

A clinical study of anemia in children aged 6 months to 5 years, in a tertiary care centre, Bengaluru, India.

Jennifer Wu*, Siva Saranappa

Department of Pediatrics, Kempegowda Institute of Medical Sciences, Karnataka, India

Received: 29 April, 2024, Manuscript No. AAJCP-21-37399; Editor assigned: 02 May, 2024, Pre QC No. AAJCP-21-37399 (PQ); Reviewed: 16 May, 2024, QC No. AAJCP-21-37399; Revised: 23 May, 2024, Manuscript No. AAJCP-21-37399 (R); Published: 30 May, 2024, DOI:10.35841/0971-9032.28.05.2245-2249.

Abstract

Background: Anemia is the most commonly seen hematological disease in children. The WHO has estimated that globally, 1.62 billion people are anemic, with the highest prevalence of anemia (47.4%) among preschool-aged children; of these 293 million children, 89 million live in India. This study, was conducted to evaluate the factors causing anaemia in children aged between 6 months to 5 years of age and its prevalence within this age group.

Methods: This study is a prospective observational study conducted in KIMS Hospital, Bengaluru, Karnataka. A total of 200 children in the age group of 6 months to 5 years with features of anemia or having Hb<11 gm/dl were included in the study for a duration of 18 months between January 2019 to June 2020. Detailed history was recorded and examination findings were noted. The data collected was tabulated and statistically analysed accordingly.

Results: From a study sample of 200 children, 57.5% of the children with anemia fell between the age group of 6 months to 2 years and 42.5 % children were in the age groups of 2 to 5 years. A greater male predominance was seen (61%) with male to female ratio of approximately 1.56:1. Most of the children were found to have mild (46%) and moderate anemia (46%) with only a minority (8%) presenting with severe anemia. 56.5% of the children had a normal nutritional status while 41 % were malnourished and 2.5% had both wasting and stunting. Exclusive breastfeeding (for 6 months) history was present in 59% of the children. These children belonged mostly to the upper lower (45%) and lower middle (41%) socioeconomic status. This study also showed anemia in children most commonly presented majorly with concurrent involvement of the respiratory system (31%), followed by infectious diseases (30%) and gastrointestinal (23%).

Conclusion: Our study helps to come to the conclusion that iron deficiency anemia is a multifactorial hematological disease. By learning about the predisposing risk factors, we can take the necessary precautions to prevent anemia in these children. In some ways which we can help to prevent anemia would be to improve the nutritional status of the child by involving parents and counselling them regarding important feeding practices.

Keywords: Anemia, Hematological disease, Predisposing risk, Children.

Accepted on 15th May, 2024

Introduction

Anemia is a global public health problem which affects the developing and the developed countries, with higher prevalence in developing countries. By definition, anemia is defined as a reduction in Hemoglobin (Hb) by two standard deviations below the mean, based on age-specific norms or decrease in their oxygen carrying capacity to meet physiologic needs, which may vary by the age, altitude and pregnancy status. The WHO has estimated that globally, 1.62 billion people are anemic, with the highest proportion of anemia (47.4%) among preschool-aged children; of these 293 million children, 89 million live in India. National Family Health Survey (NFHS) done in 2005-2006 revealed that at least 80% of children in India aged between 12-23 months are anemic. There are several potential causes of anemia in the context of the Indian population which include, nutritional- low iron and low vitamin C intake; parasitic infections, such as hookworm and malaria.

Nearly 47 million or 4 out of 10 children in India do not meet their full human potential because of chronic undernutrition or stunting. Further according to the report, 38.4% of children aged under five in India are stunted (too short for their age), while 21% suffer from wasting, meaning their weight is too low for their height. It is now a known fact that a high prevalence of anemia among under five-year-old children arises from the combination of increased iron needs due to accelerated growth and development, and is mainly associated with diet which is poor in heme iron.

Exclusive breastfeeding is an important nutritional aspect for the child's growth and development. WHO and UNICEF have recommended that breastfeeding should be initiated within the first hour of birth and be exclusively breastfed for the first 6 months of life.

Then from the age of 6 months, children should begin eating complementary foods while continuing to breastfeed for up to 2 years and beyond, as the child has maximum brain growth and myelination in this period. Even though human milk has low iron content, it is better suited for needs of a growing infant, having much better bioavailability for iron than cow's milk. When complimentary feeds are initiated by 5 or 6 months of age, breast milk supply reaches maximum and plateaus off subsequently with depletion of calcium and iron stores. If the complementary feeds are mostly vegetarian items and cow's milk, then there is risk of developing deficiency of calcium, iron, zinc, vitamin A, folic acid, vitamin c and vitamin B12. It is said that the baby is 'biologically ready' to receive semi solids by 4 -6 months of age. Early weaning practices lead to contamination and infections because of unhygienic preparations and late weaning leads to growth faltering and malnutrition. Hence, most children fall into the pit of malnutrition during the weaning and post weaning phase [1].

