

Original Research Article

Nutritional assessment and prevalence of anaemia in adolescents

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ABSTRACT

Background: Anaemia is a major public health problem especially in adolescents due to increased nutritional requirements, rapid growth, menstrual blood loss, poor dietary practices and limited awareness. In this study anaemia was classified according to the WHO age and sex specific haemoglobin cut-offs. The study aimed to evaluate knowledge, dietary practices and haemoglobin status among adolescents and to determine factors associated with its prevention.

Methods: A cross-sectional study was conducted among 400 adolescents using a structured questionnaire to collect information on demographic characteristics, awareness of anaemia, dietary habits, health-seeking behaviour, and related risk factors. Estimation of haemoglobin and anthropometric measurements were done. The factors between male and female participants were compared and significant relationships were identified by statistical analysis.

Results: Anaemia was found in 15.0% of the 400 adolescents. Haemoglobin level <11g/dL was significantly more common in female adolescents than in male adolescents (18.0% vs. 9.0%). Stomach upset (21.3%) was a commonly reported symptom. Anaemia awareness was poor; 66.2% had never heard about anaemia, and 63.3% were not aware of the causes. There were significant differences in anaemia education, dietary practices. Menstruating adolescents reported irregular menstrual cycles (42.4%) and heavy menstrual bleeding (40.0%).

Conclusions: Poor dietary practices, inadequate awareness and limited preventive health behaviour are still major challenges in reducing the burden of anaemia among adolescents. Comprehensive school and community-based nutrition education, regular screening, promotion of balanced diets with iron and other micronutrients, and early preventive measures are necessary for better adolescent health and reducing prevalence of nutritional anaemia.

Keywords: Adolescent, Anaemia, Menstrual, Dietary, Education

INTRODUCTION

Anaemia is still one of the most common nutritional and public health problems globally, affecting people of all age groups, particularly adolescents with rapid physical growth and increased nutritional needs. It is defined as a fall in the concentration of haemoglobin, the number of red blood cells or the packed cell volume below accepted reference values for age and sex, with a consequent reduced capacity of the blood to carry oxygen.¹ The World Health Organization (WHO) defines anaemia as a

condition in which haemoglobin concentrations are below the normal reference values derived, as a consequence of deficiencies of one or more essential nutrients.² In the present study, Anaemia was identified based on haemoglobin concentration only, therefore, the specific subtype or underlying cause of anaemia (e.g., iron, Vit B₁₂ or folate deficiency could not be determined. During adolescence, the developmental stage is critical and a deficiency in nutrient intake, rapid growth and physiological changes can significantly increase the risk

of anaemia, affecting physical growth, cognitive performance, immunity and overall well-being.³

Iron deficiency anaemia (IDA) is the most common and the most prevalent type of anaemia worldwide. Iron is an essential micronutrient required for the synthesis of haemoglobin and transportation of oxygen. IDA greatly contributed by inadequate dietary intake, low iron bioavailability, persistent blood loss, parasitic infections, poor absorption and raised physiological demands during growth.⁴ Nutritional anaemia can also be caused by deficiencies of vitamin B₁₂ and folate, as well as iron deficiency. Vitamin B₁₂ deficiency due to dietary deficiency, malabsorption syndromes, gastrointestinal disease, autoimmune disease or long-term use of certain drugs disrupts normal erythropoiesis. Common clinical symptoms are fatigue, neurological disorders and impaired cognitive function. A deficiency of folate leads to megaloblastic anaemia and also affects DNA synthesis and the maturation of red blood cells. Key risk factors include poor nutrition, gastrointestinal issues, alcohol use, pregnancy and some medications.⁵

Anaemia is unacceptably prevalent worldwide. It is a major problem for both industrialised and developing countries, affecting more than 2 billion people. Adolescents are a particularly vulnerable population but there is regional variation. The burden is even greater in under-developed countries due to nutritional deficiency, socio-economic inequality and limited access to healthcare.⁶ Adolescent anaemia is a major public health problem in India with significant regional variations and higher burden in adolescent girls due to higher iron requirements with growth and menstruation.⁷

Anaemia has effects beyond low haemoglobin levels. It can also affect negatively physical capacity, school performance, immune competence and quality of life. Chronic anaemia can increase cardiovascular workload, impair neurological development and may support long-term health sequelae. Some types of anaemia have also been associated with chronic illnesses and autoimmune disorders which further stress the importance of early diagnosis, prevention and successful management strategies.^{8,9}

