

## Prevalence of Anemia in Children Between 2 to 10 Years of Age: An Observational Study

Vijay Kumar Gupta<sup>1</sup>, Amit Patidar<sup>2</sup>, Neeta Singh<sup>3</sup>, Yusuf Ahmed<sup>4</sup>

<sup>1,4</sup> Senior Resident Department of Paediatrics, Veerangana Avanti Bai Lodhi, Autonomous State Medical College, Etah, Uttar Pradesh

<sup>2</sup> Senior Resident Department of Paediatrics, Atal Bihari Vajpayee, Government Medical College (ABVGMC), Vidisha

<sup>3</sup> Department of Paediatrics, PGMO, District Hospital, Shivpuri, Madhya Pradesh

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Corresponding author: Dr. Yusuf Ahmed

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### Abstract

**Introduction:** Anaemia is the most common hematological disease of the pediatric age group. Highest prevalence of anaemia is seen in children of developing countries. The present study was conducted in Shrimant Rajmata Vijayaraje Scindia Medical College Shivpuri, Madhya Pradesh to identify prevalence of anemia in children between 2 to 10 years of age.

**Material and methods:** This is an observational study conducted in SRVS, Medical college and associated District Hospital from January 2021 to June 2021 and includes 500 children coming to OPD and admitted in IPD. Complete blood count was obtained by taking 5ml of blood using fully automated MINDRAY Hemat analyser-BC5800. Peripheral blood smear study was performed on all the children. Anemia was diagnosed according to the World Health Organization (WHO) standard for the given age. The data was analyzed and interpreted using descriptive and inferential statistics.

**Results** (47%) were male and 265 (53%) were female. A total of 410 (82%) children were anemic and mild, moderate, and severe Anemia was found in 60.97%, 25.60%, and 13.41%, respectively. Both mild and moderate Anemia was more prevalent in girls (54.33% and 27.92%) compared to boys (45.10% and 13.19%)

**Conclusion:** Anaemia is still a major health problem in children between 2 to 10 years. Nutritional deficiency, particularly, iron deficiency is the leading cause of anemia. This can be primarily prevented by proper nutritional habits and adequate treatment.

**Keywords:** Anaemia Hematological Disease, Pediatric Age Group. Developing Countries.

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## Introduction:

Anemia is a major public health problem all over the world. It occurs in almost all physiological age groups but preschool children are the most severely affected. According to World Health Organization (WHO), globally, the highest prevalence of Anemia is in preschool children (47.4%). The prevalence of Anemia, in preschool children (0 to 4.9 years) in various WHO regions are variable with Africa (67.6%), and Southeast Asia (65.5%) occupying the top of the list(1). In India, 89 million preschool age children suffer from Anemia (1,2).

As per the World Bank data, the prevalence of anemia among under 5 children, in India is 59 in 2011 . According to National Family Health Survey (NFHS-4) data, prevalence among children less than five years of age was reported to be 60% . There are several potential causes of anemia in the context of Indian children has been identified which include, nutritional- low iron intake and low vitamin C intake; lower gastric acidity; parasitic infections, such as hookworm and malaria; and repeated pregnancies in case of women with reproductive age-group.(3-10)

Development of anemia in children is multifactorial. Many factors contribute to the occurrence of anemia, including biological, socioeconomic, environmental, health and nutrition. Now, it is well established fact that the high prevalence of anemia among in children arises from the combination of increased iron needs due to accelerated growth and development, and is mainly associated with diets poor in heme iron. In children, anemia causes depression of the immune system with increased propensity for infection; and reduction of cognitive function, growth and psychomotor development, which leads to difficulties in learning and reduced physical capacity.

These changes may persist even after appropriate drug treatment.(11-12)

Anemia affects individuals of both gender and all ages, there is a need for localized and age- and context-specific studies to improve our knowledge of prevalence patterns and associated risk factors of Indian population. The present study was done to determine the prevalence of and associated risk factors for anemia in children.

## Materials and Methods

This is a observational study, carried out to analyse prevalence of anemia in children in a tertiary care teaching hospital. The study was conducted in Department of Paediatrics, SRVS , Govt. Medical College, Shivpuri, M.P. between January 2021 to June 2021. The study was approved by Institutional Ethics Committee. Written informed consent was obtained from patient before enrolling them into the study.

