

## ORIGINAL RESEARCH

# Prevalence and outcome of anemia among hospitalized children at a tertiary hospital

Sonu Akhani<sup>1</sup>, Khyati Satodiya<sup>2</sup>, Bela Shah<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of Pediatrics, B. J. Medical College and Civil Hospital, Ahmedabad, India.

<sup>2</sup>Resident, Department of Pediatrics, B. J. Medical College and Civil Hospital, Ahmedabad, India.

<sup>3</sup>Professor, Department of Pediatrics, B. J. Medical College and Civil Hospital, Ahmedabad, India.

### ABSTRACT

**Background:** Anemia is a 'silent killer' disease affecting not only developing countries but also the developed countries, with major consequences on their health and socioeconomic development. The present study was undertaken with an aim to find the prevalence of anemia amongst the patients attending tertiary care hospital.

**Material and Methods:** Present study was single-center, observational study, conducted in children aged between 6 Month to 12 years, who are admitted in pediatric ward, diagnosed as anemia as per WHO classification.

**Results:** Prevalence of anemia was 43.55 %. The prevalence of anemia was more in 5-12 year of age group (43.11%), boys (52 %), in lower socioeconomic class (40.89%), partially immunized children (58.58%), children on vegetarian diet (75.5 %). Most common degree of anemia at the time of admission was severe anemia (42.06 %), followed by moderate (39.37%) and mild anemia (18.57%). Microcytic hypochromic anemia was most observed peripheral smear seen (42.56%), followed by dimorphic anemia (28.82%). MCV was low in 71.47% patients, MCV was on higher side in 12.33% patients, MCHC was low in 76.07 % patients and MCH was low in 71.47 % patients. In 71.47% patients RDW was on higher side. 75.48% patients had iron deficiency, 50.81% patients had ferritin deficiency, and 42.15 % patients had vitamin B12 deficiency. 564 cases (83.80%) had nutritional anemia (42.64% had iron deficiency anemia, 12.33% had megaloblastic anemia and 28.82% had dimorphic anemia 561 patients were discharged ,91 patients were expired and 21 patients went DAMA. Most common cause of death is septicaemia and an acute respiratory distress syndrome (28.57 %), followed by congestive cardiac failure (26.37%) and disseminated intravascular coagulation (21.17%).

**Conclusion:** Regular deworming, proper dietary counselling and supplementation of micronutrient are required to decrease the prevalence of anemia among children.

**Keywords:** anemia, hospitalised children, dimorphic, nutritional

**Corresponding Author:** Dr. Sonu Akhani, Assistant Professor, Department of Pediatrics, B.J.Medical College and Civil Hospital, Ahmedabad, India.

**Email:** [dr.sonuakhani@gmail.com](mailto:dr.sonuakhani@gmail.com)

## INTRODUCTION

Anemia is a 'silent killer' disease affecting not only developing countries but also the developed countries, with major consequences on their health and socioeconomic development. Anemia is defined as decrease in red cell mass, the function of RBC is to deliver oxygen from lung to the tissue.<sup>1,2</sup> The decrease of RBC may result from deficiency of vitamin B12, iron, folic acid, or blood loss.<sup>2</sup>

It occurs in all age groups but children, pregnant women and lactating women are more severely affected due to increased demand. Worldwide anemia among the children is one of the most serious concerns, with iron deficiency being the most common cause.<sup>3,4</sup> The most common cause of anemia in children is nutritional anemia. The primary reason for this is the faulty feeding technique i.e., improper breast feeding and complementary feeding practices; compared to the increased requirement for rapid growth and development.<sup>3</sup>

Iron is most common micronutrient deficiency in our country. Impaired psychomotor development and cognitive function are well described with vitamin B12 and iron deficiency anemia.<sup>4,5</sup> It has been observed that anemia is most often asymptomatic in the mild stage and is therefore frequently missed from early diagnosis. The present study was undertaken with an aim to find the prevalence of anemia amongst the patients attending tertiary care hospital.

## MATERIAL AND METHODS

Present study was single-center, observational study, conducted in department of paediatrics, at XXX medical college & hospital, XXX, India. Study duration was of 2 years (January 2020 to December 2020). Study approval was obtained from institutional ethical committee.

### Inclusion criteria

- All children aged between 6 Month to 12 years, who are admitted in pediatric ward, diagnosed as anemia as per WHO classification. parents willing to participate in present study

### Exclusion criteria

- Children with anemia of <6 month OR >12 years of age.
- Children with thalassemia

Study was explained to patients in local language & written consent was taken from parents of participants. All cases underwent detailed history taking and thorough clinical examination. Anaemia patients were classified according to WHO classification into mild, moderate, and severe anemia.

