Original Research Article

# Cross sectional study of nutritional anaemia in rural area of Bihar

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## Abstract

**Background:** Anemia is a global public health problem affecting both developing and developed countries. This study was done to evaluate the etiology of nutritional anaemia in rural children admitted to Department of Paediatrics in Mata Gujri Memorial Medical College & Lions Seva Kendra Hospital, Kishanganj, Bihar. **Materials & Methods**: The study design was observational cross-sectional study at MGM Medical College & Lions Seva Kendra Hospital, Kishanganj, from August 2019 to July 2020 for period of one year and the participant means all patients aged between 6 months to 12 years, admitted in paediatric ward of this hospital for any complain evaluated for anaemia. All patients with haemoglobin levels less than the WHO cut off levels for anaemia were included in the study. Those who were on drugs, other conditions causing bone marrow suppression were excuded from the study. Serum iron, iron binding capacity, ferritin, vitamin B12, and folic acid level analysis were conducted with auto analyser using commercial kits. **Results:** In this study a total 475 were examined and 95 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 B12 deficiency in (3.1%) children. **Conclusion:** Iron deficiency continues to be the main cause of nutritional anaemia in children, despite a policy being in place and a program that has been initiated for a long time to eradicate it.

**Keywords:** Nutritional anaemia, iron deficiency anaemia, vitamin B12 deficiency, folic acid deficiency, Bihar



## Introduction

Anemia is defined as an abnormal reduction in the number of circulating red blood cells, the quantity of hemoglobin and the volume of packed red cells in a given unit of blood [1]. The etiology of anemia is the result of a wide variety of causes that can be isolated, but more often coexist. Iron deficiency has been the prominent cause for onset of anemia, whereas other causes identified include heavy blood loss as a result of menstruation, or parasite infections such as hookworms, schistosomiasis, and other infections like malaria, cancer, tuberculosis, and HIV. In addition, micronutrient deficiencies, including vitamins A and B12, foliate, riboflavin, and copper can increase the risk of anemia [2, 3].

Anaemia is amajor public health problem all over the world especially in developing countries. Anaemia 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 anaemia 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, make this silent morbidity complete unacceptable in modern times [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. Folic acid deficiency is less widespread and is often observed with iron deficiency. Vitamin $B_{12}$ deficiency is far rarer. Therefore, the focus in this article is on Iron-deficiency anemia in children [5].

Anemia is a global public health problem affecting 1.62 billion people globally, which corresponds to 24.8% of the population as per World Health Organization (WHO) [6, 7] It is a significant burden on the social and economic development for both the developing and developed countries alike [6]. Anemia, which is the most prevalent nutritional problem worldwide, occurs more commonly in young children, pregnant women, and women of child bearing age. The prevalence of iron deficiency anemia, which is the commonest cause for anemia, is 52% in Indian women aged 15–49 years, as per WHO statistics [8].

Anaemia is a major public health issue, and particularly so in low-income and middle-income countries where 93% of all cases of anaemia globally are thought to occur [9]. Studies on anaemia in low-income and middle-income countries have focused on women of reproductive age and their children because anaemia during pregnancy and early childhood is associated with important adverse effects for the child—including low birth weight, poor mental and motor development, and mortality—and for the mother, particularly maternal mortality [10-13].

Anaemia is also associated with increased mortality and morbidity from infectious disease. The third National Family Health Survey found that the prevalence of anaemia among under 5 children there is a national programme to control anaemia for many years [14]. The

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term `nutritional anaemia` encompasses all pathological conditions in which the blood haemoglobin concentration drops to an abnormally low level, due to a deficiency in one or several nutrients. The main nutrients involved in the synthesis of haemoglobin are iron, folic acid, and vitamin B12. In public health terms, iron deficiency is by far the first cause nutritional anaemia worldwide.

Several factors contribute to the occurrence of anemia and nearly half of (43%) the anemia cases in childhood are due to iron deficiency [15]. The deficiency may result from inadequate dietary intake of iron, malabsorption of iron, an increased iron demand during rapid growth in children and chronic blood loss. Other causes of anemia include folate and vitamin B12 and A deficiencies, malaria, intestinal helminths, viral infections, chronic disease, hemoglobinopathies, hemolysis, and bone marrow disorders [14, 16, 17].

Different studies also claimed that factors such as age, sex, residence, early initiation of complementary food, under-nutrition, maternal health status, maternal education, and poor socioeconomic status are significantly associated with anemia [18-20]. Anemia during childhood adversely affects mental, physical and social development of the children in short- and long-term outcome; it causes abnormalities of immune function, poor motor and cognitive development, poor school performance, and reduced work productivity in the life of the children, thereby decreasing earning potentials and negatively affect national economic growth [19, 20]. Anemia is also an important cause of morbidity and mortality in African children where resources to determine the underlying etiology remain poor [18].

