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PREVALENCE AND ETIOLOGY OF NUTRITIONAL ANEMIA IN CHILDREN AGED 6 MONTHS TO 60 MONTHS IN FATEHABAD DISTRICT OF HARYANA

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ABSTRACT

Nutritional anemia is a very common childhood problem and is a major public health challenge in many developing countries including India. The prevalence of anemia in preschool-age children is 47.4%. The present study was carried out to find out the prevalence of different grades and etiology of nutritional anemia in children aged 6 months to 60 months in Fatehabad district of Haryana. This was a prospective study of children aged 6 months to 60 months that presented with anemia at Balaji Children's Hospital in Fatehabad city in Haryana. Total 100 anemic children (including both boys and girls) between the ages of 6 months to 60 months formed the study group. Relevant history was taken and a complete physical examination done. Hemoglobin estimation was done using Sahli's Acid-Hematin methods. With clinical symptoms and hemoglobin estimation, the prevalence of different grades of anemia was detected. Ferritin, vitamin B12 and folic acid levels were measured in the venous blood using chemiluminescent technique (Advia Centaur, Siemens, USA). The anemic patients who had ferritin <12ng/dl were diagnosed as having iron deficiency. Vitamin B12 and folic acid levels below 210pg/ml and 3.3ng/ml were diagnosed as vitamin B12 and folic acid deficiency. Prevalence of mild, moderate and severe anemia as judged by WHO, recommended cut-off values of haemoglobin among anemic children aged 6 months to 60 months was 3%, 64 % and 33% respectively. Pure or mixed iron deficiency anemia was the commonest type of anemia noted in 63% children followed by pure or mixed B12 deficiency in 21% anemic children. Of the pure variety, iron deficiency was the commonest cause occurring in 45% children. It is concluded that nutritional anemia continues to be a significant public health problem in children aged 6 months to 60 months and iron deficiency either alone or in combination is the commonest nutritional cause of anemia. Pure or mixed vitamin B12 deficiency is an important but yet not commonly recognized cause of anemia among these children.

Keywords: *Anemia, Haemoglobin, Iron Deficiency, Vitamin B12, Folic Acid, Children Aged 6 Months to 60 Months*

INTRODUCTION

Nutritional anemia is a significant public health problem that occurs worldwide in both developed and developing countries. The World Health Organization (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 anemic children, 89 million live in India. Approximately 50% of anemia cases are caused by iron deficiency. Preschool children in India constitute about 16% of the total population which are vulnerable from the nutritional standpoint. The main reason for this vulnerability is the easy susceptibility to malnutrition and infection (Pasricha *et al.*, 2010).

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. Low oxygenation of brain tissues, a consequence of anemia, may lead to

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impaired cognitive function, growth and psychomotor development, especially in children. Infants, under 5-year-old children have greater susceptibility to anemia because of their increased iron requirements due to rapid body growth and expansion of red blood cells (Prakash *et al.*, 2011). There is a paucity of data on etiology of nutritional anemia among preschool children with special reference to micronutrient deficiencies. The present study was undertaken to determine the prevalence of various grades of anemia among preschool children aged 6 months to 60 months and an attempt is also made to define the etiology of nutritional anemia among this vulnerable group of children.

MATERIALS AND METHODS

It was a cross sectional study conducted at the Balaji Children's Hospital in Fatehabad city of Haryana. The study was designed to include anemic children aged 6 months to 60 months (5 years). Between April 2013 and December 2013, a consecutive sample of anemic children (100 patients) who presented at the outpatient department and the children's emergency room with a primary diagnosis of anemia was included into this study. Recruited subjects in obvious life-threatening conditions such as cardio-respiratory and neurological complications were first stabilized before history was taken. On enrolment, detailed history including medical and dietary was taken. Physical and systemic examination was carried out for each of the patients. As per the WHO recommendations, anemia was diagnosed when Hb was <11 g/dl for children <6 year. Anemia was further graded as mild (Hb = 9.0 - 10.9 g/dl), moderate (Hb = 6.0 - 8.9 g/dl) and severe (Hb <6.0 g/dl) for children <6 year. (UNICEF/UNU/WHO/MI, 1998)

Data Collection: Data pertaining to gender, age, weight, and serum hemoglobin levels were collected from the charts of children aged between 6 months and 60 months who were hospitalized from April 2013 to December 2013. Patients were categorized by age as follows: 6-12 months, 13-24 months, 25-36 months, 37-48 months and 49-60 months.

Subjective Parameters: Age was recorded from birthday by calendar to the nearest of year (<6 months and >6 months). Standing height was recorded without shoes and with light cloths on a wall mounted measuring tape to the nearest of centimeters (<5 mm and >5 mm). Weight was recorded without shoes and with light cloths on a Krups weighing machine with a least count of 500 grams.

