

## Spectrum Of Anemia In Adolescents Admitted at A Tertiary Care Centre: A Retrospective Study

Nathe N<sup>1\*</sup>, Kale V<sup>2</sup>, Havnur M<sup>3</sup>, Torane K<sup>4</sup>, Deore B<sup>5</sup>

DOI:<https://doi.org/10.17511/jopm.2024.i04.01>

<sup>1\*</sup> Neha Nathe, Assistant Professor, Department of Pathology, Dr Vasanttrao Pawar Medical College Hospital and Research Centre, Nashik, Maharashtra, India.

<sup>2</sup> Vidya Kale, Assistant professor, Department of Pathology, Dr Vasanttrao Pawar Medical College Hospital And Research Centre, Nashik, Maharashtra, India.

<sup>3</sup> Mamata Havnur, junior resident, Department of Pathology, Dr Vasanttrao Pawar Medical College Hospital And Research Centre, Nashik, Maharashtra, India.

<sup>4</sup> Kunal Torane, Assistant professor, Department of Pathology, Dr Vasanttrao Pawar Medical College Hospital And Research Centre, Nashik, Maharashtra, India.

<sup>5</sup> Bharati Deore, Assistant professor, Department of Pathology, Dr Vasanttrao Pawar Medical College Hospital And Research Centre, Nashik, Maharashtra, India.


**Introduction:** Anemia in adolescents needs to be studied as it affects the development and health of an individual in adult life. Adolescent anemia refers to a group of anemias that occur between the age of 10- 19 years. Anemia in adolescents needs to be studied as it affects the development and health of an individual in adult life. Morphological examination of anemia is important to find out the underlying cause.

**Material and Methods:** A Retrospective Observational study was conducted on patients 10- 19 years old visiting the hematology section of the central clinical laboratory at Dr VPMCH and RC Nashik, Maharashtra from September 2022 to September 2023.

**Results:** A total of 473 patients were included in the study of which 323(68% were anemic. This includes 54% females and the maximum patients were in the late adolescence stage. On studying RBC Indices and morphology, it was observed that 242(75% cases had Microcytic Hypochromic anemia.

**Conclusion:** Anemia is most commonly seen in adolescents, especially in girls of the late adolescent age group. Microcytic hypochromic Anemia is most common among adolescents. Morphological assessment is necessary in all cases for accurate diagnosis and treatment.

**Keywords:** Adolescents, Anemia, Microcytic Hypochromic Anemia

Corresponding Author	How to Cite this Article	To Browse
Neha Nathe, Assistant Professor, Department of Pathology, Dr Vasanttrao Pawar Medical College Hospital and Research Centre, Nashik, Maharashtra, India. Email: <a href="mailto:natheneha186@gmail.com">natheneha186@gmail.com</a>	Nathe N, Kale V, Havnur M, Torane K, Deore B, Spectrum Of Anemia In Adolescents Admitted at A Tertiary Care Centre: A Retrospective Study. Trop J Pathol Microbiol. 2024;10(4):59-63. Available From <a href="https://pathology.medresearch.in/index.php/jopm/article/view/666">https://pathology.medresearch.in/index.php/jopm/article/view/666</a>	

<b>Manuscript Received</b> 2024-10-03	<b>Review Round 1</b> 2024-10-10	<b>Review Round 2</b> 2024-10-17	<b>Review Round 3</b> 2024-10-24	<b>Accepted</b> 2024-10-31
<b>Conflict of Interest</b> None	<b>Funding</b> Nil	<b>Ethical Approval</b> Yes	<b>Plagiarism X-checker</b> 13.36	<b>Note</b>
 © 2024 by Nathe N, Kale V, Havnur M, Torane K, Deore B. Published by Siddharth Health Research and Social Welfare Society. This is an Open Access article licensed under a Creative Commons Attribution 4.0 International License <a href="https://creativecommons.org/licenses/by/4.0/">https://creativecommons.org/licenses/by/4.0/</a> unported [CC BY 4.0].				
				

## Introduction

Anemia is defined as a decrease in the number of red blood cells or the haemoglobin concentration lower than normal limits. Anemia is a serious global public health problem that particularly affects young children, menstruating adolescent girls and women, and pregnant and postpartum women. Indian population has a high prevalence of anemia, especially in rural areas. Anemia in adolescents needs to be studied as it affects the development and health of an individual in adult life. Adolescent anemias refer to a group of anemias that occur between the age of 10- 19 years. Adolescent females are more prone to develop anemia due to menstrual blood loss and poor nutritional status. [1], [2], [3],[9],[10]. The factors responsible for the high prevalence of anemia may be poor iron intake from the diet (vegetarian diet), infection like malaria, parasitic infestation and menorrhagia through menstruation.[1],[12]. Anemias due to chronic diseases and genetic disorders (sickle cell anemias and Thalassemias) are also seen in adolescents. Gastrointestinal Diseases such as varices, polyps, colitis, peptic ulcers, and Inflammatory bowel diseases can lead to anemia by causing bleeding during adolescence.[2] Anemia is a frequent cause of hospital admission for various bone marrow diseases. Morphological examination of anemia is important to find out the cause of anemia.

