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Article

Prevalence of Anemia in Children Under 5 Years

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Abstract: Background: Iron deficiency anemia (IDA) is a predominant nutritional deficiency across the globe, impacting the growth, cognitive progression, and general well-being of a child, and is particularly common among infants and young children because of their rapid growth and high demand for iron. Dietary deficiency, malabsorption, chronic blood loss, or increased physiological demand may lead to IDA. Sever long-term consequences such as neurodevelopmental impairment and immune system damage caused by lack of early intervention, demonstrate the importance of early diagnosis and management. Although a prevalent condition, IDA is particularly underdiagnosed in some areas, pointing to the need for enhanced strategies for screening, prevention, and management. The aim of the study is to determine IDA prevalence within the pediatric population in Tikrit Teaching Hospital and to determine the principal risk factors for its development. Subjects and methods: A cross-sectional study design was conducted on 100 pediatric patients that ran from March 1, 2024, to January 15, 2025 at Tikrit Teaching Hospital. The researchers collected data by means of structured questionnaires that included demographic data, nutritional habits, medical history, and risk factors. Results: Of the children sampled 36% were males while 64% were females. As for their ages, 35% were below 12 months with the most impacted age group being under 2 years of age at 62%. The prevalence of anemia is high at around 60%. 16% pica consumption behaviors, that is eating non-food substances, while 12% had a milk intake of greater than 16-24 ounces a day. 28% only ate vitamin C-rich foods that help in iron absorption. 45% had issues concerning growth whereas 80% had a prior illness. 76% had a familial history of anemia while 45% had history of IDA. 72% were on iron supplements or multivitamins and 28% were not. Conclusions: There was a high prevalence of IDA in children, especially among infants and in those under five years old. The major contributing factors were inadequate dietary intake, recurrent infections, and a family history of anemia. There is a pressing need for early screening, enhanced dietary education, and preventive strategies in order to alleviate the burden of IDA in the pediatric population.

Keywords: Iron Deficiency Anemia, Mean Corpuscular Volume, Glucose-6-Phosphate Dehydrogenase, Total Iron Binding Capacity, American Academy of Pediatrics

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1. Introduction

One of the world's most nutritional concerns is Iron deficiency anemia IDA. In children, it is a common type of anemia. When there is a short supply of iron, the body's ebb and flow of iron cannot sustain the body's requirements, resulting in less oxygen being distributed to the body's tissues. In children iron deficiency anemia IDA has a negative impact on the staggering of development, and the behavior, and the growth of the children [1]. In 2019, WHO released data in the WHO African Region reporting that 39.8% of children aged between 6 and 59 months, which accounts for around 269 million children, were reported to have anemia. The African Region has 60.2% IDA [2].

A 2022 systematic review and meta-analysis focusing on children under five indicated that iron deficiency and iron deficiency anemia remain prevalent, particularly in low- and middle-income countries. [3] One U.S. study estimated that 1% to 2% of children aged one to five years have iron deficiency anemia, though iron deficiency without anemia is more common [4].

Anemia is the most significant indicator of ID and ID and IDA are used interchangeably. But, lack of anemia can result in iron-deficiency, which can affect tissues. Iron deficiency is manifested in different stages. In the case of low iron requirement, iron stores are depleted first. After the iron stores are reduced, hemoglobin levels may stay normal for a while which means that iron deficiency is observed in the absence of anemia. Plasma ferritin level and plasma transferrin saturation are the only parameters decreased at this time. Negative iron balance which continues after iron stores are exhausted is manifested with decreased hemoglobin. Conclusively, reduced body iron stores have been defined as ID and worsening of this condition and development of anemia is defined as IDA [5].

Anemia is a decrease in erythrocytes or a hemoglobin (Hb) level 5 percentiles below the normal hemoglobin level in healthy individuals of the same age. The lower limit of the normal value for different age groups and genders should be determined when defining anemia. In our country, and in the world, the most common cause of anemia is iron deficiency anemia. **[1].**

2. Materials and Methods

2.1 Type of study

The study is a Cross - sectional study that had conducted from March 1, 2024, to January 15, 2025.

2.2 Study Sample

The sample was selected randomly in the children's wards on the third floor in Tikrit Teaching Hospital. The selected children (100) were aged more than two months and less than five years.

2.3 Exclusion criteria

1. Neonate (0 – 28 days)
2. Patient with chronic hereditary anemia (eg: thalassemia, sickle cell anemia, G6PD)
3. Patient with chronic disease (eg: chronic renal failure, liver disease, inflammatory bowel disease

2.4 Questionnaire

Data were collected using a questionnaire specially designed by our researchers and collected manually by visiting patients at Tikrit Teaching Hospital, questionnaire information was taken from the families of sick children present at Tikrit Teaching Hospital and then analysis information was collected from the inquiries of the children's floor at Tikrit Teaching Hospital. Children with anemia were diagnosed according to the Reference Ranges of Hematological and Iron Parameters in Pediatric Iron Deficiency Anemia established by the World Health Organization (WHO) [18] (Table 1).

