Clinicopathological correlation of severe anemia in children below 5 years of age in the region of Kutch district, Gujarat

Kalpesh B Kubavat[1], Niraj A Bharadva[2], Shreyash R Mehta[2]

[1]Department of Pathology, Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat, India.
[2]Department of Community Medicine, Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat, India.
Correspondence to Kalpesh B Kubavat, E-mail: kalpesh_can@yahoo.com

Abstract

Background: About 24.8% of world population is affected by anemia. Because of low monthly income and more incidences of communicable and noncommunicable diseases, the prevalence and severity of anemia is higher in developing countries. Children and pregnant women are the most vulnerable groups to anemia. The brain, which is the fastest developing organ in infancy and early childhood, is the most affected organ and children as they are developing as well are the most affected age group.

Objective: To determine the magnitude of severe anemia and its socioeconomic, nutritional, and biological risk factors among children aged below 5 years who visited GK General Hospital (GH), Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat, India, from November 2014 to November 2015.

Materials and Methods: A total number of 100 children aged below 5 years attending pediatric clinic at GKGH with hemoglobin level of 7 g/dL and below were included in this study. Detailed history and thorough clinical examination was done for each case. This was followed by investigations such as complete blood count with red cell indices, peripheral blood film smear, erythrocyte sedimentation rate, serum iron, total iron binding capacity, and serum ferritin.

Result: A total of 3,000 children had participated in the study. The overall prevalence of severe anemia was 100 (3.33%). Education and occupation of both father and mother are significantly associated with children's anemia. Low consumption of all the three foodstuffs was significantly associated with anemia, with vegetable showing the highest OR of 6.49. Intestinal parasitic infection is also significantly associated with anemia with OR of 6.4.

Conclusion: Severe anemia in children aged below 5 years of age is more prevalent in children of multigravida mother, low education of parents, and low socioeconomic status of family. Anemia was more common among children who consumed low dairy products and fruits and vegetables with intestinal parasitic infection.

KEY WORDS: Clinicopathological, severe anemia, children below 5 years, Kutch

Introduction

Decrease in hemoglobin (Hb) concentration, or red blood cell (RBC) mass, or oxygen carrying capacity is defined as anemia. Anemia is a major health problem worldwide. It is most often a hidden deficiency, with a few overt symptoms.[1] Prevalence of anemia is high in the developing countries. Its causes are multifactorial, varying from micronutrient deficiencies such as iron, folate, and vitamin B12 to infectious diseases such as malaria and worm infections.[2,3] The global prevalence of anemia in school-age children was 25.4% as per the joint report of the WHO and CDC in 2008.[4] The normal proliferation and differentiation of hematopoietic stem cells in the bone marrow requires several essential nutrients such as iron, folate, and vitamin B12.[5] About 50% of anemia is owing to iron deficiency worldwide and accounts for roughly 841,000 deaths annually worldwide.[6] According to the WHO's report, in 2001, prevalence of IDA among school-age children in developing countries was 48.1%.[7]

About 24.8% of world population is affected by anemia. Because of low monthly income and more incidences of communicable and noncommunicable diseases, the prevalence and severity of anemia is higher in developing countries. Children because of increased nutrient requirement for development and pregnant women because of increased requirement for fetus are the most vulnerable groups to anemia. It affects the people in terms of ill health, premature death, and lost earnings. The brain, which is the fastest developing organ in infancy and early childhood, is the most affected organ and children as they are developing as well are the most affected age group. It impairs the cognitive development of children. So, this study was designed to determine the magnitude of severe anemia and socioeconomic, nutritional, and biological risk factors for it among children aged below 5 years who visited GK General Hospital (GH), Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat, India.

Materials and Methods

This study was done at GKGH, from November 2014 to November 2015. A total number of 100 children aged below 5 year attending pediatric clinic at GKGH with Hb level of 7 g/dL and below were included in this study. Children with congenital heart diseases, tuberculosis, malignancies, or genetic disorders were excluded from the study. Each case was serially numbered, and detailed history and thorough clinical examination was done for each case. This was followed by investigations such as complete blood count (CBC) with red cell indices, peripheral blood film (PBF) smear, erythrocyte sedimentation rate, serum iron, total iron binding capacity (TIBC), and serum ferritin.

