Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-8, Issue-5 | September-October 2022
DOI: 10.53339/aimdr.2022.8.5.13
Page no- 98-104 | Section- Research Article (Pediartrics)

Etiology and Risk Factors of Iron Deficiency Anemia in Children under Five Years: A Cross-sectional Study in 250 Bedded General Hospital, Thakurgaon

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Received: 02 June 2022
Revised: 26 July 2022
Accepted: 04 August 2022
Published: 22 August 2022

Abstract

Background: Although there are several potential contributing factors to iron deficiency anemia in young children, eating foods with low levels of bioavailable iron is probably the biggest one. Young children are most at risk for iron deficiency due to fast development and usually insufficient dietary iron intake. The aim of this study was to assess the etiology and risk factors of iron deficiency anemia in children under five years. **Material & Methods:** This cross-sectional study was conducted in 250 bedded general hospital, Thakurgaon, Bangladesh, during the period from December 2020 to January 2022. Total 100 children having iron deficiency anemia under five years were included in this study. **Results:** Among 100 children with iron deficiency anemia, more than half (51%) of the children were in the age group of less than 1 year. Majority (52%) of the children were female. Most of the children (42%) were from low income family. More than half (65%) of the children had mild anemia. Inadequate iron-based food intake was the commonest (72%) causes of the study patient. Children taking iron supplementation was 14% and mothers taking iron supplementation during pregnancy was 67%. Dietary diversity score was poor for most of the children (59%). 67% had low birth weight and 28% had overweight. Children with early (<6 months) introduction of complementary foods was more than half (68%). **Conclusions:** Inadequate iron-based food intake is the commonest causes of iron deficiency anemia. Children mothers taking iron supplementation during pregnancy, low dietary diversity score, low birth weight and early (<6 months) introduction of complementary foods are the main risk factors.

Keywords:- Etiology, Risk Factors, Iron Deficiency Anemia, and Children.

INTRODUCTION

Anemia is characterized as a situation in which people belonging to the same reference population have blood hemoglobin levels that are below optimum.[1] One of the most severe and prevalent nutritional deficiency illnesses that pose a public health risk in poor nations is anemia.[2] Though the proportion varies among demographic groups and geographical areas, according to the existing local conditions, iron deficiency is thought to be the cause of about 50% of anemia cases.[3] For children aged 6 to 59 months, an anemia diagnosis is categorized as mild (Hb=10.0-10.9 g/dl), moderate (Hb=7.0-9.9 g/dl), severe (Hb<7.0g/dl), and normal (Hb≥11.0 g/dl) Hb level of concentration. In addition to hereditary reasons, anemia can also result from parasite infections like malaria, current infectious diseases, and dietary

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deficiencies including those in iron, zinc, vitamin B12, and proteins, especially in impoverished countries.[4] According to the World Health Organization (WHO), nutritional anemia is a condition in which the blood's hemoglobin content is lower than what is deemed normal for a person's age, gender, physiological state, and altitude, regardless of what caused the deficiency in necessary nutrients.[5,6] Lack of minerals such iron, folic acid, vitamin B12, copper (which has an erythropoietic function), vitamins C and E (associated to hemorrhagic conditions), and vitamin A can cause nutritional anemia (related to cellular differentiation of red blood cells and mobilization of the iron of the reticuloendothelial system).[7] Given the susceptibility that pregnant women, women in reproductive age, and children under the age of five are exposed to, this nutritional deficit, which exists around the world, is acknowledged as one of the most significant.[8,9] The newborn iron stores, growth rate, food, and iron loss have a major role in the genesis of anemia in babies.[10] Loss in children also happens as a result of whole milk consumption in liquid form during the first year of life and blood found in stools.[11,12] Intestinal parasites are a further potential source of iron loss, while research has shown that most parasitic illnesses are only incidentally responsible for iron deficiency anemia in children under the age of five.[13,14,15,16,17] Even though anemia may be avoided, it has been linked to a significant amount of morbidity and death in children under the age of five.[18] Children who suffer from anemia experience negative consequences, particularly in the first two years of life, including behavioral delays, reduced cognitive development (impaired learning and decreased academic achievement), low immunity and growth weight, fatigue, difficulty concentrating, lethargy, increased mortality, and susceptibility to infection.[3,19,20] Dizziness, tiredness, tension in the body, generalized weakness, lack of appetite, low body weight, pale skin, eyes, and palms, as well as, in more severe cases, unconsciousness and death, are common symptoms of anemia in children.[21] As a result, both wealthy countries and countries with medium- and low-incomes view this shortage as a serious public health issue.[9,22] Between 1995 and 2011, there was a decline in the prevalence of anemia among children under the age of five over the world, which varied by area and was higher in Central, Western, and Eastern Africa as well as South Asia.[1,23] At least 55 percent of children under the age of five in these nations had anemia in 2011, which is five times greater than the rate in wealthy nations. The prevalence stagnated in high-income nations between 1995 and 2011 despite the global pattern of reduction observed by Stevens et al. In South Africa, it climbed from 30 to 46 percent over this time.[24] This study was conducted to assess the etiology and risk factors of iron deficiency anemia in children under five years.

