International Journal of Contemporary Pediatrics
*Reddy BA et al. Int J Contemp Pediatr. 2018 Jul;5(4):1431-1435*
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20182541

**Original Research Article**

# Prevalence and types of anemia among children at a tertiary care hospital

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**Received:** 25 March 2018
**Accepted:** 27 April 2018

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## ABSTRACT

**Background:** The anemic children tend to have average or below average academic performance due to effect of anemia on cognitive and behavioral aspect of the child. The objective of the study is to study prevalence and types of anemia among children at a tertiary care hospital.
**Methods:** A total of 6000 patients attended the outpatient department of the SVS hospital, Mahabubnagar during the study period. Out of them 1237 patients were pediatric patients who attended the pediatric outpatient department. Among these 1237 children, 823 children were found anemic. Among these 823 anemic children, 100 were randomly included in the present study for further investigations. Thus, final sample size of the present study was randomly selected 100 anemic children.
**Results:** The incidence of anemia was found to be very high i.e. 66.5%. It was found that the prevalence of anemia was 60.9% among females compared to only 39.1% among male children. The prevalence of anemia was significantly higher in females compared to males. In both males and females, the iron deficiency anemia was the most common type of anemia found in the present study. Maximum prevalence of iron deficiency anemia was seen in 1-5 years of age in females. Maximum prevalence of iron deficiency anemia was seen in 1-5 years of age in males. The most common grade of anemia was moderate grade followed by mild.
**Conclusions:** Iron deficiency anemia is more prevalent in female children. In males also, it is not found to be very low. Its prevalence in males is also noticeable.

**Keywords:** Anemia, Deficiency prevalence, Morbidity

## INTRODUCTION

Anemia is widely common health problem. It affects both the sexes and all age groups more so in females. It is widely prevalent in both the developed as well as developing countries and more so in the developing countries. Almost around 3.5 billion populations are estimated to be suffering from varying degrees of anemia all over the world.[1]

But the prevalence of anemia in developed or industrialized world is significantly less as compared to the developing world. For example, as per World Health Organization the prevalence of anemia is only around 16% in Europe as compared to a whooping of around 64% in developing countries like Africa.[2]

Anemia affects the individual health in a variety of ways. It not only affects physical health and well-being of the child but also affects the mental development of the child as well as damages the development socially. The anemic children tend to have average or below average academic performance due to effect of anemia on cognitive and behavioral aspect of the child. Anemia during childhood also has future consequences which can hamper the work

capacity in their adult life.[3] "National nutritional anemia prophylaxis programme" was started by Government of India to overcome the problem of anemia in vulnerable groups. These vulnerable groups are under 11 children, adolescent girls, pregnant women and lactating women. They are vulnerable groups as the prevalence of anemia is the highest in these groups compared to other groups in the India population. They are given iron and folic acid tablets through Anganwadi centres and primary health centres and sub centres. The adult dose of iron and folic acid tablet is 100 mg of elemental iron and 0.5 mg of folic acid.[4]

The most common cause of anemia in children is having an anemic mother. Second most common cause of anemia in children is poor diet which is deficient of iron and other essential nutrients. Poor absorption from gut due to presence of oxalates and phytates in the vegetarian diet also leads to the occurrence of anemia among children. Anemia due to loss of blood is very rare cause of anemia in the children. But worm infestation is not so rare. All these lead to significant magnitude of anemia among children. The most common type of anemia is iron deficiency anemia in more than 80% of the children in India. Folate deficiency anemia and megaloblastic anemia occupy the lower places after iron deficiency anemia in children. Hence prevention is also simple and cost effective. But looking at the vast population of children and pregnant women in India its implementation is not so easy. Poverty and low income makes it impossible for people to have balanced diets. Both sufficiency and quality of diet lacks in countries like India. Even then Government and various non-governmental organizations and some institutions are well engaged in tackling this problem. Simple measures like anemia screening of pregnant women and supplementation of iron and folic acid tablets during pregnancy, regular de-worming for children, health education on well balanced diets, supplementary nutrition programs are some efforts directed in this direction.[5]

Present study is an attempt to study the prevalence and types of anemia among children attending outpatient department of tertiary care hospital and make them aware about prevention of anemia.

## METHODS

***Study design***: A Hospital based cross sectional study

***Sample size***

A total of 6000 patients attended the outpatient department of the SVS hospital, Mahabubnagar during the study period. Out of them 1237 patients were pediatric patients who attended the pediatric outpatient department. Among these 1237 children, 823 children were found anemic. Among these 823 anemic children, 100 were randomly included in the present study for further investigations. Thus, final sample size of the present study was randomly selected 100 anemic children.

The present study was carried out from May 2016 to June 2017 at the department of Pediatrics, SVS Hospital, Mahabubnagar. Written informed consent was obtained from parent of each child after detailed explanation of the purpose of the study.

