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*Original Research Article*

# A Study on the Prevalence of Iron Deficiency Anaemia Project in One Slum School in Mumbai

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## ABSTRACT

The objective of this study is to investigate the prevalence of iron deficiency anaemia among adolescent boys and girls of the poor to lower income group families. This study was as a part of medical project under the flag ship of Inner Wheel Club of Bombay Film City of district 314, located at Mumbai with a motive to serve the under privileged school children. The study was conducted in a school located in a slum area of Mumbai. Total 156 students [boys: 44.87% (n = 70) and girls: 55.13% (n=86)] of standard VIII and IX class were investigated for complete blood count (CBC) and haemoglobin (Hb). Prevalence of iron deficiency anaemia based on Haemoglobin assay was 61.54%; MCH: 28.21%; MCHC: only 1.28% and MCV: 34.62%. Thus, there was marked variation in prevalence rates of anaemia based on different parameters of CBC.

***Keywords:*** Prevalence, Iron Deficiency Anaemia, Adolescents, Haemoglobin (Hb), Mean Cell Haemoglobin (MCH), Mean Cell Haemoglobin Concentration (MCHC), Mean Cell Volume (MCV).

## INTRODUCTION

Adolescence has been defined by the World Health Organization as the period of life spanning the ages between 10 to 19 years. [(1)] This is the formative period of life when the maximum amount of physical, psychological, and behavioral changes take place. This is a vulnerable period in the human life cycle for the development of nutritional anemia, which has been constantly neglected by public health programs. Malnourishment is a common problem in Indian population. Even in children it is very common. Anaemia that also 'Iron deficiency anaemia' is very common. Prevalence of anaemia in India is higher than that in many countries of the world. Nutritional anaemia is a major public health problem in India, and is primarily due to iron deficiency. [(2)]

The National Family Health Survey-3 (NFHS-3) data suggests that anaemia is widely prevalent among all age groups and its prevalence is particularly high among the most vulnerable - nearly 58% among pregnant women; 50% among non-pregnant, non-lactating women; 56% among adolescent girls (15 - 19 years of age); 30% among adolescent boys (15 - 19 years of age); and around 80% among children under 3 years of age. [(3)]

We decided to take up "Iron Deficiency Anaemia Project" in Shri Samarth Vidyalay, which is located in slum area of Jogeshwari (East), one of the western suburbs of Mumbai and cater educational need for the children of nearby slum area from 1st Standard to 10th Standard (S.S.C.). We took up this research project keeping in mind the social awareness and welfare, as the school is located in slum area, where children are from poor to lower income group families with possibility of more prevalence of iron deficiency anaemia because of poor nutrition.

To detect anaemia among these children, they were investigated for Complete Blood Count (CBC) and Blood Group by a private pathology laboratory by Hematology Analyser with inbuilt automatic cell counter with printer. (Mindray BC-1800; Manufacturer: Vector, India). Report print outs were taken and analyzed.

**Trends in Prevalence of Iron deficiency Anaemia among Adolescent Girls and Boys:**

The prevalence of anaemia among adolescent girls (Hb < 12 g/dl) and boys (Hb < 13 g/dl) is alarmingly high, as per NFHS-3 and the National Nutrition Monitoring Bureau Survey. Over 55% of adolescent girls are anaemic. The prevalence of anaemia among girls between 15 to 19 years of age remains at 55.8%. On the other hand, prevalence of anaemia among boys of 15 to 19 years of age is 30.2 %. [(2)] The strategy of The National Iron-Plus Initiative for adolescents (10- 19 years of age) is weekly supplementation (Tablet with 100 mg of elemental Iron and 500 µg of Folic acid)

## MATERIALS AND METHODS

**Study design:**

Analytical, descriptive and laboratory analysis of blood samples was conducted to determine prevalence of iron deficiency anaemia among 156 adolescent boys (n = 70) and girls (n = 86) of poor to lower socio-economic class studying in standard VIII and IX of Shri Samarth Vidyalay, located in slum area of Jogeshwari (East), one of the western suburbs of Mumbai, India. A total of 156 blood samples of students who had agreed and given written consent of their parents to participate in the study were investigated for "anaemia project". Venous blood specimens were examined for complete blood count (CBC), haemoglobin and blood group. The name, age, sex etc. needed for the students were recorded by respective class teachers and other volunteers/ laboratory technician.

Iron deficiency anaemia was defined as per NFHS-3 and the National Nutrition Monitoring Bureau Survey based on Hb levels in adolescents.

