P-ISSN: 2664-3685
E-ISSN: 2664-3693
www.paediatricjournal.com
IJPG 2021; 4(2): 07-09
Received: 06-05-2021
Accepted: 09-06-2021

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Assessment of serum ferritn level in detection of iron deficiency anaemia in paediatric patients: Prospective analysis

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DOI: https://doi.org/10.33545/26643685.2021.v4.i2a.148

Abstract
Introduction: Major form in which iron is stored in the body is serum ferritin. It can detect early changes in body iron store. It causes little patient discomfort as compared to bone marrow iron studies. In this study, we used serum ferritin level to assess the level of iron storage in the children less than five years of age. Iron stores are depleted below this value.
Materials & Methods: Sample size includes 100 children under the age of 5 years from the opd of the department. The blood was divided into two halves, one was sent for cbc evaluation and from other half the serum was separated through centrifugation for the estimation of serum ferritin level.
Results: The range of the serum iron level in the study was 0.2 – 340 ng/ml. The mean serum iron level in the study was 51.8 ng/ml. Out of 100 patients, there were 76 patients with serum level less than 12 ng/ml; they were iron deficient. There were 20 children with iron deficiency in the infants group, there were 34 patients in toddlers group and there were 24 children in preschool group.
Discussion & Conclusion: For the early detection of the status of the iron stores in the body is done by serum ferritin concentration. Iron deficiency anemia continues to be a significant public health problem in the world. Serum ferritin level is a good screening test for early detection of iron deficiency anemia in children less than 5 years of age. When it is used in assess with other test for iron status in body, it is considered as more specific indicator for the detection of the iron stores.

Keywords: Anaemia, serum ferritin, iron deficiency, paediatric patients

Introduction

In children, iron represents an essential nutrient for growth and proper function of many organs and systems, mainly erythropoiesis. It must be obtained from the diet and absorbed in the upper gastrointestinal tract [1]. When iron requirements are not met, as when the balance of iron intake, iron stores and the body's loss are insufficient to fully support the production of erythrocytes, it is referred to as iron deficiency (ID). In 30% of cases, the ID, if left untreated, evolves in iron deficiency anemia (IDA) which represents the most frequent form of anemia in childhood [2].

Iron deficiency is a common nutritional deficiency worldwide and is considered a significant public health concern in both developing and developed countries. For young children in the United States, the prevalence of iron deficiency is ~15%, and the prevalence of iron deficiency anemia is ~2%. The prevalence of iron deficiency peaks in early childhood, a sensitive time for the rapidly developing brain. Iron deficiency (anemic and nonanemic) has a negative impact on neurodevelopmental outcomes [3].

Iron is vital for the processes of monoamine metabolism, myelin synthesis, and metabolic function of the brain. Animal studies show that early postnatal iron deficiency alters brain development and cognition. Human studies reveal that iron deficiency is associated with poor outcomes across multiple domains of child development. Impairments in cognitive, social, and emotional functioning may persist into adolescence and young adulthood among individuals who had iron deficiency in early childhood. There is some evidence that iron supplementation in infants and young children with iron deficiency is associated with improvements in motor and cognitive functioning when treatment is provided for a therapeutically appropriate duration [4, 5].

Since anemia is the most important indicator of iron deficiency, the terms ID and IDA are often used interchangeably.

However, iron deficiency may develop in the absence of anemia and the tissues may be affected from this condition. Iron deficiency is manifested in different stages. If iron requirement is below intake, iron stores are reduced primarily. After the iron stroes are reduced, hemoglobin levels may stay normal for a while which means that iron deficiency is observed in the absence of anemia [6]. At this time, only plasma ferritin level and plasma transferrin saturation are reduced. 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 [7].

Major form in which iron is stored in the body is serum ferritin. It can detect early changes in body iron store. Many authors recommend it as the most important blood test for the diagnosis of iron deficiency. It causes little patient discomfort as compared to bone marrow iron studies [8]. In this study, we used serum ferritin level to assess the level of iron storage in the children less than five years of age. Iron stores are depleted below this value. Hence, primary prevention by way of screening for iron deficiency in apparently non-anemic individuals especially children is very important.