Physiological Parameter: Hemoglobin was done using the Sahali's hemoglobinometer using standard procedure protocol. (Wintrobe MN 1975) The measured values were tabulated and compared to the standard values of grading of anemia according to WHO guidelines with < 11 gram % of hemoglobin considered as anemic (WHO 1975). Ferritin, vitamin B12 and folic acid levels were measured in the venous blood using chemiluminescent technique (Advia Centaur, Siemens, USA). The anemic patients who had ferritin <12ng/dl were diagnosed as having iron deficiency. Vitamin B12 and folic acid levels below 210pg/ml and 3.3ng/ml were diagnosed as vitamin B12 and folic acid deficiency. Combined or mixed deficiency anemia was interpreted when more than one micronutrient deficiency (iron, vitamin B12 and folic acid) existed together (Gruchy, 1986). The nutritional status of each child was assessed using Gomez classification of weight for age (Gomez, 1955).

Statistical Analysis: Results of the study are presented in percentage.

RESULTS AND DISCUSSION

Total number of anemic children was 100, out of which 54 were girls and 46 were boys. All the children were within the age group of 6 months to 60 months (5 years). (Table 1)

Table 1: Age and sex distribution of 100 anemic children aged 6 months to 60 months studied for etiology of anemia

Age (months)	Girls	Boys	Total
6 – 12 M	9	9	18
13 – 24 M	11	10	21
25 – 36 M	12	8	20
37 – 48 M	11	9	20
49 – 60 M	11	10	21

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Present study showed that overall prevalence of severe anemia among preschool children in the age group of 6 months to 60 months was 35 %. The highest prevalence of severe anemia was present in the boys (34.78 %) than in girls (30.35 %). It was also observed that 3.57 % of girls and 2.17 % of boys were mildly anemic and 62.5% of girls and 63.04 % of boys were moderately anemic. Among the 6 months to 60 months children, mild anemia was found in 3%, moderate anemia in 64 % children and severe anemia in 33% (Table 2)

Table 2: Number of anemic children suffering from different grades of anemia aged 6 months to 60 months

Age (months)	Hemoglobin (g/dl)									Percentage
	<6.0			6.0-8.9			9-10.9			
	Girls	Boys	Total(%)	Girls	Boys	Total(%)	Girls	Boys	Total(%)	
6 – 12 M	4	3	7%	5	6	11%	0	0	0%	18%
13 – 24 M	3	3	6%	8	6	13%	0	1	1%	21%
25 – 36 M	3	4	7%	9	4	23%	0	0	0%	20%
37 – 48 M	3	4	7%	6	5	11%	2	0	2%	20%
49 – 60 M	4	2	6%	7	8	15%	0	0	0%	21%
Total	17	16	33%	35	29	64%	2	1	3%	100%

Table 3 shows prevalence of different grades of undernutrition in anemic children aged 6 months to 60 months i.e. 53.57 % of girls and 50.0 % of boys were mildly undernourished, 32.14 % of girls and 47.82 % of boys were moderately undernourished and 8.92% of girls and 2.17 % boys were severely undernourished. Among 100 anemic patients, 98.21% of girls and 100% of boys suffered from different grades of malnutrition.

Table 3: Prevalence of grades of undernutrition (According to Gomez Classification) anemic children aged 6 months to 60 months

Age (Months)	Undernutrition								Total	
	Normal(>90%)		Mild(75-89.9%)		Moderate(60-74.9%)		Severe(<60%)		Girls	Boys
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys		
6 – 12 M	1	0	3	1	5	8	0	0	9	9
13 – 24 M	0	0	6	5	5	5	0	0	11	10
25 – 36 M	0	0	10	3	2	4	0	1	12	8
37 – 48 M	0	0	5	6	2	3	4	0	11	9
49 – 60 M	0	0	6	8	4	2	1	0	11	10
Total	1	0	30	23	18	22	5	1	54	46

Table 4: Etiology of anemia in 100 children anemic children aged 6 months to 60 months

Type of anemia	Gender of children				Number of children
	Girls	Percentage	Boys	Percentage	
Pure iron deficiency	24	44.44	21	45.65	45
Pure vitamin B ₁₂ deficiency	6	11.11	3	6.52	9
Pure folic acid deficiency	1	1.85	0	0	1
Mixed iron deficiency	10	18.51	8	17.39	18
Mixed vitamin B ₁₂ deficiency	5	9.25	7	15.21	12
Mixed folic acid deficiency	2	3.7	3	6.52	5
Unspecified	6	11.11	4	8.69	10
Total	54		46		100

Table 4 shows the prevalence and etiology of anemia: Of the 100 children, aged 6 months to 60 months pure or mixed iron deficiency anemia was found in 63 % children followed by pure or mixed vitamin B12

Research Article

deficiency in 21% children. Pure or mixed iron deficiency anemia was found in 62.95 % girls and 63.04 % boys. Pure or mixed vitamin B12 deficiency was noticed in 20.36% girls and 21.73 % boys. Pure iron deficiency was the commonest cause occurring in 45% children. Vitamin B12 deficiency and folic acid deficiency alone was noticed in 9 % and 1% children respectively.

