



STUDY OF HAEMATOLOGICAL PARAMETERS AND VARIOUS RISK FACTORS IN CHILDREN SUFFERING FROM IRON DEFICIENCY ANAEMIA

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ABSTRACT

Iron scarcity is one of the common cause of anaemia in the whole world. The risk factors of iron deficiency anaemia is the challenging task in the children under ten. The aim of the present study was to assess the iron deficiency indicating parameters and special haematological parameters in children under ten. Total 179 patients were studied. After applying the inclusion and exclusion criteria, a total of 75 patients were eligible for the study. The data was collected and compared with 75 age and sex matched healthy controls from the same age group. The statistical analysis was done using SPSS 17.0 software. All the patients were assessed for iron deficiency anaemia by measuring the haemoglobin concentration, serum ferritin, iron levels, percentage saturation of transferrin, total iron binding capacity, mean corpuscular haemoglobin level (MCHC) and mean corpuscular volume (MCV). The concentrations of haemoglobin, serum ferritin, iron, percentage saturation of transferrin and mean corpuscular volume (MCV) were significantly reduced ($P < 0.01$) when compared with control group. The total iron binding capacity was significantly enhanced ($P < 0.01$) when compared with control group. Iron deficiency anaemia remains a common health problem in pre-school going children who lives in low socioeconomic region. The use of numerous biochemical and haematological variables allow to diagnose the iron deficiency anaemia within time.

KEYWORDS: Iron Deficiency Anaemia (IDA), Serum Ferritin, Haematological parameters, Risk Factors.

INTRODUCTION

Worldwide iron deficiency anaemia (IDA) is the most common haematological disorder among the preschool going children.^[1] The World health organization (WHO) has estimated that, about two billion peoples worldwide are anaemic. Out of this more than 50% anaemia was attributed due to iron deficiency.^[2] The preschool going children and pregnant women are most affected Population of IDA.^[3]

As the name indicates, IDA mainly caused due to insufficient iron. As per the mechanism, without iron human body cannot produce sufficient haemoglobin. This results of IDA which further leads to tiredness and short breath.^[4]

The important cause of IAD is paracytic infections caused by hookworms, whipworms and roundworms. Worms cause intestinal bleeding. This further may leads to undetected blood loss in the stool of under five children.^[5] In addition to this, the deficiency of essential vitamins, infectious diseases such as helminth infection, malaria, tuberculosis, HIV and various inflammatory disorders are the common risk factors. As these are most

common haematological disorders, it may manifest in the orofacial region as atrophic glossitis, mucosal pallor, and angular cheilitis.^[2] The iron is essential for activity of various enzymes involved in the various biochemical and neurochemical reactions. Due to iron deficiency the child mainly suffers from neurological symptoms like poor attention span, learning disability, weak memory, weak motor development and behavioral disturbances. Febrile seizures is the major risk factor caused due to iron deficiency children.^[2,3,6]

In India the prevalence of IDA is very high. About 65% of the preschool going children suffers from IDA. As India is developing country the nutritional disorders are prevalent in high concentration in pregnant women and preschool going children.

The present study was aimed to assess the serum iron, ferritin, total iron binding capacity, certain haematological parameters and possible risk factors in iron deficiency anaemia in preschool going children.

MATERIALS AND MATERIALS

The present work was carried out in the Department of general Pathology and in collaboration with Department of Biochemistry, Rangoonwala Dental College and Research Centre, Pune, (MS). Prior to start the study, local institutional ethical clearance was obtained and utmost care was taken during experimental procedure according to the Declaration of Helsinki 1964.

Study type: community based cross sectional case-control study.

This study has been performed on total 150 subjects which includes 75 age and sex matched (49 males and 26 females) healthy controls and 75 (51 males and 24 females) from the age group 0-10 years. All the patients were from low socio-economical class and having poor sanitation.

Inclusion criteria

1. All the cases of suspected iron deficiency anaemia belonging to the age group of 0-10 years.
2. All the patients having haemoglobin less than 10gm/dl.

Exclusion criteria

1. Patients previously transfused with blood within 120 days,
2. Patients already on iron therapy.

Controls

1. Having haemoglobin concentration within the normal range from the same age group.

After obtaining a written consent form from the parents of all the subjects who were included in the study and by giving detail information of study, blood samples were collected from controls and patients. Total 5ml blood was withdrawn aseptically from the antecubital vein from each subject in a plain container and EDTA bulbs. The samples were centrifuged at 3000 rpm for 10 min to separate serum. Lipaemic and icteric samples were discarded.

All haematological parameters were carried out by automatic methods. Adequate quality control measures were taken on each test procedure to ensure the reliability of the results. Haematological and biochemical investigations were done in haematology laboratory and biochemistry laboratory, respectively.

I. Biochemical Examination

1. *Serum Iron Estimation*- Serum iron estimation was done with the help of the automated Dimension IRON method by Dade Behring Dimension Biochemistry Analyser.
2. *Total Iron Binding Capacity*-TIBC estimation was done with the help of kit manufactured by Randox Laboratories LTD, UK.
3. *Serum Ferritin Assay*- Serum ferritin assay was done with the help of ferritin serozyme kit manufactured by Biochem Immunosystems, Italy.

