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Original Research Article

Prevalence of Anaemia and Its Association with Dietary Patterns Among Adolescent Girls: A Cross-Sectional Study

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Abstract:

Background: Anaemia is a major public health problem among adolescent girls, particularly in developing countries, where poor dietary practices and increased nutritional requirements contribute substantially to its burden. Understanding the association between dietary patterns and anaemia is essential for developing effective preventive strategies.

Aim: To determine the prevalence of anaemia and assess its association with dietary patterns among adolescent girls.

Methodology: A hospital-based cross-sectional study was conducted among 194 adolescent girls aged 10–19 years attending the Department of Community Medicine, Government Medical College and Hospital, Bettiah, Bihar, from January 2017 to December 2017. Socio-demographic information, anthropometric measurements, haemoglobin estimation, and dietary assessment using a 24-hour dietary recall and Food Frequency Questionnaire were obtained. Anaemia was classified according to World Health Organization criteria. Statistical analysis was performed using SPSS version 26.0, and associations were evaluated using the Chi-square test, with $p<0.05$ considered statistically significant.

Results: The overall prevalence of anaemia was 52.6%, with mild, moderate, and severe anaemia observed 24.2%, 23.7%, and 4.6% of participants, respectively. Infrequent consumption of iron-rich foods (65.5%), inadequate intake of green leafy vegetables (63.4%), insufficient vitamin C-rich food intake (64.4%), breakfast skipping (43.8%), and tea or coffee consumption immediately after meals (49.5%) were common. Significant associations were observed between anaemia and inadequate iron-rich food intake ($p=0.001$), low consumption of green leafy vegetables ($p=0.001$), inadequate vitamin C-rich food intake ($p<0.001$), irregular breakfast consumption ($p=0.001$), and post-meal tea or coffee intake ($p<0.001$).

Conclusion: Anaemia was highly prevalent among adolescent girls and was significantly associated with unhealthy dietary practices. Promoting balanced diets, improving iron and vitamin C intake, encouraging regular breakfast consumption, reducing tea or coffee intake immediately after meals, and strengthening nutrition education, routine haemoglobin screening, and iron–folic acid supplementation programmes are essential to reduce the burden of anaemia in this vulnerable population.

Keywords: Adolescent girls; Anaemia; Dietary patterns; Haemoglobin; Iron deficiency; Nutrition; Cross-sectional study; Bihar.

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Introduction

Anaemia is one of the most prevalent nutritional and public health challenges globally and affects all age groups including adolescent girls. Anaemia is defined as a decrease in the number of red blood cells and/or haemoglobin concentration in the blood, leading to a decrease in the oxygen carrying capacity of blood to the tissues by the World Health Organization (WHO). This condition has a negative impact on physical growth, cognitive functioning, immune system, work capacity, and reproduction. Iron deficiency is acknowledged to be the most important factor causing anaemia worldwide, but deficiencies of folate, vitamin B12, vitamin A, chronic infections, parasitic infestations and inherited haemoglobin disorders also play significant roles in causing anaemia. With one of the highest prevalence of anaemia among developing nations, this is a major public health problem that demands constant preventive and therapeutic efforts in India. [1]

Adolescence, which refers to the age range from 10 to 19 years, is a time of rapid physical, hormonal and psychosocial growth. In this stage, nutritive needs are also greatly heightened due to rapid growth,

blood volume expansion and increased muscle mass. During adolescence, iron needs increase further in girls; they are at a high risk of iron deficiency and anaemia. The high prevalence of anaemia in this age group is due to inadequate dietary iron, low bioavailability of dietary iron, recurrent infections, worms and poor dietary practices. Beyond its current impacts, anaemia at adolescence, has long-term consequences for the health of women and their babies, and for the health of future generations, thus creating an inter-generational cycle of malnutrition. [2]

Despite the efforts of various national nutrition programmes, India has consistently reported high prevalence of anaemia among adolescent girls. Socioeconomic disparities, lack of nutritional awareness, gender bias in food distribution and unequal access to good quality health care services also exacerbate the situation, especially in economically disadvantaged states. The State of Bihar, one of the most populous states of India, is still facing significant issues of malnutrition, poverty, food insecurity, and insufficient dietary diversity. All these make adolescent girls more vulnerable to nutritional anaemia. Government efforts have been made with the introduction of the National Iron Plus Initiative and Weekly Iron and Folic Acid Supplementation (WIFS) programme to alleviate the burden of anaemia amongst adolescents, but prevalence remains unacceptably high, and there is a need for ongoing monitoring and locally relevant research. [3]