DISCUSSION

The term 'nutritional anemia' encompasses all pathological conditions in which the blood hemoglobin concentration drops to an abnormally low level, due to a deficiency in one or several nutrients. The main nutrients involved in the synthesis of hemoglobin are iron, folic acid, and vitamin B₁₂. Iron deficiency is by far the first cause of nutritional anemia worldwide. Folic acid deficiency is less widespread and is often observed with iron deficiency. Vitamin B₁₂ deficiency is far rarer (Prakash *et al.*, 2011).

Nutritional anemia is a big problem in India. Studies done prior to 1985, in India, gave an average prevalence rate of anemia as 68% in pre-school children (Rao *et al.*, 1980, Singla *et al.*, 1982). Based on studies by the National Nutrition Monitoring Bureau, anemia prevalence among children one to five years of age was around 66%, with a wide range of 33 to 93% across different states (NNMB, 2003).

The prevalence of anemia among children 6-35 months has increased from 74 % in National Family Health Survey II (NFHS-2) to 79 % in National Family Health Survey III (NFHS-3). However, there has been a slight reduction in the prevalence of severe anemia, while there has been an increase in the overall anemia, in between 1999 to 2006. As per data collected in NFHS III, in India, almost 8 in 10 (78.9%) children age 6-59 months are anemic, including 40 % who are moderately anemic and 3 % who are severely anemic. The prevalence of anemia does not vary by sex of the child. The data collected in NFHS-3 indicated that in Haryana, the prevalence of mild, moderate and severe anemia among children aged 6 month to 5 years was 25.8%, 42.2% and 4.3% respectively and the overall prevalence of anemia in 6 M – 11M, 12M - 23M, 24M - 35M, 36M - 47M and 48M - 59M was found to be 81.3%, 88.5%, 76.7%, 65% and 54.3% respectively (NFHS III, 2006).

In the present study the prevalence of mild, moderate and severe anemia in anemic children aged 6 months to 60 months was found to be 3%, 64% and 33% respectively. In our study no association was found between anemia and gender of patients. It was also observed that most of the anemic patients were suffering from different grades of malnutrition.

In the present study iron deficiency anemia was found to be the commonest followed by vitamin B12 and folic acid deficiencies. Pure iron deficiency anemia was found in 45% in 100 anemic children aged 6 months to 60 months which formed the study group. The notable feature of the present study was the presence of vitamin B12 deficiency as 9%, which was the second most common cause of deficiency anemia. In a similar study carried out among 90 preschool children (3 months to 3 year age) to find out the etiology of nutritional anemia it was observed that pure iron deficiency anemia (IDA) was present in 41.4 per cent (37/90) of anemic children and vitamin B12 deficiency alone or in combination with iron was diagnosed in 14.4 and 22.2 per cent anemic children respectively. Similarly folate deficiency, IDA with infection and anemia of chronic diseases (ACD) was diagnosed in 2.2, 3.3 and 12.2 per cent cases respectively (Gomber *et al.*, 1998).

The higher prevalence of combined deficiency anemia as noticed in the present study may be attributed to inadequate food intake, poor stores and other nutritional deficiencies among these children. In the present study, in 10% of children the cause of anemia could not be ascertained.

Although the Indian anemia-control program recommends that children younger than 5 years receive iron and folic acid supplements, results show that this approach has not successfully controlled anemia prevalence. The findings of our study support the need for a broad public-health strategy for the control of anemia among Indian children beyond delivering iron supplementation alone. Low dietary-iron intake, particularly in breastfeeding children, ideally should be alleviated with a combined approach of iron supplementation, fortification of complementary foods, and dietary education in order to decrease the prevalence of anemia in children aged 6 months to 60 months.

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Conclusion

To conclude, childhood anemia continues to be a significant public health problem in preschool children and iron deficiency either alone or in combination is the commonest nutritional cause of anemia. Pure or mixed vitamin B12 deficiency is an important yet not commonly recognized cause of anemia in preschool children aged 6 months to 60 months.

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