METHODS

Selection of samples

This was a cross-sectional study conducted from 27/09/2025 to 25/02/2026 among adolescents residing in selected urban and peri-urban areas of Bengaluru, Karnataka; Doddabasthi, Sulikere and Chikkabasthi, respectively. Also, the study had participants from educational institutions like Deeksha STEM School, PA International School and Padmashree Institute of Management and Sciences. Sites were selected intentionally to include adolescents from both community and institutional settings.¹⁰

Study population and sampling

The study population consisted of 400 male and female adolescents between the ages of 12-19 years. A convenient sampling technique was adopted for the recruitment of participants. The study included adolescents who were available during the data collection period, and who provided informed consent (and assent where applicable). As this was a convenience sample, not one drawn using stratified or quota-based sampling to ensure proportional representation across age and sex groups, the final sample included a higher proportion of female and older adolescent (15-19 years) participants and reflects the age and gender composition of the participating institutions and community sites.¹⁰

Data collection tools

Data were collected through a standard structured questionnaire and a portable haemoglobin meter. The questionnaire was developed to collect data on sociodemographic characteristics, dietary habits, menstrual history, physical activity patterns, supplement use, lifestyle factors and symptoms associated with anaemia. Haemoglobin concentration was determined using a portable haemoglobin meter which allowed for immediate determination of anaemia status among participants.¹⁰

Data collection procedure

Phase I: Survey and Hb assessment

The first phase was to interview participants with the structured questionnaire and to check haemoglobin levels. Demographic characteristics, dietary practices, iron-rich food intake, menstrual history, physical activity, sleep patterns, supplement use and symptoms of anaemia, were collected. Haemoglobin concentration was measured with a Quick Check Plus Digital Automatic Haemoglobin Metre, following the manufacturer's operating instructions. All haemoglobin measurements were carried out by trained personnel using a standard operating process to ensure uniformity. Anaemia was classified according to the World Health Organization (WHO) haemoglobin cut-off values for age and sex. Teenagers 10-11 years of age were classified as anaemic if their haemoglobin level was <11.5 g/dL. Anaemia was defined as haemoglobin <12.0 g/dL in adolescents aged 12-14 years. For 15- to 19-year-old teenagers the cut-off was <12.0 g/dL for females and <13.0 g/dL for males (Figure 1).

Phase II: Nutrition counselling

The anaemia status of each participant was assessed by haemoglobin estimation. Individualised dietary counselling was provided to participants who were identified as anaemic. Counselling focused on improving knowledge of causes, symptoms and health effects of

anaemia. There was advice on iron-rich food sources, factors affecting the absorption of iron, menstrual hygiene, prevention and management of worm infestation with appropriate hygiene and deworming measures (Figure 2).¹¹



Figure 1: Sample collection drive.

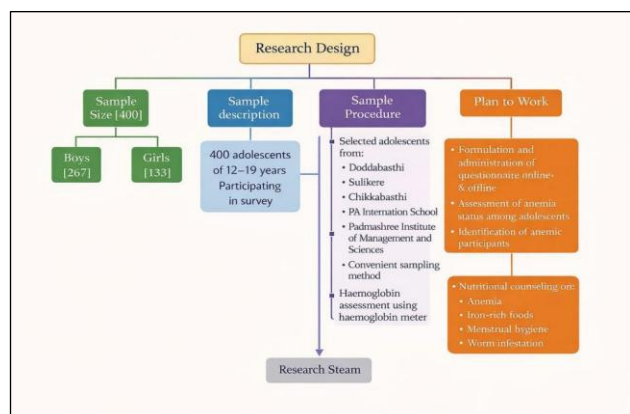


Figure 2: Bird's eye view of the methodology.

Statistical analysis

Data were analysed using IBM SPSS Statistics version 22.0 and R software version 3.2.2. Descriptive statistics are presented as mean $\pm$ standard deviation (SD) for continuous variables and frequencies with percentages for categorical variables. The independent Student's t-test was used to compare the continuous variables between the two groups, and the Chi-square test or Fisher's exact test was used to test the association between the categorical variables as appropriate. Statistical significance was determined at p value <0.05 .