## Inclusion criteria

Children with the both gender and age group of 2 years to 10 years admitted in Paediatric ward of SRVS , Government Medical College, Shivpuri and diagnosed having anemia are included in this study.

## Exclusion criteria

The children who were not investigated with complete hemogram; and/or having final diagnosis as haemoglobinopathies; and/or currently consuming multivitamin and/or mineral supplements on a regular basis were excluded from the from the study.

For the diagnosis of anemia, WHO criteria for haemoglobin (Hb) threshold in different age group were used and according to this haemoglobin threshold is 11.0gm/dl for age group of 6 months to 5 years.(13) According to WHO criteria, severity of anemia is

classified as: (i) severe anemia: Hb <7.0gm/dl; (ii) moderate anemia: Hb 7.0-8.9gm/dl; and (iii) mild anemia: Hb 9.0-10.9gm/dl.(13)

A detailed history of the patient was evaluated; a thorough physical examination was carried out and laboratory investigations including complete haemogram and peripheral smear study were done. Various Data on a range of socioeconomic, demographic, and childhood-related illnesses were captured. Venous blood sample was collected in all children under strict aseptic precautions in EDTA anticoagulant for hematological investigations. Hemoglobin (Hb) estimation was done using cyanmethemoglobin method 20micro liter of

anticoagulated blood was added to 5ml of freshly made standardized Drabkin's solution in a vial. This was inverted several times to mix the solution. It was allowed to stand for 10min and the solution was read in spectrophotometer at 540nm and grading of Anemia was done by hemoglobin levels according to recent WHO guidelines.

Peripheral blood smear study was performed on all the children. Peripheral smear was stained by Leishman's stain. Staining characteristics and morphological abnormalities of red cells were observed. The distribution, anisocytosis, poikilocytosis, along with white blood cell morphology and platelet morphology were observed. Reporting was done by Pathologist.

**Table 1: Sex Variation in Our Study**

VARIABLES	GROUP	NUMBERS (%)
Gender	Male	235 (47%)
	Female	265 (49%)

**Table 2: Severity of Anaemia**

VARIABLES	GROUP	NUMBERS (%)
Anemia	No anemia	90 (18%)
	Anemia	410 (82%)
	Mild anemia	250 (60.97 %)
	Moderate anemia	105 (25.60 %)
	Severe anemia	55 (13.41 %)

**Table 3: Distribution According to Our Study**

GENDER	NO ANEMIA	MILD ANEMIA	MODERATE ANEMIA	SEVERE ANEMIA	TOTAL	p-value
MALE	62 (26.38%)	106 (45.10 %)	31 (13.19 %)	36 (15.31 %)	235 (100 %)	0.01
FEMALE	28 (10.56 %)	144 (54.33 %)	74 (27.92 %)	19 (7.16 %)	265 (100 %)	0.01
TOTAL	90 (18 %)	250 (50 %)	105 (21 %)	55 (11 %)	500 (100 %)	0.01

## Results

A total of 500 cases were studied and the cases are divided into groups on the basis of gender and severity of anemia. Out of 500 cases, 235 of the children (47%) were male and 265 (53%) were female. A total of 410 (82%) children were anemic and mild, moderate, and severe Anemia was found in 60.97%, 25.60%, and 13.41%, respectively.

The degree of Anemia based on sex distribution showed that both mild and moderate Anemia was more prevalent in girls (54.33% and 27.92%) compared to boys (45.10% and 13.19%) and the data are statistically significant with p-value less than 0.05.

### Statistical Analysis:

The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures Independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 software was used to analyse the collected data. p value of <0.05 was considered to be statistically significant.

## Discussion

The present study was undertaken to know the prevalence of anemia in children of 2 to 10 years of age. This is a prospective study conducted from January 2016 to June 2021. Total of 500 children were studied. Childrens were randomly selected in both OPD and IPD. The overall prevalence in this study of anemia in children of 2 to 10 years is 82%. Prevalence of anemia in males is 73.61% and in females is 89.43%. that is prevalence is more in female children than males in 2 to 10 years age group and it is statistically significant. The prevalence of Anemia in my study is almost equal to Verma et al study(14). The prevalence of anemia is more

in females compared to males in my study as like in Verma et al study.