Table 1. Reference Ranges of Hematological and Iron Parameters in Pediatric Iron Deficiency Anemia

Parameter	1-12	13-24	25-36	37-48	49-59
RBCs (million /μL)	3.5 - 5.1	3.9 – 5.3	4.0 – 5.2	4.1-5.3	4.2 – 5.4
Hemoglobin HGB (g/dL)	10.0-14.0	10.5 – 13.5	11.0– 13.5	11.0– 13.5	11.5– 14.0
Mean corpuscular volume MCV (fl)	70 – 84	73 – 85	74 - 87	75 - 88	76 - 89
Mean corpuscular Hemoglobin MCH (pg)	24 – 30	25 – 31	25 - 31	26 - 32	26 - 32

Mean corpuscular Hemoglobin concentration MCHC(g/dL)	32 – 36	32 – 36	32 - 36	32 - 36	32 - 36
Red cell distribution width RWD (%)	11.5-14.5	11.5-14.5	11.5-14.5	11.5-14.5	11.5-14.5
Hematocrit HCT (%)	31 – 41	33 – 39	34 - 40	35 - 41	36 - 42
Ferritin (ng/ml)	20 – 275	20 – 275	20 - 275	20 - 275	20 - 275
Total Iron Binding Capacity TIBC (µg/dL)	240 - 450	240 – 450	240 - 450	240 - 450	240 - 450

2.5 Presentation and data analysis

All data presentation and analysis done by manual statistical methods. Data was represented by suitable tables and figures which was designated by computer programs.

2.6 Ethical and approval consideration

Permission was taken from people to fill the information required and they were assured regarding the confidentiality of their responses. The aim of study was splained.

3. Results

This cross-sectional study assessed the prevalence of iron deficiency anemia (IDA) among 100 pediatric patients at Tikrit Teaching Hospital through a structured questionnaire. Our study found that 60 out of the 100 children were diagnosed with IDA. Therefore, our results and analysis are based solely on these 60 children who were confirmed to have iron deficiency anemia. It is considered a high prevalence (Table 2 and Fig. 1).

Table 2. Age and Gender Distribution of Pediatric Patients with Iron Deficiency Anemia

Age	No	Male	Female
1-12 months	21	4	17
13-24 months	16	7	9
25-36 months	7	3	4
37-48 months	11	5	6
49-59 months	5	3	2
Total	60	22	38

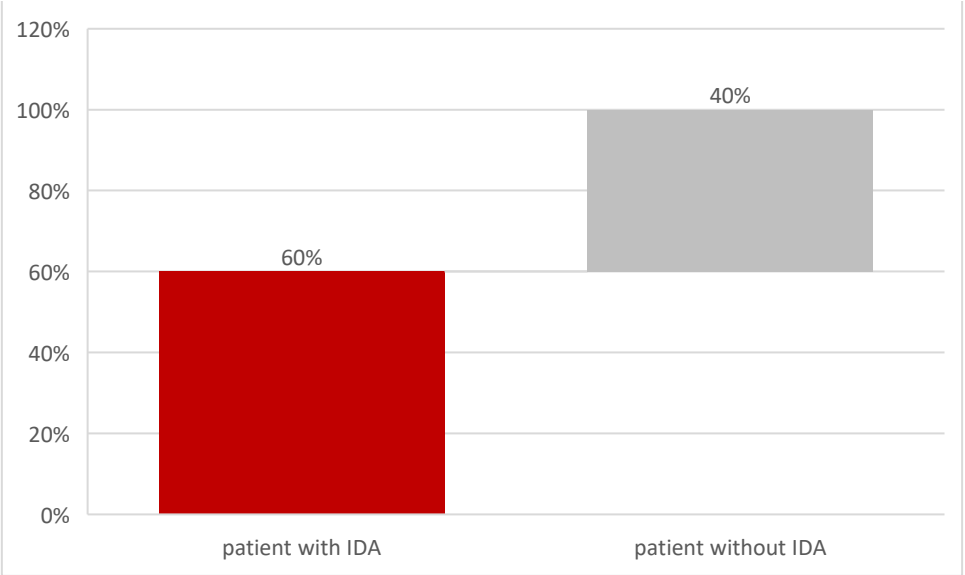

Figure 1. Prevalence of iron deficiency anemia among pediatric patients

The table (3) shows that 10 children (16%) exhibited pica behavior, such as eating non-food items like ice or dirt, while 50 children (84%) did not. The presence of pica behavior

in a significant portion of the sample may suggest a potential contributing factor to iron deficiency anemia, as this behavior is often associated with nutritional deficiencies.

