

Original research article

Clinico Hematological Profile of Anemia in Adolescent Age group: a Retrospective Study from Eastern India.

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Abstract

Introduction: Globally anemia is one of the most important health problems. Adolescents are young people between the ages of 10 to 19 years. Anemia in adolescence may cause a wide range of functional consequences across the life course, including reduced resistance to infection, impaired physical performance and neurodevelopment, and suboptimal schooling outcomes.

Aims and objectives: To estimate the prevalence of anemia, to determine the morphological types and patterns of anemia and to assess the etiological factors for different types of anemia among adolescent age group of Eastern India.

Materials and methods: It is a retrospective observational study conducted in the department of Hematology at a tertiary care center in Bihar with a sample size of 200 cases. All patients belonging to adolescent age group (10-19 years) having sign and symptoms of anemia were chosen for study whereas children less than 10 years, patients on hematinic and Covid and viral positive cases were excluded. Clinical and demographic data along with hematological findings were retrieved from medical records and data were analysed by SPSS version 25.

Results: 55% (n=110) patients were males while 45% (n=90) were females. Amongst males, 31.9% (n=23) were anemic in early adolescent age group and 39.4% (n=15) were anemic in age group 15-19 years. While in females, 48.8% (n=21) were anemic in early adolescents and 78.7% (n=37) were anemic in late adolescent age group. Overall prevalence of anaemia among the study subjects was found to be 40.9%. The prevalence of mild and moderate anaemia was almost similar, each comprising of 39.1% and 39% respectively whereas 3.1% cases had severe anaemia.

Conclusion: The prevalence of anemia amongst adolescents was a moderate public health problem. Factors associated with anemia were low socioeconomic status, rural background, larger family size, poor dietary habits and personal hygiene.

Keywords: Anemia, Adolescents, socioeconomic status, rural

Introduction

Anemia is one of the most serious health issues worldwide.¹ Adolescents are teenagers who are between the ages of 10-19 years.² Adolescence is a period of rapid growth, reproductive maturation, and developmental transitions, all of which necessitate greater nutritional intake, making adolescents more sensitive to nutritional deficiencies.³ Anemia in adolescence can have a variety of functional repercussions over the course of a person's life, including decreased resistance to infection, diminished physical performance and neurodevelopment, and poor academic performance.⁴

Anemia affects more than two-thirds (69%) of children aged 6 to 59 months. There are 31% of people who are mildly anaemic, 37% who are moderately anaemic, and 2% who are severely anaemic. In NFHS-5, the overall prevalence of anaemia in children increased from 64 percent to 69 percent. In NFHS-5, there is no discernible difference in the prevalence of anaemia among girls and boys. Anemia is substantially more common in children whose moms are anaemic. Although anaemia levels vary depending on background characteristics, anaemia is common among children of all ages. Even if their mother has 12 or more years of schooling, over two-thirds (68%) of children in Bihar are anaemic.⁵

In Bihar, 64 percent of women have anaemia, with 30 percent having mild anaemia, 32 percent having moderate anaemia, and 2% having severe anaemia. Anaemia is most prevalent among urban women and women aged 15 to 19, however it affects every category of women. Since NFHS-4, anaemia has grown by 3 percentage points in women. In Bihar, about one-third of men (30%) are anaemic. Those between the ages of 15 and 19, as well as men living in rural regions, are more likely to be anaemic.⁵

Multiple studies have found that factors linked to anaemia differ across adolescents and adults.⁶ Anemia prevalence may differ between early adolescents (age 15–19 years) and older adolescents (age 15–19 years), according to studies.⁷ During adolescence, iron deficiency anaemia (IDA) is the most common anaemia. Accelerated growth, hormonal changes, starvation, and the onset of menstrual cycles in girls are all key factors during this time.⁸

The adolescence age group is the most neglected in public health and nutrition research as priorities are usually given to pregnant women, lactating mothers, and their children less than 2 years. There is paucity of data on the prevalence of anemia in this part of country where poverty is rampant and access to health care facilities is meagre.

Aims and objectives:

1. To estimate the prevalence of anemia among adolescents in Eastern India.
2. To determine the morphological types and patterns of anemia in adolescents.
3. To assess the etiological factors for different types of anemia in adolescent age group.