## Material and Methods

**Study Design:** Retrospective Observational

**Study Duration:** September 2022 to September 2023

**Sampling technique:** Universal sampling

**Inclusion Criteria:** All indoor patients, between 10-19 years of age, whose CBC blood samples were received in the central clinical laboratory, Department of Pathology, Dr Vasantrao Pawar Medical College Hospital and Research Centre, Adgaon, Nashik

**Exclusion Criteria:** Patients not falling in the adolescent age group. Adolescent patients whose CBCs were not done.

**Methodology:** Ethics committee permission is sought before initiation of the study.

According to the WHO definition of anemia, hemoglobin (Hb) values lower than 12 g/dl in females and lower than 13 g/dl in males are diagnosed as anemia. The age-specific cut-off points for hemoglobin as per WHO guidelines were followed.

For all the cases, the Complete Blood Count (CBC) was performed on a fully automated Sysmex XN550 six-part cell counter. The Peripheral Blood Smear (PBS) stained by Fields stain was studied to correlate the readings of the cell counter. Peripheral Blood Smear findings and Red Cell Indices like Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Red Cell Distribution Width (RDW) were studied to diagnose and categorise the morphological type as well as the severity of anemia. The parameters considered for the data analysis are age, gender, the severity of anemia and morphological type of anaemia. Depending on the haemoglobin concentration, the patients were divided into three different categories: 1. Mild (haemoglobin 10 to 12.9 gm/dl in males and 11.9 gm/dl in females) 2. Moderate (8.0 to 9.9 gm/dl), 3. Severe (less than 7 gm/dl) Morphological classification was done based on RBC indices which were correlated with peripheral smear findings and these were categorised as 1. Normocytic Normochromic anaemia (MCV between 80 to 100 femtoliter and MCH between 27 to 32 picograms) 2. Microcytic hypochromic (MCV less than 80 femtoliter and MCH below 27 picograms) 3. Macrocytic ( MCV more than 100 femtoliters)

**Data Analysis Procedure** Data will be analyzed by Excel spreadsheet and results documented in proportions and percentages.

## Results

We studied a total of 473 adolescents out of which 323 were anemic. The prevalence of Anemia in adolescence was 68%. Among these 323 patients 148(46%) were male and 175(54%) were females. Among all females 80% (175/219) were anemic. 58% (148/254) of male adolescents had anemia. The age-wise distribution of anemic adolescents is given in Tables 3 and 4.

These patients are divided into three groups as per age; early adolescents (10-13yrs), late adolescents (14-16 Yrs) and late adolescents (17-19 Yrs).

On categorising the cases according to age, it was found that 96(29%) were early adolescents, 53(17%) were mid adolescents and 174(54%) were late adolescents. Females in the late adolescent age group were most affected by anemia occupying 36% of total anemic adolescents.

On classifying anemia according to severity, it was observed that 18 cases had Hb less than 7 gm%.117 had moderate anemia and 188 had mild anemia. 49% of patients of all anemic individuals had mild anemia.

On studying RBC Indices and morphology, it was observed that 242 cases had Microcytic Hypochromic anemia, 57 cases had macrocytic anemia and 24 cases showed Normocytic Normochromic anemia.

Many cases showed dimorphic blood pictures, of which the predominant morphologic finding was taken into consideration. 2 cases showed fragmented RBCs, polychromasia, and nucleated RBCs and were diagnosed as Hemolytic anemia.

**Table 1: Age-wise prevalence of anemia among adolescents**

Age Group	Total Patients	Total Anemic Patients
Early Adolescents(10-13 Yrs)	143	96(67%)
Mid Adolescents(14-16 Yrs)	74	53(72%)
Late Adolescents (17-19 Yrs)	256	174(70%)
Total	473	323(68%)

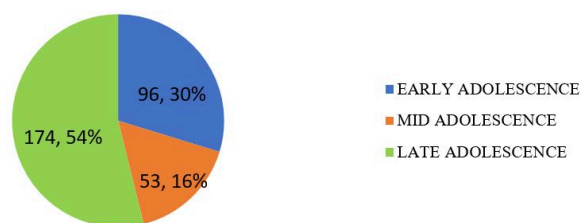
**Table 2: Age and gender-wise prevalence of all patients**