Ethical considerations

The study protocol was reviewed and approved by the institutional Ethics Committee (IEC) of Padmashree Institute of Management and Sciences, Bangalore. Prior permission was obtained from the concerned institutions and community authorities before the commencement of the study. Informed consent was obtained from

participants and, where applicable, from parents or guardians. Confidentiality and anonymity of the collected information were maintained throughout the study.

RESULTS

A total of 400 adolescents participated in the study, of whom 267 (66.8%) were females and 133 (33.3%) were males. Most participants were older adolescents: 293 (73.3%) were aged 15-19 years and 107 (26.8%) were aged 10-15 years. A higher proportion of females (77.2%) than males (65.4%) were in the 15-19 years age category, whereas males had a greater representation in the 10-15 years age group (34.6% vs. 22.8%). Age group and gender were significantly associated ($p=0.012^*$).

Overall, 42.5% of the adolescents belonged to medium-income families, followed by low-income (35.5%) and high-income (22.0%) families. Among females, 40.0%, 38.6% and 21.0% belonged to medium-, low- and high-income families, as compared to 46.6%, 29.3% and 24.1% of males. Family income did not differ significantly by gender ($p=0.190$).

Haemoglobin levels above 11 g/dL accounted for 85.0% of the total study population, while haemoglobin levels below 11 g/dL accounted for 15.0%. The gender-wise analysis showed that haemoglobin (<11 g/dL) was more prevalent in females (18%) than in males (9%). However, the percentage of males with haemoglobin levels >11 g/dL was higher than that of females (91.0% vs 82.0%). The association between haemoglobin level and gender was found to be statistically significant (Fisher's Exact Test, $p=0.018$), indicating a significant difference in haemoglobin status between male and female adolescents (Table 1).

Table 1: Hb level-frequency distribution of adolescents studied in males and females.

Hb Level	Gender, N (%)		Total, N (%)
	Female	Male	
<11	48 (18)	12 (9)	60 (15)
>11	219 (82)	121 (91)	340 (85)
Total	267 (100)	133 (100)	400 (100)

$P=0.018^*$, Moderately significant, Fisher Exact Test

Menstrual characteristics were evaluated in female adolescents ($n=250$). Regular periods were reported in 57.6% and irregular periods in 42.4% overall. 40% of participants reported heavy menstrual bleeding, and 60.0% reported no excessive bleeding. In the gender-based analysis, males were coded as "Not Applicable" for menstrual variables, and both menstrual regularity and excessive bleeding were significantly associated with gender ($p<0.001$ for both). The results suggest that heavy and irregular menstruation are highly prevalent among the adolescent girls in the study population (Figure 3).

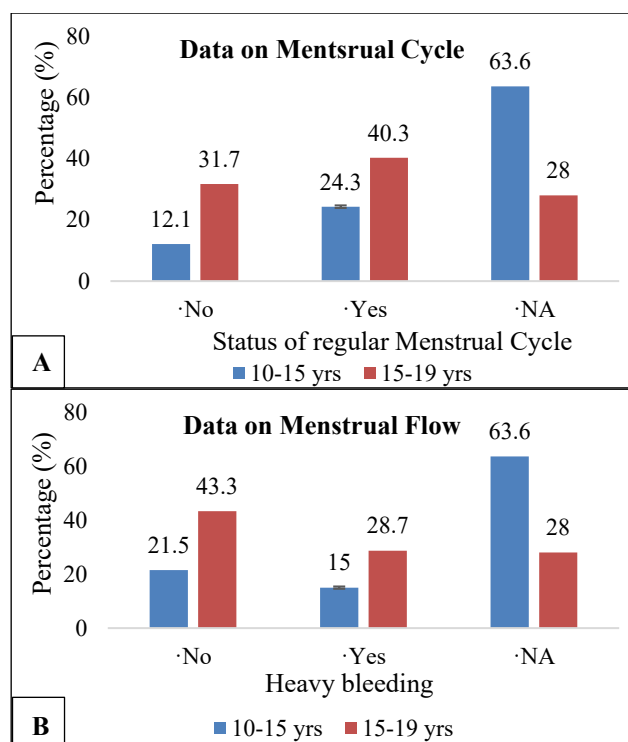


Figure 3 (A, B): Menstrual regularity and heavy menstrual bleeding among adolescents.