Comparison with Sundareshan et al Study - Tamilnadu in Sundareshan et al study (15) the age group of children included are 8-16 years compared to 6-12 years in our study. The Prevalence of anemia is nearly equal in both studies. In Sundareshan et al study prevalence of anemia is more in females, same as in my study(15). Comparison with Sethi V et al Study (16) – Delhi A -study of 393 children reported the prevalence of 66.4% anemia amongst primary school children (6-11years) in the national capital territory of Delhi.

Iron deficiency anemia (IDA) is the commonest nutritional disorder in the world. Around 30% of the world's population are anemic, mainly due to iron deficiency. In developing countries like India, this figure is frequently exacerbated by malaria and worm infections(17). The effects of IDA on children are the most dangerous one because their bodies are still developing, including the brain, which is the fastest developing organ in infancy and early childhood. IDA impair impairing the cognitive development of children.(18) A large portion of iron deficiency is preventable with appropriate and timely intervention.

As per the National Family and Health Survey-4 (NFHS) (conducted during 2015-2016) data, the prevalence of Anemia in India; in children aged 6-59 months is 58.4%. In Andaman and Nicobar Islands (India) it is 49%. The higher prevalence of Anemia in preschool children may be attributed to poor maternal iron stores during pregnancy and lactation, rapid growth, delayed initiation of complementary foods and poor dietary intake of iron.

The most prevalent conditions were mild and moderate Anemia, probably because mild and moderate Anemia is usually asymptomatic, and may remain undetected

and untreated (19, 20). This study showed a higher prevalence of Anemia i.e 82 %. The prevalence of Anemia in males in this study was 73.61 % and slightly higher 89.43 % in females. A similar higher prevalence (54.4%) of Anemia in girls has been reported in a study done on adolescent school children in urban Kathmandu, Nepal (21).

Basu et al. also found a high prevalence of Anemia among girls in Chandigarh (22). The higher prevalence reported in the above studies is due to subjects in the adolescent age group who had increased iron requirement during the growth period and also recurrent menstrual blood loss. This study was limited with the fact that it is an observational study which reported the overall prevalence of Anemia and its severity. It included only the children who attended the Pediatric OPD and IPD during the study period and whose parents gave consent for enrolment. Secondly, being a Observational study, no causal effect relationship could be established. Chronically ill children were also not included which might have undermined the values. Further studies, to know the etiology of Anemia and appropriate interventions including awareness among people about diet rich in iron, folate and other micronutrients is needed.

Sayyari AA et al in a similar study like us studied prevalence of anaemia in 2-12-year-old Iranian children. In this study haemoglobin levels were used to estimate the prevalence of anaemia in children 2- 12 years old in the Islamic Republic of Iran. Of 4170 children aged 2- 6 years, 7.3% were diagnosed with mild anaemia, 2.5% moderate anaemia and 1.0% severe anaemia [WHO definitions]. The prevalence of anaemia was significantly higher in rural than urban areas

Hall A et al made a report on the haemoglobin concentrations and prevalence of anaemia in schoolchildren in eight countries in Africa and Asia. Blood samples

were collected during surveys of the health of schoolchildren as a part of programmes to develop school-based health services. Rural schools in Ghana, Indonesia, Kenya, Malawi, Mali, Mozambique, Tanzania and Vietnam. Nearly 14 000 children enrolled in basic education in three age . Anaemia was found to be a severe public health problem (defined as >40% anaemic) in five African countries . More boys than girls were anaemic, and children who enrolled late in school were more likely to be anaemic than children who enrolled closer to the correct age. It was concluded that anaemia is a significant problem in schoolchildren in sub-Saharan Africa. School-based health services which provide treatments for simple conditions that cause blood loss, such as worms, followed by multiple micronutrient supplements including iron, have the potential to provide relief from a large burden of anaemia.

