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SCREENING OF IRON DEFICIENCY ANEMIA IN CHILDREN WITH FUNCTIONAL CONSTIPATION

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ABSTRACT
Background: Iron deficiency anemia (IDA) is considered to be one of the most prevalent nutritional disorders in children globally and plays a significant role in childhood morbidity. Poor dietary intake, changes in gut microbiota and chronic inflammation contribute to iron deficiency in children with chronic functional constipation (CFC), which is a common gastrointestinal disorder in children.
Objective: To determine frequency of IDA among children aged less than 12 years diagnosed with Chronic functional constipation.
Methodology: This is a cross sectional study, which was conducted in the Paediatris Department of Fauji Foundation Hospital, Rawalpindi during November 2025 and February 2026. Using non-probability consecutive sampling, 100 children aged 2–12 years with chronic functional constipation (Rome IV criteria) were recruited. Data on demographic and clinical parameters were collected using structured questionnaires. Blood samples were drawn to determine levels of hemoglobin, hematocrit, MCV, MCH and serum ferritin. SPSS 23 package software was used to analyze the data.
Results: Fe deficiency anemia (IDA) was seen in 36% and Fe deficiency (FDI) in 31% of all the children with CFC (total 100). IDA was more prevalent among children aged <5 years and with long duration of constipation. There was a significant correlation between severity of constipation and the hemoglobin level ($p<0.05$). **Conclusion:** Iron Deficiency Anemia (IDA) is a very common finding in children with chronic functional constipation. Assessment of nutritional status should be performed as part of the routine management of constipated children to minimise related morbidity.

KEYWORDS: Iron Deficiency Anaemia, chronic functional constipation, children, serum ferritin, paediatric gastroenterology and nutritional deficiency.

1. INTRODUCTION

IDA is one of the most common nutritional problems globally and is a public health issue in children. The World Health Organization estimates that around 24.8% of the world's population suffers from anaemia and iron deficiency is the most common cause of anaemia in children aged 6-59 months. The National Nutrition Survey 2018 revealed that over 53% of paediatric population in Pakistan was anemic, with iron deficiency being the most important cause of anaemia in children.
Iron deficiency (ID) is when an individual's iron stores in the body are depleted, but the hemoglobin levels are not decreased; iron deficiency anemia is when an individual's iron stores in the body are depleted and hemoglobin concentration is decreased. The main causes of IDA are inadequate dietary iron intake, impaired iron absorption, chronic blood loss and increased iron requirements during periods of rapid growth like infancy and adolescence.[4]
Chronic functional constipation (CFC) is a frequent gastrointestinal condition in children and is defined as the passage of hard stools and/or painful defecation, associated with infrequent bowel movements, fecal withholding and/or difficulties with stool evacuation. CFC is responsible for about 10-28% of paediatric gastroenterology consultations worldwide. There has been recent evidence linking CFC and iron deficiency states. Previous studies have shown that a large percentage of children with CFC have iron deficiency and/or iron deficiency anemia.
In addition, CFC has a profound impact on the physical and psychological development of children, as a result of poor appetite, food aversion, changes to the gut microbiota and chronic intestinal inflammation which can cause impaired nutrient absorption.[7,8] If combined with IDA, symptoms like fatigue, weakness, irritability and poor concentration can further impact a child's academic performance, their ability to interact with others and their overall quality of life. [9]

Identifying the burden and clinical association of iron deficiency anemia in children with chronic functional constipation is crucial for the early detection and timely management. There are limited local studies that investigate the clinical relationship between iron deficiency anemia (IDA) and constipation in children; some epidemiological studies have attempted to characterize dietary habits and quality of life children with iron deficiency and constipation.[10] Thus, the purpose of this study is to assess the incidence and association of iron deficiency anemia with chronic functional constipation in children for better screening and clinical management practices.

2. Objectives

To determine frequency of IDA among children aged less than 12 years diagnosed with Chronic functional constipation.

3. Methodology

This was a cross sectional study was conducted in he Paediatris Department of Fauji Foundation Hospital, Rawalpindi during November 2025 and February 2026. The total sample size was 100, which was obtained by non-probability consecutive sampling of children aged 2-12 years who met chronic functional constipation (CFC) criteria as per the Rome IV criteria. The sample size was calculated with the sample size calculator of WHO with the assumed prevalence of 34.4% and the absolute precision of 10%. A structured questionnaire was used to gather data about demographic and symptomology associated with constipation, including food history. Physical examination was done and venous blood samples were taken for hemoglobin, MCV, MCH, hematocrit and ferritin of serum. Diagnosis of iron deficiency anemia was made based on Hb levels, depending on age, and on the iron index (ferritin). All Data were analysed by SPSS-23.