Investigation like CBC, Red cell indices like MCV, MCHC, MCH, Reticulocyte count, G6PD, sickling test, Serum vitamin B12, Serum ferritin, Serum iron, HPLC, bone marrow examination, Urine routine micro, Stool routine micro were done. After that anemia typing, degree of anemia was studied. In all patients vital monitoring like heart rate, blood pressure, temperature recording and monitoring for any complication was done. Patients were treated with supplementation, dietary modification, packed cell volume transfusion and treatment of underlying condition. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

## RESULTS

In present study total Paediatric admission were 1545 after excluding patients less than 6 month of age, 673 patients had anemia and prevalence of anemia was 43.55 %. The prevalence of anemia was more in 5-12 year of age group (43.11%) followed by 1-5 year of age group (41.69 %). Among total 673 patients 52.0% patients were males and 48.0% patients were female. Higher prevalence of anemia was found in lower socioeconomic class (40.89%), partially immunized children (58.58%), children on vegetarian diet (75.5 %).

**Table 1: General characteristics**

Characteristics	No. of cases (n=673)	Percentages
Age		
6 Month -1 Years	103	15.30%
1-5 Years	280	41.60%
5-12 Years	290	43.09%
Gender		
Male	350	52.01%
Female	323	47.99%
Socioeconomic Status (modified Kuppuswami classification)		
Upper Middle	70	10.40%
Lower Middle	109	16.20%
Upper Lower	241	35.81%
Lower	253	37.59%
Immunisation Status		
Fully Immunized	205	30.46%
Partially Immunized	394	58.54%
Unimmunized	74	11.00%
Diet		
Vegetarian	508	75.48%
Mixed	165	24.52%

Most common complaints at the time of admission were cough and cold (33 %), followed by fever (29.4%), decreased appetite (29.0%), diarrhoea and vomiting (25 %). Other complaints were worm infestation (2.64 %), poor scholastic performance (18.1 %) & pica (3.3 %).

**Table 2: Presenting Complaints on admission:**

Complaints	No. of cases (n=673) (%)
Cough/Cold	222 (33.0%)
Fever	198 (29.4%)
Decreased Appetite	195 (29.0%)
Diarrhoea/Vomiting	168 (25.0%)
Easy Fatiguability	155 (23.0%)
Difficulty In Breathing	141 (21.0%)
Poor scholastic performance	122(18.10%)
Lethargy	60 (8.9%)
Abdominal distension	47 (7.0%)
Febrile convulsion	42(6.23%)

Ear discharge	40(5.93%)
PICA	22 (3.3%)
Worm Infestation	18(2.64%)
Bleeding	16 (2.37%)

Most common finding seen at the time of admission was pallor (100 %), followed by knuckle hyperpigmentation (16.57%), hepatomegaly (10.73%) and tachycardia (10.52%).

**Table 3: Presenting Signs at The Time of Admission**

Signs	No. of cases (n=673) (%)
Pallor	673 (100.00%)
Knuckle Hyperpigmentation	111 (16.57%)
Hepatomegaly	72 (10.73%)
Tachycardia	71 (10.52%)
Crepitation	67 (10.00%)
Tachypnoea	46 (6.88%)
Icterus	42 (6.28%)
Murmur/Gallop Rhythm	38 (5.66%)
Increased JVP	38 (5.62%)
Splenomegaly	34 (5.17%)
Mouth Ulcer	28 (4.24%)
Angular Stomatitis	24 (3.63%)
Pedal Edema	23 (3.49%)
Lymphadenopathy	15 (2.21%)
Cyanosis	8 (1.28%)
Clubbing	7 (1.02%)

In present study, most common degree of anemia at the time of admission was severe anemia (42.06 %), followed by moderate (39.37%) and mild anemia (18.57%).

**Table 4: Distribution of Severity of Anemia in Various Age Group**

Age	Severity of anemia			Total
	Mild	Moderate	Severe	
6 month-1 Years	17 (16.50%)	39 (37.86%)	47 (45.63%)	103
1-5 Years	54 (19.28%)	105(37.50%)	121 (43.21%)	280
5-12 Years	54 (18.62%)	121 (41.72%)	115 (39.65%)	290
<b>Total</b>	<b>125 (18.57%)</b>	<b>265(39.37%)</b>	<b>283 (42.06%)</b>	<b>673</b>

Among total 673 patients, 383 patients were <5 years of age among them only 70 patients were having normal nutrition while other were suffering from malnutrition.