Objectives

To assess the etiology and risk factors of iron deficiency anemia in children under five years.

MATERIAL AND METHODS

This cross-sectional study was conducted in 250 bedded general hospital, Thakurgaon, Bangladesh, during the period from December 2020 to January 2022. Total 100 children having iron deficiency anemia under five years were

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included in this study. Consent of the patients and guardians were taken before collecting data. After collection of data, all data were checked and cleaned. After cleaning, the data were entered into computer and statistical analysis of the results being obtained by using windows-based computer software devised with Statistical Packages for Social Sciences version 22. After compilation, data were presented in the form of tables, figures and charts, as necessary. Numerical variables were expressed as mean and standard deviation, whereas categorical variables were count with percentage.

Inclusion Criteria

- Age under five years
- Diagnosed with iron deficiency anemia

Exclusion Criteria

- Age above five years
- Patients transferred to another hospital

RESULTS

This current study was conducted among 100 children having iron deficiency anemia under five years. [Table 1] shows the demographical characteristics of the children with iron deficiency anemia. More than half (51%) of the children were in the age group of less than 1 year. The mean age of the children was 11 months (SD±2.2 months). Majority (52%) of the children were female. Most of the children (42%) were from low income family. More than half (65%) of the children had mild anemia, 33% had moderate anemia and 2% had severe anemia [Figure 1]. [Table 2] shows the laboratory parameters of the children with iron deficiency anemia. Here, mean hemoglobin was 8.1 g/dL (SD±0.06 g/dL), mean corpuscular volume was 61.9 fL (SD±0.36 fL), mean ferritin was 4.6 mg/L (SD±0.05 mg/L), mean iron was 24.8 mg/dL (SD±0.4 mg/dL) and total iron-binding capacity was 420.5 mg/dL (SD±8.2 mg/dL). From [Table 3], we found that inadequate iron-based food intake was the commonest (72%) causes of the study patient followed by breastfeeding with inadequate supplementary food (36%), inadequate calorie intake (12%) etc. and 16% causes was unknown. [Table 4] shows the risk factors of the children with iron deficiency anemia. Children without taking iron supplementation was 86% and mothers taking iron supplementation during pregnancy was 67%. Dietary diversity score was poor for most of the children (59%). 67% had low birth weight and 28% had overweight. Children with early (<6 months) introduction of complementary foods was more than half (68%).

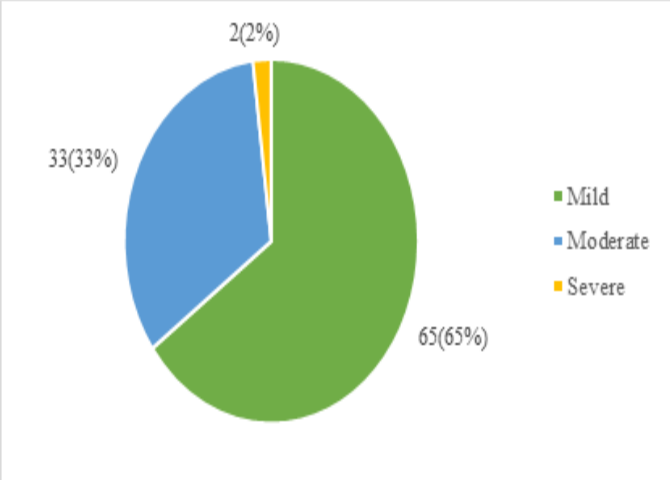

Figure 1: Distribution of anemia by severity among the children with iron deficiency anemia under five years. (n=100)

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Table 1: Demographical characteristics of the children with iron deficiency anemia. (n=100)

Characteristics		**n**	**%**
Age (in months	≤12	51	51
	13-24	26	26
	25-36	10	10
	37-48	8	8
	49-60	5	5
	Mean±SD	11±2.2	
Gender	Male	48	48
	Female	52	52
Socioeconomic status	High income	26	26
	Middle income	32	32
	Low income	42	42

Table 2: Laboratory parameters of the children with iron deficiency anemia. (n=100)

Parameter	**Mean±SD**
Hemoglobin (g/dL	8.1±0.06
Corpuscular volume (fL)	61.9±0.36
Ferritin (mg/L)	4.6±0.05
Iron (mg/dL)	24.8±0.4
Total iron-binding capacity (mg/dL)	420.5±8.2

