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Study Of Iron Deficiency Anaemia And Blood Indices In Paediatric Age Group.

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ABSTRACT

This cross-sectional study aimed to investigate the prevalence of iron deficiency anemia (IDA) in the pediatric age group and explore the correlation between blood indices and the severity of anemia. A sample of 200 pediatric participants, aged 1 to 18 years, from our department, was selected through systematic random sampling. Demographic data, medical history, and dietary habits were collected using standardized questionnaires. Blood samples were obtained to measure hemoglobin concentration, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and serum ferritin levels. Anemia status was categorized into three groups: non-anemic, iron-deficient without anemia, and iron deficiency anemia. Correlation analysis was performed to assess the relationship between blood indices and anemia severity. The prevalence of anemia in the pediatric population was 45%, with 15% of cases classified as iron deficiency anemia. Younger children (1-5 years) exhibited a higher prevalence of anemia, possibly due to increased iron demands during rapid growth and inadequate iron intake during the transition from breastfeeding to solid foods. The participants with iron deficiency anemia showed significantly lower hemoglobin levels, microcytic and hypochromic red blood cells (MCV and MCH), and depleted serum ferritin levels. Correlation analysis revealed a strong positive association between hemoglobin and serum ferritin ($r=0.87$, $p<0.001$), as well as a positive correlation between hemoglobin and MCV ($r=0.78$, $p<0.001$), but a negative correlation between hemoglobin and MCH ($r=-0.53$, $p=0.005$). This study highlights the substantial burden of iron deficiency anemia in the pediatric population, particularly in younger children, and emphasizes the value of blood indices in diagnosing and monitoring the condition. Early detection and intervention are essential to prevent adverse health consequences. Future research and public health initiatives are necessary to develop effective strategies for preventing and managing iron deficiency anemia in children.

Keywords: Iron deficiency anemia, Paediatric, Blood indices.

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INTRODUCTION

Iron deficiency anemia (IDA) is a common nutritional disorder affecting the paediatric population worldwide [1, 2]. It is characterized by a decrease in the number of red blood cells and a reduction in hemoglobin levels due to insufficient iron availability in the body. IDA in children is a significant public health concern as it can lead to impaired cognitive development, decreased physical performance, and compromised immune function, thereby impacting the overall well-being and growth of affected individuals [3].

During the paediatric age group, which encompasses infancy, childhood, and adolescence, the demand for iron is particularly high due to rapid growth and an increase in blood volume [4]. Infants are born with a limited iron reserve, and exclusive breastfeeding, while beneficial in many aspects, may not always provide sufficient iron. As children transition to a solid food diet, inadequate intake of iron-rich foods and a diet primarily composed of processed or fast foods can further contribute to the risk of developing IDA [5-7].

Blood indices play a crucial role in diagnosing and monitoring IDA. Hemoglobin concentration, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and serum ferritin levels are essential markers used to assess iron status. These indices aid in identifying children at risk of IDA, facilitating early intervention and appropriate management [8-10].

This study aims to explore the prevalence and etiological factors of iron deficiency anemia in the paediatric age group and investigate the correlation between blood indices and the severity of anemia. Understanding these aspects will contribute to the development of effective strategies for prevention, early detection, and targeted intervention, ultimately reducing the burden of IDA on the health and development of children.

MATERIAL AND METHODS

The study was conducted using a cross-sectional design to investigate iron deficiency anemia and blood indices in the paediatric age group. The target population consisted of children between the ages of 1 and 18 years, attending paediatric clinics in various hospitals and healthcare centers.

A total of 200 paediatric participants were selected through systematic random sampling from our department during the study period. Informed consent was obtained from the parents or guardians of each child before their inclusion in the study. Detailed information regarding the participants' age, gender, medical history, and dietary habits was collected using standardized questionnaires.

Blood samples were collected by trained phlebotomists using aseptic techniques. Hemoglobin concentration, mean corpuscular volume (MCV), and mean corpuscular hemoglobin (MCH) were measured using automated hematology analyzers. Serum ferritin levels, a reliable indicator of iron stores, were determined using enzyme-linked immunosorbent assay (ELISA) kits.

To diagnose iron deficiency anemia, the World Health Organization (WHO) criteria for anemia in children were applied, which include hemoglobin levels below the age-specific cutoff values. Children were categorized into three groups: non-anemic, iron-deficient without anemia, and iron deficiency anemia.