Choi JW et al investigated the association between *Helicobacter pylori* (*H. pylori*) infection and iron deficiency anaemia in prepubescent children under 12 years of age. *It was concluded that H. pylori* infection does not seem to contribute to iron deficiency in prepubescent children. Egbi G et al studied anaemia among school children older than five years in the Volta Region of Ghana. The Ghana School Feeding Programme (GSFP) was instituted on pilot basis in an effort to provide nutritious lunch to school children. This cross-sectional study involved a random sample of 143 pupils aged 6 to 12 years. Blood samples were collected and analysed for serum-ferritin (SF), C-reactive protein (CRP), haemoglobin and malaria-parasitaemia (MP). Stool samples were examined for soil-transmitted helminthes. The study findings underscore the need for multi-pronged approaches that address both malaria control and nutrition in order to reduce anaemia among pupils.

Behera S, Bulliyya G et al saw magnitude of anemia and hematological predictors among children under 12 years in Odisha, India. The present study evaluates the prevalence of anemia and status of various hematological parameters among children of Khurda district, Odisha. Prevalence of anemia was 62%. In this population, boys had a lower mean Hb value than that of the girls. All grades of anemia were higher among school age children than preschool children. Mean plasma ferritin was found to be higher in school age boys than their counterpart girls. The mean level of WBC count was found to be higher among preschool age boys than among the school age boys. Similar study was done by Gomber S et al on prevalence & etiology of nutritional anaemia among school children of urban slums. The prevalence of anemia was higher with concomitant acute infection among study population, which is a matter of concern. Since the hematological parameters are interrelated with each other as well as with the age and gender, relevant intervention strategy and constant monitoring are needed while providing public health nutrition programs to eradicate anemia.

Lopez A et al in their article in Lancet. 2016 Feb on Iron deficiency anaemia elaborated that anaemia affects roughly a third of the world's population; half the cases are due to iron deficiency. It is a major and global public health problem that affects maternal and child mortality, physical performance, and referral to health-care professionals. Measurement of serum ferritin, transferrin saturation, serum soluble transferrin receptors, and the serum soluble transferrin receptors–ferritin index are more accurate than classic red cell indices in the diagnosis of iron deficiency anaemia.

In addition to the search for and treatment of the cause of iron deficiency, treatment strategies encompass prevention, including food fortification and iron supplementation. Oral iron is usually recommended as first-

line therapy, but the most recent intravenous iron formulations, which have been available for nearly a decade, seem to replenish iron stores safely and effectively.

### **Conclusion**

Female children had higher prevalence of anaemia in all socioeconomic classes. In anemic children, most of them have mild and moderate grade anemia. We recommend deworming as a routine for at risk and diagnosed individuals. Government policies should be made to fortify iron with flour, salt, oil etc., in order to tackle the problem of anemia at root level.

### **Declarations:**

**Funding:** None

**Conflicts of interest/Competing interests:** None

**Code availability:** Not applicable

**Consent to participate:** Consent taken

**Ethical Consideration:** There are no ethical conflicts related to this study.

**Consent for publication:** Consent taken

### **WHAT THIS STUDY ADD TO EXISTING KNOWLEDGE**

Nutritional deficiency, particularly, iron deficiency is the leading cause of anemia in the present study. In addition to nutritional deficiency, socioeconomic factors like, gender, maternal education and SE class also play an important role in development of anemia. Being more frequent in children below 10 years of age, it may lead to this vulnerable population to future hematologic, infectious, psychomotor and developmental disorders. These disorders can be primarily prevented by proper nutritional habits and adequate treatment.

## CONTRIBUTION BY DIFFERENT AUTHORS

**First author** Dr Vijay Kumar Gupta Senior Resident Department of Paediatrics, Veerangana Avanti Bai Lodhi Autonomous State Medical College, Etah, Uttar Pradesh Data collection and Statistical Analysis

**Second author** Dr. Amit Patidar Senior Resident Department of Paediatrics, Atal Bihari Vajpayee Government Medical College (ABVGMC), Vidisha References and Discussion

**Third author:** Dr. Neeta Singh PGMO Department of Paediatrics, District Hospital Shivpuri, Madhya Pradesh Data collection and statistical analysis

**Fourth and Corresponding** Dr. Yusuf Ahmed Senior Resident Department of Paediatrics, Veerangana Avanti Bai Lodhi Autonomous State Medical College, Etah, Uttar Pradesh

Concept and Discussion

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