Folic acid deficiency is less widespread and is often observed with iron deficiency. Vitamin B12 deficiency is far rarer and it occurs mainly in vegetarians. There are various studies done to find out the prevalence of iron deficiency anaemia in paediatric population in India and other developing countries. But there is paucity of studies using laboratory measurements to find out the exact cause of nutritional anaemia in Indian population. Hence this study was done with the objective to study cause of nutritional anaemia in paediatrics patients.

**Materials & Methods**

The study design was observational cross-sectional study at setting in MGM Medical College & Lions Seva Kendra Hospital, Kishanganj from August 2019 to July 2020 for period of one year and the participant means all patients aged between 6 months to 12 years, admitted in paediatric ward of this hospital for any complain evaluated for anaemia. All patients with haemoglobin levels less than the WHO cut off levels for anaemia were included in the study. Those who were on drugs, other conditions causing bone marrow suppression were excuded from the study. Serum iron, iron binding capacity, ferritin, Vitamin B12, and Folic acid level analysis were conducted with auto analyser using commercial kits.

**Results**

About 100 patients with anemia as defined by WHO, admitted in paediatric ward from the period from August 2019 to July 2020, were included in study. There were 54(56.8%) boys and 41(43.2%) girls in the study population. 5 patients were excluded as two children were diagnosed with thalassemia minor and another 3 patients were diagnosed as acute lymphocytic leukaemia. The characters of the study population are depicted in the table 1. Serum transferrin level was done in only 90 patients because of the non-availability of kits during study period. Total admitted 475 patients were included in study,anemia cases were taken up for the study was 95 [Tables 1-8].

**Table 1:** Types of anemia among participants [n=95]

| Type of Anemia | Number of Cases [Percentage] |
|---|---|
| Nutritional cause | 62 (65.3%) |
| Non-Nutritional causes | 33 (34.7%) |
| Only Iron Deficiency | 42 (67.7%) |
| Only Folic acid Deficiency | 7 (11.2%) |
| Only vitamin B 12 Deficiency | 2 (3.2%) |
| Combined nutritional Deficiency | 11 (17.7%) |

**Table 2: Shows age distribution of patients in study [n=95]**

| Age in years | No of patients | Percentage (%) |
|---|---|---|
| < 1 yrs | 10 | 10.5 |
| 1to 2 yrs | 19 | 20 |
| 2 to 5 yrs | 18 | 18.9 |
| 5 to 10 yrs | 25 | 26.31 |
| >10 yrs | 23 | 24.21 |
| Total | 95 | 100 |

**Table 3: Shows gender distribution of patients in study**

| Gender | No of patients | Percentage (%) |
|---|---|---|
| Male | 54 | 56.8 |
| Female | 41 | 43.2 |

**Table 4: Shows hemoglobin levels of patients studied**

| Hemoglobin | No of patients | Percentage (%) |
|---|---|---|
| <7 gr/dl | 3 | 3.1 |
| 7 to 8 gr/dl | 5 | 5.26 |
| 8 to 9 gr/dl | 6 | 6.31 |
| 9 to 10 gr/dl | 15 | 15.78 |
| 10 to 12 gr/dl | 66 | 69.47 |
| Total | 95 | 100 |

**Table 5: Shows levels of serum ferritin, serum iron, TIBC, serum transferrin level of patients studied**

| No of patients | Parameters | % | Mean ±SD |
|---|---|---|---|
| Serum Ferritin<br><7<br>>7 | <br>13<br>82 | <br>13.68<br>86.32 | 64.8 ±118 |
| Serum Iron<br><22<br>>22 | <br>26<br>69 | <br>27.36<br>72.64 | 45.51±43.3 |
| TIBC<br>>400<br><400 | <br>38<br>57 | <br>40<br>60 | 377.01± 97.51 |
| SerumTransferin<95<br>>95 | 2<br>73 | 2.6<br>97.4 | 310± 99.2 |

**Table 6: Shows incidence of Iron deficiency**

| Iron deficiency | No of patients | Percentage (%) |
|---|---|---|
| No | 44 | 46.3 |
| Yes | 51 | 53.7 |
| Total | 95 | 100 |

**Table 7: Shows Folic acid level of patients studied**

| Folic acid level | No of patients | Percentage |
|---|---|---|
| <4 | 14 | 14.7 |
| 4 to 15 | 79 | 83.15 |
| >15 | 2 | 2.15 |
| Total | 95 | 100 |

