

**ORIGINAL ARTICLE****Prevalence of anemia in children in a children's hospital**<sup>1</sup>Vinay Kumar Rai, <sup>2</sup>Anil Kumar Gupta<sup>1</sup>Associate Professor, Department of Paediatrics, F H Medical & Hospital, Agra, Uttar Pradesh, India;<sup>2</sup>Professor, Department of Paediatrics, Department of Paediatrics, Venkateshwara Institute of Medical Sciences, Gajraula, Uttar Pradesh, India**ABSTRACT:**

**Background:** To assess the occurrence of anemia and the factors linked to it in pediatric hospital patients. **Materials & Methods:** A total of 100 subjects were enrolled. The age of children between 6 months to 5 years were included. Complete history was taken. Patients were divided into age groups as follows: 6 – 10 months, 11 - 22 months, 23 - 35 months, and  $\geq 36$  months. **Results:** Anemia showed a significant correlation with nutritional status (p-value = 0.01). The Marascuilo procedure for multiple comparisons, it revealed that anemia was more prevalent among malnourished children than well-nourished children (p-value = 0.003). **Conclusion:** The significant occurrence of anemia raises the possibility that it might play a role as a contributing factor leading to hospitalization.

**Keywords:** Anemia, Children, Prevalence.

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**INTRODUCTION**

Deficiency anemia is a significant public health problem that occurs worldwide in both developed and developing countries. In 1980, the World Health Organization (WHO) estimated that 700 million people worldwide suffered from anemia and more than two billion people worldwide have been affected by it. Approximately 50% of anemia cases are caused by iron deficiency. <sup>1</sup> In the Americans, the rate of anemia is especially high among children, with a prevalence of 50% in Mexico and between 45% to 70% in different regions of the Ecuador. <sup>2,3</sup> In Brazil, population-based studies conducted in several regions of the country have shown that the prevalence of anemia varies between 30% and 60%. <sup>4,5</sup> Batista & Migliolo found that approximately 45% of under 5-year-old children in Brazil were anemic. <sup>6</sup>

Worldwide, at any given moment, more individuals have iron-deficiency anemia than any other health problem. <sup>7</sup> Anemia is the most common morbidity among micronutrients and affects health, education, economy, and productivity of the entire nation. Anemia, like fever, is a manifestation and not a disease per se. The most common group among the causes for anemia is malnutrition and among that group, iron deficiency makes up the bulk of it. A large portion of iron deficiency is preventable with appropriate and timely intervention. Iron deficiency is the most common nutritional disorder in the world. The numbers are staggering: two billion people – over 30% of the world's population – are anemic, mainly due to iron deficiency; and in developing countries this figure is frequently exacerbated by malaria and worm infections. <sup>8</sup> Iron deficiency affects more people than any other condition, constituting a public health

epidemic. It exerts the heaviest overall toll in terms of ill-health, premature death, and lost earnings. The effects of anemia on children are the most dire because their bodies are still developing, including the brain, which is the fastest developing organ in infancy and early childhood. Iron deficiency, and the anemia that results from it, is a major health problem affecting more than 3.5 billion people in developing countries, reducing vitality for the young and old alike, and impairing the cognitive development of children. Anemia is most often a hidden deficiency, with a few overt symptoms. <sup>9</sup> Because global estimates for iron deficiency prevalence are not available, anemia, which affects 30% of the world population, <sup>10</sup> has been used as an indicator of iron deficiency and iron deficiency anemia. Hemoglobin determination, however, is neither sensitive nor specific as a screening test for iron deficiency. The former occurs because a large proportion of total body iron must be lost before hemoglobin levels fall below the laboratory definition of anemia. <sup>11</sup> Anaemia is a common disorder, affecting a third of the world population most of whom live in resource poor countries. <sup>12</sup> Although diagnosis of anaemia can easily be done by traditional Sahli's haemoglobinometer, or more recently by electronic cell counters, yet physicians and healthcare workers try to detect anaemia by looking at conjunctival, tongue, palmer, or nail bed pallor. <sup>13</sup> Often physicians use clinical assessment of pallor as a screening test, and order haemoglobin test if one or more sites suggest presence of pallor. This is especially true of crowded outpatients departments of public hospitals, where most doctors either believe that accurate estimation of haemoglobin is either not worth the time and effort

needed to obtain it or do not have access to facilities to measure haemoglobin. Iron deficiency anemia has major health and economic consequences. In adults, it leads to a substantial loss of productivity. During pregnancy, it is associated with low birth weight, preterm labor, infant, and maternal mortality.<sup>14</sup> Hence, this study was conducted to assess the occurrence of anemia and the factors linked to it in pediatric hospital patients.