Overall, 33.8% of the participants had heard about anaemia and 66.2% of the participants were not aware of the disease. The proportion who had not heard of anaemia was slightly higher among males (68.4%) than among females (65.2%), but the difference was not statistically significant ($p=0.584$). 63.3% of teenagers did not know what causes anaemia. The most common reasons cited by respondents were blood loss, iron or micronutrient deficiency, poor diet and other reasons. The perceived causes of anaemia did not differ significantly (Figure 4).

Overall, 73.3% of adolescent participants reported having received education about anaemia at school or college, while 26.8% had not received any sort of education. More females (77.2%) reported having received anaemia education than males (65.4%). 22.8% of females and 34.6% of males had not received any kind of education regarding anaemia. The association between gender and anaemia education was statistically significant ($p=0.012^*$) (Table 2).

The dietary assessment revealed that meal frequency and green leafy vegetable consumption did not differ significantly between adolescents aged 10-15 years and 15-19 years ($p=0.882$ and $p=0.637$, respectively). However, significant differences were observed in junk food consumption ($p<0.001^{**}$), tea or coffee consumption with meals ($p=0.037^*$), inclusion of nuts and seeds in the diet ($p<0.001^{**}$), and nutritional supplement use ($p=0.021^*$). Adolescents aged 10-15 years were more likely to include nuts and seeds in their diet (Table 3).

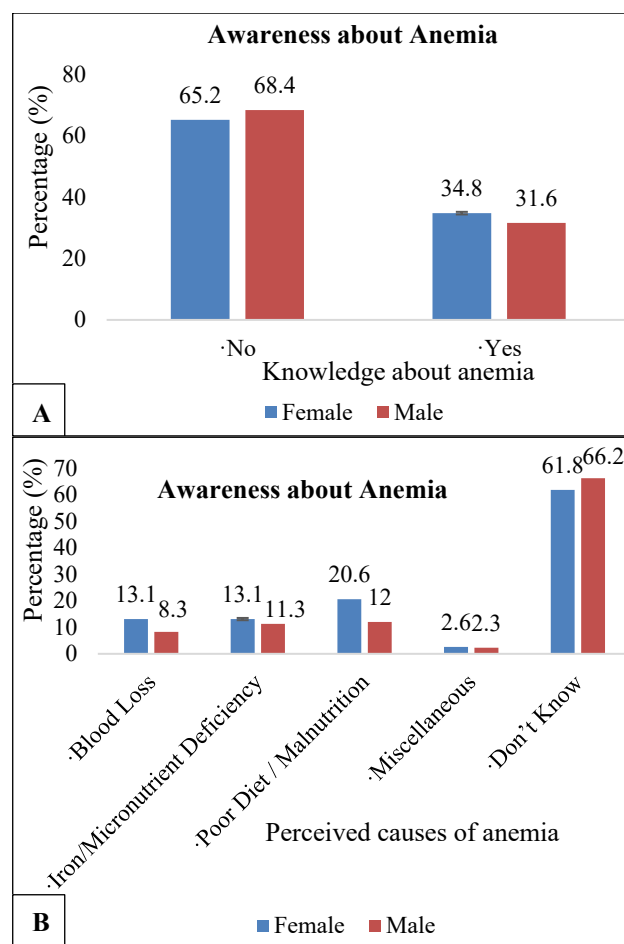


Figure 4 (A, B): Awareness about anemia among adolescents.

(Figure 4A): $P=0.584$, Not significant, Chi-Square Test/Fisher Exact Test; (Figure 4B): $P=0.268$, Not significant, Chi-Square Test/Fisher Exact Test

Table 2: Anemia health education awareness-frequency distribution of adolescents studied in males and females.

Awareness	Gender, N (%)		Total, N (%)	P value
	Female	Male		
Have you been educated about anemia in school/college?				
No	61 (22.8)	46 (34.6)	107 (26.8)	0.012*
Yes	206 (77.2)	87 (65.4)	293 (73.3)	

$P=0.012^*$, Moderately significant, Chi-Square Test/Fisher Exact Test

Gut health and dietary practices differed significantly by gender for stomach upset ($p=0.013^*$) and meal skipping ($p=0.006^{**}$). Stomach upset was reported by 20.2% of females and 23.3% of males (21.3% overall). In terms of skipping meals, 37.8% of the adolescents reported often skipping meals and 28.3% sometimes. Most participants (98.5%) said they had never taken a deworming tablet. Only 21.5% of adolescents knew of foods that improve digestion and iron absorption, while 78.5% were not aware of any. There were no significant differences

between genders in terms of worm infestation, digestion and iron absorption ($p>0.05$) (Table 4).
deworming practices, medications used or knowledge of

Table 3: Dietary intake assessment of adolescents studied in different age groups.

