 months. A small percentage of respondents were reported to seeking medical attention if symptoms occurred, but overall preventive practices were inadequate regarding anemia (Table 5).

Most respondents reported having heard about anemia and correctly identified anemia as a condition characterized by decreased red blood cells. Respondents were able to recognize nutrient deficiency and menstrual blood loss as major cause of anemia. Most of respondents were aware with symptoms and harmful effects of anemia, however knowledge regarding personal hemoglobin status and normal range of hemoglobin in females were comparatively low. The attitude toward anemia of respondents is positive where most of the respondent's perceived anemia as a public health concern and believed that it could be prevented through nutritional changes. Majority of respondents agreed that regular medical checkups are important and vitamin C enhanced the iron absorption. Positive attitude observed regarding benefits of iron rich food preparation. Respondents had poor attitude toward tea/coffee consumption affects iron absorption. Despite relatively good knowledge and favorable attitudes, preventive practices were suboptimal. A less proportion of respondents reported regular daily consumption of iron rich foods, considerable number are respondents skips meals frequently. Very small percentage of respondents had tested their hemoglobin in previous six months and only 34% of respondents had taken deworming tablets regularly in past 6 months. A small percentage of respondents were reported to seeking medical attention if symptoms occurred, but overall preventive practices were inadequate regarding anemia.

The statistical tests show knowledge scores increase with age with significant association ($\chi^2=25.97$, $p<0.001$). Attitude scores showed a borderline association with age ($\chi^2=9.456$, $p=0.051$). Practice scores varied significantly across age groups ($\chi^2=14.319$, $p=0.006$) with better practices observed among respondents aged 17-19 years (Table 6).

Table 7 depicts the distribution of KAP scores and education category. Education level showed a significant association with knowledge regarding anemia ($\chi^2=10.948$, $p=0.004$), with higher knowledge observed among respondents with higher education. Attitude was also significantly associated with education level ($\chi^2=17.336$, $p<0.001$). Practice scores were significant associated with education level ($\chi^2=17.336$, $df=2$, $p<0.001$), this shows the higher education was linked to better knowledge, attitudes and practices regarding anemia.

Table 6: Association between age group and KAP scores.

Age group (years)	Poor N (%)	Moderate N (%)	Good N (%)	Total (n)	χ^2	P value
Knowledge score					25.978	0.000
10-13	8 (16.0)	6 (12.0)	36 (72.0)	50		
14-16	0	10 (12.5)	70 (87.5)	80		
17-19	0	6 (8.6)	64 (91.4)	70		
Attitude score					9.456	0.051
10-13	0	22 (44.0)	28 (56.0)	50		
14-16	4 (5.0)	22 (27.5)	54 (67.5)	80		
17-19	0	22 (31.4)	48 (68.6)	70		
Practice score					14.319	0.006
10-13	42 (84.0)	8 (16.0)	0	50		
14-16	68 (85.0)	10 (12.5)	2 (2.5)	80		
17-19	46 (65.7)	24 (34.3)	0	70		

Table 7: Association between education level and KAP scores.

Education level	Poor N (%)	Moderate N (%)	Good N (%)	Total (n)	χ^2	P value
Knowledge score					10.948	0.004
High class education	8 (8.7)	12 (13.0)	72 (78.3)	92		
Low class education	0	10 (9.3)	98 (90.7)	108		
Attitude Score					17.336	<0.001
High class education	0	34 (37.0)	58 (63.0)	92		
Low class education	4 (3.7)	32 (29.6)	72 (66.7)	108		
Practice Score					17.336	<0.001
High class education	82 (89.1)	8 (8.7)	2 (2.2)	92		
Low class education	74 (68.5)	34 (31.5)	0	108		

Table 8: Association between caste and KAP scores.

Caste	Poor N (%)	Moderate N (%)	Good N (%)	Total	χ^2	P value
Knowledge score					6.26	0.181
General	0	8 (16.7)	40 (83.3)	48		
OBC	8 (6.2)	12 (9.2)	110 (84.6)	130		
SC/ST	0	2 (9.1)	20 (90.9)	22		
Attitude score					17.45	0.002
General	4 (8.3)	12 (25.0)	32 (66.7)	48		
OBC	0	50 (38.5)	80 (61.5)	130		
SC/ST	0	4 (18.2)	18 (81.8)	22		
Practice score					3.51	0.477
General	34 (70.8)	14 (29.2)	0	48		
OBC	104 (80.0)	24 (18.5)	2 (1.5)	130		
SC/ST	18 (81.8)	4 (18.2)	0	22		