Age Group	Total Male	Anemic Male	Total Female	Anemic Female
Early Adolescents( 10-13 Yrs)	90	55(61%)	53	41(77%)
Mid Adolescents(14-16 Yrs)	53	34(64%)	21	19(90%)
Late Adolescents (17-19 Yrs)	111	59(53%)	145	115(86%)
Total	254	148(58%)	219	175(80%)

**Table 3: Age and gender-wise distribution of anemic adolescents**

Age Group	Male	Female	Total
Early Adolescents( 10-13 Yrs)	55(17%)	41(12%)	96(29%)
Mid Adolescents(14-16 Yrs)	34(11%)	19(6%)	53(17%)
Late Adolescents (17-19 Yrs)	59(18%)	115(36%)	174(54%)
Total	148(46%)	175(54%)	323

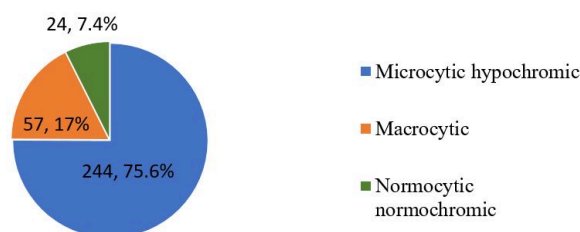
**fig 1 . Age Distribution Of Anemia**



**Table 4: Degree (severity) of Anemia**

Severity of Anemia	Total	Male	Female
Severe (<7gm%)	18(5%)	10	8
Moderate (7-10 gm%)	117(36%)	59	58
Mild (>10gm%)	188(49%)	79	109

**fig 2. MORPHOLOGIAL TYPE OF ANEMIA**



**Table 5: Morphologic type of anemia**

Morphologic type	No. of patients	Percentage
Microcytic hypochromic	244	75.6%
Macrocytic	57	17%
Normocytic normochromic	24	7.4%

## Discussion

The study includes patients from a tertiary care centre in the North Maharashtra region. We studied blood parameters and peripheral smears of these patients to find out the prevalence and type of anaemia in the adolescent age group. The prevalence of anaemia in our study was 68%, which was quite high as the denominator population was adolescents visiting the hospital and not the general population. A study in Bundelkhand showed a prevalence of 52.8%.[4] Another study done in Nepal showed a prevalence of 56.3%.[5] Other studies including only adolescent girls found 50% and 52.5% prevalence.[6,7]

Anemia is predominantly found in girls, which was 54% of the study population (175/323) and 86% of total adolescent girls in the present study. In the Bihar study prevalence of anemia was 62% and 32.4% in girls and boys respectively.[6]

A study has 74% of girls and 26% of boys involved in anemia. Other studies also show similar findings[3]. A study in Bundelkhand shows that 57% of all adolescent girls and 50% of all adolescent boys were involved in anaemia. [4]Similarly, 52.3% of girls and 47.7% of boys were affected by anemia in adolescence in Neal[5]. The higher percentage of anemia in girls is due to low iron intake, menstrual loss, pregnancy, illiteracy etc. [9],[10],[14].

After puberty, anemia was seen constantly in over 50% of females. Males showed a peak of anemia during puberty and a progressive increase of anaemia with age. [15] There are few anemia studies including both male and female adolescents. Although girls are more affected, adolescent boys should also be studied as a significant population of boys is found to be anemia in various studies[11]. Anemia in adolescents affects their cognitive physical growth and development.

Maximum cases were in the late adolescence stage in our study which was similar to a study in Bihar. Neal's study shows a higher incidence in girls more than 18 years old 17.5%. [5]. In girls, early marriage and pregnancy can be a reason for the high number of cases in late adolescence. In Bundelkhand, maximum cases were in early adolescence followed by mid adolescence stage.[4]

The percentage of severe anemia was less(5%) in our study which is comparable to other studies. It was 5.8% and 6.9%in other studies.[4, 5] Nepal study shows more cases of mild anemia which were 69.7%.[5] A study in Belkare shows 32.1% severe anemia in girls which was very high compared to our study. Rekha K et al shows 43.3% mild and 3.3% severe anemia cases in girls.[8]The severe anemia in our study was due to leukaemia, bone marrow infiltration by tumour, haemolytic anemia and iron deficiency anemia.

Most cases of mild anemia showed microcytic hypochromic peripheral smear which points towards Iron deficiency anemia. Many other studies also showed similar results.[4-8]. Dvijendra N et found that the most common type observed was microcytic hypochromic 32.56%, while in the early adolescent period, it was normocytic normochromic. [4]Several other studies show iron deficiency anemia in many females which was 87% in a study. [2] [11].

Other causes of anemia were macrocytic anemia, dimorphic anemia, vitamin deficiency and hemoglobinopathies. Although many studies found that the most common anemia was a nutritional deficiency, investigating anemia in adolescents is necessary to reduce vulnerability to illness requiring hospital services.[13]

## Conclusion

Anemia is a major health problem seen in adolescents, especially in girls of the late adolescent age group. Microcytic hypochromic anemias are the most common among adolescents. Morphological examination of anemia is necessary in all cases for accurate diagnosis and treatment.