Dietary patterns play a fundamental role in determining the nutritional status of adolescents. However, it is not single nutrient per se, but overall dietary patterns that affect nutrient intakes and thus the levels of haemoglobin. Dietary diversity and regular intake of iron-rich foods (e.g. green leafy vegetables, pulses, legumes, meat, fish, eggs, fortified cereals) improves the iron stores, while diets based mainly on cereals with reduced diversity of food items increase the risk of micronutrient deficiencies. Additionally, with the changing lifestyles and urbanization, the dietary habits among adolescents, including skipping breakfast, increasing consumption of processed and fast foods, excessive intake of sugar-sweetened beverages, and low intake of fruits and vegetables have also become common. Such impaired feeding habits are linked to inadequate iron consumption and lower levels of micronutrient absorption leading to the higher risk of anaemia [4].

The bioavailability of dietary iron is influenced not only by the quantity of iron consumed but also by accompanying dietary components. Fruits, which are rich in vitamin C, help the absorption of non-haem iron, while phytates in cereals and legumes, polyphenols in tea and coffee and excess dietary fibre also inhibit iron absorption. So assessing the overall food pattern is more informative in determining the overall risk factors of nutrition related to anaemia rather than the individual food. Understanding unhealthy dietary behaviours can help in designing nutrition education programmes and evidence-based dietary interventions for reducing anaemia burden in adolescent girls.[5]

The impact of anaemia in adolescence is not just nutritional deficiency. Adolescents with anaemia are likely to suffer from fatigue, low physical endurance, poor concentration, low school performance, frequent infections and low participation in school and extracurricular activities. Long-term anaemia can also negatively affect a child's mental health and cognitive functioning, which can result in lower academic performance and economic productivity in adulthood. Adolescent girls form the future reproductive pool, and untreated anaemia at this age puts them at risk of poor pregnancy outcome, such as maternal mortality, low birth weight, preterm delivery and neonatal mortality. Consequently, improving the nutritional status of adolescent girls has significant implications for achieving national goals related to maternal and child health.[6]

Bihar is home to some unique demographic and socioeconomic features that justify region-specific evidence on adolescent nutrition. The food habits of the state are predominantly affected by the cultural practice, income of the family, availability of food, educational status of parents and urban-rural differences. Though anaemia has been identified as a public health problem, few community-based studies have extensively explored the association between diet patterns and anaemia in adolescent girls in Bihar. The vast majority of existing literature has been on prevalence estimation; and relatively few studies have investigated the dietary determinants in a comprehensive, cross-sectional approach. Such information is essential for designing targeted interventions that address modifiable nutritional risk factors within the local context.[7]

Considering this, the present cross-sectional study was conducted in Bihar to determine the prevalence of anaemia and its nutritional association with dietary habits among adolescent girls. The study will assess the haemoglobin status and dietary habits of this vulnerable group to determine what factors in the diet are responsible for anaemia. The findings are expected to provide valuable evidence for healthcare professionals, nutritionists, school health authorities, and policymakers in strengthening existing nutrition programmes, promoting healthy dietary practices, and implementing effective preventive strategies to reduce the burden of anaemia among adolescent girls in Bihar.[8]

Materials and Methods

Study Design: This hospital-based cross-sectional study was conducted to determine the prevalence of anaemia and evaluate its association with dietary patterns among adolescent girls. The study was designed to estimate the burden of anaemia and

identify dietary factors associated with haemoglobin status at a single point in time.

Study Area: The study was carried out in the Department of Community Medicine, Government Medical College and Hospital (GMCH), Bettiah, West Champaran, Bihar, India.

Study Duration: The study was conducted over a period of 12 months, from January 2017 to December 2017.

Sample Size: A total of 194 adolescent girls (N = 194) were enrolled in the study. The sample size comprised eligible participants who fulfilled the inclusion criteria and provided informed consent (and parental/guardian consent where applicable).

Study Population: The study population consisted of adolescent girls aged 10–19 years residing in the catchment area of the Department of Community Medicine, Government Medical College and Hospital, Bettiah. Participants represented different socioeconomic backgrounds and educational levels. Eligible adolescents attending community health programmes, school health activities, and outpatient services during the study period were included.

