

# Study of Prevalence of Anaemia in School Children and Factors Associated with It

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## ABSTRACT

**Introduction:** Anaemia is the most common hematological disease of the pediatric age group. Highest prevalence of anaemia is seen in developing countries. The present study was conducted in Guntur to identify prevalence of anemia in children.

**Material and methods:** This is a prospective study conducted in school children from June 2015 to June 2016 and includes 750 children from government and private schools.

**Results:** Prevalence of anaemia was more among females, vegetarians, children with low socio economic status.

**Conclusion:** Anaemia is still a major health problem in our country. Childhood anaemia still continues to be a significant public health problem in school children between 6-12 years

**Keywords:** Anaemia, Low Socioeconomic Status, Iron Fortification

## INTRODUCTION

Anaemia is the most common hematological disease of the pediatric age group. Highest prevalence of anaemia is seen in developing countries. Anaemia is widely prevalent in India and affects both sexes and all age groups.<sup>1</sup>

Global anemia prevalence when examined for each physiological group using the WHO global data on anaemia reports that most affected groups are pregnant women (69%) and school age children (33%).<sup>2</sup>

In Asia the prevalence of nutritional anemia is particularly high in countries such as Bangladesh (74-80%), Indonesia (37-73%), and India (34-69%).<sup>3</sup> Since several decades, it has been known to be important problem in most tropical countries.

WHO global data show, that anaemia due to iron deficiency affects approximately 30% of World's population and about 37% of school children.<sup>4</sup> In Indian children, high prevalence of anaemia varying from 27% to 90% has been reported in different studies.<sup>5</sup> The population differences in the prevalence of anaemia are explained by environmental factors affecting nutrition, chief among these are economic status, ethnic customs and geographic considerations.<sup>6</sup>

Because of the high prevalence and severe consequences of anaemia are long lasting and possibly irreversible in children has led international organizations like WHO, UNICEF, NFHS, Govt. of India and other NGO's agencies to reduce the prevalence of anaemia as major goal. Several strategies were implemented to achieve this goal including iron fortification, use of iron supplements, deworming for school children, Mid day meal programme and education regarding nutrition, but the goal still needs to be achieved.<sup>7</sup>

Study aimed to know the prevalence of anemia and various factors associated with it in school going children with the objectives to know the prevalence of anaemia in school going children, to study the association between Socio-Economic Status (SES) and anaemia and to detail the association between dietary habits and anaemia.

## MATERIAL AND METHODS

This was a prospective study conducted in school children from June 2015 to June 2016 and schools were selected in which our Hospital performs health checkups every year and Government schools nearer to our Hospital after taking consent from the competent authority.

### Source of Data

School going children in the age group of 6-12 years both Government and Private schools were selected and minimum of 125 Students from each school were selected from 1<sup>st</sup> to 7<sup>th</sup> class approximately 20 children from each class were selected randomly by using class roll numbers. Preliminary visits were made to the schools and the Head of teachers instructed the children to obtain their parent's consent. Only those children whose parents consented were included in the study.

### Inclusion Criteria

School children in the age group of 6-12 years both boys as well as girls.

### Exclusion criteria

Children age less than 6 years and more than 12 years are excluded from the study.

Children suffering from any illness are not taken into the study.

Exclusion criteria were based on the relevant information from the parents / guardians and with complete physical examination.

### Method of Collection of Data

About 750 children were included in the study after obtaining consent from parent and school teachers. Four Government and Two Private schools were selected. Sample size was calculated by the formula  $\{(1.96)^2 \times P \times (1-P)\} /$

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(0.05)<sup>2</sup> considering the prevalence of anemia as 50%, and 95% confidence interval, the target sample size was 384. Considering non-response rate as 20%, the sample size was 461. more than required number was taken to minimize the premissible errors. Parental and school authority consent was obtained in the written format which was also approved by ethical committee. A preplanned questionnaire was used to collect the health details of the children and Socioeconomic status of the parents and dietary habits of the children. Complete physical examination was done for all children.

