



Original Research Article

A study of prevalence of anemia in pediatric population in a tertiary care hospital in Amritsar

Neha Uppal^{1,*}, Anju Sharma¹, Sahiba Kukreja¹

¹Dept. of Biochemistry, Sri Guru Ram Das Institute of Medical Sciences & Research, Amritsar, Punjab, India



ARTICLE INFO

Article history:

Received 15-07-2018

Accepted 12-12-2018

Available online 21-09-2019

Keywords:

Anaemia

Pediatric anaemia

Children

Iron deficiency anaemia

ABSTRACT

Introduction: Anaemia has a major negative impact in the development of children and increases the risk of child mortality. It also reduces the cognitive and physical development. IDA is also ranked as the third leading cause of disability worldwide and the 13th leading risk factor for the global disability adjusted life years. Anaemia among children has been characterized as the haemoglobin (Hb) concentration present below the diagnostic reference range. These Hb levels vary based on the age of the child and the laboratory that is diagnosing the patient. Reference ranges have to be followed based on the age and diagnosing laboratory. As per the study by World Health Organization (WHO), the Hb levels among children have been characterized for recognizing the case of anaemia. These Hb levels are <11 gm % (children in the age group of 6-59 months), <11.5 gm % (children in the age group of 5-11 years), and 12 gm % (children in the age group of 13-14 years). In almost half of these cases, the abnormality is not evident following simple full blood examination and is only detected by complete anaemia panel to differentiate between various causes so that exact treatment can be provided for proper development.

Materials and Methods: The present study will be undertaken in the Department of Biochemistry, Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar.

Study Design: The present observational cross-sectional study was conducted on total of 300 children aged 6-60 months, diagnosed with Low Haemoglobin (11 gm % <) on Complete Blood Count analysis and willing to participate in the study with informed consent.

Exclusion Criteria: Patients suffering from serious infections, chronic infections and patients who have received BT in past 8 weeks or haematinics in past 4 weeks were excluded from the present study. 5 ml of venous blood will be taken in a dry disposable syringe under all aseptic conditions by venipuncture from ante cubital vein for biochemical investigations which will be done on the same day of sample collection. Serum Iron, TIBC (direct), serum B12, Folate and Serum Ferritin were estimated by enhanced chemiluminescence assays on vitros 500.

Results: Total of 190 (63%) children were found anaemic out of which 52 % children were found Iron deficient and 10 % were diagnosed with megaloblastic anaemia.

Conclusion: Such high prevalence of anaemia should be addressed immediately (in form of supplementation and health education at regular intervals) to prevent adverse health effects in children.

© 2019 Published by Innovative Publication.

1. Introduction

Anaemia is one of the most extensive pandemics, affecting mostly developing countries, India being one of those depicting very high statistics of anaemia. About 3.5 billion persons are affected by anaemia in developing countries. Anaemia in children has been defined as the mean

haemoglobin (Hb) concentration present below established cut-off levels that generally varies based on the age of the patient. The values also vary depending on the diagnosing laboratory. The diagnostic criteria set by World Health Organization (WHO) for diagnosing anaemia is an Hb levels of <11 gm % in children in the age group of 6-59 months, <11.5 gm% in children in the age group of 5-11 years and 12 gm % in older children (aged 13-14).¹

* Corresponding author.

E-mail address: docneha12@gmail.com (N. Uppal).

Anaemia among children is a grave issue that increases the risk of mortality and puts a negative impact on the cognitive and physical development of the child. Anaemia does not provide an early indication of iron deficiency, therefore the actual number of individuals with iron deficiency is almost 2.5 times that of anaemia.² This poses an important economic and health consequences in the middle and low socio-economic countries. In 2003, the United Nations General Assembly constituted strong goals for reducing the prevalence of anaemia by 2010. Despite these goals, the incidence of anaemia among children increased during 1990-2010.^{3,4}

In majority of patients anaemia was caused due to iron deficiency, while smaller proportion suffered due to deficiencies of micronutrients (folate, and vitamins A and B12). Diseases that cause blood loss, parasitic infections (filariasis), and chronic diarrhoea, may also cause anaemia.^{5,6} This may be due to the fact that infants, toddlers, and post weaning have feed poor in iron bioavailability. This is particular concern during the vulnerable period of 9 to 18 months.