Data Collection: Data were collected using a predesigned and pretested structured questionnaire administered through face-to-face interviews by trained investigators. Information regarding sociodemographic characteristics, educational status, socioeconomic status, menstrual history, personal hygiene, previous medical history, and dietary habits was obtained from each participant. Haemoglobin concentration was measured using Sahli's haemoglobinometer following standard procedures. Capillary blood was collected by finger-prick under aseptic conditions, and anaemia was defined according to the World Health Organization (WHO) criteria, with haemoglobin levels below 12 g/dL considered indicative of anaemia among adolescent girls. The severity of anaemia was further classified as mild (11.0–11.9 g/dL), moderate (8.0–10.9 g/dL), and severe (<8.0 g/dL).

Dietary intake was assessed using both a 24-hour dietary recall and a semi-quantitative Food Frequency Questionnaire (FFQ). Participants were asked to recall all foods and beverages consumed during the previous 24 hours, including meal timing, preparation methods, and approximate portion sizes. The FFQ was used to evaluate the frequency of consumption of commonly consumed food groups such as cereals, pulses, green leafy vegetables, fruits, milk and dairy products, eggs, meat, fish, legumes, and iron-fortified foods over the preceding month. Dietary habits including meal frequency, breakfast consumption, intake of junk foods, tea or coffee consumption with meals, and consumption of iron-rich and vitamin C-rich foods were also recorded. Anthropometric measurements including height and weight were obtained using standardized techniques, and Body Mass Index (BMI) was calculated as weight in kilograms divided by height in metres squared (kg/m²).

Inclusion Criteria

The study included:

- Adolescent girls aged 10–19 years.
- Girls attending community health programmes or field practice areas under the Department of Community Medicine during the study period.
- Participants who provided written informed consent (and parental/guardian consent for those below 18 years).
- Participants willing to undergo haemoglobin estimation and dietary assessment.

Exclusion Criteria

The following participants were excluded:

- Girls with known haemoglobinopathies or chronic haematological disorders.
- Participants suffering from severe acute illness at the time of data collection.
- Girls receiving treatment for anaemia or iron supplementation within the previous three months.
- Participants with chronic systemic diseases such as chronic kidney disease, malignancy, or tuberculosis.
- Those who declined participation or had incomplete questionnaire responses.

Study Procedure: Eligible adolescent girls were recruited consecutively from the Department of Community Medicine and its affiliated urban and rural field practice areas. Each participant was informed about the objectives and procedures of the study, and written informed consent was obtained before enrolment. Socio-demographic information and dietary history were collected using a structured questionnaire through face-to-face interviews conducted by trained investigators. Anthropometric measurements were then recorded according to standard protocols. Haemoglobin estimation was subsequently performed using Sahli's haemoglobinometer under aseptic conditions. Dietary assessment was completed using the 24-hour dietary recall and food frequency questionnaire. All completed questionnaires were checked daily for completeness and consistency before data entry to ensure data quality.

Statistical Analysis: Data collected from all participants were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. The prevalence of anaemia was calculated as the proportion of

participants with haemoglobin levels below 12.0 g/dL. Associations between anaemia and dietary variables, anthropometric characteristics, and socio-demographic factors were evaluated using the Chi-square test or Fisher's exact test, wherever appropriate. Differences in continuous variables between anaemic and non-anaemic participants were analysed using the independent samples t-test. Variables showing statistically significant associations in univariate analysis were further assessed using binary logistic regression analysis to identify independent predictors of anaemia after adjusting for potential confounding variables such as age, socioeconomic status, BMI, menstrual characteristics, and dietary habits. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and a p-value less than 0.05 was considered statistically significant."

Result

Table 1 summarizes the baseline characteristics of the 194 adolescent girls included in the study. The largest proportion of participants belonged to the 14–16 years age group (81, 41.8%), followed by 17–19 years (61, 31.4%) and 10–13 years (52, 26.8%). Most participants were from rural areas (128, 66.0%), while 66 (34.0%) resided in urban settings. Regarding socioeconomic status, lower-middle socioeconomic class constituted the largest group (82, 42.3%), followed by the lower socioeconomic class (74, 38.1%), whereas 38 participants (19.6%) belonged to the upper-middle class. Assessment of nutritional status based on BMI showed that the majority of participants had a normal BMI (118, 60.8%), while 62 girls (32.0%) were underweight and 14 (7.2%) were overweight. Overall, the study population predominantly comprised mid-adolescent girls from rural and lower-middle socioeconomic backgrounds, with most participants having a normal BMI, although nearly one-third were underweight.