Table 3: Etiologies of the children with iron deficiency anemia. (n=100)

Etiology	**n**	**%**
Inadequate iron-based food intake	72	72
Breastfeeding with inadequate supplementary food	36	36
Inadequate calorie intake	12	12
Blood loss	3	3
Eosinophilic gastroenteritis	2	2
Unknown	16	16

Table 4: Risk factors of the children with iron deficiency anemia. (n=100)

Risk factors		**n**	**%**
Child iron supplementation	Yes	14	14
	No	86	86
Iron supplementation during pregnancy	Yes	67	67
	No	33	33
Dietary diversity score	Good	41	41
	Poor	59	59
Low birth weight	Yes	67	67
	No	33	33

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Overweight	Yes	28	28
	No	72	72
Introduction of complementary foods	<6 months	68	68
	≥6 months	32	32

DISCUSSION

This current study was conducted among 100 children having iron deficiency anemia under five years to assess the etiology and risk factors of iron deficiency anemia in children under five years. More than half (51%) of the children were in the age group of less than 1 year. The mean age of the children was 11 months (SD±2.2 months). Majority (52%) of the children were female. In the study of Kessy JP et al,[24] among 303 children the majority, (n=169, 55.8%) were in the age group 2-12 months where median (IQR) age in months was 10 (6-18) and 153 (50.5%) were male and 150 (49.5 %) female. Most of the children were from low income family. Thus, they could not afford iron efficient food. Mild anemia was commonest (65%) among the children. In the study of Gebreweld A et al,[25] was 11.16±1.53 g/dl. Of the anemic under-five children. Mean hemoglobin was 8.1 g/dL (SD±0.06 g/dL), mean corpuscular volume was 61.9 fL (SD±0.36 fL), mean ferritin was 4.6 mg/L (SD±0.05 mg/L), mean iron was 24.8 mg/dL (SD±0.4 mg/dL) and total iron-binding capacity was 420.5 mg/dL (SD±8.2 mg/dL). Similar results found in the study of Huang SC et al,[26] where the mean values for hemoglobin, serum ferritin levels, and transferrin saturation of patients with ID were 8.2g/dL, 4.5mg/L, and 6.3%, respectively. Inadequate iron-based food intake was the commonest (72%) causes of the study patient followed by breastfeeding with inadequate supplementary food (36%), inadequate calorie intake (12%) etc. and 16% causes were unknown. Huang SC et al,[26] found that the most common causes of ID were inadequate intake in age group <2 years (55.6%) and blood loss in age group 2-10 years (46.1%) and breastfeeding with inadequate supplementary food (40.5%) was an exclusive cause in age group of <2 years which is similar to our study. In our study, children without taking iron supplementation was 86% and mothers taking iron supplementation during pregnancy was 67%. Parbey PA et al.[27] children whose mothers received iron supplementation during pregnancy were 7.6 times more likely to have anemia as compared to those who did not and the difference was statistically significant [AOR=7.64(95%CI:1.41-41.20.93);p= 0.018]. The overall quality and nutritional sufficiency of a diet that may affect blood formation may be assessed using dietary variety.[28] In our study, dietary diversity score was poor for most of the children (59%). 67% had low birth wight and 28% had overweight. In the study of Parbey PA et al,[27] children with poor dietary diversity were 9.15 times more likely to have anemia as compared to those with good dietary diversity and the difference was statistically significant [AOR=9.15(95%CI:3.13-26.82);p<0.001].

Similarly in the study of Gebreweld A et al,[28] underweight children were 2.1times (AOR = 2.11; 95% CI: 1.21–3.69) more likely to be anemic than children with normal weight. Children with early (<6 months) introduction of complementary foods were more likely to be

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anemic (68%) than children with timely (≥6 months) initiation of complementary foods in our study. In the study of Gebreweld A et al,[28] children with early (<6 months) introduction of complementary foods was 3.5 times (AOR = 3.53; 95% CI: 1.23–10.18) more likely to be anemic than children with timely (>6 months) initiation of complementary foods.

Limitations of the study

In our study, there was small sample size and absence of control for comparison. Study population was selected from one center in one centre of Rangpur Division, Bangladesh, so may not represent wider population. The study was conducted at a short period of time. The sampling was retrospective and there was no random allocation, so there is risk of selection bias.

CONCLUSIONS

Inadequate iron-based food intake is the commonest causes of iron deficiency anemia. Children mothers taking iron supplementation during pregnancy, low dietary diversity score, low birth weight and early (<6 months) introduction of complementary foods are the main risk factors. Primary prevention of iron deficiency anemia is recommended; the role of secondary prevention through screening programs remains inconclusive but recommended by some professional organizations. Treatment of children identified with IDA includes both dietary counseling and oral iron supplementation.

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Source of Support: Nil, Conflict of Interest: None declared