Venous blood sample was collected in all children under strict aseptic precautions in EDTA anticoagulant for hematological investigations. Hemoglobin (Hb) estimation was done using cyanmethemoglobin method 20micro liter of anticoagulated blood was added to 5ml of freshly made standardized Drabkin's solution in a vial. This was inverted several times to mix the solution. It was allowed to stand for 10min and the solution was read in spectro-photometer at 540nm and grading of Anemia was done by hemoglobin levels according to recent WHO guidelines. Peripheral blood smear study was performed on all the children. Peripheral smear was stained by Leishman's stain. Staining characteristics and morphological abnormalities of red cells were observed. The distribution, anisocytosis, poikilocytosis, along with white blood cell morphology and platelet morphology were observed. Reporting was done by Pathologist. According to latest WHO guidelines anemia was taken HB < 11.5gm/dl. And mild anemia HB 11 – 11.4gm/dl, moderate 8 – 10.9gm/dl and severe HB < 8gm/dl.

## STATISTICAL ANALYSIS

The data obtained was reanalyzed using Windostat 9.2 version. By using this Chi square and ANOVA tests were done.

## RESULTS

A total of 750 cases were studied of which 54.9% were male and 45.1% were female. The children belonged to government and private schools. The age proof of all children was obtained from the school documents. Consent was taken from the principals and informed consent was given by parents by accepting for health camps.

As per table-1 out of 750 students, 348 (46.4%) students were not having anaemia and 402 (53.6%) were anaemic i.e. having Hb value <11.5 g/dl. Out of 402, 146 (19.5%) students were having mild anaemia, 244(32.5%) were having moderate anaemia and 12 (1.6%) were having severe anaemia.

As per table-2 the association between socioeconomic status and sex was found statistically insignificant

(p>0.05). Children which were included in our study were belonging to class III, class IV and class V according to modified Kuppaswamy's classification. Data regarding the socioeconomic status were obtained from the school records. The association between social economic status and diet was found statistically insignificant (p>0.05). 579 out of 750(77.2%) children consumed mixed (non-vegetarian) diet and 171 (22.8%) children were pure vegetarian.

In this study, Anemia was considered when Hemoglobin was less than 11.5gm% for both male and female children of 6-12 years age based on WHO criteria. The overall prevalence of anaemia in 6-12 years of age was 53.6%. Anaemia was seen in 46% of males and 62.4% of females of study group. The prevalence of anaemia was more in girls than boys. This was statistically significant.

As per table-3 the association between prevalence of anemia in diet and sex was statistically significant. Prevalence of anaemia among vegetarians: Males (47.4%) and Females (74.7%). Prevalence of anaemia among non-vegetarians: Males (46.1%) and Females (57.6%). Anemia was more prevalent in vegetarian group of children (62.5%) compared to non-vegetarian group of children (51%).

As per table-4 the association between prevalence of anaemia in SES and sex was found to be statistically insignificant. The prevalence of anaemia in children belonging to class III as per modified Kuppaswamy's classification was less than children belonging to class IV and class V. The socioeconomic status plays a major role in prevalence of anaemia. 69.2% of female children had anaemia, 34.6% of males anemic in class III socioeconomic status. 61.7% of female children had anaemia compared to 48.4% of males

Grade	Total
Normal (>11.5gms/dl)	348 (46.4%)
Mild (11-11.4gms/dl)	146 (19.5%)
Moderate (8-10.9gms/dl)	244 (32.5%)
Severe (<8gms/dl)	12 (1.6%)

**Table-1:** Prevalence of anaemia according to grading of anaemia in children between 6 to 12 years

SES	Sex		Total
	Male	Female	
Class I	0	0	0
Class II	0	0	0
Class III	26 (6.3)	26 (7.7)	52 (6.9)
Class IV	310 (75.2)	240 (71.0)	550 (73.3)
Class V	76 (18.5)	72 (21.3)	148 (19.7)
Total	412 (100.0)	338 (100.0)	750 (100.0)