The cut off value for determination of iron deficiency anaemia is:

Blood Hb concentration < 13 g/dL in boys and < 12 g/dL in girls [(2,3)]

Blood MCH < 27 pg [normal MCH = 27 to 33 (30 ± 3) pg]. [(4)]

Blood MCHC < 31% [normal MCHC = 31 to 35 (33 ± 2) % [(4)]

Blood MCV < 82 fL [normal MCV = 82 to 98 (90 ± 8) fL [(4)]

Iron deficiency is the commonest cause of anaemia in India. In Iron deficiency anaemia, RBCs are microcytic (low MCV) and hypochromic (low MCHC) due to deficient haemoglobin synthesis. The goal of therapy in individuals with iron-deficiency anaemia is not only to repair the anaemia, but also to provide stores of at least 0.5 to 1 gm of iron. Sustained treatment for a period of 6-12 months after correction of the anaemia will be necessary to achieve this. [(4)]

**Blood sample collection and examination:**

Blood sample of 5ml was collected from each student by vein puncture into ethylene diamine tetra-acetic acid (EDTA) sterile bulb for Hb and CBC and plain sterile bulb for Blood Group investigations. The

blood samples were analyzed for Hb, R, B.C. count, total & differential W.B.C. count, Platelet count, haematocrit and Blood Group. The EDTA blood sample was tested and analyzed by pathologist using Hematology Analyser with inbuilt automatic cell counter with printer. (Mindray BC-1800; Manufacturer: Vector, India).

***Statistical analysis:***

The data was obtained from instrumental analysis for all blood samples. It was tabulated as shown in Tables 1 to 5 and analyzed statistically.

**Treatment:**

1) All adolescent girls and boys were first given:

Tablet Albendazole: 400 mg (Aldol-400 of HAB Pharmaceuticals & Research Ltd., Dehradun) 1 tablet stat.

As these students live in slum area in unhygienic conditions, chances of worm infestations (hook worm and others) are common due to contaminated/ impure water supply and poor sanitation conditions. So, first they were treated with broad spectrum anthelmintic Albendazole, followed by:

2) Anaemic students were given: Capsule Ferrous fumarate: 300 mg + Folic acid: 1.5 mg + Vitamin B12: 15 µg, (Autrin of Wyeth Limited, Bandra, Mumbai) 1 capsule daily after lunch.

The anaemic students were given one Capsule Autrin after lunch by respective class teacher to ensure drug compliance and avoid iron poisoning due to overdosage in them or their younger brother/sister at home.

## RESULTS

When 156 students were investigated, then based on CBC investigation reports:

i. Hb basis: 96 (61.54%) students were anaemic.

ii. MCH basis: 44 (28.21%) students were anaemic.

iii. MCHC basis: Only 2 (1.28%) students were anaemic.

iv. MCV basis: 54 (34.62%) students were hypovolemic.

**Table: 1: Haemoglobin (Hb) g/dL Reports:**

| Class | n | ≤5 | >5 - ≤10 | >10-≤11 | >11 -≤12 | >12-≤13 | >13 - ≤14 | >14 |
|---|---|---|---|---|---|---|---|---|
| VIII A | 27 | 0 | 3 | 3 | 10 | 11 | 0 | 0 |
| VIII B | 44 | 0 | 6 | 14 | 15 | 7 | 2 | o |
| IX A | 44 | 0 | 6 | 3 | 11 | 20 | 3 | 1 |
| IX B | 41 | 1 | 4 | 9 | 11 | 13 | 2 | 1 |
| Total | 156 | 1 | 19 | 29 | 47 | 51 | 7 | 2 |
| % | 96 = 61.54% Anaemic | | | | 38.46% Normal* | | | |

*Normal Hb (g/dL): Adolescence: 13 and Childhood: 12
Haematocrit % values: Adolescence: 40 and Childhood: 36
Lowest Hb level: 4.8 g/dL (n = 1). Highest Hb level: 14.6 g/dL (n = 1).

**Table: 2 Mean Cell Haemoglobin (MCH) pg:**

| CLASS | n | 15 to < 21 | ≥ 2 1 to < 27 | ≥ 27 to 33 | >33 |
|---|---|---|---|---|---|
| VIII A | 27 | 1 | 6 | 20 | 0 |
| VIII B | 44 | 1 | 12 | 29 | 2 |
| IX A | 44 | 0 | 9 | 32 | 3 |
| IX B | 41 | 2 | 13 | 23 | 3 |
| Total | 156 | 4 | 40 | 104 | 8 |
| % | | 44 = 28.21% Hypochromic. | | 71.79% Normal* | |

* Normal MCH = 27 to 33 (30 ± 3) pg. Lowest MCH: 15.4 (n = 1). Highest MCV: 36.4 pg (n = 1).

**Table: 3: Mean Cell Haemoglobin Concentration (MCHC) %:**

| CLASS | n | < 25 | ≥ 25 to < 31 | ≥ 31 to 35 | > 35 |
|---|---|---|---|---|---|
| VIII A | 27 | 0 | 1 | 26 | 0 |
| VIII B | 44 | 0 | 0 | 42 | 2 |
| IX A | 44 | 0 | 0 | 43 | 1 |
| IX B | 41 | 0 | 1 | 39 | 1 |
| Total | 156 | 0 | 2 | 150 | 4 |
| % | | 2 = 1.28% Hypochromic | | 154 = 98.72% Normal | |

Normal MCHC = 31 to 35 (33 ± 2) %. Lowest MCHC= 26.5% (n = 1). Highest MCHC = 35.7% (n = 1).