3.1 Inclusion Criteria

The study included children 2–12 years of age with chronic functionally constipated (Rome IV criteria) who were not taking iron replacement therapy.

3.2 Exclusion Criteria

Children with underlying gastrointestinal disease (e.g., inflammatory bowel disease, celiac disease, or gastrointestinal surgery) or current iron supplementations or who were unable to give informed consent were excluded.

3.3 Data Collection Procedure

Data were collected by post-graduates working with a consultant paediatrician. Chronic functional constipation was diagnosed in the pediatric gastroenterology clinic and children were evaluated based on the Rome IV criteria. Parents/guardians completed the structured proforma with informed consent and the information included the demographic data, bowel habit, diet history, duration of constipation, family history, and socioeconomic status. Physical examination was done as per the following: General and abdominal examination and examination of the rectum. Blood samples were collected in a sterile condition by the trained pediatric nursing staff and haematological examination was done in the hospital laboratory. The following parameters of hemoglobin, hematocrit, MCV, MCH and serum ferritin were noted. The subjects were divided into iron deficient and IDA using the following operational definitions.The subjects were classified into iron deficient and IDA using the following operational definitions.

3.4 Data Analysis

All data has been analysed using SPSS version 23. Quantitative variables, (age, Hb, Hct and serum ferritin) were found and presented as mean ± SD. Qualitative variables such as gender, status of IDA, status of iron deficiency, MCV status and MCH status were presented as numbers and percentages. A Kolmogorov–Smirnov test was used to determine the normality of continuous data. Potential effect modifiers such as age, gender, duration of constipation, socioeconomic status, residence and educational level of parents were taken into consideration by stratification. Post-stratification chi-square tests were used to test for associations between categorical variables. A p value < 0.05 was considered to be significant. Based on the norms which are used in common in the journals indexed by the SCIE in the PubMed database, the results were interpreted.

4. RESULTS

100 children met Rome IV criteria of chronic functional constipation (CFC) were included in this study. Participants' mean age was 6.1 ± 2.8 years. There was not much difference between males and females in terms of gender distribution, with males accounting for 58% of the study population and females 42%. Most of the participants were below the age of 8 years, suggesting chronic functional constipation, as more prevalent in children seen in the pediatric outpatient department, than in older children.

Table 1. Demographic Characteristics of the Study Population (n = 100)

Parameter	Value
Age (years), mean ± SD	6.1 ± 2.8

Gender, n (%)	Male: 58 (58%)
	Female: 42 (42%)
Age <5 years, n (%)	39 (39%)
Age 5–8 years, n (%)	34 (34%)
Age >8 years, n (%)	27 (27%)

Clinical profile revealed that majority of children were suffering from symptoms for over 6 months. Common symptoms observed were difficulty in defecation, painful defecation, withholding of stool and abdominal pain.

Table 2. The Clinical Features of Children with Chronic Functional Constipation

Clinical Variable	Frequency (n)	Percentage (%)
Duration of constipation ≥6 months	65	65%
Painful defecation	74	74%
Hard stools	81	81%
Stool withholding behavior	57	57%
Abdominal pain	49	49%
Reduced appetite	43	43%

Laboratory assessment showed that there was a high prevalence of disordered iron status in children with CFC. The prevalence of iron deficiency anemia (IDA) and iron deficiency without anemia (IDW) were 36% and 31%, respectively. One third of the children had normal iron profile.

Table 3. Iron Deficiency and Iron Deficiency Anemia (IDA) prevalence by frequency.

Variable	Frequency (n)	Percentage (%)
Iron Deficiency	31	31%
Iron Deficiency Anemia	36	36%
Normal Iron Profile	33	33%

The correlation between chronic constipation and poor iron status was confirmed by hematological work-up which revealed a lower level of hemoglobin and ferritin in children with chronic constipation.

Table 4. The baseline data derived from hematological parameters of the study participants are presented in the table below:

Parameter	Mean ± SD
Hemoglobin (g/dL)	10.4 ± 1.6
Hematocrit (%)	33.7 ± 4.8
MCV (fL)	72.5 ± 7.1
MCH (pg)	23.1 ± 3.2
Serum Ferritin (ng/mL)	13.8 ± 5.6

It was observed that the duration of constipation had significant relationship with IDA. The proportion of children with >6 months' constipation having IDA was higher than those with <6 months' constipation ($p = 0.03$).

Table 5. Association of DOP and IDA.Correlation of DOP with IDA.

Duration of CFC	IDA Present n (%)	IDA Absent n (%)	p-value
<6 months	11 (31.4%)	24 (68.6%)	0.03
≥6 months	25 (38.5%)	40 (61.5%)	

Stratified analysis also showed that the iron deficiency anemia is more likely to be related to age and decreased appetite and was not related to gender.