**Table 8: Shows Vitamin B12 levels of patients studied**

| Vitamin B 12 level | No of patients | Percentage |
|---|---|---|
| <140 | 7 | 7.4 |
| 141 to 500 | 62 | 65.3 |
| >500 | 26 | 27.3 |
| Total | 95 | 100 |

**Discussion**

India is the highest contributor to child anaemia among developing countries. In this study a total 475 were examined and 95 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 B12 deficiency in (3.1%) children. Susmita et al (21) study data for 6- to 59-month-old children were taken from the fourth round of the National Family Health Survey conducted in 2015-16 (NFHS-4). The study sample consisted of 1,37,347 children.

He study found that in India in 2015-16, 56% of 6- to 59-month-old children were anaemic - a decrease of only 13.5 percentage points since the NFHS-3 study conducted in 2005-06. It is well known that iron supplementation is necessary for child growth and brain development. This study suggests that, in addition, the socioeconomic conditions of households in India need to be improved to prevent child anaemia. Low birth weight and low maternal nutritional status are also responsible for the high prevalence of anaemia among children in India [21].

Kotecha PV revealed that 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 [5].

Pasricha et al [22] studied the micronutrients such as vitamin B12, folate, and iron and vitamin A concentration of 396 children in the age group of 12 to 23 months in rural Karnataka in South India. They found that 65.6% had at least one micronutrient deficiency and those children between 1to 2 yrs. who are breast feeding should be targeted during micronutrient supplementation programs. Children who continued to breastfeed received less nutrition from complementary foods and belonged to poorer families with higher food insecurity. A structural equation model for children's vitamin B-12 concentrations was developed that highlighted the interrelation between wealth, continued breastfeeding, complementary diet, and vitamin B-12 concentrations in children. Micronutrient deficiencies are common in this population. Rural Indian children between 1 and 2 y of age who continue to breastfeed should be especially targeted during micronutrient-supplementation programs [22].

Ahmed F et al [23] studied the prevalence of selected micronutrient deficiencies amongst anemic adolescent school girls in rural Bangladesh and to examine their relationship with haemoglobin levels. They found that 28% of the girls had depleted iron stores, 25% had folic acid deficiency, 89% had vitamin B2 and 7% had vitamin B12 deficiencies. They conclude that there is coexistence of micronutrient deficiencies among anemic adolescent girls in rural Bangladesh, although they don't suffer from energy deficiency. Of all micronutrient, only iron and vitamin B12 concentrations were found to be related to the HB concentration.

Metz J et al [24] reviewed the prevalence of anemia based on biochemical evidence. He found that overall contribution of vitamin B12 deficiency to the global burden ofanemia was not significant, except perhaps in women and their infants and their children in

vegetarian communities. He also found that it was unlikely that folate deficiency makes major contribution to the burden of anemia in developing countries.

It seems unlikely that folate deficiency makes a major contribution to the burden of anemia in developing countries. Iron-deficiency anemia may coexist with vitamin B12 and especially folate deficiency, and may confound the hematological features of the vitamin deficiencies whose prevalence would then be underestimated. Supplementation of the diet of pregnant women with folic acid can virtually eliminate folate-deficiency anemia in these women. There are very few data on the hematological effect of vitamin B12 supplementation or fortification at the population level. The addition of vitamin B12 to the supplementation of the diet of pregnant women with iron and folic acid does not produce an increased hematological response, at least in nonvegetarian populations. There are numerous reports of the effect of folic acid fortification of food on tests of folate status, but only a single published report on the hematological response was found [24].

In our study, a total 975 were examined and 95 children were found to be anemic and they were taken up for the study. Nutritional was seen in 62 children, out of which only iron deficiency was seen in 42(67.7%) children, only Folic acid deficiency in 7(11.2%), and only vitamin B12 deficiency in 2(3.2%) children. Iron deficiency anemia was the commonest cause of nutritional anemia in our study. These shows that in spite of awareness of iron deficiency anemia and the steps taken to eradicate iron deficiency anemia in 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 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 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 neighbourhood of the cut-off point were inflated by acute inflammation [25]. Finally, the sample size of this study is small and hence the result of this study could not be generalized to the whole population. Hence further studies are recommended to formulate a policy in treating those patients with nutritional anemia.

**Conclusion**

In summary, Iron deficiency continues to be the main cause of nutritional anemia in children, in spite of awareness of iron deficiency and step taken to eradicate it, while folate deficiency and vitamin B12 contribute in a low proportion.

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