Malnutrition being one of the important risk factor for causing anemia, includes undernutrition (wasting, stunting, underweight), inadequate intake of vitamins or minerals; overweight, obesity, and resulting diet-related noncommunicable diseases. Around 45% of deaths among children under 5 years of age have been linked to undernutrition. These mostly occur in low and middle-income countries. Poverty increases the risk of, and risks from, malnutrition. People who are poor are more likely to be affected by different forms of malnutrition. Both point towards the importance of food security in the given population. Food security, as defined by the United Nations' committee on World food security, is all people, at all time, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life. Food security is a combination of three main elements: food availability, food access and food utilization [2].

Anemia also causes suppression of the immune system with increased tendency for infection; and depression of cognitive function, growth and psychomotor development, leading to difficulties in learning and reduced physical capacity. Since it is a multifactorial condition, even the history of the patient is as important as the physical examination and laboratory tests.

Population	Non-anaemia	Anaemia		
		Mild	Moderate	Severe
Children 6-59 months of age	110 or higher	100-109	70-99	Lower than 70
Children 5-11 years of age	115 or higher	110-114	80-109	Lower than 80
Children 12-14 years of age	120 or higher	110-119	80-109	Lower than 80

Table 1. It is a statistical test which is applied to sets of categorical data to evaluate any observed difference.

The OpenEpi software version 3 was used and the data was analysed using the Chi Square test. It is a statistical test which is applied to sets of categorical data to evaluate any

Looking at the condition from all its aspects will help reduce the disease burden in our state and country. The most common of the causes is said to be nutritional anemia, mainly iron deficiency. Therefore, the term iron deficiency anemia is being used synonymously with the term anemia. In Karnataka, NFHS-5 fieldwork was conducted from 10th July 2019 to 11th December 2019 by Nielsen India Pvt. Ltd. and an increase in anemia of children in the age group of 6 months to 5 years was seen. In Bangalore, a similar fieldwork also revealed an increase by 7.2% of children with anemia in the age group of 6 months to 5 years [3].

Materials and Methods

This is a prospective observational study conducted in 200 children aged 6 months to 5 years of age over a time span of 18 months in KIMS Hospital, Bengaluru. These children included were evaluated and screened for anemia by haemoglobin estimation and other relevant investigations. This study was approved by the Institutional Ethics committee of the institute. Informed consent was obtained from the parents or the legal guardians of the children [4].

Inclusion criteria

- Children aged between 6 months to 5 years with clinical features of anemia.
- Children ages between 6 months to 5 years with hemoglobin less than 11gm/dl.

Exclusion criteria

- Children on treatment or already diagnosed with anemia.
- Patient not willing to give informed consent.

On admission, a detailed history with emphasis on current and past symptoms were taken, with importance to the nutritional status of the child, their socioeconomic status, and history of breastfeeding. Children selected for the study underwent hematological work-up including complete hemogram, peripheral blood smear, red blood cell indices. Further work up such as an iron profile, reticulocyte count, RDW, folic acid and vitamin B12 levels were done if required. The WHO criterion was used for the diagnosis of anemia and the degree of anemia was further categorised as follows (Table 1).

observed difference. A p-value less than 0.05 is considered as statistically significant [5].

Results

The proportion of anemia in children between 6 months to 5 years depended on various factors. From the 200 children taken for this study, 46% were found to have mild anemia, 46% had moderate anemia and only 8% of children had severe anemia. Anemia was seen more commonly in children between the ages of 6 months to 2 years (57.5%) in comparison to children between 2 to 5 years (42.5%). The proportion of anemia was seen to be greater in male (61%) than female (39%) children [2].

While examining the peripheral smear, microcytic blood picture was commonly seen (81%) with a minority of children

having normocytic blood picture (17%) and dimorphic blood picture (2%) and was statistically significant ($p\text{-value} < 0.001$). This indicates that nutritional deficiency is one of the important causative factor of anemia in this study. While further work up was done in children with clinical features suggestive of Iron deficiency anemia, parameters like Iron, transferrin saturation, ferritin were decreased and RDW was increased in almost all cases which were evaluated. Vitamin B12 and folic acid levels were done in 4 children out of 5 with dimorphic anemia, in which 1 had vitamin B12 deficiency and 2 had folic acid deficiency while the other 2 cases had normal levels of vitamin B12 and folic acid (Table 2).