Materials & Methods

The present study is a prospective one which was carried out at medical college and associated hospital. The ethical committee of the college was informed about the research work and the ethical clearance certificate was obtained prior to the start of the study. Sample size includes 100 children under the age of 5 years from the opd of the department. Parents of the children were informed about the study in detail and written informed consent was obtained from them. Children whose parents refused to gave written informed consent, presence of any infection, inflammation and history of any haematological abnormalities were excluded from the study. The study population was categorized into three groups; Infants (3-12 months), Toddlers (13-23 months) and Preschool-age (24-60 months) groups.

Pre formed Performa was prepared to collect the history and personal data of the included children. The area was sterile prior to the blood drawn. Total of 5 ml of venous blood was drawn from the included patients. The blood was divided into two halves, one was sent for cbc evaluation and from other half the serum was separated through centrifugation for the estimation of serum ferritin level. The serum samples were stored in the deep freezer. In different batches the serum estimation of the ferritin level was done. ELISA technique was used or the assayed for the estimation of serum ferritin level. Systmax hematolgy analyzer was used for the assessment of serum ferritin. Patients with serum ferritin level less than 12 ng/ml was considered as iron deficient paediatric patients.

The data were collected and the statistical analysis was done with the help of SPSS version 16. Data were collected and entered in Statistical Package for Social Sciences (SPSS, version 16) for analysis. Descriptive statistics were calculated. Chi-square test was applied for evaluation and calculation of significance in each of the characteristics of the population at $P \leq 0.05$.

Results

The present study was done with the aim of estimation of serum iron in the paediatric patients. Total sample sizes of 100 patients were included in the study. The paediatric patients with age of 3 – 12 months were considered as infants, with age range of 13 – 24 months were considered as toddlers and there were considered as preschools in age range of 25 – 60 months.

The age range of the patients included in the study was 5 – 60 months. There were 28 patients in age group of 3 – 12 months, there were 48 patients in age group of 13 – 24 months and there were 24 patients in age group of 25 – 60 months.

The range of the serum iron level in the study was 0.2 – 340 ng/ml. The mean serum iron level in the study was 51.8 ng/ml. Out of 100 patients, there were 76 patients with serum level less than 12 ng/ml; they were iron deficient. There were 20 children with iron deficiency in the infants group, there were 34 patients in toddlers group and there were 24 children in preschool group.

Table 1: Frequency and comparison of iron deficiency in different age groups paediatric patients

Age categories	N	Non Iron deficient	Iron deficient	P value
Infants	28	20	8	< 0.78
Toddlers	48	34	14	
Pre school	24	22	2	
Total	100	76	24	

Discussion

Iron deficiency is the commonest nutrient deficiency in the world and a major public health risk in both the developing and industrialized countries. It affects more than a billion people of different age groups around the world. It is the commonest cause of anaemia and is also a common deficiency among non-anaemic children, especially among children of resource limited countries [9]. A study by Ekwochi *et al*. [10] showed that iron deficiency was present in 27.5% of non-anaemic children under 5 years. Iron is necessary for healthy function and development of brain. There is evidence that its deficiency without anemia causes fatigue. It can affect visual and auditory functioning and is weakly associated with poor cognitive development in children.

There are many numerous reasons for iron deficiency anaemia, however in children there are basic four reason or iron deficiency; decreased reserves at birth, reduced intestinal absorption, chronic loss of blood and inadequate intake with diet. In low birth weight infants and in babies with perinatal blood loss, the stores are exhausted earlier [11]. The amount of iron in breast milk is at the highest level in the first month, but it decreases gradually in the subsequent periods and is reduced up to 0.3 mg/l approximately in the fifth month. Although the amount of iron received from breast milk is typically low, its absorption is considerably high (50%). Solid foods, given after the sixth month, should be rich especially in iron, zinc, phosphorus, magnesium, calcium and vitamin B6.