Table 8 illustrates the distribution of KAP scores and caste category. The association between caste and respondents' knowledge, attitude, and practice regarding anemia was analyzed. The association between caste and knowledge score was not statistically significant ($\chi^2=6.26$, $p=0.181$), indicating that knowledge levels were similar across caste groups. Attitude scores, however, showed a significant association with caste ($\chi^2=17.45$, $p=0.002$), indicating the attitude towards anemia varied across caste categories. Practice scores did not differ significantly by caste ($\chi^2=3.51$, $p=0.477$) indicating the preventing

practices are poor among all groups while good practices were very low these results suggested that caste did not strongly influence knowledge or practice but attitude towards anemia varied significantly among different caste.

Table 9 depicts the distribution of KAP scores and Family type category. The association between family type and respondents' knowledge, attitude, and practice regarding anemia was assessed among respondents. Knowledge scores showed a significant association with family type

($\chi^2=7.001$, $p=0.030$), higher knowledge observed among respondents from joint families (90.2%) compared to nuclear families (76.9%). Attitude was also significantly associated with family type ($\chi^2=7.296$, $p=0.026$), as a higher proportion of respondents from joint families (68.9%) demonstrated a high attitude score compared to

those from nuclear families (59.0%). However, practice scores are not significant association with family type ($\chi^2=1.329$, $p=0.514$). Poor practice was common in both joint (77.0%) and nuclear families (79.5%), indicating that family type did not significantly influence preventive practices related to anemia.

Table 9: Association between family type and KAP scores.

Family type	Poor N (%)	Moderate N (%)	Good N (%)	Total (n)	χ^2	P value
Knowledge score					7.001	0.030
Joint family	4 (3.3)	8 (6.6)	110 (90.2)	122		
Nuclear family	4 (5.1)	14 (17.9)	60 (76.9)	78		
Attitude score					7.296	0.026
Joint family	0	38 (31.1)	84 (68.9)	122		
Nuclear family	4 (5.1)	28 (35.9)	46 (59.0)	78		
Practice score					1.329	0.514
Joint family	94 (77.0)	26 (21.3)	2 (1.6)	122		
Nuclear family	62 (79.5)	16 (20.5)	0	78		

A statistically significant association was observed between knowledge and attitude scores ($\chi^2=23.1$, $p<0.001$), indicating that higher knowledge levels were associated with more favorable attitude towards anemia. However, knowledge was not significantly associated with practice ($\chi^2=0.55$, $p=0.968$). A significant association was observed between attitude and practice ($\chi^2=16.56$, $p=0.002$), suggesting that positive attitudes were related to better preventive practices, although overall practice level remained low (Table 10).

Table 10: Association between knowledge, attitude and practices.

Variables	χ^2	P value
Knowledge versus attitude	23.15	<0.001*
Knowledge versus practice	0.55	0.968
Attitude versus practice	16.56	0.002*

*Significantly associated

DISCUSSION

Iron deficiency anemia remains a major public health concern among adolescent girls in India. The present study assessed the knowledge, attitude, and practices regarding iron deficiency anemia among adolescent girls and examined their association with socio demographic variables residing in an urban area of Prayagraj.

In the present study, the majority of respondents had heard about anemia and possessed a moderate level of knowledge regarding its causes, symptoms, and prevention. It was also found that knowledge regarding hemoglobin levels and normal hemoglobin range was limited among respondents. The findings in our study showed that 92% of respondents had heard about anemia, which indicates a relatively high level of awareness among participants. Similar study was done by at IGIMS,

Patna where 92% of adolescent girls had heard about anemia and shows good knowledge towards causes symptoms and preventions regarding anemia.¹⁴ In our study 81% respondents correctly identified what is anemia, which was like a study done by in north Gujarat where 79% of respondents were aware that anemia is a medical condition with decreased RBCs or hemoglobin and had a good knowledge about the condition of anemia.¹⁵

The respondents identified that nutritional deficiency and menstrual blood loss can be the major causes of anemia. However, knowledge regarding other causes such as worm infestation and poor iron absorption was comparatively lower. The attitude of respondents towards anemia prevention that 70% of respondents were found anemia to be a public health problem while 82% were knew that it can be prevented through nutritional changes. 96% of the total respondents were understood the importance of regular medical checkups but only 22% reported seeking medical attention when anemia symptoms were suspected, while a majority (78%) did not seek care.

