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ORIGINAL ARTICLE

Assessment of Nutritional Health and Anemia Rates Among Rural Adolescents

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ABSTRACT:

Background: Adolescents in rural India face a dual burden of malnutrition and anemia, often exacerbated by socio-economic inequalities and limited access to health and education services. This study aimed to assess the nutritional status and prevalence of anemia among rural adolescents. **Objectives:**To evaluate the extent of undernutrition and anemia in adolescents aged 10–19 years residing in a rural block, and to explore differences between school-going and non-school-going populations. **Materials and Methods:**A community-based cross-sectional study was conducted on 1250 adolescents, including 781 males and 469 females. Data were collected on schooling status, age, sex, nutritional indices, and hemoglobin levels. Nutritional status was assessed using BMI-for-age criteria, and anemia was diagnosed using WHO hemoglobin cut-offs. **Results:**Undernutrition was found in 42.9% of boys and 31.9% of girls, with a higher prevalence in non-school-going adolescents. Anemia was significantly more prevalent among females (48.7%) than males (29.3%). Stunting was most common in early adolescence, especially at ages 10–14. Educational discontinuation correlated with poorer health indicators. **Conclusion:**The findings highlight a high burden of malnutrition and anemia among rural adolescents, particularly among girls and those out of school. Urgent community-based, gender-sensitive interventions targeting both nutrition and education are needed to safeguard adolescent health and development.

Keywords: Adolescents, Anemia, Undernutrition, Rural Health, School Dropout

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INTRODUCTION

Adolescence is a critical period of rapid physical, mental, and emotional development, demanding optimal nutritional support to ensure healthy growth and prevent long-term health consequences. Malnutrition and anemia, particularly iron-deficiency anemia, remain major public health challenges among adolescents in rural India. Despite various national programs, the nutritional status of rural adolescents continues to be compromised due to poverty, dietary insufficiencies, gender discrimination, and lack of awareness regarding healthy eating habits [1,2].

Anemia, characterized by reduced hemoglobin levels, is especially prevalent in adolescent girls due to the onset of menstruation, poor iron intake, and parasitic infections. According to the World Health Organization (WHO), iron deficiency is the most widespread nutritional disorder globally, affecting over 50% of adolescent girls in low-income countries [3]. Recent studies indicate that more than 40–60% of adolescents in rural regions of India suffer from some form of anemia, making it a silent epidemic with long-term implications such as reduced cognitive performance, poor academic achievements, delayed puberty, and lower immunity [4,5].

Nutritional status is often assessed through anthropometric parameters such as Body Mass Index (BMI), Mid-Upper Arm Circumference (MUAC), and dietary intake surveys. Evidence from rural surveys shows that adolescent boys also face malnutrition due to high physical activity levels and low energy intake, challenging the common gendered assumptions around undernutrition [6]. Moreover, rural adolescents are often excluded from targeted nutrition programs due to lack of school attendance, poor health-seeking behavior, and insufficient community-level screening [7].

The double burden of malnutrition—coexisting undernutrition and micronutrient deficiencies—poses a formidable barrier to achieving the goals of India's Anemia Mukt Bharat and National Nutrition Mission. This is particularly true in remote rural areas where food insecurity, cultural taboos, and inadequate access to health services persist. Periodic deworming, iron and folic acid supplementation, and health education initiatives have been launched, but their efficacy remains variable and region-specific [8,9].

Hence, there is a pressing need for community-based assessments to understand the true magnitude of nutritional deprivation and anemia prevalence among

rural adolescents. Such studies provide crucial baseline data for policymakers to tailor interventions addressing local determinants of adolescent malnutrition. The present study aims to assess the nutritional status and determine the prevalence of anemia among adolescents in a rural block, with the goal of identifying gaps in current preventive strategies and recommending region-specific solutions [10].