Also shows the prevalence of excessive milk consumption among the study participants. It indicates that 7 children (12%) consumed more than 16–24 oz of milk per day, while 53 children (88%) consumed less than that. Excessive milk intake, especially when it exceeds the recommended amounts, can interfere with the absorption of iron and may contribute to the development of iron deficiency anemia in children.

It shows that 26 children (44%) were exclusively breastfed for the first six months without the use of iron supplements, while 34 children (56%) were not exclusively breastfed. Exclusive breastfeeding for the first six months is crucial for infant health, but it is important to ensure that iron supplementation or iron-rich foods are introduced as needed to prevent iron deficiency anemia.

This table shows the prevalence of vitamin C intake among the study participants. It indicates that 17 children (28%) consumed foods rich in vitamin C, while 43 children (72%) did not. Vitamin C is essential for enhancing iron absorption, and its intake may play a role in preventing or mitigating iron deficiency anemia.

This table illustrates the prevalence of growth-related issues among the study participants. It shows that 27 children (45%) had growth-related problems, such as underweight, overweight, or abnormal height changes, while 33 children (55%) did not report any growth-related issues. These findings suggest that growth problems may be linked to iron deficiency anemia, as inadequate iron can affect normal growth and development in children.

This table shows the impact of growth-related issues during the study period. Height, weight, and abnormal growth patterns demonstrated and confirmed that there were 27 children with growth issues (45%), and 33 children who had, and reported, no growth issues (55%). These results show that iron deficiency anemia may be associated with the presence of growth-related problems, since iron deficiencies can hinder growth and development.

This table shows the impact of infections and illnesses during the study period. 48 children (80%) had prior infections and illnesses, while 12 children (20%) did not. This result shows that infections that have recently been acquired are associated with the risk of developing iron deficiency anemia, since infections can elevate body hepcidin levels, which leads to the impairment of iron absorption and contributes to anemia.

This table shows and confirms the presence of previously diagnosed anemia among study participants. 27 children (45%) had been previously diagnosed and confirmed with anemia, while 33 children (55%) had not. The presence and high rate of previously diagnosed anemia illustrates and confirms the likelihood for underlying, or recurrent iron deficiency anemia. This may suggest the need for monitoring and management of iron deficiency anemia.

This table presents the prevalence of a history of blood loss among study participants. Only 5 children (8%) reported a blood loss history due to accidents, surgery, or other causes, while 55 children (92%) did not. A history of blood loss may lead to iron deficiency anemia as it decreases the overall volume of blood and iron stores.

This table describes the frequency of chronic illnesses among the participants of the study. It indicates that 50 participants (84%), as opposed to 10 participants (16%), were without chronic illnesses of which some may (like gastrointestinal and metabolic disorders) further increase the risk of iron deficiency anemia by affecting one's ability to absorb iron. Iron deficiency anemia can arise from chronic conditions which affect the absorption of iron.

The table describes the frequency of a family history of anemia or blood disorders among the participants of the study. 46 participants (76%) had family history of anemia or blood disorders, while 14 participants (24%) did not. From a genealogical standpoint, one could be predisposed to iron deficiency anemia.

This table describes the prevalence of the study participants using iron supplements and/or multivitamins. 43 participants (72%) of the study were using iron supplements (or) multivitamins as opposed to 17 participants (28%). Iron deficiency anemia, especially that

which is aggravated by poor iron intake, is significantly influenced by the use of multivitamins and iron supplements. This is particularly true in children who are more susceptible to it because of various health conditions or dietary issues.

Table 3. Factors affecting anaemic patients

Factors affecting patients	Yes %	No %	Total %
Pica consumption	16	84	100
Excessive milk consumption	12	88	100
Exclusive breast milk for 6 months	44	56	100
Vit C intake	28	72	100
Growth problems	45	55	100
Resent infection or illness	20	80	100
Occurrence of previous anaemia	45	55	100
History of blood loss	8	92	100
Chronic diseases	16	84	100
Family history of anaemia	24	76	100
Use of supplement	28	72	100

4. Discussion

Iron deficiency anemia (IDA) is a significant public health issue, particularly among young children, due to the crucial role iron plays in growth, development, and immune function. The present study aimed to investigate the prevalence and associated factors of iron deficiency anemia among children attending the Tikrit Teaching Hospital. The findings provide valuable insights into the factors influencing iron deficiency anemia and emphasize the importance of early identification and intervention.

Our study found that 60 out of the 100 children were diagnosed with IDA. Therefore, our results and analysis are based solely on these 60 children who were confirmed to have iron deficiency anemia. It is considered high prevalence. The study included 60 patients, with a predominance of females (64%) compared to males (36%). This gender disparity aligns with existing literature, which reports that anemia can sometimes be more prevalent in females due to dietary and metabolic factors rather than menstruation alone. A study on school-aged children in Istanbul similarly found a higher prevalence of anemia among females, suggesting that gender differences in anemia prevalence may emerge earlier in childhood due to dietary and metabolic factors rather than menstruation alone [5].