Dietary intake assessment	Age in years, N (%)		Total, N (%)	P value
	10-15 years	15-19 years		
How many meals do you eat in a day				
3	93(86.9)	253 (86.3)	346 (86.5)	0.882
4	14 (13.1)	40 (13.7)	54 (13.5)	
How often do you include green leafy vegetables in your diet?				
Monthly	37 (34.6)	94 (32.1)	131 (32.8)	0.637
Weekly	70 (65.4)	199 (67.9)	269 (67.3)	
How often do you consume junk food?				
Daily	22 (20.6)	31 (10.6)	53 (13.3)	<0.001**
Monthly	29 (27.1)	140 (47.8)	169 (42.3)	
Weekly	56 (52.3)	122 (41.6)	178 (44.5)	
Do you drink tea or coffee with meal?				
No	73 (68.2)	165 (56.3)	238 (59.5)	0.037*
Yes	34 (31.8)	128 (43.7)	162 (40.5)	
If yes how often?				
Daily	0 (0)	7 (2.4)	7 (1.8)	0.052+
Frequently	4 (3.7)	21 (7.2)	25 (6.3)	
Rarely	17 (15.9)	73 (24.9)	90 (22.5)	
Sometimes	13 (12.1)	30 (10.2)	43 (10.8)	
NA	73 (68.2)	162 (55.3)	235 (58.8)	
Do you include nuts or seeds in your diet?				
No	41 (38.3)	165 (56.3)	206 (51.5)	<0.001**
Yes	66 (61.7)	128 (43.7)	194 (48.5)	
Are you currently taking any supplements?				
No	107 (100)	279 (95.2)	386 (96.5)	0.021*
Yes	0 (0)	14 (4.8)	14 (3.5)	
Total	107 (100)	293 (100)	400 (100)	

Chi-Square Test/Fisher Exact Test; +Suggestive significance (p value: $0.005< p<0.10$); *Moderately significant (p value: $0.01< p\leq 0.05$); **Strongly significant (p value: $p\leq 0.01$)

Table 4: Gut health of adolescents.

Gut health and anaemia	Gender, N (%)		Total, N (%)	P value
	Female	Male		
Do you feel stomach upset?				
No	198 (74.2)	84 (63.2)	282 (70.5)	0.013*
Sometimes	15 (5.6)	18 (13.5)	33 (8.3)	
Yes	54 (20.2)	31 (23.3)	85 (21.3)	
Have you ever had a worm infestation?				
No	261 (97.8)	133 (100)	394 (98.5)	0.081+
Yes	6 (2.2)	0 (0)	6 (1.5)	
When was the last time you took a deworming tablet				
Never	261 (97.8)	133 (100)	394 (98.5)	0.219
Within 6 months	5 (1.9)	0 (0)	5 (1.3)	
More than 6 months ago	1 (0.4)	0 (0)	1 (0.3)	
Do you take any medicine often for stomach issue?				
No	261 (97.8)	131 (98.5)	392 (98)	0.617
Yes	6 (2.2)	2 (1.5)	8 (2)	
Do you skip meals				
Never	79 (29.6)	57 (42.9)	136 (34)	0.006**
Often	101 (37.8)	50 (37.6)	151 (37.8)	

Continued.

Gut health and anaemia	Gender, N (%)		Total, N (%)	P value
	Female	Male		
Sometimes	87 (32.6)	26 (19.5)	113 (28.3)	
Do you know any food that improves digestion and iron absorption?				
No	211 (79)	103 (77.4)	314 (78.5)	0.716
Yes	56 (21)	30 (22.6)	86 (21.5)	
Total	267 (100)	133 (100)	400 (100)	

DISCUSSION

The present study assessed haemoglobin status, awareness, dietary practices and menstrual characteristics among 400 adolescents from urban and peri-urban communities and educational institutions in Bengaluru. Overall, 15.0% of the adolescents were anaemic, and the prevalence was significantly higher among females than males. Although 73.3% of the participants reported having received education about anaemia, awareness of the condition and its causes was low. Dietary practices differed significantly between the younger and older age groups, and menstrual irregularity and heavy menstrual bleeding were common among the girls. Each of these findings is compared with previous studies below.