MATERIALS AND METHODS

This community-based cross-sectional study was conducted to assess the nutritional status and prevalence of anemia among adolescents residing in a rural block. The study focused on evaluating both anthropometric indicators and hemoglobin levels to gain a comprehensive understanding of the nutritional challenges in this vulnerable age group.

The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from parents or guardians, and assent was obtained from adolescent participants prior to inclusion.

Study Design and Setting

A cross-sectional, descriptive study was carried out in selected villages of a rural block under the authority of a tertiary care teaching institution. The study period spanned one year and included adolescents from both school-going and out-of-school populations.

Study Population

The study included adolescents aged 10 to 19 years residing in the rural block. A total of **1250 adolescents** were recruited using a multistage random sampling technique. Among the participants, **781 were males** and **469 were females**.

Inclusion Criteria

- Adolescents aged 10–19 years
- Permanent residents of the selected rural block
- Willing to provide assent/consent along with parental consent

Exclusion Criteria

- Adolescents with known chronic illnesses (e.g., thalassemia, sickle cell disease)
- Those on iron or vitamin supplementation in the previous three months
- Participants unwilling to provide blood samples

Sampling Method

A multistage random sampling technique was employed. Villages were randomly selected from the rural block. Within each village, households were chosen by systematic random sampling, and eligible adolescents from each household were invited to participate.

Data Collection Tools and Procedure

Data collection was conducted through structured interviews and clinical assessments by trained healthcare personnel. A pretested questionnaire was used to collect demographic information, dietary patterns, personal hygiene, physical activity, and socio-economic background.

Anthropometric Measurements

- **Height and weight** were measured using standardized procedures to calculate Body Mass Index (BMI) according to WHO growth charts.
- **Mid-Upper Arm Circumference (MUAC)** was also recorded as an additional nutritional indicator.

Hemoglobin Estimation

Capillary blood samples were collected using finger prick technique under aseptic precautions. Hemoglobin levels were measured using the HemoCue method. Anemia was classified as per WHO criteria:

- Mild Anemia: 11.0–11.9 g/dL
- Moderate Anemia: 8.0–10.9 g/dL
- Severe Anemia: <8.0 g/dL

Data Analysis

Data were entered in MS Excel and analyzed using SPSS software. Descriptive statistics were used to summarize sociodemographic data and anemia prevalence. Chi-square tests were applied to assess associations between gender, age groups, and anemia prevalence. P-value <0.05 was considered statistically significant.

RESULTS

Table 1 shows the distribution of school-going and non-school-going adolescents according to age and gender. Among boys, the majority were school-going across all age groups, with a gradual increase in the percentage of non-school-going adolescents as age advanced, especially notable from age 16 onwards. The highest number of non-school-going boys was recorded at age 19. A similar trend was observed among girls, where the non-school-going percentage increased significantly in higher age brackets, particularly from ages 16 to 19. This shift indicates that dropout rates increase with age, especially in late adolescence, more prominently among females.

Table 2 shows the nutritional status of adolescents in school-going and non-school-going groups. Among school-going boys, 41.9% were found to be undernourished, whereas in non-school-going boys, the prevalence rose to 46.7%. Similarly, among girls, 29.9% of school-going adolescents and 38.8% of non-school-going adolescents were undernourished. The combined prevalence of undernourishment was higher among boys (42.9%) than girls (31.9%), and the differences were statistically significant.

Table 3 shows the distribution of undernourished adolescents according to age categories. Among boys, the highest number of undernourished individuals was observed in the 14–16 years group (96), followed by 17–19 years (89), and 10–13 years (85). Among girls, a similar trend was noted, with 74 undernourished in the 14–16 years group, 79 in 17–19 years, and 66 in the 10–13 years age bracket.

Table 4 shows the prevalence of anemia in school-going and non-school-going adolescents. In school-going boys, anemia was present in 30%, while among non-school-going boys, it was slightly lower at 22%. However, in girls, anemia was markedly higher, with 49% of school-going and 46% of non-school-going adolescents being anemic. Overall, the prevalence of anemia among females was significantly higher compared to males.