***Inclusion criteria***

- All children aged 1-15 years with anemia

***Exclusion criteria***

- Children less than 1 year.
- Children more than 15 years.
- Prior iron therapy and blood transfusion in the preceding 3 months.
- Preexisting abnormal neurological status.
- Children on oral hematinics

Children were screened by history and clinical examination for pallor. Children who were pale were investigated. 6-8 ml of blood was drawn by vene puncture for complete hemogram and iron studies.

***Investigations***

Blood count performed on an automated blood cell counter (sysmex K 1000/SF 3000) including Hemoglobin (Hb), packed cell volume (PCV), Mean corpuscular volume (MCV), Mean corpuscular hemoglobin concentration (MCHC), Reticulocyte count. Iron stores were evaluated by serum iron, ferritin, and total iron binding capacity (TIBC). Serum iron and TIBC were estimated by established method. Serum ferritin was determined by ELISA (Organtec GmbH, Germany).

Other investigations include estimation of serum B12, folic acid in case of megaloblastic anemia and bone marrow examination in case of unexplained anemia where all cell lines are decreased and to rule out malignancies. Hb electrophoresis was done in case of hemolytic anemia.

In some cases, to know the cause other special investigations like upper gastrointestinal endoscopy, tissue biopsies and imaging studies are done.

The essential parameters for definition of iron deficiency anemia included Hb <11 gm/dl, MCV <70 fl and microcytic hypochromic red cells.

In addition, ≥1 of the following 3 lab criteria have to be fulfilled

- Serum iron <60 mcg/dl
- Serum ferritin <7 ng/ml or
- TIBC > 400 mcg/dl

- Severity of anemia was based on WHO criteria
- Mild anemia –Hb 10.1-10.9 gm/dl
- Moderate anemia -7.1-10 gm/dl
- Severe anemia - ≤7 gm/dl

Each iron deficient child was matched with iron sufficient child of same age and sex.

## RESULTS

Table 1 shows incidence of anemia in the present study. During the study period, a total of 1237 children attended the pediatric outpatient department. The incidence of anemia was found to be very high i.e. 66.5%.

**Table 1: Incidence of anemia in the present study.**

| Anemia | Number | Percentage |
|---|---|---|
| Yes | 823 | 66.5 |
| No | 414 | 33.5 |
| Total | 1237 | 100 |

Table 2 shows sex wise distribution of anemic children. It was found that the prevalence of anemia was 60.9% among females compared to only 39.1% among male children. With chi square value of 4.235 and p value of 0.01980, the prevalence of anemia was significantly higher in females compared to males. This may be due to negligence towards nutrition of the female child in the families.

**Table 2: Sex wise distribution of anemic children.**

| Sex | Anemia | | Total |
|---|---|---|---|
| | Yes | No | |
| | Number (%) | Number (%) | Number (%) |
| Male | 322 (39.1) | 188 (45.4) | 510 (41.3) |
| Female | 501 (60.9) | 226 (54.5) | 727 (58.7) |
| Total | 823 (66.5) | 414 (33.5) | 1237 (100) |

Table 3 shows distribution of study subjects as per the type of anemia. In both males and females, the iron deficiency anemia was the most common type of anemia found in the present study. This was followed by anemia due to blood loss in males and hemolytic anemia in females.

**Table 3: Distribution of study subjects as per the type of anemia.**

| Type of anemia | Male (%) | Female (%) |
|---|---|---|
| Iron deficiency anemia | 32 (78) | 48 (81.3) |
| Megaloblastic anemia | 02 (4.8) | 02 (3.4) |
| Anemia of chronic disease | 01 (2.4) | 03 (5.1) |
| Blood loss | 04 (9.7) | 02 (3.4) |
| Hemolytic anemia | 02 (4.8) | 04 (6.7) |
| Total | 41 (41) | 59 (59) |

Table 4 shows age wise distribution of iron deficiency anemia among females. Maximum prevalence of iron deficiency anemia was seen in 1-5 years of age in females. As the age increased, the prevalence of iron deficiency anemia decreased.

**Table 4: Age wise distribution of iron deficiency anemia among females.**

| Age group (years) | Number | Percentage |
|---|---|---|
| 1-5 | 19 | 32.2 |
| 6-10 | 17 | 28.9 |
| 11-15 | 12 | 20.3 |
| Total | 48 | 100 |

Table 5 shows age wise distribution of iron deficiency anemia among females. Maximum prevalence of iron deficiency anemia was seen in 1-5 years of age in males. As the age increased, the prevalence of iron deficiency anemia decreased.

**Table 5: Age wise distribution of iron deficiency anemia among males.**

| Age group (years) | Number | Percentage |
|---|---|---|
| 1-5 | 18 | 43.9 |
| 6-10 | 08 | 19.5 |
| 11-15 | 06 | 14.6 |
| Total | 32 | 100 |

Table 6 shows distribution of study subjects as per the grade of anemia. The most common grade of anemia was moderate grade followed by mild. Severe anemia was found in only 16% of the cases. Moderate grade of anemia was more pronounced in males than females whereas females have shown more prevalence of mild as well as severe grade of anemia.

