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Research Article

Cross sectional study of Nutritional anaemia in Indian Paediatric population

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Abstract: To find out the etiology of nutritional anemia in Indian children admitted to a tertiary hospital. The study Design is Observational cross sectional study Setting is Tertiary-level hospital from October 2010 – September 2011 for a period of one year. And the Participants means all patients aged between 6 months to 13 years, admitted in paediatric ward of this hospital for any complaints were evaluated for anaemia. All patients with Hemoglobin levels less than the WHO cut off levels for anaemia were included in the study. Those who were sick and those who were on drugs, other conditions causing bone marrow suppression were excluded from the study. Serum iron, iron binding capacity, ferritin, vitamin B12, and folic acid analyses were conducted with auto analyzers using commercial kits. The results in this study a total of 975 were examined and 98 children were found to be anaemic and they were taken up for the study. Nutritional anaemia was seen in 63 children, out of which only iron deficiency was seen in 43(68.25%) children, only folic acid deficiency in 7(11.11%) and only vitamin B_{12} deficiency in 2 (3.1%) children. In conclusion Iron deficiency continues to be the main cause of nutritional anemia in children, despite a policy being in place and a program that has been initiated for a long time to eradicate it.
Keywords: Nutritional aanaemia, iron deficiency anaemia, vitamin B_{12} deficiency, folic acid deficiency.

INTRODUCTION

Anaemia is a major public health problem all over the world especially in developing countries. Anemia prevalence in young children continues to remain over 70% in most parts of India and Asia despite a policy being in place and a program that has been initiated for a long time. The irreparable damage that anemia in childhood can cause particularly to the development of a young child on one hand and the knowledge and mechanism available for its control on the other, makes this silent morbidity completely unacceptable in modern times where we strive for millennium development Goal 4 [1]. Out of all the causes, like nutritional anaemias, Hemolytic anaemias, chronic infections, lymphoreticular malignancy, etc., nutritional anaemias account for the major cause of anaemias.

Pregnant women, infants, young children and adolescents are at a higher risk of nutritional anaemia as they have a high demand of nutrients such as iron, folic acid, vitamin B_{12} and other nutrients. Nutritional anaemia is prevalent all over the world, with an estimated one billion people being iron deficient [2]. In India, anaemia is an important health problem, especially among children. Anaemia in children results in impaired cognitive performance, behavioral and language development and scholastic achievement. Anaemia is also associated with increased mortality and morbidity from infectious diseases [3]. The third National Family Health Survey (NFHS – 3)(2005-06) found that the prevalence of anaemia among under 5 children approaches 70% even though there is a national programme to control anaemia for many years [4].

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 B_{12}. In public health terms, iron deficiency is by far the first cause of nutritional anemia worldwide. The three main reasons for IDA in children are:

- Poor bioavailability of iron consumed, related to the low consumption of absorption enhancers and a high consumption of absorption inhibitors in the second year of life
- Insufficient intake of iron as compared to the need
- Increased requirement during the rapid growth stage of infancy and early childhood, between six and twenty-three months.

Folic acid deficiency is less widespread and is often observed with iron deficiency. Vitamin B_{12} deficiency is far rarer and it occurs mainly in vegetarians [5].

There are various studies done to find out the prevalence of iron deficiency anaemias in paediatric population in India and other developing countries [6, 7]. But there is paucity of studies using laboratory measurements to find out the exact cause of nutritional anaemia in Indian population [8]. Hence this study was done with the objective to study cause of nutritional anaemia in pediatric patients admitted in a tertiary care setting.

Study design: Observational cross sectional study

METHODS

This Observational cross sectional study was conducted in paediatric ward of Vydehi Institute of Medical Sciences and Research Centre, a tertiary care hospital in southern India from October 2010 to September 2011 for a period of one year. Informed consent was taken from the care takers of the patients for this study. Permission was taken from the Ethics committee of the hospital for this study. All patients admitted in paediatric ward of this hospital for any complaints were evaluated for anaemia. Those patients who were less than 6 months of age, sick patients and those patients who were on drugs, other conditions causing bone marrow suppression were excluded from the study. All other patients with Hemoglobin levels less than the WHO cut off levels for anaemia were included in the study. WHO Expert group proposed that anaemia should be considered to exist when Haemoglobin is below the following levels in venous blood. 6 months to 6 years 11 gm / dl, less than 12 g/dL for girls from 6 to 18yrs and boys from 6 to 14 years, and less than 13 g/dL for boys from 15 to 18 yrs of age [9].