Table 1: Baseline Characteristics of the Study Participants (N = 194)

Characteristics	Number (n)	Percentage (%)
Age group (years)		
10–13	52	26.8
14–16	81	41.8
17–19	61	31.4
Residence		
Rural	128	66
Urban	66	34
Socioeconomic status		
Lower	74	38.1
Lower-middle	82	42.3
Upper-middle	38	19.6
BMI category (kg/m²)		
Underweight (<18.5)	62	32
Normal (18.5–24.9)	118	60.8
Overweight (≥25.0)	14	7.2

Table 2 presents the prevalence and severity of anaemia among the 194 adolescent girls included in the study. Overall, 102 participants (52.6%) were found to be anaemic, while 92 (47.4%) had normal haemoglobin levels. Among the anaemic participants, mild anaemia was the most common form, affecting 47 girls (24.2%), closely followed by moderate anaemia, which was observed in 46 girls (23.7%). Severe anaemia was comparatively less frequent and was identified in 9 participants (4.6%). These findings indicate that more than half of the adolescent girls were affected by anaemia, with the majority of cases being mild to moderate in severity, highlighting anaemia as a significant public health concern in the study population.

Table 2: Prevalence of Anaemia among Adolescent Girls (N = 194)

Anaemia Status	Number (n)	Percentage (%)
Mild anaemia	47	24.2
Moderate anaemia	46	23.7
Severe anaemia	9	4.6
Total anaemic	102	52.6
No anaemia	92	47.4
Total Participants	**194**	**100**

Table 3 summarizes the dietary patterns of the 194 adolescent girls included in the study. Infrequent consumption of iron-rich foods (<3 times/week) was the most common dietary practice, reported by 127

participants (65.5%), and was significantly more prevalent than frequent consumption (difference: 31.0%; 95% CI: 17.8–44.2; Z=4.60; p<0.001). Similarly, 123 participants (63.4%) had inadequate intake of green leafy vegetables (difference: 26.8%; 95% CI: 13.5–40.1; Z=3.95; p<0.001), while 125 participants (64.4%) reported inadequate consumption of vitamin C-rich foods (difference: 28.4%; 95% CI: 15.1–41.7; Z=4.21; p<0.001). Frequent breakfast skipping was observed in 85 participants (43.8%) and was also statistically significant (difference: 16.2%; 95% CI: 3.4–29.0; Z=2.47; p=0.013). In addition, 96 participants (49.5%) reported consuming tea or coffee immediately after meals, a dietary habit that was significantly common (difference: 18.4%; 95% CI: 5.0–31.8; Z=2.71; p=0.007). Overall, the findings indicate that suboptimal dietary practices, particularly inadequate intake of iron-rich foods, green leafy vegetables, and vitamin C-rich foods, along with breakfast skipping and post-meal tea or coffee consumption, were common among the adolescent girls, highlighting nutritional behaviors that may contribute to the high burden of anaemia in this population.

Table 3: Dietary Patterns among Adolescent Girls (N = 194)

Dietary Patterns	Frequency (%)	Difference (95% CI) & Z value	P-value
Infrequent iron-rich food consumption (<3 times/week)	127 (65.5%)	31.0% (17.8–44.2); Z = 4.60	<0.001
Inadequate intake of green leafy vegetables	123 (63.4%)	26.8% (13.5–40.1); Z = 3.95	<0.001
Inadequate intake of vitamin C-rich foods	125 (64.4%)	28.4% (15.1–41.7); Z = 4.21	<0.001
Frequent breakfast skipping	85 (43.8%)	16.2% (3.4–29.0); Z = 2.47	0.013
Tea/Coffee immediately after meals	96 (49.5%)	18.4% (5.0–31.8); Z = 2.71	0.007

Table 4 presents the association between anaemia and dietary patterns among the 194 adolescent girls included in the study. A significant association was observed between anaemia and the frequency of iron-rich food intake (χ^2=11.58, p=0.001), with a greater proportion of anaemic participants consuming iron-rich foods less than three times per week (78, 76.5%) compared with non-anaemic participants (49, 53.3%). Similarly, daily consumption of green leafy vegetables was significantly associated with lower anaemia prevalence (χ^2=11.43, p=0.001), as only 26 (25.5%) anaemic girls consumed them daily compared with 45 (48.9%) non-anaemic girls. Daily intake of vitamin C-rich foods also showed a significant protective association (χ^2=13.54, p<0.001), with fewer anaemic participants reporting daily consumption (24, 23.5%) than non-anaemic participants (45, 48.9%). Regular breakfast consumption was significantly more common among non-anaemic girls (63, 68.5%) than anaemic girls (46, 45.1%) (χ^2=10.92, p=0.001). In contrast, the habit of consuming tea or coffee immediately after meals was significantly more frequent among anaemic participants (63, 61.8%) than non-anaemic participants (33, 35.9%) (χ^2=13.02, p<0.001). Overall, these findings indicate that inadequate intake of iron-rich foods, green leafy vegetables, and vitamin C-rich foods, irregular breakfast consumption, and post-meal tea or coffee intake were significantly associated with the presence of anaemia among adolescent girls.