The incidence of anaemia among children less than five years negatively impacts the mental development and future social performance of these patients. Iron deficiency anaemia, especially during first two years of life reduces cognitive development, school performance, and work capacity during later years.^{7,8} Iron deficiency anaemia reduces the ability of an individual to fight infections by reducing cell-mediated immunity, thus increasing the rates of morbidity due to acute infections. It has also been associated with reduction in linear growth and physical work capacity.^{9,10}

Iron deficiency anaemia among children is considered as a critical health issue and is a prevalent form of micronutrient deficiency. The global prevalence of anaemia (defined as haemoglobin level of <110 g/L) in children aged 6-59 months is 43% and half is attributable to iron deficiency anaemia (IDA) which is defined as haemoglobin level of <110 g/L and ferritin level of <12 μ g/L. IDA has been linked to impaired brain development and cognitive functions, thus increasing the risk of morbidity and mortality among children.¹¹ Most of the burden of IDA is in the resource poor settings of Africa and Asia. Sometimes it may be secondarily due to some inflammatory disorder or underlying thalassemia carrier state (which is wrongly treated as Iron deficiency anaemia).¹²

Iron deficiency has been recognized as the common cause of childhood anaemia in the Western world. The Child Health Subgroup of the National Screening Committee undertook a review in 2013 and concluded that screening of iron deficiency in children aged under 5 should not be recommended.¹²

Various diagnostic tests are usually applied in the initial evaluation of high risk population groups suffering

from Iron deficiency anaemia. Reference ranges for specific laboratories and age groups becomes of paramount importance and should always be referred to for accurate diagnosis of anaemia. In spite of the availability of many practical laboratory modalities to screen anaemic patients; these measurements are not readily available in many rural settings. Here Clinical expertise becomes the primary modality for the diagnosis and management of anaemic patients.¹³

The Child Health Subgroup of the National Screening Committee undertook a review in 2013 and concluded that screening of iron deficiency in children aged under 5 should not be recommended.¹² Thus the present study will be conducted to find the prevalence of anaemia in children aged 5 months to 5 years and find the exact cause so that exact treatment can be provided for proper physical and cognitive development of the child.

2. Materials and Methods

2.1. Study design

The present observational study was undertaken in the Department of Biochemistry in collaboration with Department of Paediatrics, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar after taking clearance from ethical committee of the institute.

2.2. Inclusion criteria

This study was carried out on total of 523 patients and 300 subjects (sample size calculated by Epi Info 7 software for population surveys) willing to participate in the study after informed consent and having mean haemoglobin levels below 11 g % were considered for the study.

2.3. Exclusion criteria

Patients suffering from serious infections, chronic infections and those who have received BT in past 8 weeks and haematinic in past 4 weeks were excluded from the present study.

2.4. Collection and processing of blood samples

5 ml of venous blood was taken in a dry disposable syringe and needle (21 gauge) under all aseptic conditions by venepuncture in ante cubital vein in a dry acid washed vial for complete blood count. Children having mean haemoglobin levels below the cut off of 11 g% were further processed for biochemical investigations. All biochemical assays were done on the same day. Serum Iron is spread on a vitros iron slide and is separated from transferrin in the underlying layer due to acidic pH. The iron form is reduced to ferrous form and bound to a dye for forming colored complex.¹⁴ TIBC (direct) is based on the turbidometric analysis. The solution is made

acidic in nature, which separates iron from transferrin. The separated iron is allowed to bind to chromazural B. Reagent 2 is added to this solution to shift the pH to neutral, thus increasing the affinity of transferrin to iron. Binding of transferrin is measured by the change in absorbance.¹⁵ Serum B12 is measured using a competitive binding immunoassay technique. The vitamin B12 in the sample is allowed to compete with horseradish peroxidase labelled B12 conjugate. Vitamin B12 in the sample is released by alkaline denaturation and biotinylated intrinsic factor is allowed to interact with the sample. The aliquot of this mixture is added to streptavidin coated well and allowed to undergo a competitive reaction with B12-HRP conjugate. The reading is measured using luminescent reaction and provides the value of vitamin B12.¹⁶ Folate is also measured using competitive binding test. The competition occurs between the folate in the sample with the horseradish peroxidase labelled folate for the binding site on the streptavidin coated wells. The reading is measured using luminescent reaction and provides the value of folate.¹⁶ Serum Ferritin is measured using immunometric technique. The ferritin present in the sample is allowed to react with biotinylated antibody. This combination is captured by the streptavidin coated well. The captured combination is allowed to react with horseradish peroxidase labelled antibody conjugate. The reading is measured using luminescent reaction and provides the value of ferritin.¹⁶ were estimated by enhanced chemiluminescence assays on vitros 500 ortho clinical diagnostics.

2.5. Statistics

The comparison was done by students 't' test on the number of variables for each parameter. Correlation was done by Pearson's correlation analysis. Logistic regression analysis was also done on the variables of each parameter.