In those patients found to have anaemia, the following laboratory investigations were done like mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), serum ferritin, serum iron, total iron binding capacity(TIBC), serum transferrin (TRF), serum folate assay and serum vitamin B_{12} assay. 5 ml of blood was collected in an EDTA tube for the study. Serum hemoglobin was estimated by spectrophotometric method by automated machine, serum ferritin by Chemiluminescent immunoassay, serum iron by Ferrozine_no deproteinization, TIBC by ion exchange resin ferrozine method, serum transferrin (TRF) by rate nephelometry, serum folate assay and vitamin B_{12} assay by Chemiluminescent immunoassay. The normal values for various study parameters in this study were considered from Text Book of Nelson [10].

In those patients who are included in the study, the above investigations were done after 3 a febrile days, in case they were suffering from acute infective or inflammatory conditions [11].

RESULTS

100 patients with anaemia as defined by WHO, admitted in the paediatric ward from the period from October 2010 – March 2011, were included in the study. The age of the patients ranged from 6 months to 13 years. There were 66 (66 %) boys and 34 (34 %) girls in the study population. 2 patients were excluded as one child was diagnosed with Thalassemia minor and another patient was diagnosed as acute lymphocytic Leukemia. The characters of the study population are depicted in the table-1.

Table-1: Age distribution of patients studied

Age in years	No. of patients	%
<1	10	10.2
1-2	21	21.4
2-5	20	20.4
5-10	25	25.5
>10	22	22.4
Total	98	100.0

Mean ± SD: 6.03±4.28 Years.

Table-2: Gender distribution of patients studied

Gender	No. of patients	%
Male	65	66.3
Female	33	33.7
Total	98	100.0

Table-3: Hemoglobin levels of patients studied

Hemoglobin	No. of patients	%
<7	3	3.1
7-8	5	5.1
8-9	6	6.1
9-10	15	15.3
10-12	69	70.4
Total	98	100.0

Table-4: Levels of serum ferritin, Serum Iron, TIBC and Serum transferrin levels of patients studied.

	Number of patients	%	Mean ± SD
Serum Ferritin			
<7	13	12.5	
>7	85	87.5	64.86±118.29
Total	98	100.0	
Serum Iron			
<22	28	28.9	
>22	70	71.1	45.64±43.36
Total	98	100.0	
TIBC			
>400	39	40.0	
<400	59	60.0	377.01±97.51
Total	98	100.0	
Serum Transferrin			
<95	2	2.6	
>95	73	97.4	310.22±99.53
Total	75	100.0	

Table-5: Incidence of Iron deficiency of patients studied

Iron deficiency	No. of patients	%
No	45	46.0
Yes	53	54.0
Total	98	100.0

Table-6: Folic Acid levels of patients studied

Folic Acid	No. of patients	%
<4	15	15.3
4-15	81	82.6
>15	2	2.04
Total	98	100.0

Table-7: Vitamin B12 levels of patients studied

Vitamin B_{12}	No. of patients	%
<140	7	7.14
141-500	64	65.3
>500	27	27.5
Total	98	100.0

Table-8: The range and distribution of hematological parameters in these patients

Hematological parameters	No. of subjects	Range	Distribution			
Blood Folate pg/ml	98	2.4 - > 20	< 4 15 (15.3)	4- 10 61(62.2)	10 – 15 12(12.3)	>15 10(10.3)
Serum B12 ng/ml	98	82 - >1500	<140 7(7.2)	140 – 200 6(6.1)	200 – 500 58(59.7)	>500 27(27.8)
Serum Iron mcg / dl	98	7 – 284	<22 29(29.8)	22 – 50 36	>50 33(38.1)	
TIBC mcg/dl	98	187 – 636	<250 8(8.2)	250 -400 51(52)	>400 39(39.8)	
Serum Ferritin mcg / l	96	2.2-711	<7 12(12.5)	7-140 75 (78.1)	>140 9(9.3)	
Serum Transferrin mg/dl	75	17 – 578	<95 2(2.6)	95-385 58(77.3)	>385 15(20)	

Numbers in parenthesis are the percentages

Serum transferring could be done in only 75 patients because of the non availability of kits during the study period.