Materials and methods:

A retrospective study was conducted in Hematology department, Indira Gandhi Institute of Medical Sciences, Patna over a period of two years from July 2019 to June 2021 and it was approved by the Institutional Ethical and Scientific committee. A total of 200 cases belonging to adolescent age group coming to various OPDs were involved in the study. A predesigned proforma was made in which patient characteristics were entered. Medical records were studied and data were collected.

Inclusion criteria:

All patients belonging to adolescent age group (10-19 years) coming to various OPDs were chosen for study.

Exclusion criteria:

1. Children less than 10 years.
2. Patients having medication history of hematinics in the past fortnight prior to data collection.
3. Covid and viral positive cases.

The required quantity of venous blood was collected in EDTA vials. The collected blood was analysed using fully automated analyser, SIEMENS ADVIA 2120i having 6 part differentials from which the following parameters were obtained Hb%, PCV, RBC count, RBC indices-MCV, MCH, MCHC, RDW, total WBC including differential count, platelet count and reticulocyte count. The peripheral smears were prepared on glass slides and stained with Leishman's stain. The reticulocyte count was done by Supravital staining technique using brilliant cresyl blue.

Tests such as serum ferritin, serum vit B 12 & folate estimation, bone marrow aspiration and biopsy, Hemoglobin electrophoresis, osmotic fragility and Coomb's test were done depending on specific requirement. Other ancillary tests including stool examination, ultrasonography and x-ray were done whenever required.

Data was recorded and analyzed using Statistical Package for Social Sciences version 25 (SPSS version 25). Chi square test and Fisher's exact was applied to test the association of qualitative data and student's t test was applied to test the association of quantitative data. Results were recorded as frequencies, means \pm standard deviations (SD) and p-values. For all purposes, a p-value of < 0.05 (95% confidence level) was considered as the criteria of significance.

Results:

The present study was carried out on 200 patients belonging to adolescent age group. These 200 patients were categorized into two age subgroups, 10- 14 years (early adolescents) and 15-19 years (late adolescents).

Overall 55% (n=110) patients were males while 45% (n=90) were females. Amongst males, 31.9% (n=23) were anemic in early adolescent age group and 39.4% (n=15) were anemic in age group 15-19years. While in females, 48.8% (n=21) were anemic in early adolescents and 78.7% (n=37) were anemic in late adolescent age group. In males, majority of anemic patients presented with mild anemia while in females majority presented with moderate anemia. (Table 1)

Table 1: Prevalence (%)of anemia by haemoglobin (g/dl) amongst early and late adolescent age group.

Age group in yrs	Males			Females		
	Mild (12.0-12.9g/dl)	Moderate (9.0-11.9g/dl)	Severe (<9.0 g/dl)	Mild (11.0-11.9g/dl)	Moderate (8.0-10.9g/dl)	Severe (<8.0g/dl)
10-14yrs	13 (56.5%)	09 (39.1%)	01 (4.3%)	10 (47.6%)	11 (52.3%)	00 (0.0%)
15-19yrs	08 (53.3%)	07 (46.6%)	00 (0.0%)	16 (43.2%)	19 (51.3%)	02 (5.4%)

Most of the anemic patients belonged to joint family and of lower socioeconomic class. The majority of patients were Hindus and residents of rural areas. The majority of patients' marital status was single. Most of them were literate. (Table 2)

Table 2: Socioeconomic and demographic characteristics amongst early and late adolescent age group patients.

Risk factors	Categories	Males				Females			
		Anemia present		Anemia absent		Anemia present		Anemia absent	
		10-14yrs	15-19yrs	10-14yrs	15-19yrs	10-14yrs	15-19yrs	10-14yrs	15-19yrs
Age group in yrs		23	15	49	23	21	37	22	10
Family size	< 5	06	06	31	14	08	11	15	06
	> 5	17	09	18	09	13	26	07	04
Socioeconomic status	Low	15	11	32	12	15	19	11	06
	Medium	08	04	16	10	06	18	10	04
	High	00	00	01	01	00	00	01	00
Religion	Hindu	18	11	39	21	17	28	16	08
	Muslim	04	03	08	02	04	08	06	02
	Christian	01	00	02	00	00	01	00	00
	Others	00	01	00	00	00	00	00	00
Dietary habit	Veg	15	10	23	11	13	21	08	05
	Non veg	08	05	26	12	08	16	14	05
Residence	Urban	05	04	10	06	04	08	06	04
	Rural	18	11	39	17	17	29	16	06
Marital status	Single	23	12	49	21	21	31	22	09
	Married	00	03	00	02	00	06	00	01
Education status	Illiterate	07	04	14	08	05	11	07	04
	Literate	16	11	35	15	16	26	15	06
H/O iron prophylaxis	Yes	01	00	00	00	04	10	00	00
	No	22	15	49	23	17	27	22	10