**Table: 4: Mean Cell Volume (MCV) fL:**

| Class | n | < 60 | ≥60 to < 71 | ≥71 to <82 | ≥ 82 to 98 | > 98 |
|---|---|---|---|---|---|---|
| VIII A | 27 | 1 | 1 | 5 | 20 | 0 |
| VIII B | 44 | 0 | 6 | 10 | 27 | 1 |
| IX A | 44 | 0 | 2 | 10 | 29 | 3 |
| IX B | 41 | 1 | 5 | 13 | 19 | 3 |
| Total | 156 | 2 | 14 | 38 | 95 | 7 |
| % | | = 34.62% Hypovolemic | | | 102 = 65.38% Normal | |

Normal MCV = 82 to 98 (90 ± 8) Fl
Lowest MCV= 59.0 fL (n=1). Highest MCV= 104.9 fL (n=1).

**Table 5: Prevalence of Iron Deficiency Anaemia:**

| Parameter | n | Normal n % | Anaemic n % | Lowest Value | Highest Value |
|---|---|---|---|---|---|
| Haemoglobin g/dL | 156 | 60 = 38.46 | 96 = 61.54 | 4.8 | 14.6 |
| MCH pg | 156 | 112 = 71.79 | 44 = 28.21 | 15.4 | 36.4 |
| MCHC % | 156 | 154 = 98.72 | 02 = 1.28 | 26.5 | 35.7 |
| MCV fL | 156 | 102 = 65.38 | 54 = 34.62 | 59.0 | 104.9 |

## DISCUSSION

Iron deficiency anemia is the commonest type of anemia throughout the world and in one study it has been reported to affect about 50 - 60% of young children and pregnant females and 20 - 30% of non-pregnant females in the developing countries. Girls are more likely to be a victim due to various reasons. In a family with limited resources, the female child is more likely to be neglected. She is deprived of good food and education, and is utilized as an extra working hand to carry out the household chores. The added burden of menstrual blood loss, normal or abnormal, precipitates the crises too often. [5,6] This study was planned to highlight the problems of anaemia in adolescent boys and girls from slum area of Mumbai.

Anemia is estimated to affect about 2000 million people mostly in developing countries. [7] Most of the earlier research on anemia in different parts of the world including India was mainly focused upon females. [8] By conducting this study, efforts are made to highlight this problem in adolescent boys and girls.

In our study for adolescent boys and girls (students), on Hb basis 61.54% students were anaemic which correlates with other studies. Surprisingly, our study further shows that on MCH basis 28.21% students were anaemic and on MCHC basis 1.28% that is only 2 out of 156 students was anaemic! However, on MCV basis 34.62% students were anaemic.

Iron deficiency anaemia is most important indication for medicinal iron. Iron salt is normally administered orally. A dose of 200 - 300 mg of elemental iron per day should result in the absorption of iron up to 50 mg/day. This supports a red cell production level of two to three times normal in an individual with a normally functioning marrow and appropriate erythropoietin stimulus. However, as Hb level rises, erythropoietin stimulation decreases and amount of iron absorbed is reduced. A total of 200 mg elemental iron (infants and children: 3-5 mg/Kg) given daily in 3 divided doses, produces the maximal haemopoietic response. Prophylaxis dose is 30 mg elemental iron daily. [9]

Ferrous fumarate contains 33% of elemental iron {Tablets 325 mg and 195 mg contains 107 mg and 64 mg Iron content respectively}, is tasteless, stable and moderately soluble in water w.r.t. Ferrous sulfate. [9,10] It is also less gastric irritant.

Apart from specific treatment, students and their parents were advised by a

nutritionist to modify their food habits i.e. consumption of micro-nutrients foods viz. green leafy vegetables, sprouted pulses, date palm (rich in absorbable iron) and fruits rich in Vitamin C: Lemon, amla, guava, etc.

## CONCLUSION

Occurrence of anemia in undernourished children and those belonging to poor socio-economic status is a well documented fact. [(11-15)]

Normally iron deficiency anaemia is diagnosed and treated on the basis of Hb level.

In 'Iron deficiency anaemia', RBCs are microcytic (low MCV, normal MCV= 90 ± 8 fL) and hypochromic (low MCHC, normal MCHC= 33 ± 2%) due to deficient Hb synthesis.

The National Family Health Survey-3 (NFHS-3) data suggests that prevalence of anaemia is 56% among adolescent girls (15 - 19 years of age); 30% among adolescent boys whereas our findings suggest that prevalence of anaemia (hypochromic and hypovolemic) among students (adolescent boys and girls), based on Hb, MCH and MCV findings was 61.54%, 28.21% and 34.62% respectively, but based on MCHC only 2 (1.28%) students were anaemic! Thus, there was marked variation in prevalence rates of anaemia based on different parameters of CBC. Hence at the end of analysis all 156 students were treated by:

*Tablet Aldol-400: Albendazole 400 mg, 1 tablet stat and all anaemic students (96) based on Hb report were given * Capsule Autrin: 1 daily after lunch for 3 months on all working days from Monday to Saturday in school under supervision of class teacher.


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