## MATERIALS & METHODS

A total of 100 subjects were enrolled. The age of children between 6 months to 5 years were included. Complete history was taken. Patients were divided into age groups as follows: 6 – 10 months, 11 - 22 months, 23 - 35 months, and  $\geq$  36 months. Hemoglobin levels were measured according to the hospital's standard protocols, utilizing an ABX apparatus. To classify the severity of anemia, the following thresholds were employed: 10.0-10.9 g/dL indicated mild anemia, 7.0-9.9 g/dL indicated moderate anemia, and less than 7 g/dL indicated

severe anemia. Data was collected. Pearson's chi-square test was done. The results were analysed using SPSS software.

## RESULTS

The results of the chi-square test for trend demonstrated a declining trend in the proportion of anemic cases with increasing age, ranging from 70% in children aged 6 to 11 months to 35.8% in children aged 35 months and older. Anemia showed a significant correlation with nutritional status (p-value = 0.01). The Marascuilo procedure for multiple comparisons, it revealed that anemia was more prevalent among malnourished children than well-nourished children (p-value = 0.003). Comparisons between the other groups did not yield statistically significant differences. Additionally, the Marascuilo procedure indicated a significantly higher proportion of anemia cases in children with respiratory infections compared to those with gastroenteritis (p-value < 0.001) or other diseases (p-value < 0.001).

**Table 1: Prevalence of anaemia**

Variable	Hemoglobin				P –value
	<11g/dL		>11g/dL		
	N	%	n	%	
Age (months)					
6-11months	14	70	6	30	0.017*
11-23	20	66.7	10	33.3	
24-35	12	54.6	10	45.4	
>35	10	35.8	18	64.2	
Nutritional status					
Malnourished	6	75	2	25	0.017*
Well- nourished	48	55.9	38	44.1	0.029*
Obese	4	66.7	2	33.4	
Diagnosis					
Respiratory infections	16	72.8	6	27.2	0.001*
Gastroenteritis	24	53.4	21	46.6	0.000*
Others	15	45.5	18	54.5	

## DISCUSSION

Millions of children are affected by anemia worldwide and more than half of them due to iron deficiency. Moreover, iron deficiency sets in much before the appearance of frank anemia. Thus, the prevalence of iron deficiency is estimated to be two times higher than that of anemia.<sup>14,15</sup> Owing to the deficiency in laboratory methods, most patients with anemia present with complications. Therefore, screening is vital for early diagnosis. HemoCue is by far the most widely used POC device for hemoglobin measurement. Neufeld et al. studied the validity of HemoCue using capillary blood among the adult population of Mexico and compared it with Celldyn as a gold standard method using venous blood.<sup>16</sup> Hence, this study was conducted to assess the occurrence of anemia and the factors linked to it in pediatric hospital patients.

In the present study, the chi-square test for trend demonstrated a declining trend in the proportion of anemic cases with increasing age, ranging from 70% in children aged 6 to 11 months to 35.8% in children aged 35 months and older. Anemia showed a significant correlation with nutritional status (p-value = 0.01). The Marascuilo procedure for multiple comparisons, it revealed that anemia was more prevalent among malnourished children than well-nourished children (p-value = 0.003). A study by Dos Santos RF et al, the prevalence of anemia and associated factors in patients of a children's hospital in Recife was done. A cross-sectional study was developed involving 595 male and female children aged from 6 to 59 months old, who were hospitalized in 2007. Children with a hemoglobin concentration less than 11 g/dL were considered anemic. The relationship between studied variables and anemia

was evaluated by Poisson regression analysis. There was a 56.6% prevalence of anemia (95% CI: 46.6-54.6). Anemia was significantly correlated with low weight (Prevalence ratio - PR = 1.39; 95% CI: 1.18-1.64), young age (PR = 2.01; 95% CI: 1.57-2.56) and a diagnosis of acute lower respiratory disease (PR = 1.57; 95% CI: 1.27-1.96). The high prevalence of anemia suggests that it may contribute as a causal factor for hospitalization, especially because the period of hospitalization was short and the patient was likely to be anemic at the time of admission. This study stresses the importance of evaluating the overall nutritional status of patients, including their ingestion of microelements. This is especially important in children, because of their greater susceptibility to anemia. Measures directed at the prevention and control of anemia, including increased coverage of supplementation and fortification programs are strongly recommended.<sup>17</sup>