The age group most affected by iron deficiency anemia in this study was 0-12 months (35%), followed by 13-24 months (27%). These findings are consistent with a study conducted by the American Academy of Pediatrics (AAP) [6], which reported that infants and toddlers are at the highest risk of IDA, particularly during the transition from exclusive breastfeeding to complementary foods. The AAP study correlates the low content of iron in the breast milk with the rapid infantile growth; hence, the considerable loss of iron supports our findings that pinpoint the infancy stage as a critical period for IDA mitigation [7].

Growth-related issues were seen in 45% of the study's children, with primary concerns being underweight, stunting, and growth delay. These issues have often been linked with deficiencies in nutrition that deficiency in iron. These findings are of the same nature as those of Mesias et al. [8], where children with IDA were found to have lesser growth percentiles, more so in weight-for-age and height-for-age, as in their non-anemic counterparts. Their study also argued chronic iron deficiency might have a negative impact on the attainment of intangible and tangible developmental milestones [9].

The impact of dietary habits in our study was also considerable. It was observed that 72% of the children were not consuming vitamin C-rich foods, essential for iron

absorption. Further, 56% of the children were not breastfed for the recommended six-month period. These two factors may have negatively impacted the prevalence of IDA. AAP recommends exclusive breastfeeding for the initial 6 months; starting at 4-6 months, iron supplementation is recommended for infants exclusively breastfed. Our findings are similar to those reported by Moretti et al. [10] who found that inadequate breastfeeding duration and poor iron intake constitute risk factors for iron deficiency anemia, as greater rates of IDA were documented in this population. Furthermore, the study advocated for the timely introduction of iron-containing foods along with breastfeeding [11].

Some 72% of participants were taking iron and/or multivitamins, indicating a degree of understanding among the caregivers of the importance of iron in the prevention of anemia. Yet a significant portion of the children still showing signs of IDA suggests that the children were not following a recommended supplement regimen and points to a gap in the understanding around supplement control and IDA. This supports the findings of Ozdemir et al. [12] study in which it was shown that iron supplementation did not prevent rationed IDA due to supplementation not being consistent along with poor dietary intake and/or improper iron absorption [8].

Eighty percent of children in the study sample presented with recent infections/illnesses and 16% had chronic illness that could affect the absorption of iron and/or blood production. This study correlates with that of Ganz [13], in which he documented how chronic illness and infections escalate hepcidin and the absorption of iron is in peptic silos. The study of Wawer et al. [14], also correlates with this as he explained how IDA is exacerbated by poor metabolism of iron in the inflammatory state, which shows that anemia management needs to address the chronic inflammatory state [15].

A family history of anemia and/or blood disorders, noted in 76% of the cases, indicates the presence of factors that are likely to be common within that family, and could be dietary or health-related factors, contributing to IDA and points to a probable genetic predisposition.

This is similar to Che et al. [11], findings who stated that children whose parents have anemia have a greater risk of anemia themselves, even when considering their diet. Their work indicated that some people may have a greater risk due to some genetic differences regarding how the body manages iron [16].

Our findings also highlight the absolute necessity of screening for iron deficiency anemia, especially among infants, toddlers, and children with a family history of anemia. Educational public health campaigns should aim to educate caregivers on the consumption of iron-rich foods, and on the appropriate and safe use of iron supplements, particularly for at risk children. Also, a reduction in the children's gastrointestinal problems and infections may improve their iron deficiency. These interventions were also advocated in a similar manner by Rouault (2013), who emphasized the importance of screening and the need to prevent IDA in young children [17].

5. Conclusion

A significant proportion of child patients attending Tikrit Teaching Hospital have anemia, especially iron deficiency anemia (IDA). 60% of the children in the study have an anemia diagnosis. This is a significant proportion of the sample. There was emphasis on how the younger population suffers the most due to the age group's sensitivity toward iron deficiency. A combination of risk factors was outlined which led to IDA such as bad eating habits, overconsumption of milk, insufficient intake of iron and vitamin C rich foods, too many infections, and a history of anemia in the family. Concerns regarding the absence of proper physical growth due to IDA were present in 50% of the children affected. Many of the children were already diagnosed with anemia in the past but the children in fact still suffered from a lack of iron showing that more effective management and follow-up was required. IDA was present in a high number of children which was due to poor education and treatment adherence along with the possibility of alternative iron supplements being required. There is a pressing need to address the high prevalence

of IDA in children through early screening, education on nutrition pertaining to children, and structured preventative measures.

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