II. Hematological Examination

1. *Automated Blood Count (Complete Blood Count)*- A complete blood count (CBC) was analyzed by the ABX PENTRA 60 which is a fully automated (Microprocessor controlled) haematology analyser used for the in vitro diagnostic testing of whole blood specimens. The ABX PENTRA 60 is able to operate either in CBC mode (12 parameters) or in CBC + 5DIFF mode (26 parameters). The blood is well mixed (though not shaken) and placed on a rack in the analyzer. This instrument has many different components to analyze different elements in the blood. The cell counting component counts the numbers and types of different cells within the blood. The results are printed out or sent to a computer for review.

Statistical Analysis

The statistical analysis was carried out by using the SPSS (Statistical Package for Social Sciences) statistical software, version 17.0 for Windows. An independent-sample *t*-test ($P < 0.01$) and one-way ANOVA test were used for comparison of hematological parameters. The results were expressed in mean. Results were considered to be statistically significant when the two-sided *P* value was less than 0.01. ANOVA (analysis of variance) showed significant *P* value ($P < 0.01$) between mean platelet volume (MPV) in females and males and in iron deficiency anaemia patients.

RESULTS

The children studied had low socioeconomic condition with monthly per capita income of less than two monthly wages. About 8% were low birth weight, current weight for age and length for age deficient ($< -2z$ -scores) were 6% and 10% respectively. Out of them 12% were overweight ($BMI \geq 2z$ scores).

Table No. -1. Shows the mean biochemical parameters of controls and IDA patients.

Serial No	Biochemical parameters	Control (n=75)	IDA(n=75)	P value <
1	Serum iron (g/dL)	76.81	21.83*	0.01
2	Serum ferritin (ng/mL)	179.01	10.12*	0.01
3	% saturation of transferrin	24.16	6.74*	0.01
4	TIBC (g/dL)	331.42	408.46*	0.01

Table-1 shows the baseline characteristics of serum iron indices of all the subjects. Values were expressed in mean only.

*indicates statistically significant ($p < 0.01$)
 n=number of patients.

Table No. -2. Investigations showing the mean of comparative haematological values in controls and IDA patients.

Serial No	Haematological parameters	Control (n=75)	IDA (n=75)	P value <
1	Hb (g/dL)	14.75	10.51*	0.01
2	RBC (million/cmm)	5.7	4.14*	0.01
3	ESR (mm/1 st hr)	10	38.71*	0.01
4	PCV %	45	30.87*	0.01
5	MCV(μm^3)	85	66.9*	0.01
6	MCH (pg)	29	24.01*	0.01
7	MCHC (g/dl)	28.54	34.76*	0.01
8	MPV (μm^3)	9.3	7.80*	0.01
9	Platelet ($\times 1000/\text{cmm}$)	321.54	338.86*	0.01

Values were expressed in mean only.

*indicates statistically significant ($p < 0.01$)
 n=number of patients.

DISCUSSION

In our study out of 75 IDA patients (51 males and 24 females) 78% were in age group between 0-2 years, 7.3% in age group of 3-5 years and 4.7% in age group of 6-10 years. According to these results, it should be noted that supplementation of iron and increased iron storage have been recently linked with the maternal complications.^[7]

In contrast, our study showed that, IDA is the most prevalent in the 0-2 years which includes 78% of the total population. Most of the children were from low socio-economic class. And the iron deficiency may be due to poverty and poor sanitation.^[8] Hookworm infection is more common cause in the present contest which might be due to low maintained sanitation. Various researcher shown that, hookworm infection is second most prevalent parasitosis in India.^[4] Also nutritional insufficiency is the most common cause of IDA.^[8] Weight loss, reduced appetite, diarrhoea, attention problem, weakness were the most chief complaints of IDA patients. Whereas premature babies, pale skin color, dyspepsia, headache, are other common problems, with IDA and controls. These observations are in accordance with the previous study of Elwood.^[9] In our study the concentrations of MCV, MCH, Hb were depleted significantly when compared with the healthy controls. Our results are in support with the Bainton and Finc et al that, Hb and haematocrit parameters were decreased drastically when compared with the healthy controls children.^[10,11]

The mean values of serum iron was significantly lower in patients group compared to controls. It may be due to poor nutritional supplementation and enhanced iron demand for growth.^[2] Among the biochemical variables, the total iron binding capacity (TIBC) was increased in patients group indicates that severe iron deficiency in patients with iron deficiency anaemia.^[12]

Chronic and infectious diseases like malaria and diarrhoeal diseases can interfere the iron intake, absorption and its metabolism.^[6] In addition to this the dietary insufficiency, malabsorption, chronic blood loss, intravascular haemolysis should be carefully revealed out.

The right time investigation of iron deficiency and its risk factors definitely provide opportunities to better family care.

CONCLUSION

Iron deficiency anaemia is very common and serious health problem in under ten years children in India. The unawareness of maternal education, sanitation, low levels of household monthly income are the major risk Factors in IDA in these children. The awareness about the nutritional food and proper sanitation is important in children living in low socio-economic belt.

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