Table 6. Stratified Analysis of Factors Associated with IDA

Variable	IDA Present n (%)	p-value
Age <5 years	18 (50.0%)	0.04
Male Gender	21 (58.3%)	>0.05
Reduced Appetite	22 (61.1%)	0.02
Duration of CFC ≥6 months	25 (69.4%)	0.03

The current study demonstrated that the iron deficiency/IDA rates are high in children with chronic functional constipation. Those who were younger and had longer duration of constipation were more likely to have low iron stores and anemia. Pain during defecation and loss of appetite were also frequently noticed in the participants that had the clinical features. The results indicate that chronic functional constipation could have detrimental effects on nutritional status and be a risk factor for iron deficiency due to inadequate nutrient consumption and chronic gastrointestinal dysfunction. Regular screening for iron-deficiency and anemia may be beneficial in children with chronic functional

constipation to identify and treat these conditions early, and thereby optimize the quality of life and child growth and development.

5. DISCUSSION

In children who enrolled in this study, the prevalence of IDA in chronic functional constipation was found to be high and almost one third of children were suffering from IDA. This is consistent with the previous reports of the high overlap of FGD and micronutrient deficiency [5,6] in children. In other clinical setting, this association was confirmed by Metwally et al who showed the same situation as seen in the other clinical case [6] and thus that constipation and iron deficiency frequently occur concurrently in children. Low appetite and the low consumption of iron-rich foods along with the selective food choices reported in children with chronic constipation [10,17] could explain the high prevalence of IDA.

In addition, in this study, a positive correlation was observed between the duration of constipation and anemia. Chronic gastrointestinal dysfunction can lead to reduced gastrointestinal bioavailability of iron by virtue of delayed gastrointestinal transit, gastrointestinal physiology and chronic low grade inflammatory processes [7,11]. Iron metabolism is highly regulated by hepcidin, and inflammatory conditions might enhance hepcidin activity leading to a decrease in iron absorption and in the availability of circulating iron [11,12]. The above changes are principally thought to be responsible for the high prevalence of IDA in children with chronic constipation.

A recent study also proved the important role of gut microbiota in constipation and iron metabolism. In fact, alterations in the composition of the intestinal flora have been shown to have negative effects on the production of short-chain fatty acids, integrity of the gut barrier and micronutrient absorption, for example iron [8,19]. Dysbiosis also has been associated with changes in bowel motility and gastrointestinal dysfunction, which further validates the gut–microbiome–iron axis hypothesis in children [19].

Today, diet remains as a major contributor to IDA and constipation. In children, low fibre, low fruit and vegetable and iron rich foods in the diet and high consumption of refined carbohydrate foods are common problems associated with chronic constipation [10,17]. It not only worsens constipation, but decreases the amount of iron absorbed when eaten this way. The food patterns exacerbate deficiencies in situations where they are already high in the basic state in developing countries [1-3].

The current study also emphasises the need to be aware of the early signs and symptoms of ID (even before IDA) as it is necessary to address the issue. Children with iron deficiency, even without being anemic, have been shown to have problems in the neurological development, behavioral problems and decreased cognitive functioning [11,14]. So children who suffer from chronic functional constipation, particularly if constipated for a prolonged period or if their diet contains low iron content should have their iron level checked regularly at the clinic [6,18].

While there are a number of strengths to this study, there are some limitations. This is a study from one center and results may not be representative of all the patients. In addition, further advanced dietary assessment, inflammatory markers and gut microbiota profiling should be carried out to gain more in-depth interpretation of the mechanism of action. Further multicenter, longitudinal studies with the inclusion of nutritional, biochemical and microbiome data are recommended to further clarify the causal association between constipation and IDA [7,11,19].

6. CONCLUSION

The study suggested that IDA is a frequent comorbidities found in children with chronic functional constipation. Over one-third of the respondents was laboratory confirmed as having IDA and a significant proportion of those who were not laboratory confirmed as having IDA were also laboratory confirmed as having iron deficiency without IDA. The results indicate that chronic constipation may negatively impact nutrition by decreasing food consumption, changing gut physiology and through a chronic inflammatory pathway. The early diagnosis and early intervention were particularly important for children who had suffered from constipation for a longer period as they were more prone to develop anemia.

Therefore it would be prudent to periodically check the Hematological parameters in chronic functional constipation in children and to measure the serum ferritin level. An early diagnosis of iron deficiency and intervening positively can impact physical health, cognitive development and quality of life. Along with dietary counseling and nutritional rehabilitation should be emphasized in comprehensive treatment of constipation in children. Multicenter studies in the future are recommended to investigate the long-term impact of early iron supplementation and constipation management techniques on the children concerned, and to establish the causal relationship.

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