Demographics	Number (Total=200)	Percentage (%)
Age		
6 months to 2 years	115	57.5
2 years to 5 years	85	42.5
Gender		
Male	122	61
Female	78	39
Severity of anemia		
Mild	92	46
Moderate	92	46
Severe	16	8
Peripheral smear		
Dimorphic	5	2.5
Microcytic	162	81
Normocytic	33	16.5
Nutritional status		
Normal	113	56.5
Grade I malnutrition	52	26
Grade II malnutrition	15	7.5
Grade III malnutrition	5	2.5
Grade IV malnutrition	10	5
Wasting and stunting	5	2.5
Mother's education		
Postgraduate	1	0.5
Graduate	6	3
Secondary	57	28.5
Primary	102	51
Illiterate	34	17
Socioeconomic status		
Lower	1	0.5

Upper lower	90	45
Lower middle	82	41
Upper middle	21	10.5
Upper	6	3
Concurrent illness		
Central nervous system	5	2.5
Gastrointestinal	46	23
Infectious diseases	61	30.5
Renal	11	5.5
Respiratory	62	31
Others	15	7.5
Exclusive breastfeeding		
Till 6 months	118	59
Less than 6 months	82	41

Table 2. The proportion of anemia in children between between 6 months to 5 years depended on various factors.

According to IAP classification of malnutrition and Waterlow's classification, it was also seen that 56% of the anemic children had normal nutritional status whereas 41% were underweight and a minor 2.5% suffered from wasting and stunting. In this study, it was seen that 56% of the anemic children had normal nutritional status whereas 41% were underweight and a minor 3% suffered from wasting and stunting. A P value of <0.001 was seen which is of high statistical importance. Mother's education status was taken as a factor to compare the proportion of anemia. It was found that 51% of children with anemia had mother's who had only completed education at a primary level. This was followed by 29% seen with mother's having completed secondary education [3].

Highest proportion of anemia was seen in children belonging to upper lower class (45%), followed by lower middle class (41%), Upper middle class (11%), upper class (3%), lower class (0.5%). P value of 0.024 was observed which is of statistical significant [5].

Discussion

In our clinical study, anemia was seen more commonly in children between the ages of 6 months to 2 years (57.5%) in comparison to children between 2 to 5 years (42.5%). The higher number of anemic children were seen in the ages of 2-5 years (61%) than 6 months to 2 years (39%). A higher proportion of anemia in children below 2 year of age. The cause in this age group is usually due to inadequate iron intake in the diet and the weaning practices which are undertaken. One example for this is excessive consumption or starting cow's milk before 6 months of age, which has low iron content and can lead to blood loss from milk protein colitis. The proportion of anemia based on the gender was also discussed [1].

Anemia was seen more in males (61%) in comparison to females (39%). The higher proportion of anemia was seen in females. But no gender predominance was observed, hence iron deficiency anemia can occur equally in either male or female children. The study also compared the severity of anemia according to the WHO classification, with equal occurrence of mild and moderate anemia (46%) and only 8% children having severe anemia. In the study by higher proportion of moderate anemia was seen (46.8%) with 26.6% of children had mild anemia and 3.6% had severe anemia. In the same study, she also evaluated proportion of anemia based on the peripheral blood picture, with 45% having normocytic anemia, 37% with microcytic anemia and 18% with dimorphic anemia. In a study conducted by, 71 (87.6%) out of a total of 81 infants between the ages of 3 to 6 months had anemia; 69% mild, 28% moderate and 2.8% severe. Highest prevalence (92.3%) was seen at 3 months of age [6]. In our study, most of the peripheral blood pictures seen was microcytic blood picture (81%) mostly suggestive of the diagnosis of Iron-deficiency anemia. Out of the 16 children with severe anemia, 5 (31%) had a dimorphic blood picture which is due to nutritional vitamin B12 and folic acid deficiency [4].

In a total of 108 children with moderate and severe anemia, further evaluation was done in in children with clinical features of anemia and those with dimorphic peripheral blood picture. In children who were evaluated for Iron deficiency anemia, serum levels of iron and ferritin were taken into account as they are sensitive markers. In all 18 children (100%), serum iron was reduced along with reduced transferrin saturation levels [7]. From the 25 children evaluated for serum ferritin, 15 children (60%) had reduced levels while the other 10 (40%) had normal ferritin levels.

Serum ferritin indicated depletion of iron tissue stores hence it is a sensitive marker for iron deficiency anemia but it also is an acute phase reactant that becomes elevated in response to inflammation. In individual studies, there has been correlation between child's nutritional status and anemia. In his study, also had a majority of children (58.33%) who belonged to the underweight category. In our study, according to the IAP classification, more than half (56.5%) of children had a normal nutritional status but the remaining half (43.5%) were either malnourished or wasted/stunted.