### What the study adds to existing knowledge?

This study highlights that anemia is still a major problem among adolescents and its evaluation is necessary for better treatment and prevention.

### Permission from Institutional research board:

Yes

### Funding: Nil

### Conflict of interest: None initiated

### Contribution details:

Nature of work	1	2	3	4	5
Concept	*	*			
Design		*			
Definition of intellectual content	*				
Literature search	*		*	*	
Data acquisition	*		*	*	*
Data analysis	*	*	*		
Statistical analysis	*			*	*
Manuscript preparation	*	*	*	*	
Manuscript editing			*		*
Manuscript review	*	*	*	*	*
Guarantor	*	*			

## References

1. World Health Organization. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. World Health Organization; 2011. . [Crossref][PubMed][Google Scholar]

2. Wu J, Hu Y, Li M, Chen J, Mao D, Li W, Wang R, Yang Y, Piao J, Yang L, Yang X. Prevalence of anemia in Chinese children and adolescents and its associated factors. *International journal of environmental research and public health*. 2019 Apr;16(8):1416. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
3. Ocak S, Kilicaslan O, Yildirmak ZY, Urganci N. Adolescents and anemia. *The Medical Bulletin of SisliEtfal Hospital*. 2017;51(4):309-17. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
4. Nath D, Shevra CR, Prakash S, Chourasiya OS. To study the prevalence of undernutrition and anemia in adolescents in Bundelkhand region. *Indian Journal of Pathology and Oncology*. 2020;7(1):53-7. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
5. Sinha AK, Singh G, Karki Karna K. Prevalence of anemia amongst adolescents in Biratnagar, Morang Dist. Nepal. *International Journal of Pharmaceutical & Biological Archives*. 2012;3(5):1077-81 [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
6. Chauhan S, Kumar P, Marbaniang SP, Srivastava S, Patel R. Prevalence and predictors of anaemia among adolescents in Bihar and Uttar Pradesh, India. *Scientific Reports*. 2022 May 17;12(1):8197. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
7. Raj A, Chopra AK. A study showing correlation between anaemia and common parasitological diseases among adolescent girls in villages of PHC Belkhera, Madhya Pradesh, India. *Int J Community Med Public Health*. 2016 Jan;3(1):373-79. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
8. Alvarez-Uria G, Naik PK, Midde M, Yalla PS, Pakam R. Prevalence and severity of anaemia stratified by age and gender in rural India. *Anemia*. 2014 Oct;2014. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
9. Ford ND, Bichha RP, Parajuli KR, Paudyal N, Joshi N, Whitehead Jr RD, Chitekwe S, Mei Z, Flores-Ayala R, Adhikari DP, Rijal S. Factors associated with anaemia among adolescent boys and girls 10–19 years old in Nepal. *Maternal & child nutrition*. 2022 Jan;18:e13013. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
10. Kumari R, Bharti RK, Singh K, Sinha A, Kumar S, Saran A, Kumar U. Prevalence of iron deficiency and iron deficiency anaemia in adolescent girls in a tertiary care hospital. *Journal of clinical and diagnostic research: JCDR*. 2017 Aug;11(8):BC04. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
11. Scott S, Lahiri A, Sethi V, de Wagt A, Menon P, Yadav K, Varghese M, Joe W, Vir SC, Nguyen PH. Anaemia in Indians aged 10–19 years: Prevalence, burden and associated factors at national and regional levels. *Maternal & Child Nutrition*. 2022 Oct;18(4):e13391. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
12. vanZutphen KG, Kraemer K, Melse-Boonstra A. Knowledge gaps in understanding the etiology of anemia in Indonesian adolescents. *Food and nutrition bulletin*. 2021 Jun;42(1\_suppl):S39-58. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
13. Corrons JL, Krishnevskaya E. Rare anemias in adolescents. *Acta Bio Medica: AteneiParmensis*. 2021;92(1). [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
14. Aguayo VM, Paintal K, Singh G. The Adolescent Girls' Anaemia Control Programme: a decade of programming experience to break the inter-generational cycle of malnutrition in India. *Public health nutrition*. 2013 Sep;16(9):1667-76. [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]
15. Alvarez-Uria G, Naik PK, Midde M, Yalla PS, Pakam R. Prevalence and severity of anaemia stratified by age and gender in rural India. *Anemia*. 2014;2014:176182. doi: 10.1155/2014/176182. Epub 2014 Dec 4. PMID: 25614831; PMCID: PMC4277798 [[Crossref](#)][[PubMed](#)][[Google Scholar](#)]