**Table 5: Association Between Anemia and Nutritional Status in Children Less Than 5 Year**

Nutritional status	Severity Of Anemia			
	Mild	Moderate	Severe	Total
Normal nutrition	17 (24.28%)	21 (30.00%)	32 (45.71%)	70 (100%)
Moderate acute	34(20.98%)	61(37.65%)	67(41.35%)	162(100%)

malnutrition				
Severe acute malnutrition	15 (9.93%)	38 (25.16%)	98 (64.9 %)	151 (100%)

In present study Microcytic hypochromic anemia was most observed peripheral smear seen (42.56%), followed by dimorphic anemia (28.82%).

**Table 6: Classification of Anemia as Per Peripheral Smear**

Peripheral Smear	No. of cases (n=673) (%)
Microcytic Hypochromic (MH)	287(42.56%)
Dimorphic (DM)	194(28.82%)
Normocytic Normochromic (NC, NC)	109(16.29%)
Macrocytic (MC)	83(12.33%)

In present study MCV was low in 71.47% patients, MCV was on higher side in 12.33% patients, MCHC was low in 76.07 % patients and MCH was low in 71.47 % patients. In 71.47% patients RDW was on higher side.

**Table 7: Correlation Between Hematological Parameters and Anemia**

Parameters		No. of cases (n=673) (%)
MCV	Decrease	481(71.47%)
	Increase	83(12.33%)
	Normal	109(16.19%)
MCHC	Decrease	512(76.07%)
	Normal	161(23.92%)
MCH	Decrease	481(71.47%)
	Normal	192(28.52%)
RDW	Increase	481(71.47%)
	Normal	192(28.52%)

In present study 75.48% patients had iron deficiency, 50.81% patients had ferritin deficiency, and 42.15 % patients had vitamin B12 deficiency. Sickling test was positive in 1.78% patients, DCT/ICT was positive in 0.90% indicate autoimmune Hemolytic anemia and HPLC was positive in 2.81% patients.

**Table 8: Specific Parameters in Anemia**

Parameters		No. of cases (n=673) (%)2
Iron	Decrease	508(75.48%)
Ferritin	Decrease	342(50.81%)
Vitamin B12	Decrease	277(42.15%)
Sickling test	Positive	12(1.78%)
G6PD activity	Present	673(100%)
Hb electrophoresis	Abnormal	19(2.81%)
Direct/indirect coombs test (DCT/ICT)	Positive	6(0.9%)
	Negative	667(99.10%)

In present study dietary management + supplements (advise regarding weaning of breast feeding, complementary feeding practices, iron rich food and supplements like iron vitamin B12, folic acid, vitamin A) were given to all. 254 patients received packed cell volume transfusion. Supportive treatment in form of IV fluids (73.41 %), IV antibiotics (78 %) and diuretics (15.72 %) were given whenever indicated.

**Table 9: Treatment Modalities**

Treatments		No. of cases (n=673) (%)
Packed cell volume transfusion		254(37.74%)
Supportive	IV fluids	492(73.41%)
	IV antibiotics	525(78.00%)
	Diuretics	106(15.72%)

In present study out of 673 patients ,564 cases (83.80%) had nutritional anemia (42.64% had iron deficiency anemia, 12.33% had megaloblastic anemia and 28.82% had dimorphic anemia), 2.68 % patients had anemia due to hemolysis like sickle cell anemia, and autoimmune Hemolytic anemia

**Table 10: Distribution of Anemia as Per Diagnosis**

Type of anemia	No. of patients (n=673)	Percentage
Anemia due to nutritional deficiencies		
• Iron deficiency anemia	287	42.64%
• Megaloblastic	83	12.33%
• Dimorphic	194	28.82%
Anemia due to Hemolysis		
• Sickle cell anemia	12	1.78%
• Autoimmune Hemolytic anemia	6	0.90%
Others		
Pneumonia	38	5.64%
Urinary tract infection	21	3.12%
Dengue	16	2.37%
Viral hepatitis	11	1.63%
Malaria	3	0.5%
Malignancies	2	0.30%

In present study 561 patients were discharged ,91 patients were expired and 21 patients went DAMA. Most common cause of death is septicaemia and an acute respiratory distress syndrome (28.57 %), followed by congestive cardiac failure (26.37%) and disseminated intravascular coagulation (21.17%).