Blood sample for Hb estimation and peripheral blood smear (PBS) was obtained by the finger prick method. About 15 mL of venous blood was obtained from antecubital vein by 5 cc syringe. The blood sample was collected in an autoclaved test tube to obtain sufficient amount of serum for estimation of other parameters (i.e., serum iron, TIBC, and serum ferritin). Hb estimation was done by cyanmethemoglobin method. Reporting of PBS was done before all other tests were carried out. Serum iron and TIBC were done by ferrozine method. Serum ferritin was done on TOSHO AIA 360. CBC and RBC indices were done on auto hematology analyzer—ERMA PCE-210(3-PARTS).

Result

A total of 3,000 children had participated in the study, of which 58.5% were female and 41.5% male subjects. With regard to educational status of children's parents, 2,089 (69.63%) of their mothers and 1,115 (37.16%) of their fathers had primary education, while 900 (30%) of their fathers were graduates and above, and 101 (3.37%) of their mothers were graduates and above. The majority [2,129 (70.97%)]of the children's parents, had a monthly income less than Rs. 10,000.

Children's Hb level was used to determine the prevalence of anemia. The overall prevalence of severe anemia was 100 (3.33%). Education and occupation of both father and mother is significantly associated with children's anemia [Table 1].

All of the children were consuming grain food sources at least once in a week. However, vegetables, fruits, and dairy products were not as frequently consumed by children as grain food sources. Vegetables, fruits, and dairy products were consumed by 2,690 (89.7%), 1,671 (55.7%), and 2,742 (91.4%) of the children. Consumption of all the three foodstuffs was significantly associated with anemia, with vegetable showing the highest OR of 6.49 [Table 2]. Overall, 721 (24.03%) of the children presented intestinal parasitic infections. Hookworm was

Table 1: Sociodemographic characteristics of children (n = 3,000)

Variable	Total	Anemia		P
		Y	N	
Age of the child (years)				
0–2	2022	60	1962	0.1
2–5	978	40	938	
Sex of the child				
Male	1246	46	1200	0.36
Female	1754	54	1700	
Family size				
Nuclear	1137	38	1099	0.98
Joint	1863	62	1801	
Income/month (Rupees)				
<10,000	2129	70	2059	0.83
≥10,000	871	30	841	
Father's education				
Primary	1115	75	1040	<0.001
Sec and Higher Sec	985	20	965	
Graduate	757	3	754	
Postgraduate	143	2	141	
Father's occupation				
No work	33	3	30	<0.001
Laborer	1918	70	1848	
Civil service	300	2	298	
Private sector	719	20	699	
Business man	30	5	25	
Mother's education				
Primary	2089	80	2009	<0.001*
Sec and Higher Sec	810	10	800	
Graduate	89	7	82	
Postgraduate	12	3	9	
Mother's occupation				
No work	2529	80	2449	<0.01*
Laborer	221	12	209	
Civil service	51	5	46	
Private sector	190	2	188	
Business man	9	1	8	

*Last two rows merged for χ^2 calculation.

Table 2: Distribution of children according to dietary habits (*n* = 3,000)

Dietary habits	Total	Anemia		P	OR (95%CI)
		Y	N		
Vegetables					
Nonconsumer	310	40	270	<0.001	6.49(4.27–9.87)
Consumer	2690	60	2630		
Fruits					
Nonconsumer	1329	60	1269	<0.01	1.93(1.28–2.89)
Consumer	1671	40	1631		
Dairy products					
Nonconsumer	258	30	228	<0.001	5.02(3.21–7.86)
Consumer	2742	70	2672		