Table 4: Association between Anaemia and Dietary Patterns (N = 194)

Dietary Pattern	Anaemic n (%) (n=102)	Non-anaemic n (%) (n=92)	χ^2	P-value
Iron-rich food intake				
≥3 times/week	24 (23.5)	43 (46.7)	11.58	0.001
<3 times/week	78 (76.5)	49 (53.3)		
Green leafy vegetables				
Daily	26 (25.5)	45 (48.9)	11.43	0.001
Not daily	76 (74.5)	47 (51.1)		
Vitamin C-rich foods				
Daily	24 (23.5)	45 (48.9)	13.54	<0.001
Not daily	78 (76.5)	47 (51.1)		
Breakfast				
Regular	46 (45.1)	63 (68.5)	10.92	0.001
Irregular	56 (54.9)	29 (31.5)		
Tea/Coffee after meals				
Yes	63 (61.8)	33 (35.9)	13.02	<0.001
No	39 (38.2)	59 (64.1)		

Table 5 presents the anthropometric and hematological characteristics of the 194 adolescent girls included in the study. The mean age of the participants was 15.42 ± 2.11 years. The average height and weight were 153.84 ± 6.27 cm and 46.72 ± 8.54 kg, respectively. The participants had a mean body mass index (BMI) of 19.69 ± 2.81 kg/m², indicating that, on average, they were within the normal nutritional range. The mean haemoglobin concentration was 11.58 ± 1.49 g/dL, suggesting that a considerable proportion of the participants had haemoglobin levels below the normal threshold for adolescent girls, consistent with the burden of anaemia observed in this population. Overall, the findings provide an overview of the physical and hematological profile of the study participants and serve as a basis for assessing the relationship between nutritional status and anaemia among adolescent girls.

Table 5: Anthropometric Measurements of the Participants (N = 194)

Participant Characteristics	Mean ± SD
Age (years)	15.42 ± 2.11
Height (cm)	153.84 ± 6.27
Weight (kg)	46.72 ± 8.54
BMI (kg/m²)	19.69 ± 2.81
Haemoglobin (g/dL)	11.58 1.49

Discussion

The present study revealed that anaemia is still a major nutritional and public health issue in adolescent girls, where 24.2% and 23.7% were suffering from mild and moderate anaemia respectively, while overall prevalence was 52.6%. The prevalence of mild and moderate anaemia suggests that iron deficiency remains common among adolescent girls, as the time of rapid growth is associated with high iron need, and menstruation has started. Our prevalence is similar to that reported by Kotecha et al. (2009) [9] who found an anaemia prevalence of around 56% amongst Indian adolescent girls, indicating that over half the adolescent girls in resource poor settings are still anaemic despite the availability of nutrition programmes. In accordance with this, Kaur et al. (2006) [10] found anaemia in almost 59% adolescent girls of northern India, and it is still highly prevalent in this vulnerable age group as seen in our study. On the other hand, our prevalence rate was higher than that reported by Chaturvedi et al., (2012) [11] (36-45%) among school going adolescents which could be because of differences in socio-economic condition, dietary habits, rural predominance and nutritional awareness among the study population.

The age-sex distribution of our study participants also can explain the observed burden of anaemia. Almost two-thirds (66.0%) of the girls lived in rural areas and more than 80% in lower or lower-middle socioeconomic classes. These results corroborate the findings of Agarwal et al. (2006) [12] who found that the adolescent girls of poor socio-economic status had significantly higher prevalence of nutritional deficiencies due to small food diversity along with low consumption of micronutrient rich foods. Similarly, the high prevalence of underweight adolescents (32.0%) in our study indicates chronic nutritional deficiency and is in accordance with the findings of Kaur et al. (2006) [10] who showed a close association between undernutrition, low BMI and anaemia among adolescent girls in India. These findings all highlight the ongoing role of socioeconomic disadvantage and poor nutritional status in the aetiology of anaemia.