**Table 11: Outcome of The Patients**

Outcome	No. of cases (n=673) (%)
Discharge	561(83.35%)
DAMA	21(3.12%)
Expiry	91(13.52%)

## DISCUSSION

Anemia is a major world health problem and is an important cause of morbidity and mortality much of which can be preventable.<sup>1</sup> A systematic approach through proper history, physical examination and relevant investigations are very essential to diagnose the various causes of anemia. The most common cause of anemia in children is related to nutritional deficiency especially iron deficiency seen in 30% cases.<sup>2</sup>

The reported prevalence of nutritional anemia in preschool children varies from 44 to 74 percent.<sup>3</sup> Children of today are citizens of tomorrow and upon them depend the weal and welfare of the community. In a country like India, children fall an easy prey to anemia as majority of them remain ill-fed, ill-clothed and undernourished due to poverty and ignorance. If not detected at the earliest point of time, this disease will spread so widely as to impair or endanger the very physical condition of the children.

The prevalence of anemia was 43.55 % in present study and similar findings were noted in study conducted by Mauricio et al.,<sup>6</sup> (51.3 %), Salvador villapando et al.,<sup>7</sup> (50 %) and Dipshikha Maiti,<sup>8</sup> (42.5 %). In present study, majority of nutritional anemia was present at age 1-12 years because of prolonged breast feeding, late weaning with poor supplementation of solids, poverty, illiteracy, ignorance etc. Similar findings noted in study conducted by Policarpo et al.,<sup>9</sup> the highest number of patients belonged to age group 1-5 years and by Angesom et al.,<sup>10</sup> the highest number of patients in the age group 5-12 year.

Higher prevalence of anemia in males as compared to females in present study due to the gender bias prevailing in our society where male child are given more care and are being brought to hospital early and more frequently for treatment so more male admission as compared to female. As study conducted by Alexie Robert et al.,<sup>11</sup> and Ali Salami et al.,<sup>12</sup> also prevalence to anemia is more in males as compared to female.

Higher prevalence of anemia in lower socioeconomic class mostly due to low level of educational status which may affect the nutrition status negatively. Low income limits the type of amount of food available and higher incidence of infections among them, poor hygiene, irregularity in immunization low serving of Iron-rich foods, lack of adequate nutrition information and a high number of illiterate etc. In a similar study conducted by Mahroof M.K. et.al.,<sup>13</sup> and Policarpo et al.,<sup>9</sup> lower classes were worse affected proving that the poor hygiene, irregularity in immunization and lack of nutritious diet among this population is important reason for morbidity and mortality in these strata of society.

Higher (75.5 %) incidence of anemia in the patients on vegetarian diet is due to less bioavailability of non-heme iron present in vegetarian diet because of the naturally occurring absorption inhibitors like phytate, oxalate, polyphenols and a greater number of vitamins like iron vitamin B12 in non-vegetable diet like meat and eggs.

Prevalence of anemia was more in children with SAM and MAM than normally nourished children because of micronutrient deficiencies, vitamin deficiencies, low immunity, increased predisposition for infective disease etc. in malnourished children. While in the study done by KA George et al.,<sup>14</sup> it was observed that anemia is more prevalence in normal nourished children than malnourished this is because this child has easy accessibility to health care centre and so screened better.

A similar study conducted by Mahroof M.K. et al.,<sup>13</sup> it was observed that most common presenting complaints was fever followed by cough/cold seen in 53.49% and 46.32% of total patients. S R Madhusudan et al.,<sup>15</sup> observed that most common presenting complaints was fever followed by cough/cold seen in 54.78% and 55.78% of total patients. Large proportion of patients presented with congestive cardiac failure in form of tachycardia, increased JVP, gallop rhythm, and hepatomegaly. According to study conducted Policarpo et al.,<sup>9</sup> most

common sign at the time was admission is pallor seen in 72.77%% of the patients followed by crepitation as recurrent respiratory tract infection is more commonly seen in patients of anemia.

Mild anemia and severe anemia were more commonly seen in age group 1-5 year of age due to high iron demands associated with rapid growth rate and erythropoiesis, diets poor in bioavailable iron and low maternal reserve during pregnancy. whereas moderate anemia is more common in 5-12 year of age. Similar study conducted by Sahu et al,<sup>16</sup> and Aboubakari et al,<sup>17</sup> reveals that moderate anemia is the most common degree of anemia. A study conducted by Vivian U et al,<sup>18</sup> it was observed that 83.60% patients were recovered, while 2.80% left against medical advice and 13.60% died.