The prevalence of anaemia varies widely between studies, depending on the population, the age range and the haemoglobin thresholds applied.¹² The prevalence in the present study (15.0%) was lower than the 28.4% reported for Indian adolescents aged 10-19 years in the nationally representative Comprehensive National Nutrition Survey (CNNS) 2016-18, and much lower than the 59% reported among adolescent girls in rural Telangana.^{13,14} A prevalence similar to ours (14.0%) was found among children and adolescents of low socio-economic status attending two schools in the suburbs of Jakarta, Indonesia.¹⁵ The lower prevalence in our sample may partly reflect its urban and institutional setting, the inclusion of boys, who have a lower prevalence than girls,¹⁶ and differences in age range, haemoglobin cut-off and measurement method (a portable haemoglobin meter rather than laboratory estimation). Hospital-based paediatric studies are also not directly comparable with community-based adolescent samples such as ours.¹⁷

Anaemia was twice as common in girls as in boys in our study (18.0% vs. 9.0%; $p=0.018$). This is consistent with the CNNS, in which anaemia was present in 40% of girls and 18% of boys aged 10-19 years, and with a longitudinal survey of adolescents in Uttar Pradesh and Bihar, in which the prevalence in 2018-19 was 63% among girls and 30% among boys.^{16,18} Iron deficiency and iron deficiency anaemia were also more frequent in females than in males among Indonesian children and adolescents.¹⁵ The greater susceptibility of girls is generally attributed to their higher iron requirements during growth and to menstrual blood loss.^{3,7} Although the absolute prevalence in our sample was lower than in

these surveys, the roughly two-fold excess among girls was similar.

Family income was similarly distributed among boys and girls in our sample ($p=0.190$), and anaemia was not analysed by income. Previous studies, however, have reported a significant association between the prevalence of anaemia in adolescent girls and the socio-economic status of the family, and low socio-economic status is regarded as a strong risk factor for iron deficiency in children and adolescents.^{14,15} The relationship between household income and haemoglobin status in this population therefore warrants further analysis.

Irregular menstrual cycles (42.4%) and heavy menstrual bleeding (40.0%) were common among the girls. Heavy menstrual bleeding is a well-recognised cause of iron deficiency and iron deficiency anaemia in women, and anaemia and iron deficiency affect the quality of life of women with heavy menstrual bleeding.^{19,20} Because menstrual characteristics in our study were self-reported and not clinically assessed, the proportion with heavy bleeding should be interpreted cautiously. Nevertheless, menstrual blood loss is a plausible contributor to the higher prevalence of anaemia among the girls, and menstrual health should be addressed alongside haemoglobin screening and nutrition counselling.

Awareness of anaemia was low in our study: 66.2% of the adolescents had never heard of anaemia and 63.3% did not know its causes. Low awareness has been reported in other groups as well. Only about half (50.5%) of female health-care professional students in Tamil Nadu were aware of anaemia, and among adolescent girls in a residential school in Telangana, where most (86.2%) had heard of anaemia, only 27.6% knew iron-rich foods and 38% could not name any cause.^{21,22} In our study, awareness did not differ significantly between boys and girls ($p=0.584$), indicating that knowledge gaps are shared by both sexes. Reported exposure to anaemia education was higher among females than males (77.2% vs. 65.4%; $p=0.012$), but this was not reflected in better awareness. The low awareness despite 73.3% of participants reporting prior education on anaemia suggests that the education received in schools and colleges may be infrequent, brief or poorly retained. A quasi-experimental study in female adolescents found that health education produced a significant improvement in knowledge and attitudes towards preventing anaemia, which supports the

need for structured and repeated education, ideally combined with screening.¹¹

Several dietary practices differed between the younger (10-15 years) and older (15-19 years) adolescents. About 40.5% of the adolescents drank tea or coffee with meals, and this was more common in the older group (43.7% vs. 31.8%). The polyphenols in tea and coffee inhibit the absorption of non-haem iron, and dietary guidance for iron deficiency anaemia therefore advises separating tea and coffee from iron-rich meals and pairing iron-rich foods with enhancers such as vitamin C.^{23,24} Daily junk food consumption was more frequent among the younger adolescents (20.6% vs. 10.6%), which may displace more nutrient-dense foods, whereas nuts and seeds were more often included in their diets (61.7% vs. 43.7%). Only 3.5% of the adolescents were taking supplements, all of them in the older age group. Meal skipping was reported by about two-thirds of the participants (often 37.8%, sometimes 28.3%) and was more frequent among girls than boys ($p=0.006$). The relationship between dietary habits and anaemia in adolescent girls has been examined in Ranchi, and dietary counselling of the kind provided to anaemic participants in this study is a recognised approach to the management of iron deficiency anaemia in women.^{25,26} Pooled evidence from systematic reviews also indicates that nutrition-specific interventions, such as iron supplementation, are effective in raising haemoglobin and reducing anaemia.²⁷ Together, these observations suggest that improving dietary practices and strengthening supplementation are important entry points for prevention in this age group.