Anemia is a hematological health problem which is assessed through the level of hemoglobin in blood and 81% respondents were aware that anemia is the condition of decreased RBCs still 90% of participants had not checked their hemoglobin levels in the past six months. The studies done in past years found that only 3-4% of respondents checked hemoglobin in past years, which was found 10% comparatively higher in our study.^{16,17}

Tea and coffee had tannin which hinders the iron absorption in the body but only 44% of the respondents in our study were aware that tea/coffee affect the iron absorption which is correlated to the study conducted in Devangere city, Karnataka where 43% respondents answered that the tea coffee inhibit iron absorption in

body. However, despite relatively good knowledge and positive attitudes, preventive practices among respondents were inadequate.¹⁸

The food rich in Iron helps to prevent Iron Deficiency Anemia by supporting hemoglobin formation and promotes red blood cell production 54% of respondents reported consuming iron-rich foods regularly, 81% respondents had willing to prepare meals with iron-rich foods and 92% respondents were aware about the benefits of iron rich meal preparation that helps in iron deficiency which is higher than the studies conducted in previous years.^{2,19} It reported that 64.76% and 60.7% of girls, respectively, agreed that iron-rich food is beneficial for iron deficiency anemia, while 49.48% and 59% were confident in preparing iron-rich food.

Worm infestation could be the cause of iron deficiency anemia where majority of respondents did not consume deworming tablets, only 34% respondents had taken the deworming tablets in the last six months which was similar to study done in Moradabad where only 29% adolescent girls had taken deworming tablets in past 6 months.¹⁷

There was a significant association with knowledge score ($\chi^2=25.978$, $p<0.001$) and practice score ($\chi^2=14.319$, $p=0.006$), which indicates that older adolescents had better knowledge and preventive practices related to anemia. Education level was also significantly associated with knowledge score ($\chi^2=10.948$, $p=0.004$) and attitude score ($\chi^2=17.336$, $p<0.001$), suggesting that higher educational level will improve awareness and perceptions regarding anemia. Family type variable showed a significant association with knowledge ($\chi^2=7.001$, $p=0.030$) and attitude score ($\chi^2=7.296$, $p=0.026$), whereas caste did not show a significant association with knowledge or practices which is correlated to the study where the significant association was found to knowledge with the demographic variables like age ($\chi^2=16.833$, $p=0.032$) and class ($\chi^2=20.866$, $p=0.008$).²⁰

The knowledge and practice scores were not significantly associated, which indicates that knowledge alone may not necessarily translate into improved health behaviors unless it is accompanied by positive attitudes and behavioral motivation.

Overall, the study shows that although adolescent girls have a basic awareness about iron deficiency anemia, major gaps have still existed in detailed knowledge and actual practices such as regular intake of iron-rich foods and deworming tablets. Many respondents understood the importance of prevention but were not consistently following healthy behaviors and preventive practices. Therefore, there is a need for effective health education programs focusing on improving dietary habits, promoting iron supplementation, encouraging deworming practices, and ensuring regular health check-ups to better prevent anemia among adolescents.

The study was conducted on a small sample size ($n=200$) and only in an urban area of Prayagraj, so the results may not apply to all populations. The study was cross-sectional, so it cannot show cause and effect. The data was self-reported, so there may be chances of recalling and reporting errors. Also, hemoglobin testing was not done, which could have given more accurate results regarding hemoglobin levels for prevalence rate of anemia in the selected area.

CONCLUSION

The present study assessed the knowledge, attitude and practices regarding iron deficiency anemia among adolescent girls residing in an urban area of Prayagraj, Uttar Pradesh. The findings of the study revealed that a majority of respondents had heard about anemia, indicating a relatively good level of general awareness. The study also found that the majority of respondents had a positive attitude toward anemia prevention. Most participants believed that anemia is a public health problem and agreed that it can be prevented through proper nutrition and regular medical check-ups. However, despite adequate awareness and favorable attitudes, preventive practices were found to be inadequate among many respondents. A large proportion of participants reported skipping meals, and only a small percentage had checked their hemoglobin levels in past 6 months. Similarly, only a limited number of respondents reported taking deworming tablets or seeking medical attention when symptoms of anemia were suspected. The study also demonstrated significant associations between certain socio-demographic variables and knowledge and attitude scores. Age, education level and family type were found to be significantly associated with knowledge and attitude regarding anemia. Overall, the findings suggest that although awareness about anemia exists among adolescent girls, there remains a gap between knowledge and actual preventive practices. Therefore, efforts should be made to improve health education and encourage appropriate health behaviors to reduce the burden of anemia among adolescent girls.

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