**Table-2:** Socioeconomic status (SES) and sex distribution of students

Diet	Male			Female			Prevalence in %
	Normal	Anaemia	Total	Normal	Anaemia	Total	
Vegetarian	40(52.6)	36(47.4)	76(100)	24(25.3)	71(74.7)	95(100)	62.5
Non-vegetarian/mixed	181(53.9)	155(46.1)	336(100)	103(42.4)	140(57.6)	243(100)	51
total	221(53.6)	191(46.4)	412(100)	127(37.6)	211(62.4)	338(100)	

**Table-3:** Prevalence of anaemia cases according to diet and sex

SES	Male			Female			Prevalence (%)
	Normal	Anaemia	Total	Normal	Anaemia	Total	
Class III	17(65.4)	9(34.6)	26(100)	8(30.8)	18(69.2)	26(100)	51.9
Class IV	160(51.6)	150(48.4)	310(100)	92(38.3)	148(61.7)	240(100)	54.2
Class V	44(57.9)	32(42.1)	76(100)	27(37.5)	45(62.5)	72(100)	52
Total	221(53.6%)	191(46.4%)	412(100%)	127(37.6%)	211(62.4%)	338(100)	53.6

**Table-4:** Prevalence of anaemia cases according to SES and sex

belonging to class IV socioeconomic status. 62.5% of female children had anaemia compared to 42.1% of males belonging to Class V socioeconomic status. Female children had higher prevalence of anaemia in all socioeconomic classes.

Total of 750 cases, 452(60.3%) had Normocytic normochromic (NN) picture, 161(21.5%) had Normocytic hypochromic (NH) picture, 135(18.0%) had Microcytic hypochromic (MH) picture, 2 (0.3%) had Dimorphic anaemia picture. Out of 452 Normocytic normochromic 331(73%) had no anaemia, 77 (17%) had mild anaemia and 44(9.7%) had moderate anemia. Out of 161 Normocytichypochromic, 14(8.7%) had no anemia, 49(30.4%) had mild anemia 98(60.9%) had moderate anemia. Out of 135 Microcytic hypochromic, 3(2.2%) had no anemia, 20 (14.8%) had mild anemia, 100(74%) had moderate anemia, 12(8.9%) had severe anemia. 2 children with moderate anaemia had Dimorphic picture.

Grading of Anemia and peripheral smear was statistically significant.

Normal – Total number of cases – 348 – blood picture

→331 were NN

→14 were NH

→3 were MH

Mild anaemia – Total number of cases 146 – blood picture

→77 were NN

→49 were NH

→20 were MH

Moderate anaemia – Total number of cases 244 – blood picture →44 were NN

→98 were NH

→100 were MH

→2 were DA

Severe anaemia – Total number of cases 12 – blood picture

→12 were MH

## DISCUSSION

The present study was undertaken to know the prevalence of anemia in school going children and to know the influence of various factors like sex, socioeconomic status and diet in case of anemia. This is a prospective study conducted from June 2015 to May 2016. Total of 750 children were studied. Children belonging to both government (4) and private (2) schools were randomly selected during medical health camps. The overall prevalence of anemia in my study that is prevalence of anemia in school children of 6 to 12 years is 53.6%. Prevalence of anemia in males is 46% and in females is 62.4%. That is prevalence is more in female children than males in 6 to 12 years age group and it is statistically

significant. Prevalence of anemia is more in vegetarian group of children that is 62.5% than non-vegetarian group of children that is 51%. Prevalence of anemia is more in lower socioeconomic classes among these classes female children had more prevalence of anemia than males. Prevalence of anemia is more in children belonging to government school than private school. In total of 750 peripheral smears 452 are normocytic normochromic, 161 are normocytic hypochromic, 135 are microcytic hypochromic and 2 are dimorphic. All severe anemia smears are microcytic hypochromic.

### Comparison of data obtained from our study with other studies in India

The prevalence of Anemia in my study is almost equal to Verma et al<sup>8</sup> study. In Verma et al<sup>8</sup> the anemia was considered when Hb level was < 12 g/dl and in our study, anemia is considered when Hb level < 11.5g/dl (According to recent WHO guidelines).