Mean hemoglobin levels in early and late male adolescent group where anemia was present were 11.7 ± 1.1 and 11.7 ± 0.8 gm/dl respectively while mean hemoglobin levels in early and late female adolescent group where anemia was present were 10.5 ± 1.0 and 10.5 ± 0.9 gm/dl respectively. (Table 3)

Mean platelet levels in anemic group of early and late male adolescents were 2.1 ± 1.3 and 1.9 ± 1.1 thousand /mm³ while mean platelet levels in anemic group of early and late female adolescents were 1.7 ± 1.0 and 2.3 ± 1.6 thousand /mm³. (Table 3)

Table 3: Distribution of hematological indicators by age group and sex

Parameters	Males				Females			
	Anemia present		Anemia absent		Anemia present		Anemia absent	
	10-14yrs	15-19yrs	10-14yrs	15-19yrs	10-14yrs	15-19yrs	10-14yrs	15-19yrs
Hb (g/dl)	11.7 ± 1.1	11.7 ± 0.8	13.2 ± 0.2	13.3 ± 0.4	10.5 ± 1.0	10.5 ± 0.9	12.2 ± 0.2	12.2 ± 0.1
WBC (thousand/mm ³)	6.8 ± 1.6	7.2 ± 1.0	7.0 ± 1.3	7.1 ± 1.1	6.3 ± 1.3	5.7 ± 0.9	6.7 ± 0.5	6.5 ± 0.9
RBC count (million/mm ³)	3.9 ± 0.3	3.9 ± 0.2	4.4 ± 0.09	4.4 ± 0.1	3.5 ± 0.3	4.3 ± 0.5	3.9 ± 0.2	4.4 ± 0.1
Hematocrit%	35.1 ± 3.3	35.3 ± 2.6	39.7 ± 0.7	39.9 ± 1.3	31.7 ± 3.0	31.5 ± 2.9	36.6 ± 0.8	36.6 ± 0.5
MCV (fl)	86.9 ± 9.8	85.5 ± 9.6	83.0 ± 1.6	82.5 ± 1.2	81.9 ± 10.5	76.8 ± 10.5	82.8 ± 1.3	84.0 ± 2.2
MCH (pg)	29.2 ± 2.4	29.2 ± 2.9	28.5 ± 0.7	28.3 ± 0.5	28.4 ± 2.9	27.1 ± 2.7	28.0 ± 0.6	28.3 ± 0.6
MCHC (g/dl)	34.0 ± 1.8	33.3 ± 1.2	33.9 ± 0.4	33.8 ± 0.2	32.9 ± 1.0	32.3 ± 0.9	33.8 ± 0.3	33.8 ± 0.2
RDW(%)	15.8 ± 3.6	17.0 ± 4.0	13.2 ± 0.6	13.0 ± 0.7	18.1 ± 3.6	20.0 ± 3.3	13.1 ± 0.7	13.0 ± 0.6
Granulocytes(%)	65.6 ± 9.1	66.5 ± 6.9	68.5 ± 7.1	63.6 ± 6.6	62.0 ± 9.6	60.6 ± 10.3	64.5 ± 9.1	66.8 ± 6.6
Lymphocytes (%)	27.8 ± 8.4	27.7 ± 6.3	25.5 ± 6.6	30.3 ± 5.8	31.2 ± 9.9	32.5 ± 9.8	28.2 ± 8.6	26.4 ± 7.6

Monocytes(%)	6.5±1.8	5.7±1.7	5.9±1.7	5.9±1.8	6.7±1.5	6.7±1.9	7.2±1.8	6.8±1.8
Thrombocytes count(thousand/mm ³)	2.1±1.3	1.9±1.1	1.4±0.1	1.5±0.1	1.7±1.0	2.3±1.6	1.4±0.1	2.1±1.5

Table 4: Classification of anemia on the basis of morphological assessment

Type of anemia	Males		Females	
	10-14yrs	15-19yrs	10-14yrs	15-19yrs
Normocytic normochromic	12	08	05	03
Microcytic hypochromic	05	03	10	28
Macrocytic normochromic	02	02	00	01
Dimorphic	04	02	06	05