Total admitted 975
Anaemia cases taken up for the study = 98

Nutritional causes (n=63) Non Nutritional causes (n=35)

Only Iron Deficiency - 43 (68.25%)
Only Folic acid Deficiency - 7 (11.11%)
Only vitamin B_{12} Deficiency - 2 (3.14 %)
Combined nutritional deficiency - 11 (17.5%)

DISCUSSION

Pasricha *et al.;* [12] studied the micronutrients such as vitamin B_{12}, folate, and iron and vitamin A concentrations of 396 children in the age group of 12 – 23 months in rural Karnataka in south India. They found that 65.6% had atleast one micronutrient deficiency and those children between 1-2 years who are breast feeding should be targeted during micronutrient supplementation programs.

Ahmed F *et al.;* [13] studied the prevalence of selected micronutrient deficiencies amongst anaemic adolescent schoolgirls in rural Bangladesh and to examine their relationship with haemoglobin (Hb) levels. They found that 28% of the girls had depleted iron stores, 25% had folic acid deficiency, 89% had vitamin B_2 and 7% had vitamin B_{12} deficiencies. They concluded that there is coexistence of micronutrient deficiencies among anaemic adolescent girls in rural Bangladesh, although they do not suffer from energy deficiency. Of all micronutrients, only iron and vitamin B12 concentrations were found to be related to the Hb concentration.

Gadowsky SL *et al.;* [14] estimated the prevalence of biochemical iron, folate, and vitamin B_{12} depletion among a group of Canadian pregnant adolescents. They found that 22% of the pregnant adolescents had anaemia, 78% had depleted iron stores and twenty-five subjects had plasma vitamin B_{12} values in the sub-optimal range.

Metz J *et al.;* [15] reviewed the prevalence of anemia based on biochemical evidence. He found that the overall contribution of vitamin B_{12} deficiency to the global burden of anemia was not significant, except perhaps in women and their infants and children in vegetarian communities. He also found that it was unlikely that folate deficiency makes a major contribution to the burden of anemia in developing countries.

In our study, a total of 975 were examined and 98 children were found to be anaemic and they were taken up for the study. Nutritional anaemia was seen in 63 children, out of which only iron deficiency was seen in 43(68.25%) children, only Folic acid deficiency in 7(11.11%), and only vitamin B_{12} deficiency in 2 (3.1%) children. Iron deficiency anemia was the commonest cause of nutritional anemia in our study. This shows that in spite of awareness of iron deficiency anemia, and the steps taken to eradicate iron deficiency anemia in the community, still iron deficiency remains the most common cause of anemia in our country. So in order to reduce the burden of iron deficiency anemia in the community, adequate education regarding the ill effects due to iron deficiency and the knowledge about diet rich in iron content, has to be imparted at the school level, health care providers and at the community level.

Some limitations in our study should be considered. Firstly, this study was conducted in hospitalized patients and hence the results in this study are not a true representative of the general population. Secondly, quantitative estimation of CRP was not done, which would have identified false positive elevation of serum ferritin. It is possible that ferritin values, especially those in the neighborhood of the cut-off point were inflated by acute inflammation [16]. Finally, the sample size of this study is small and hence the results of this study could not be generalized to the whole population even though our hospital catered to patients from all over the country. Hence further studies are recommended to formulate a policy in treating those patients with nutritional anaemias.

CONCLUSION

In summary, iron deficiency continues to be the main cause of nutritional anemia in children, in spite of awareness of iron deficiency and steps taken to eradicate it, while folate deficiency and vitamin B_{12} contribute in a low proportion.

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