The prevalence of anemia is more in females compared to males in my study as like in Verma et al study. Anemia is more prevalent in vegetarian group of children compared to non-vegetarian group of children as like in Verma et al<sup>8</sup> study. Prevalence of anemia decreases with improvement in socioeconomic status. The children included in our study were belonging to class III, Class IV and Class V only. In our study prevalence of anemia is more in class IV, must be because of more number of children in that group.

Comparison with Sundareshan et al Study - Tamilnadu in Sundareshan et al<sup>9</sup> study the age group of children included are 8-16 years compared to 6-12 years in our study. The Prevalence of anemia is nearly equal in both studies. In Sundareshan et al<sup>9</sup> study prevalence of anemia is more in females, which the same happened in my study.

Comparison with Sethi V et al<sup>10</sup> Study – Delhi A -study of 393 children reported the prevalence of 66.4% anemia amongst primary school children (6-11 years) in the national capital territory of Delhi.

The variations in the prevalence of anemia could be explained on the basis of Heterogeneity of the studied population, dietary habits, different nutritional status and incidence of worm infestation in a defined geographical area.

### Comparison with worldwide study – WHO global data based study<sup>11</sup>

According to WHO study prevalence of anemia in school children was 33%. The prevalence of anemia in our study is more than the prevalence of anaemia by WHO worldwide study in school children.<sup>11</sup> The reason may be that we have included both Government and private school children of urban area in Hyderabad but WHO prevalence of Anemia

which has included children worldwide developed as well as developing countries, cities as well as rural areas, slums as well as affluent society. Overall prevalence of anemia in school children of 6-12 years in urban Hyderabad was found to be 53.6%, which is of severe public health magnitude according to WHO. Similar prevalence was reported by Verma et al,<sup>8</sup> Sundareshan et al,<sup>9</sup> Rupali et al<sup>10</sup> from different parts of India in school children. It is evident from our study that a significant proportion of apparently healthy children suffer from anemia. That may be due to faulty habits of consumption of poor quality diet and rising trend of consuming snack and junk food. Which have lack of iron and other micronutrients. Prevalence of anemia is significantly higher in girls when compared to boys, similar to other studies. This may be due to customs and believes in the families to provide nutritious food to boys than girls. And may be due to hormonal changes which occurs at the time of onset of menarche and loss of menstrual blood in girls who already attained menarche. Prevalence of anemia is significantly higher in vegetarian group of children this is due to poor bioavailability of dietary iron coupled with low intake of haem iron derived from animal food, low intake of green leafy vegetables and dairy products. Major components of diet in developing countries like India are cereals and roots which are not favorable for iron absorption as compared with meat and fish. The frequency and amount of consumption of non-vegetarian food among the included population in quiet less as greater number of lower socioeconomic status children were included in my study. The study in Riyadh (Saudi) proved that frequent eating of red meat reduced the risk of anemia. The low prevalence of anemia in north America may be attributed to the fortification of iron in most of the available foods there.<sup>12</sup> The additional factor that may contribute to anemia in my study could be intestinal parasites, vitamin B12 and folate deficiency, low intake of vitamin C (Useful for iron absorption).

## CONCLUSION

Anaemia is still a major health problem in our country. Childhood anaemia still continues to be a significant public health problem in school children between 6-12 years. Total of 750 cases were studied in the age group of 6-12 years. 54.9% were male children, 45.1% were female children. The prevalence of anaemia in children of 6-12 years age was 53.6%. Anaemia was seen in 46% of males and 62.4% of females studied. The prevalence of anaemia was more in vegetarian group compared to the non vegetarian group according to our study. The prevalence of anaemia in children belonging to lower socio economic status is more than higher socioeconomic status. Female children had higher prevalence of anaemia in all socioeconomic classes. Prevalence of anaemia is more among government school children compared to private school children. In anemic children, most of them have moderate grade anemia. we recommend deworming as a routine for at risk and diagnosed individuals. Government policies should be made to fortify iron with flour, salt, oil etc., in order to tackle the problem of

anemia at gross root level.

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