In the present study, comparisons between the other groups did not yield statistically significant differences. Additionally, the Marascuilo procedure indicated a significantly higher proportion of anemia cases in children with respiratory infections compared to those with gastroenteritis (p-value < 0.001) or other diseases (p-value < 0.001). Another study by Abalkhail B et al, studies on the whole school student population is lacking. The objectives of this study were to identify the nutritional habits and the prevalence of anaemia among school students in Jeddah, as well as to recognize the students' awareness of their anaemic nutritional status. Data were collected from a sample of Saudi school children in Jeddah City from 42 boys' and 42 girls' schools during the month of April 2000. Anaemia was defined according to the new WHO cut-off levels for haemoglobin as: blood haemoglobin <11.5 g/dl for the 5-11 years boys and girls; <12.0 g/dl for 12-14 years boys and girls; <12.0 g/dl for 15+ girls and <13.0 g/dl for 15+ years boys. Proportion and 95% confidence intervals (CI) were calculated and significance was considered when the 95% CI did not overlap. Anaemia was reported among 20.5% of school students. Anaemia was more prevalent among students of at least 12 years as compared to the younger age group. Also, anaemia was more marked among governmental school attendees and those born to low-educated mothers. Menstruating girls were at around double the risk of being anaemic than non-menstruating girls. Anaemia was associated with negative impact on school performance and was more marked among those who failed their exams as compared to students with excellent results. Skipping breakfast was reported by 14.9% of students and this habit did not differ by age, sex, body mass index or social class. Skipping breakfast was more marked among students with poor school performance as compared to those with very good or excellent results. Only 34.1% of anaemic school students were aware of being anaemic. Awareness was nearly equal in all age

groups and social classes but girls were more aware of their anaemic status than boys. Iron deficiency anaemia appears to be prevalent among school students. At age 12 years and over, low social class and menstruating girls constitute the high-risk groups. Screening is recommended for high-risk groups and school health programs are crucial to improve students' nutritional habits, knowledge and awareness.<sup>18</sup> Iron deficiency (ID) is defined by an abnormal iron biochemistry with or without the presence of anemia. Iron deficiency is usually the result of inadequate bioavailable dietary iron, increased iron requirement during rapid growth, and increased blood loss for any reason. There are no current estimates of the total ID cases, but based on anemia as an indicator, it is estimated that most preschool children in developing countries are iron deficient.<sup>19</sup> Almost all iron compounds in the body are continuously broken down and re-synthesized. The iron that is released is very efficiently conserved and reutilized. An important consequence of this recycling is that very little iron is lost from the body on a daily basis, except when bleeding occurs. The maintenance of iron balance in adults merely requires that the amount of iron absorbed from the diet be roughly equal to what is lost from the body. The amount of iron exchanged with the environment each day is a minute percentage of total body iron. In adult men, normal iron losses in the feces, sweat, and sloughed cells amount to about 0.9 mg/day, equivalent to less than 0.1% of the iron stores, and an even smaller percentage of the total body iron. This amount is readily absorbed from most diets. Women in their childbearing years must absorb an average of 1.3 mg/day to make up for the additional iron loss in menstrual blood. Women whose menstrual blood loss is unusually heavy and/or whose diet contains little absorbable iron are at risk of developing iron deficiency.<sup>20</sup> Most anemia cases develop gradually and progressively and are due to iron deficiency. In early childhood, bad feeding habits, especially during the weaning period, exacerbate the problem. Anemia frequently develops as breast milk is replaced by foods that are poor in iron and other nutrients, including vitamin B12 and folic acid.<sup>21</sup> Low oxygenation of brain tissues, a consequence of anemia, may lead to impaired cognitive function, growth and psychomotor development, especially in children.<sup>22</sup> Infants, under 5-year-old children and pregnant women have greater susceptibility to anemia because of their increased iron requirements due to rapid body growth and expansion of red blood cells.<sup>23</sup> Anemia was, to a certain extent, associated with the reason for hospitalization. Anemia was most common in children suffering from respiratory tract diseases, followed by gastrointestinal diseases, those with other types of infection and finally non-infectious diseases. Respiratory tract diseases possibly require greater utilization of hemoglobin both due to the infectious process and increased respiratory effort, whereas

gastrointestinal diseases lead to blood loss in feces and vomit or by degradation by parasites. Lima et al. reported a higher prevalence of anemia in infants with infectious diarrhea.<sup>24</sup> The diseases occurring in the study population raised questions about functional iron deficiency, which occurs when sufficient iron is not released to meet the normal hemoglobinization of red blood cells, either because of an absence of iron stores (iron-deficiency anemia) or by blocking iron homeostasis (anemia of inflammation). Anemia of inflammation, which is common in cases of inflammation and/ or infection, is an immune-mediated process in which cytokines and cells of the reticuloendothelial system induce changes that interfere in different erythropoiesis pathways leading to anemia.<sup>25</sup>

## CONCLUSION

The significant occurrence of anemia raises the possibility that it might play a role as a contributing factor leading to hospitalization, particularly since the hospital stay was brief and the patient probably had anemia upon admission.

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