Data analysis was performed using appropriate statistical software. Descriptive statistics were used to summarize the demographic characteristics of the participants and the prevalence of iron deficiency anemia. Correlation analysis was conducted to explore the relationship between blood indices and the severity of anemia.

RESULTS

Table 1: Demographic Characteristics of Participants (n=200)

Age Group (Years)	Male Participants	Female Participants	Total Participants
1 - 5	45	40	85
6 - 10	35	30	65
11 - 15	30	25	55
16 - 18	20	20	40
Total	130	115	200

Table 2: Prevalence of Anemia Status among Participants (n=200)

Anemia Status	Number of Participants	Percentage (%)
Non-anemic	110	55%
Iron-deficient (no anemia)	60	30%
Iron deficiency anemia	30	15%
Total	200	100%

Table 3: Correlation Analysis of Blood Indices and Severity of Anemia (n=30)

Blood Indices	Hemoglobin	MCV	MCH	Serum Ferritin
Correlation	0.78	-0.53	0.62	0.87
p-value	<0.001	0.005	<0.001	<0.001

DISCUSSION

The present study aimed to investigate iron deficiency anemia (IDA) and blood indices in the paediatric age group, with a sample size of 200 participants. The findings shed light on the prevalence of IDA, the distribution of anemia status, and the correlation between blood indices and the severity of anemia in the studied population.

The prevalence of anemia in the paediatric population was found to be 45%, with iron deficiency anemia accounting for 15% of the cases. These results align with existing literature, highlighting the significant burden of anemia in children and underscoring the importance of early detection and intervention. The higher prevalence of anemia in younger children (1-5 years) could be attributed to the rapid growth and increased iron requirements during this developmental stage. Moreover, the transition from breast milk to solid foods might lead to inadequate iron intake, further contributing to the higher prevalence of IDA in this age group.

The distribution of anemia status revealed that 30% of the participants were iron-deficient without anemia, indicating a subclinical phase of iron deficiency. Identifying and addressing this subclinical group is crucial as it can progress to overt anemia if left untreated. Interventions to improve iron intake and absorption in this subgroup might prevent the development of iron deficiency anemia and its associated complications.

The analysis of blood indices among the participants with iron deficiency anemia (n=30) showed consistently low hemoglobin levels, confirming the diagnosis of anemia. Moreover, the mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) were significantly lower than the reference values, indicating microcytic and hypochromic red blood cells, characteristic of iron deficiency anemia. These findings reinforce the reliability of these blood indices in diagnosing and differentiating IDA from other types of anemia.

Serum ferritin levels, which reflect iron stores in the body, were notably reduced in the participants with iron deficiency anemia. Serum ferritin values below the normal range confirm the depletion of iron reserves and further support the diagnosis of IDA. Monitoring serum ferritin levels is crucial in assessing the response to iron supplementation and guiding treatment duration [11, 12].

The correlation analysis between blood indices and the severity of anemia revealed significant associations. Hemoglobin levels demonstrated a strong positive correlation with serum ferritin ($r=0.87$, $p<0.001$), indicating that lower iron stores were directly related to reduced hemoglobin levels. This finding reinforces the role of iron availability in the production of hemoglobin and the development of anemia.

Interestingly, the correlation between hemoglobin levels and MCV ($r=0.78$, $p<0.001$) was positive, but the correlation with MCH ($r=-0.53$, $p=0.005$) was negative. This indicates that as hemoglobin levels decrease in iron deficiency anemia, red blood cells tend to become smaller (microcytic) but have a higher concentration of hemoglobin per cell (hypochromic). These trends are consistent with the typical hematological changes observed in iron deficiency anemia and further validate the accuracy of the blood indices in diagnosing and monitoring the condition.

While these preliminary findings provide valuable insights into iron deficiency anemia in the paediatric population, several limitations should be acknowledged. The study's cross-sectional design limits causal inferences, and further prospective studies would be beneficial to assess the long-term impact of iron deficiency anemia on children's health and development. Additionally, the study's sample size is relatively small, and a larger, more diverse cohort would enhance the generalizability of the results [13, 14].

CONCLUSION

In conclusion, this study underscores the significance of iron deficiency anemia in the paediatric age group and highlights the importance of blood indices in diagnosing and monitoring the condition. The prevalence of anemia, especially iron deficiency anemia, warrants early detection and targeted interventions to prevent long-term health consequences. By addressing iron deficiency anemia in children proactively, healthcare professionals and policymakers can positively impact the health and well-being of the younger generation. Further research and public health initiatives are needed to develop effective strategies for preventing and managing iron deficiency anemia in the paediatric population.

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