3. Results

This study was conducted on 300 patients meeting the inclusion criteria after screening 523 which were taken randomly from the OPD with proper consent. The mean haemoglobin levels in these children were 8.9 gm %, much below the cut off suggested by WHO. The mean red cell indices including MCV, MCH and MCHC were in the lower side of the reference range suggesting further workup. Four children (aged above 2 years) had MCV and MCH below the reference range and were thus advised screening for thalassemia trait. The mean SD + for serum iron was 36.15 + 42.23, in the lower side of the reference range. Clinically pallor was only found in 23 patients (7.6%). Out of 300, 158 children (52.6 %) were found to have severe iron deficiency having serum Iron levels were below the reference interval. Serum Ferritin was found to be normal in all children except one in whom it was higher. This signifies high percentage

of Iron deficiency anaemia in paediatric age group.

Regarding megaloblastic anaemia levels of Vitamin B12 was below the reference interval of 239-931 in 32 children (10%). Serum Folate was low in 32 patients (10%) and higher than normal reference interval of 5-21 ng/mL in 13 patients.

Table 1: Table depicting the Range and Mean of CBC indices

| | Range | Mean |
|----------------|--------------|----------|
| Mean Hb levels | 7.2-11.0 gm% | 8.9 gm% |
| MCV | 70-107 fL% | 78.4 fL% |
| MCH | 25-37 pg% | 30.1 pg% |
| MCHC | 28-35 gm% | 31.3 gm% |

Table 2: Table depicting the range and mean of anaemia profile parameters

| Parameter | Mean±SD | Range |
|---------------------|---------------|---------------|
| Iron (µg/dL) | 36.15±42.23 | 78.39-6.08 |
| Direct TIBC (µg/dL) | 327.33±82.11 | 145.22-309.45 |
| Ferritin (ng/mL) | 25.85±19.01 | 6.84-44.86 |
| Vitamin B12 (pg/mL) | 397.79±239.85 | 157.94-637.65 |
| Folate (ng/mL) | 7.72±5.19 | 2.53-12.92 |

4. Discussion

Anaemia is an important health concern worldwide, particularly in poor populations such as in India. Anaemia in children under five years of age is of particular relevance because of effect of these parameters on physical, mental and social development. Also the physical work capacity & immunity is negatively affected by iron deficiency anaemia. The prevalence of anemia in the developing countries tends to be three to four times higher than in the developed countries. The high prevalence of Iron deficiency anaemia (app. 32%) in our study signifies the importance of screening all children below 5 years of age. Similar findings were reported by Garg and Bhalla.¹⁷ The Ferritin levels being also increased in inflammatory processes, does not give the true values in iron deficiency anaemia. Serum Iron levels are also affected in anaemia of chronic diseases. Serum Transferrin receptors can differentiate these conditions being not affected by chronic inflammation.

Megaloblastic anaemia is less prevalent than iron deficiency anaemia, stressing on the need for fortification of diets, with iron and iron supplementations. Another study by Chaturvedi S et al shows that 73.7% adolescents were anaemic.¹⁸ In a study by Shah BK et al among the adolescent girls of Nepal, the prevalence of anaemia (68.8%) was found to be higher than that of the Indian females as in our study (41.62%).¹⁹ Sudha Gandhi B et al showed that the prevalence of anemia was 52.88% in the school children of Kattankulathur.²⁰ Within India, the highest prevalence of anaemia was found in the Jharkhand

Table 3: Table depicting the percentage of individual parameters of Anemia profile

| | Pallor | Serum Iron | Serum TIBC | Serum Vit.B12 | Serum Folate |
|---------------------|--------|------------|------------|---------------|--------------|
| No. of Participants | 300 | 300 | 300 | 300 | 300 |
| % Abnormal Results | 23 | 98 | 90 | 32 | 32 |

State, where almost all the adolescent girls were anaemic.²¹

Observing such high prevalence of anaemia North India, immediate steps should be undertaken to minimize the issue. Government should implement haemoglobin estimation programmes in rural areas and school s. Health programmes should be effectively implemented for all school children on a regular basis. School teachers should give advice to both children and parents regarding advantages of balanced diet. De worming which is an important cause of anaemia should be made mandatory part of school programmes on a regular basis. The biannual deworming session must include the use of albendazole tablets. It is important to note that half tablet has to be administered to children of 1-2 years of age, while full tablet has to be administered to children of age 2 years or more. Monitoring and evaluation of government programs like ICDS Supplementary Nutritional Program should be effectively monitored. Children aged 6-60 months are prescribed IFA (iron-folic acid) syrup containing 20 mg iron and 100 mcg folic acid. This medicine is generally prescribed on biweekly basis with 100 doses per year. The medicine is provided in 100 mL bottle with standardized preparation techniques and fixed composition. An auto-dispenser has to be fixed on the bottle to ensure that only 1 mL is obtained each time. Parents of these children should be advised for improvement in dietary habits regarding consumption of green leafy vegetables should be included in diet plan. Health education and repeated seminars should be conducted.