Stomach upset was reported by 21.3% of the adolescents (and “sometimes” by a further 8.3%) and was more frequent among boys than girls ($p=0.013$). Alterations of the gut microbiome and intestinal barrier have been described in iron deficiency anaemia, and gut inflammation has been implicated in the pathogenesis of acquired aplastic anaemia, but we did not examine whether gut symptoms were associated with haemoglobin status in our sample.^{28,29} Worm infestation was uncommon (1.5%), and 98.5% of the adolescents had never taken a deworming tablet. Deworming is among the nutrition-specific interventions that have been evaluated for their effect on haemoglobin, so the very low coverage in this population suggests an opportunity for prevention.²⁷ Only 21.5% of the adolescents knew of foods that improve digestion and iron absorption, which is similar in direction to the low knowledge of iron-rich foods reported among adolescent girls in Telangana.²²

These findings emphasise the importance of community and school-based interventions for routine haemoglobin screening, menstrual health awareness, nutrition education and healthy eating practices. National initiatives such as the Anaemia Mukta Bharat (AMB) strategy and the Weekly Iron and Folic Acid Supplementation (WIFS) programme provide weekly iron and folic acid supplementation and nutrition and health

education to adolescents, and school health screening is offered under the Rashtriya Bal Swasthya Karyakram (RBSK) programme.¹⁶ The low uptake of supplements and the limited awareness observed in this study suggest that better integration and delivery of these programmes may support early detection, improve coverage of iron and folic acid supplementation and help reduce the burden of adolescent anaemia in India.

This study has few limitations. First, its cross-sectional design does not allow causal inferences. Second, participants were recruited by convenience sampling from selected communities and institutions in Bengaluru, and the sample included more girls (66.8%) and older adolescents (73.3%) than boys and younger adolescents, which may have influenced the estimated prevalence and limits generalisability to the wider adolescent population. Third, anaemia was defined by haemoglobin concentration alone, measured with a portable meter that may differ from laboratory estimation; iron, vitamin B12 and folate status, inflammation and haemoglobinopathies were not assessed, so the type and cause of anaemia could not be determined, which matters because iron deficiency accounted for only about one-fifth of anaemia among adolescents in the CNNS.¹³ Fourth, dietary practices, menstrual characteristics, awareness and education were self-reported and may be affected by recall and social desirability bias, and dietary intake was not quantified. Fifth, associations between haemoglobin status and these dietary, menstrual and awareness variables were not analysed, and potential confounders were not adjusted for. Larger, probability-based studies with biochemical assessment and multivariable analysis are needed to confirm these findings.

CONCLUSION

In this cross-sectional study of 400 adolescents in urban and peri-urban Bengaluru, 15.0% were anaemic, with girls affected twice as often as boys (18.0% vs. 9.0%). Awareness of anaemia was poor in both sexes even though most adolescents reported prior education on the subject, and meal skipping, tea or coffee intake with meals, minimal use of supplements and deworming, and a high burden of self-reported menstrual irregularity and heavy bleeding among girls were common. By describing haemoglobin status together with awareness, dietary, gut-health and menstrual characteristics in both boys and girls of a south Indian adolescent population, this study provides local baseline evidence that anaemia in adolescence is accompanied by modifiable gaps in knowledge and dietary practice, and that prevention efforts need to reach boys as well as girls. These findings support routine school- and community-based haemoglobin screening, repeated and practical nutrition education, menstrual health promotion and better coverage of iron and folic acid supplementation. Studies using probability sampling, biochemical markers of iron status and multivariable analysis are needed to identify the determinants of adolescent anaemia more precisely.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of Padmashree Institute of Management and Sciences, Bangalore, Proposal No: PIEC/PIMS/04/2025 (Date: 27/09/2025)

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