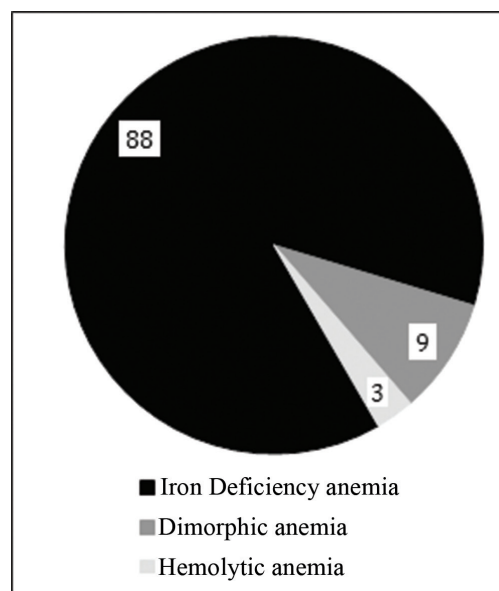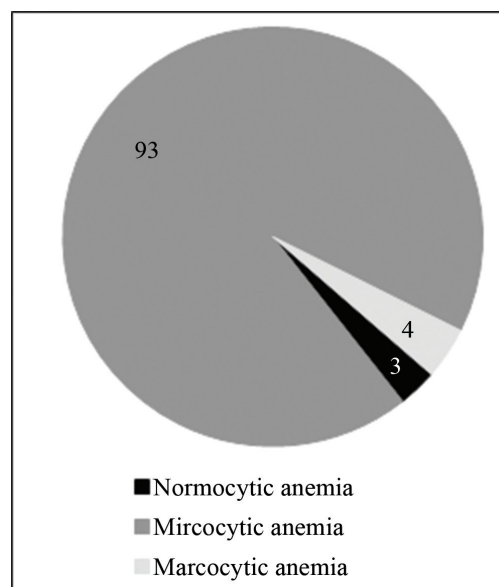**Table 3:** Distribution of children according to parasitic infestation and parity of mother (*n* = 3,000)

Variable	Total	Anemia		P	OR (95%CI)
		Y	N		
Intestinal parasitic infection					
Yes	721	20	701	<0.001	6.49(4.27–9.87)
No	2279	80	2199		
Parity of mother					
Multigravida	1319	74	1245	<0.001	3.78(2.41–5.95)
Primigravida	1681	26	1655		

Figure 1: Distribution of children according to type of anemia (*n* = 100)

Figure 2: Distribution of children according to impression on peripheral blood smear examination (*n* = 100)

the most 371 (51.46%) prevalent intestinal parasite detected, followed by *Trichuris trichiura* [172 (23.85%)] and *Ascaris lumbricoides* [178 (24.69%)]. Intestinal parasitic infection is also significantly associated with anemia with OR of 6.4. Malarial parasite was not detected on any of the smear examined. Parity of mother is also significantly associated with anemia with OR of 3.78 [Table 3]. Among anemic children, 88%, 9%, and 3% exhibited iron deficiency, dimorphic anemia, and hemolytic anemia, respectively [Figure 1]. Microscopic examination of the peripheral blood film showed microcytic picture in 93% of children [Figure 2].

Discussion

In India, pregnant women and young children aged below 5 years are the main focus of national programs for prevention and control of anemia. While information on underweight and stunting is available, information on incidence, prevalence, and severity of anemia in children are not well documented. Hence, anemia in children study and documentation should be the first priority. As a part of an intervention program, a survey was conducted to quantify the magnitude of the anemia among children aged below 5 years who visited GKGH.

The prevalence of severe anemia (Hb <7 g/dL) was 3.33% in this study, which is close to that of Gujarat (3.6%)[8] and study done by Awasthi et al.[9] This is lower than reported prevalence of 6% from Baroda.[10] This shows the prevalence of anemia as such has remained almost unchanged, but incidence of severe anemia is decreased. In this study, it was found that 74% children with severe anemia had multigravida mother which is in agreement with study done by Pasricha et al.[11] who found that anemia in toddlers were primarily associated with iron stores; however, maternal haemoglobin level and socioeconomic status were also contributory factors.[11]

In this study, we found that 93% of the children with severe anemia presented microcytic hypochromic picture on PBS, which is slightly more than finding of study done by Pasricha et al.,[11] which is 75.3%, probably owing to cases taken of only severe anemia. Studies have found that increasing the calorie intake by 20%–30% by itself has resulted in improved Hb status in India.[12,13] However, to increase iron absorption, increased calorie intake should be accompanied by increase in other vitamins and consumption of tea before and after half an hour of meal must be avoided. As anemia in this age group adversely affects cognitive performance, there is a need of effective strategy to reduce it.

Limitation

We could collect samples only from patients attending GKGH, Bhuj. So, result of the study may not be generalized for whole Kutch and other districts of Gujarat.

Conclusion

Prevalence of severe anemia in children aged below 5 years of age is more in children of multigravida mother, less educated parents, and low socio economic status of family. Anemia was more common among children who consumed low dairy products, fruits, and vegetables. Anemia was also more common in children with intestinal parasitic infection. Iron deficiency was the most common type of anemia. Anemia in childhood adversely affects cognitive performance, so there is a need of effective strategy such as improving nutrition of mother and increasing consumption of iron-rich foods to reduce it.

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