Nutrition is the most common cause of anemia in the age group for 6 months to 5 years as iron stores present at birth usually is sufficient only during the first 6 to 9 months of life after which the iron stores start depleting. Hence if the nutrition is not adequate and rich in iron, it can lead to iron deficiency. In a study done in South-Eastern Nigeria, concluded that breastfeeding for longer than 9.5 months was predictive of low to borderline hemoglobin in children 2 to 5 years old. Children with low Hb levels were breastfed a mean of 2.4 months longer than those with normal Hb. Therefore longer breastfeeding was associated with lower Hb levels [8]. After the period of exclusive breastfeeding, the weaning period is also important including the complementary and supplementary foods which are given to the child.

In our study, we also found out that most children belonged to the upper lower (45%) and lower middle (41%) socioeconomic status. Having a low socioeconomic status can also be a cause for delayed iron supplementations and having access to iron rich food during weaning [9]. Most of the children with anemia were brought to the hospital with respiratory (31%), infectious (30.5%), or gastrointestinal (23%) complaints and were incidentally found to have anemia which correlates to as the majority of the complaints which were commonly found in their study was also found to be under infectious diseases, respiratory system and gastrointestinal system. This indicates that children with mild or moderate anemia may not be brought to the hospital with complaints regarding anemia [10]. In mild or moderate anemia, most commonly the child will be asymptomatic, hence subtle symptoms and signs of anemia may not be noticed by the parents or the doctors. This goes to show that a meticulous history and medical examination is important and needs to be performed in every child in order to identify mild or moderate anemia.

Conclusion

Nutritional anemia is the single most common and important cause of anemia in children of this age. The most common causes seen in children are iron, vitamin B12 and folate deficiency, with a higher proportion of iron deficiency anemia. This may be because of delayed weaning of the child or starting cow's milk before 6 months of age. Exclusive breastfeeding should be encouraged despite the risk of anemia as it still is beneficial for the child's growth and development. Anemia can be prevented by starting adequate iron supplements and iron rich food while weaning. It mentions in his study that delayed cord clamping is associated with an improved iron status at 2-6 months of age.

Since most of the younger children might be asymptomatic, a laboratory screening should be done at 12 months of age with appropriate long term follow up. Other measures which can be beneficial are appropriate meal programs in schools, provide iron supplementation through iron fortified foods and encourage regular deworming. It is also important to counsel and educate the parents, especially the mother on effective nutritional practices (iron supplementation during pregnancy) and hygiene measures to prevent the anemia in the child.

References

1. Santos RF, Gonzalez ES, Albuquerque EC, et al. Prevalence of anemia in under five-year-old children in a children's hospital in Recife, Brazil. *Rev Bras Hematol Hemoter* 2011; 33: 100-104.
2. Gebreweld A, Ali N, Ali R, et al. 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: 0218961.
3. Buck S, Rolnick K, Nwaba AA, et al. Longer breastfeeding associated with childhood anemia in rural south-eastern Nigeria. *Int J Pediatr* 2019.
4. Marol R, Marol R. Prevalence of anemia in exclusively breastfed full term babies between 3-6 months of age. *Int J Pediatr* 2021; 8: 300.
5. Chowdhury HA, Ahmed KR, Jebunessa F, et al. Factors associated with maternal anaemia among pregnant women in Dhaka city. *BMC Women's Health* 2015; 15: 1-6.
6. Goswami S, Acharjee R, Dey S. Determinants of anaemia among children aged under five years in Assam, India. *Int J Contemp Pediatr* 2020; 7: 1.
7. Kalhan M, Kaushal P, Chayal V, et al. Prevalence of anemia among toddlers (12-36 months) in urban area of district Rohtak, Haryana. *J Fam Med Prim Care* 2022; 11: 2532-2536.
8. Rahman MH, Chauhan S, Patel R, et al. Anaemia among Indian children: A study of prevalence and associated factors among 5-9 years old. *Child Youth Serv Rev* 2020; 119: 105529.
9. Saba F, Poornima S, Balaji PA, et al. Anemia among hospitalized children at a multispecialty hospital, Bangalore (Karnataka), India. *J Fam Med Prim Care* 2014; 3: 48-53.
10. Shali T, Singh C, Goindi G. Prevalence of anemia amongst pregnant mothers and children in Delhi. *Indian J Pediatr* 2004; 71: 946.

*Correspondence to:

Jennifer Wu

Department of Pediatrics,

Kempegowda Institute of Medical Sciences,

Karnataka, India

E-mail: wenu2010@gmail.com