Table 5 shows the prevalence of stunting across different age groups. In boys, the highest prevalence of stunting was observed at age 10 (76.9%) followed by ages 12 and 14. Among girls, the highest stunting percentage was recorded at age 10 (69.8%), followed by age 11 (63.1%) and age 14 (59%). A general decline in stunting was observed with increasing age in both genders, although fluctuations were present.

Table 1: Distribution of school-going and non-school-going adolescents by age and gender (n = 1250)

Age	Male School	Male Non-School	Female School	Female Non-School
10	108	26	69	22
11	42	8	34	8
12	80	27	27	3
13	65	14	48	14
14	46	12	38	14
15	48	15	35	11
16	40	13	36	12
17	38	14	30	11
18	38	16	27	9
19	34	18	26	10
Total	539	173	370	114

Table 2: Nutritional Status – Undernourishment in Adolescents

Group	Male Total	Male Undernourished	Female Total	Female Undernourished	Male %	Female %	P-value
School going	487	204	304	91	41.9%	29.9%	0.04
Non-school going	122	57	85	33	46.7%	38.8%	0.03
Total	609	261	389	124	42.9%	31.9%	0.01

Table 3: Distribution of Undernourished Adolescents in Different Age Groups

Age Group	Male Undernourished	Female Undernourished
10–13	85	66
14–16	96	74
17–19	89	79

Table 4: Prevalence of Anemia in School-going and non-school-going Adolescents

Group	Male Total	Male Anemia	Female Total	Female Anemia
School going	487	146	304	148
Non-school going	122	26	85	39
Total	609	176	389	186

Table 5: Prevalence of Stunting by Age and Gender

Age	Male Stunted %	Female Stunted %
10	76.9	69.8
11	33.6	63.1
12	65.0	54.1
13	56.6	46.9
14	63.8	59.0
15	40.1	52.3
16	36.5	30.7
17	31.3	46.5
18	29.1	29.7

19	29.0	29.0

DISCUSSION

The present study provides a comprehensive overview of the nutritional status and anemia prevalence among adolescents residing in a rural block. Our findings revealed that undernourishment was more prevalent in males (42.9%) than in females (31.9%), aligning with earlier observations that rural adolescent boys are often more nutritionally deprived due to higher energy demands and poor dietary intake [11]. Notably, the prevalence of undernourishment was higher in non-school-going adolescents of both genders, which correlates with the literature emphasizing the positive influence of school-based mid-day meal programs and structured routines on nutritional well-being [12].

Anemia was significantly more prevalent in girls (48.7%) compared to boys (29.3%), which is consistent with existing studies that attribute menstrual blood loss, inadequate iron intake, and gender-based nutritional discrimination as major contributing factors [13]. These findings underscore the urgent need for gender-sensitive nutrition interventions in adolescent health programs.

The study also highlighted the rising dropout rates and non-school-going percentages among older adolescents, particularly girls, and their direct association with poorer nutritional and health outcomes. This supports the premise that educational continuity can play a vital protective role against malnutrition and anemia [14]. Additionally, stunting data revealed alarmingly high rates in early adolescence, particularly at ages 10 and 11, suggesting that nutritional interventions must begin earlier, preferably in pre-adolescence, to be most effective [15].

Thus, this study reinforces the strong interlinkages between school attendance, gender, socioeconomic status, and health indicators such as anemia and undernutrition. It also brings attention to the necessity of policy-level shifts to prioritize adolescent health as a national concern, particularly in rural populations.

CONCLUSION

In conclusion, this study demonstrates a high prevalence of undernutrition and anemia among rural adolescents, with non-school-going and female adolescents being particularly vulnerable. The results point to an urgent need for early, community-based, gender-sensitive interventions to tackle nutritional deficits. Strengthening school health programs, enhancing dietary quality, and addressing the causes of school dropouts could collectively improve adolescent health outcomes in rural India.

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