Majority of male patients showed normocytic normochromic blood picture on morphological assessment whereas majority of female patients had microcytic hypochromic blood picture. (Table 4)

Discussion:

Anemia is defined and adjusted for age as haemoglobin concentrations < 11.5 g/dl among adolescents 10–11 years old and < 12.0 g/dl among adolescents of 12–14 years old according to WHO.⁹ In terms of severity, mild anemia was defined as a hemoglobin concentration between 11.0 and 11.4 g/dl among adolescents aged 10–11 years and between 11.0 and 11.9 g/dl among adolescents aged 12–14 years. Moderate and severe anemia was defined by a hemoglobin concentration of between 8.0 and 10.9 g/dl and lower than 8.0 g/dl, respectively.

Anaemia is the major public health problem among adolescent girls of age 10-19 years. The reason for high incidence of anaemia among the adolescent girls are increased requirement during growth spurt, menstrual loss, low intake of iron rich food, erratic eating habits.

Majority of the patients who were anemic belonged to rural background and this was consistent with the studies done by Koushik et al.(2014) and Manjula et al.(2014).^{10,11}

In the present study overall prevalence of anaemia among the study subjects was found to be 40.9 %. A study conducted among undergraduate students of government medical college, Kottayam revealed that the prevalence of anaemia was 19.13%.¹¹ Another study which was conducted among tribal women in Wayanad district shown that the prevalence of anaemia was found to be 96.5%.¹² Under-nutrition among tribal women was the major cause identified from that study. In an another study conducted in Tamilnadu showed the prevalence of anaemia among 10-15 year old adolescent girls were found to be 58.4%.¹³ Another study conducted in Andhra Pradesh showed the prevalence of anaemia among adolescent girls was 77.33%.¹⁰

In the present study, prevalence of mild and moderate anaemia was almost similar, each comprising of 39.1% and 39 % respectively whereas 3.1% cases had severe anaemia. In a study which was conducted in Wayanad district prevalence of mild anaemia was 30.5%, that of moderate anaemia was 55.9% and that of severe was 10.1%.¹² Similar results were obtained in a study conducted among adolescent girls in Andhra Pradesh with prevalence of mild anaemia was 28.7%, that of moderate anaemia 39.33% and that of severe anaemia 9.33%.¹⁰

Even though most of the study showed that male adolescents had normocytic normochromic anaemia, the mean values of PCV, MCV, MCH and MCHC were significantly lower among anaemic subjects compared to normal subjects. This finding was in agreement with study

conducted by Manjula et al.¹¹ As iron deficiency progresses the cells become more microcytic with marked fall in MCV, MCH and MCHC.¹¹

In the present study prevalence of anaemia was more in low socio-economic category comprising 41.2% and 18.2% among medium socioeconomic group. Most of the studies conducted in various parts of India showed the high prevalence in lower socio-economic category compared to upper categories similar to our study.¹⁴ Prevalence of anemia was higher in those where their number of family members were more than 5 and this was supported by a study done by Siva et al. covering adolescent girls of Kerala. It might be due to poor health hygiene, overcrowding and poor nutrition.¹⁵

A significant association between anaemia and factors like personal hygiene (hand hygiene and footwear usage) and worm infestation shows the area needed to be focused among adolescent girls. A programme focusing on improving personal hygiene and periodical deworming is needed for them. Those adolescents who had no history of iron prophylaxis showed higher prevalence of anemia as compared to those who did not have any iron prophylaxis and this finding was consistent with that of Siva et al.¹⁵

The prevalence of anemia were 2 times higher among adolescents who had menstrual bleeding more than 5 days as compared with adolescents girls with menstrual bleeding less than or equal to 5 days.¹⁶ This finding was consistent with the study result reported in the Tangail region of Bangladesh, central Kerala, India, Nepal, and locally Bahirdar, northwest Ethiopia.^{15,17, 18,19} It might be due to the fact that with an increased duration of menstruation, there will be a high chance of more blood loss that can lead to anemia.

Conclusion:

In this study, the prevalence of anemia was a moderate public health problem. Factors associated with anemia were low socioeconomic status, rural background, larger family size, poor dietary habits and personal hygiene. As the prevalence of anemia is higher in this part of the country, government should effectively focus on implementation of anemia control programme with special emphasis on this age group.

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