The serum ferritin was found less than 12ng/ml in anemic children of the study population. Serum ferritin level is a very useful clinical tool to assess iron deficiency anemia in adults. But in children less than 5 years more efforts are needed in our own population to find out its relationship with IDA. Sukanya Linpisarn *et al*. [12], in a study carried out in Thailand in 1996, recognized that Serum Ferritin

accurately reflects total body iron stores after 6 months of age and is only depressed in iron deficiency. As revealed by the response to oral iron, serum ferritin was the only confirmatory test and was quite accurate in their population.
For the early detection of the status of the iron stores in the body is done by serum ferritin concentration. When it is used in assess with other test for iron status in body, it is considered as more specific indicator for the detection of the iron stores. Under normal conditions, a direct relationship exists between serum ferritin concentration and the amount of iron stored in the body, such that 1 µg/L of serum ferritin concentration is equivalent to approximately 10 mg of stored iron. However, measured ferritin levels have some limitation; acute and chronic inflammation can increase serum ferritin levels and the assessment of iron status but is not a cause iron deficiency [13].
Magnus Domello¨f *et al*. [14] recommended that age-specific cutoffs for iron status indicators, including hemoglobin and ferritin, should be used for young children. While characterizing a simple, easily accessible, cost effective and commonly used diagnostic test for iron deficiency anemia in developing countries and especially at primary care level, it is suggested that serum ferritin assay has been considered the best single test for the diagnosis of iron deficiency anemia.

Conclusion

Iron deficiency anemia continues to be a significant public health problem in the world. Serum ferritin level is a good screening test for early detection of iron deficiency anemia in children less than 5 years of age.

References

1. McCown JL, Specht AJ. Iron homeostasis and disorders in dogs and cats: a review. Journal of the American Animal Hospital Association 2011;47:151-60.
2. Miniero R, Talarico V, Galati MC, Giancotti L, Saracco P, Raiola G. Iron Deficiency and Iron Deficiency Anemia in Children. Iron Deficiency Anemia; IntechOpen: London, UK, 2019, 23-38.
3. Leenstra T, Kariuki SK, Kurtis JD, Oloo AJ, Kager PA, Ter Kuile FO. Prevalence and severity of anemia and iron deficiency: cross-sectional studies in adolescent schoolgirls in western Kenya. European journal of clinical nutrition 2004;58:681-91.
4. Beard J. Iron deficiency alters brain development and functioning. The Journal of nutrition 2003;133:1468S-72S.
5. Jáuregui-Lobera I. Iron deficiency and cognitive functions. Neuropsychiatric disease and treatment 2014;10:2087.
6. Beutler E, Hoffbrand AV, Cook JD. Iron deficiency and overload. ASH Education Program Book, 2003, 40-61.
7. Clark SF. Iron deficiency anemia. Nutrition in clinical practice 2008;23:128-41.
8. Stein J, Hartmann F, Dignass AU. Diagnosis and management of iron deficiency anemia in patients with IBD. Nature reviews Gastroenterology & hepatology 2010;7:599-610.
9. Mawani M, Ali SA, Bano G, Ali SA. Iron deficiency anemia among women of reproductive age, an important public health problem: situation analysis. Reproductive System & Sexual Disorders: Current Research 2016;5:1.
10. Ekwochi U, Odetunde O, Maduka I, Azubuike J, Obi I. Iron Deficiency Among Non-Anemic Under-Five Children in Enugu, South-East, Nigeria. Annals of medical and health sciences research 2013;3:402-6.
11. Anand T, Rahi M, Sharma P, Ingle GK. Issues in prevention of iron deficiency anemia in India. Nutrition 2014;30:764-70.
12. Linpisarn S, Tienboon P, Promtet N, Putsyainunt P, Santawanpat S, FUCHS JG. Iron deficiency and anaemia in children with a high prevalence of haemoglobinopathies: implications for screening. International journal of epidemiology 1996;25:1262-6.
13. Den Broek V. Iron status in pregnant women: which measurements are valid? British journal of haematology 1998;103:817-24.
14. Domellöf M, Braegger C, Campoy C, Colomb V, Decsi T, Fewtrell M *et al*. Iron requirements of infants and toddlers. Journal of pediatric gastroenterology and nutrition 2014;58:119-29.