In present study most common cause of death is septicaemia leading to multiorgan dysfunction and an acute respiratory distress syndrome seen in 28.57% patients followed by, congestive cardiac failure (26.37%) and disseminated intravascular coagulation (21.17%). According to study conducted by Vivian U et,<sup>18</sup> al most common cause of death is acute respiratory distress syndrome seen in 84.21% patients followed by congestive cardiac failure seen in 63.15% patients.

A regular health check-up should be organized along with laboratory estimation of Hb% to screen anemia and appropriate measures should be taken up by health worker in co-ordination with parents. Further evaluation of anemia is needed to detect nutritional deficiencies and other treatable etiologies to prevent the anemia. Limitations of present study were, hospital -based study and not as a community-based surveillance, investigations like bone marrow biopsy, cold and ward antibodies were not performed, sample size was small to interpret the actual prevalence of anemia.

## CONCLUSION

It is important to diagnose anemia during an early stage, by screening and to treat it early, to prevent further worsening of the disease process with its extension into adolescent in the form of growth and cognitive delay. Regular deworming, proper dietary counselling and supplementation of micronutrient are required to decrease the prevalence of anemia among children.

## REFERENCES

1. Klingman//ST gene.The hematopoietic system:Nathan J.Blum,editor,Nelson textbook of pediatrics, 21st edition, elsevier inc; 2020. pg. 2505-2602.
2. Sethi V, Govindi G, Kapil U. The prevalence of anemia amongst primary school age children (6-11 years) in National Capital Territory of Delhi. Indian J Pediatr. 2003; 70:pg.519-20.
3. Maxwell M. Wintrobe, John N. Lukens and G. Richard tec. The approach to the patient with Anemias. Wintrobe's clinical Hematology 14th edition, LWW;2012.pg.1740.
4. World Health Organization. Nutritional anaemias. Report of a WHO scientific group. World Health Organ Tech Rep Ser. 2008;37(5).pg.405.
5. DeMaeyer EH, Adiels-Tegman M. The prevalence of anemia in the world. World Health Statistics. 2006;38(16).pg.302-304.
6. Mauricio S Leite ,prevalence of anemia and associated factor among indigenous children ;results from first national survey of indigenous people's health and nutrition .Nutr J 12(2013)

7. Salvador Villalpando, The Prevalence of anemia decreased in Mexican preschool and School-age children 1-12 year of age from 1999-2000,Result from nationwide Probabilistic survey in Mexico .Salud Publica Mex 2003;45 Suppl 4:490-498
8. Dipshikha Maiti ,suchi acharya ,A study based on prevalence of anemia among children in a teaching hospital,journal of family medicine and primary care ,2019 mar;8(3):899-903
9. Policarpo Ncogo P,Romay-Barja A,Aparicio P, Prevalence of anemia and associated Facroes in children living in urban and rural setting from bata district,guinea ,2013 .Plos one.2017 may 3 ;(5):e0176613.
10. Gebreweld Angesome,, Ali N, Ali R, Fisha T. Prevalence of anemia and its associated factors among children under five years of age attending at Gugufu health center, South Wollo, Northeast Ethiopia. PLoS One. 2019;14(7):e0218961.
11. Alexie Robert A, Yaya I. Prevalence and risk factors of anemia in children aged from 6 to 59 months in Togo: analysis from Togo demographic and health survey data, 2013-2014. BMC Public Health. 2019 Feb 20;19(1):215.
12. Ali salami et al.prevalence of anemia among Lebanese hospitalized children:risk and protective factor .PLos ONE 13(8):July 23 ,2018
13. Mahroof M.K.,clinical study of anemia in rural school children of manglore,Karnataka ,international journal of contempory pediatrics .2019 March:6(2):416-421.
14. George K A,Kumar NS,Lal JJ,Sreedevi R. Anemia and nutritional status of pre-school children in Kerala.Indian journal of pediatrics .2000 aug;67(8):575-8.
15. Madhusudan.S R,Devi,M.K.,Ahuja ,S.,&Nagraj N.(2018).clinical profile of anemia among 6-60 month children living in south Karnataka-A cross sectional study .Indian journal of child health ,5(2),133-136.
16. Sahu T,Sahani N C ,Patna, L.childhood anemia -A study in tonal area of Mohana block in Orissa.Indian J community Med 2007;32:43-5.
17. Nambiema A, Robert A, Yaya I. Prevalence and risk factors of anemia in children aged from 6 to 59 months in Togo: analysis from Togo demographic and health survey data, 2013-2014. BMC Public Health. 2019 Feb 20;19(1):215.
18. Vivian U muoneke, Roland C Ibekwe. factors associated with mortality in under five children with severe anemia in ebony's,Nigeria .Indian pediatr ,2012.49:119-123.