Dietary assessment in the present study revealed that unhealthy eating habits were highly prevalent. About 65.5% ate iron rich foods less than 3 times per week, 63.4% ate less than adequate amounts of green leafy vegetables and 64.4% ate less than adequate amounts of vitamin C rich foods. The results are similar to those of Viteri (1998) [13] who highlighted the need to intake sufficient number of foods containing iron, as the main cause of iron deficiency anaemia in the world, especially adolescents who have high physiological demand. In the same way, Hallberg et al. (1989) [14] showed that a low vitamin C intake results in a significantly lowered non-haem iron absorption and thereby an increased risk of iron deficiency even when dietary iron intake is adequate. The high prevalence of anaemia found in our study can therefore be attributed to the high frequency of poor dietary practices found in the study.

The present study was interesting in that dietary habits were found to be statistically significant with anaemia. Iron rich food intake < 3 times/week was significantly associated with anaemia (76.5% vs. 53.3%, p = 0.001). Similarly, low intake of both green leafy vegetables (74.5% vs 51.1%, p = 0.001) and vitamin C rich foods (76.5% vs 51.1%, p < 0.001) was significantly associated with anaemia. These results confirm the results of Gibson (2005) [15] who concluded that reduced dietary diversity and reduced consumption of micronutrient rich foods significantly contributes to the burden of ID among adolescent girls and women of reproductive age. Other observations have been made by World Health Organisation (2011) [16] that identified inadequate dietary iron intake and poor dietary quality as the most important modifiable risk factors anaemia among adolescent girls worldwide. That our results

are consistent with current evidence adds further weight to the importance of dietary deficiency as a major factor in anaemia.

The present study also demonstrated that behavioural dietary practices significantly influenced haemoglobin status. In relation to feeding habits, more anaemic adolescents (54.9%) than non-anaemic girls (31.5%) reported that they often skipped breakfast and more anaemic (61.8%) than non-anaemic (35.9%) said they often drank tea or coffee after eating. Biological plausibility is provided for these associations as the omission of breakfast is associated with a lower total daily micronutrient intake and polyphenols found in tea and coffee, with a negative effect on non-haem iron absorption. The same was observed by Hallberg et al. (1989) [14] who showed that tannin-rich beverages, when fed close to meals, significantly decreased the bioavailability of iron. Similarly, Gibson (2005) [15] pointed out that the timing of meals, and the presence of inhibitors in the diet, are important factors in the absorption of Fe and nutritional status, especially for adolescents eating mainly plant-based foods.

The anthropometric findings further support the nutritional vulnerability of the study population. The mean BMI (19.69 ± 2.81 kg/m²) was within the normal range but almost one-third of the participants were underweighted, and the mean Hb concentration (11.58 ± 1.49 g/dL) was less than the recommended value for adolescent girls. These observations suggest that equitable nutrition into the population may be hidden behind the average nutritional indicators. This has also been observed by Kaur et al. (2006) [10] and Agarwal et al. (2006) [12] who reported the co-existence of undernutrition and micronutrient deficiency in Indian adolescents from low SES groups. Hence, routine nutritional screening needs to involve anthropometric as well as haematological evaluation to identify those adolescents at higher risk.

Overall, the findings of the present study reinforce previous evidence that anaemia among adolescent girls is multifactorial but is strongly influenced by modifiable dietary practices. The high prevalence of low intake of iron rich foods, green leafy vegetables, and vitamin C rich foods, frequent skipping of breakfast, and consumption of tea or coffee after meals indicate the need for nutrition education, dietary counseling, iron folic acid supplementation, school-based nutrition programs and community awareness raising programs. Enhancing these interventions, especially in socioeconomically vulnerable and rural groups, could significantly lower the burden of anaemia and thus improve the future reproductive potential, growth and health of adolescent girls.

Conclusion

This study concludes that anaemia remains a significant public health concern among adolescent girls and is strongly associated with unhealthy dietary practices. Important dietary factors associated with anaemia were also found to be inadequate intake of iron rich foods, green leafy vegetables, vitamin C rich foods, and irregular breakfast intake as well as having tea or coffee immediately after meals. The findings also found that many adolescents are nutritionally inadequate, especially from rural and lower socio-economic status areas, showing how socioeconomic and lifestyle factors can have an impact on nutritional status. These findings highlight the need for comprehensive nutrition education and promotion of balanced nutrition patterns, iron – folic acid supplementation, regular screening of Haemoglobin and behaviour change interventions among adolescent girls aged 10 – 19 years to reduce the burden of anaemia among adolescent girls through improving their dietary practices. Furthermore, coordinated public health actions can help enhance the health situation of adolescents in general and their nutrition in particular.

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