5. Limitations

The major limitation of the study is that it is a hospital based study thus may have overestimated the prevalence of anaemia in our settings. Similar studies can be taken up on a bigger sample size in rural settings and not only in children visiting hospitals.

6. Conclusion

As iron deficiency is the most common cause of childhood anaemia in the North India, the main focus for preventing this needs awareness by organising recurrent camps and workshops, screening and dietary advice along with iron supplementation after proper diagnosis. The implementation of government programmes should be strict with the help of in future to prevent childhood anaemia.

7. Source of funding

None.

8. Conflict of interest

None.

References

1. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity; World Health Organization ; 2011..
2. Baker RD, Greer FR. The Committee on Nutrition Diagnosis and Prevention of Iron Deficiency and Iron-Deficiency Anemia in Infants and Young Children (0-3 Years of Age). 2010;126(5):119–119.
3. Kassebaum NJ, Jasrasaria R, Naghavi M. A systematic analysis of global anaemia burden from 1999 to 2010. *Blood*. 2014;123(5):615–624.
4. The UK NSC policy on Iron Deficiency Anaemia screening in children under 5 years of age; UK National Screening Committee ; 2013..
5. Mclean E, Cogswell M, Egli I, Wojdyla D, Benoist BD. Worldwide prevalence of anaemia, WHO vitamin and mineral nutrition information system 1993-2005 ; 2009.. Public Health Nutr.
6. WHO UNCF, UNU (2001) Iron deficiency anaemia assessment, prevention, and control: A guide for program managers. Geneva. Geneva ; 2001..
7. WHO. Micronutrient Deficiencies – Iron Deficiency Anaemia. WHO; ; 2015.. Available from: <http://www.who.int/nutrition/toptics/ida/en/>.
8. Grantham-Mcgregor S, Ani C. A review of studies on the effect of iron deficiency on cognitive development in children. *J Nutr*. 2001;131(2):649–668.
9. United Nations Administrative Committee on Coordination Nutrition (ACC/SCN) 4TH Report on the world nutrition situation. Nutrition throughout the life cycle. Sub-Committee on Geneva:ACC/SCN ; 2000..
10. Iyengar GV, Nair PP. Global outlook on nutrition and the environment: Meeting the challenges of the next millennium. *Sci Total Environ*. 2000;249:331–346.
11. Commission on the Nutrition Challenges of the 21th Century. Ending malnutrition by 2020: AN agenda for change in the millennium. Final report to the ACC/SCN. *Food Nutr Bull*. 2000;21:3–88.
12. Sayed NE, Gad A, Nofal L, G N. Assessment of the prevalence and potential determination of nutritional anaemia in upper Egypt. *Food Nutr Bull*. 1999;20:417–421.
13. Beard JL, Tobin BW. Iron status and exercise. *Am J Clin Nutr*. 2000;72:594–597.
14. Tietz NW. Fundamentals of Clinical Chemistry. ed. 3. Philadelphia: WB Saunders ; 1987.. p. 819.
15. Burtis CA, Ashwood ER. Tietz Fundamentals of Clinical Chemistry. Ed 5. Philadelphia: WB Saunders; 596-600 ; 2001..
16. Summers M, Booth T, Brockas T, Edgar H, Edwards J, et al. Luminogenic reagent using 3-chloro-4-hydroxy acetanilide to enhance peroxidase luminol chemiluminescence. *Clin Chem*. 1995;41:73–73.
17. Nishi G, Manjit B. To study the prevalence of anaemia among school going children in rural area of Faridkot district, India. *Int J Contemp Pediatr*. 2016;3(1):218–223.
18. Chaturvedi S, Kapil U, Gnanasekaran N, Sachdev HPS, Pandey RM, et al. Nutrient intake amongst adolescent girls who belonged to the poor socio economic groups of the rural areas of Rajasthan. *Indian Pediatr*. 1996;33:197–201.
19. Shah BK, Gupta P. Weekly versus daily iron and folic acid supplementation in adolescent Nepalese girls. *Arch Pediatr Adolesc Med*. 2002;156(2):131–135.

20. Sudhagandhi B, Sundaresan S, William WE, Prema A. Prevalence of anemia in the school children of Kattankulathur, Tamil Nadu, India. *Int J Nutr, Pharmacol, Neurol Diseases*. 2011;1(2):184–188.
21. Census of India. Provisional population totals. Registrar-General and Census Commissioner New Delhi: Government of India. 2001. National Family Health Survey (NFHS-3). vol. I. India: IIPS ; 2005-6., p. 2005–2011.

Author biography

Neha Uppal Associate Professor

Anju Sharma Associate Professor

Sahiba Kukreja Professor and Head

Cite this article: Uppal N, Sharma A, Kukreja S. A study of prevalence of anemia in pediatric population in a tertiary care hospital in Amritsar. *Int J Clin Biochem Res* 2019;6(3):396-400.