**Table 6: Distribution of study subjects as per the grade of anemia.**

| Grade of anemia | Male | Female | Total |
|---|---|---|---|
| Mild | 06 (14.6) | 12 (20.3) | 18 (18) |
| Moderate | 30 (73.2) | 36 (61.01) | 66 (66) |
| Severe | 05 (12.2) | 11 (18.6) | 16 (16) |
| Total | 41 (41) | 59 (59) | 100 (100) |

## DISCUSSION

During the study period, a total of 1237 children attended the pediatric outpatient department. The incidence of anemia was found to be very high i.e. 66.5%. It was found that the prevalence of anemia was 60.9% among females compared to only 39.1% among male children. With chi square value of 4.235 and p value of 0.01980, the prevalence of anemia was significantly higher in females compared to males. This may be due to negligence towards nutrition of the female child in the families. In both males and females, the iron deficiency

anemia was the most common type of anemia found in the present study. This was followed by anemia due to blood loss in males and hemolytic anemia in females. Maximum prevalence of iron deficiency anemia was seen in 1-5 years of age in females. As the age increased, the prevalence of iron deficiency anemia decreased. Maximum prevalence of iron deficiency anemia was seen in 1-5 years of age in males. As the age increased, the prevalence of iron deficiency anemia decreased. The most common grade of anemia was moderate grade followed by mild. Severe anemia was found in only 16% of the cases. Moderate grade of anemia was more pronounced in males than females whereas females have shown more prevalence of mild as well as severe grade of anemia.

This study was undertaken to calculate the prevalence and to document the pattern of anemia in children aged 1-15 yrs. Among 100 cases included during the study period 66% had moderate anemia, 18% mild anemia, 16% had severe anemia. This percentage is comparable to study from PGI, Chandigarh which recorded mild, moderate and severe anemia in 14.3%, 71.4% and 14.3 % cases respectively. Mean age of children in this study is similar to the study done by Jain N et al.[6]

IDA was more common in females than males. This is similar to finding in previous studies by Gandhi S et al.[7] There is statistically significant difference in cognitive scores between males and females i.e. males have better scores than females. This difference in performance could be due to generalized nutritional deficit in females which is common and concomitant social factors. Iron deficiency is more common in female gender and will lead to high mortality as said in my present study which is similar to the study done by Muoneke VU conducted a cross-sectional study in Nigeria and revealed high mortality rates among under five children with severe anemia.[8] Coma, malnutrition, female gender, absence of blood transfusion was found to be associated with higher mortality in severe anemia.

Bhoite RM et al found that regular IFA supplementation and de-worming had beneficial effects on child growth, Hb level, and physical work capacity of school children.[9]

Gera T et al conducted a study on Iron supplementation for improving Mental Development and concluded that iron supplementation improves cognitive activity in children.[10]

Gilbert DL recently reported that children with ADHD have impaired cortical inhibition in response to transcranial magnetic stimulation that correlates with the severity of ADHD.[11]

Jain N et al conducted study in 2010 regarding prevalence of anemia in school children aged 5-16 years from government school of Rishikesh, Uttaranchal, India and found anemia in 51.5% of cases.[6] Most common blood picture was microcytic hypochromic and girl children were more anemic as compared to male children. Iron deficiency anemia was noted in 48.67% of children studied. In present study in children microcytic hypochromic anemia was found to be predominant type accounting for 84% with iron deficiency anemia being noted in 80% of cases. Sudhagandhi B et al found that prevalence of anemia among children was 52.88%. Anemia was more among females than males.[7] Present study corroborates with this study showing prevalence of anemia to be 66% in children with a higher prevalence of 69% in girls compared to 63% in boys.

Prevalence of anemia in girls found to be 69% in my study which is similar to the study done by Jondhale JP et al.[12]

In present study we found out that we were in agreement with study conducted by Balgir RS et al on nutritional status of the Ashram school tribal children in northern Orissa, who found very high prevalence of anemia ranging from 59 to 81%. Present study showed a prevalence of 66% of anemia in children.[13]

Vasanthi G et al found that rural dwellers had higher prevalence of iron deficiency anemia. Proper nutrition can reduce Iron deficiency anemia.[14]

Agarwal KN concluded that iron status improved in the group who were given the nutrition education. Awasthietal S concluded that the prevalence of iron deficiency anemia was high i.e. 70% in children aged 3-5 yrs in rural UP.[15,16]

## CONCLUSION

From this study we may conclude that iron plays a major role in child's nutrition status. Iron also plays a major role in cognition among children and cognition domains which are mainly affected are attention, concentration, and IQ. Severity of anemia has significant effect on cognition. Early identification of Iron deficiency anemia and iron supplementation may help in improving nutritional status and cognition domains in children. Iron deficiency anemia is more prevalent in female children. However due to a small group of cases studied and the study being a prevalence study further large randomized control studies considering all confounding variables are required before a definitive conclusion can be drawn.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Reddy BA, Chandra VS, Eluzai Z. Prevalence and types of anemia among children at a tertiary care hospital. Int J Contemp Pediatr 2018;5:1431-5.