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## An analytical study on presence of Anaemia in children aged 6 to 12 years and its responsible factors

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### Abstract

The most prevalent haematological condition affecting children is anaemia. The anaemia prevalence is highest in poorer nations. The goal of the current study was to determine the prevalence of childhood anaemia in Bhagalpur. 750 kids from public and private schools participated in this prospective research of schoolchildren from January 2022 to June 2022. Anaemia was more common in females, vegetarians, and kids from lower socioeconomic backgrounds. In conclusion, anaemia continues to be a serious health issue in our nation. Children in schools aged 6 to 12 still have a serious public health issue with childhood anaemia.

**Keywords:** Anaemia, low socioeconomic status, iron fortification

### Introduction

The most prevalent haematological disorder among children under the age of 18 is anaemia. The anaemia prevalence is highest in poorer nations. Both sexes and all age groups are affected by the widespread prevalence of anaemia in India.

Pregnant women (69%) and school-age children (33%), who make up the bulk of the afflicted populations, are the most impacted groups when the worldwide anaemia prevalence is studied for each physiological category using the WHO global statistics on anaemia.

nations like Bangladesh (74-80%), Indonesia (37-73%), and India (34-69%) have high rates. It has long been acknowledged as a significant issue in the majority of tropical nations. According to data from the WHO, 37% of school-aged children and roughly 30% of the world's population suffer from anaemia caused by iron deficiency. Numerous studies have noted a significant frequency of anaemia in Indian children, ranging from 27% to 90%. Economic position, ethnic traditions, and geographic considerations are the main environmental factors that have an impact on nutrition and may be used to explain community disparities in anaemia prevalence.

International organisations including WHO, UNICEF, NFHS, the Government of India, and other NGO's agencies have made reducing the prevalence of anaemia a top priority because to the long-lasting and perhaps irreversible effects it may have on children. Iron fortification, the usage of iron supplements, deworming of schoolchildren, the midday meal programme, and nutrition education are some of the measures that were used to accomplish this aim, although it has not yet been fully realised.

With the aims of determining the prevalence of anaemia in school-aged children, examining the relationship between socioeconomic status (SES) and anaemia, and describing the relationship between dietary habits and anaemia, the study sought to understand these relationships.

### Method and Materials

In order to conduct this prospective research on schoolchildren, which took place between January 2022 to June 2022, schools were chosen that were both government-run and close to our hospital, where our hospital conducts annual health checks.

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### Data Source

A minimum of 125 enrolled students in both government and private schools between the ages of 6 and 12 were chosen. From first to seventh grade, students from each school were chosen. Using class roll numbers, 20 or so kids were randomly chosen from each class. The schools were visited informally, and the head teachers gave the kids instructions on how to get their parents' approval. The research only included kids whose parents gave their permission.

### Inclusion standards

Boys and girls in the age range of 6 to 12 years old who attend school.

### Exclusion standards

The study excludes children who are less than 6 years old and older than 12 years old. Children who are unwell in any way are excluded from the research. The essential information provided by the parents or guardians and a thorough physical examination served as the basis for the exclusion criteria.

### Data Collection Procedure

After getting permission from parents and instructors at their children's schools, about 750 kids were enrolled in the research. Two private institutions and four government schools were chosen. The formula  $(1.96) 2P(1-P)/(0.05)$  was used to determine sample size. The intended sample size was 384 when the prevalence of anaemia was assumed to be 50% and the 95% confidence range. The sample size was 461 when the non-response rate was 20%. To reduce the possibility of presumptive mistakes, more samples were gathered than necessary. Written permission from the parents and the school administration, which was also authorised by the ethical committee, was acquired. To gather information about the children's food habits, socioeconomic position of the parents, and health information, a preplanned questionnaire was employed.

For each child, a thorough physical checkup was conducted. A venous blood sample from each kid was taken for haematological analysis while adhering to rigorous aseptic guidelines. The cyanmethemoglobin technique was used to estimate haemoglobin (Hb). A vial containing 5ml of newly prepared, standardised Drabkin's solution was filled with 20 microliters of anticoagulated blood. To mix the fluid, this was turned upside down numerous times. The solution was read in a spectro-photometer at 540 nm after it had been left to stand for 10 minutes, and anaemia was graded based on haemoglobin levels in accordance with recent WHO recommendations. All of the kids had peripheral blood smear tests done. Leishman's stain discoloured the peripheral smear. Red cell abnormalities in terms of morphology and staining were seen. White blood cell and platelet morphologies, as well as distribution, anisocytosis, and poikilocytosis, were seen. Reporting was done by Pathologist. According to latest WHO guidelines anemia was taken  $HB < 11.5$  gm/dl. And mild anemia  $HB 11 - 11.4$  gm/dl, moderate  $8 - 10.9$  gm/dl and severe  $HB < 8$  gm/dl.

### Statistical Analysis

Windostat 9.2 was used to reanalyze the data that had been acquired. This Chi square test and an ANOVA were conducted.

### Results

There were 750 total cases evaluated, of which 54.9% were

men and 45.1% were women. The kids attended both public and private schools. The school records were used to verify each child's age. Parents gave informed permission by accepting the offer of health camps after informed consent was obtained from the principals.

According to Table 1, out of 750 pupils, 348 (46.4%) did not have anaemia, and 402 (53.6%) had, having a Hb value of less than 11.5 g/dl. Out of 402 students, 146 (19.5%) had mild anaemia, 244 (32.5%) had moderate anaemia, and 12 (1.6%) had severe anaemia.

According to table 2, there is no statistically significant relationship between socioeconomic class and sex ( $p > 0.05$ ). According to a modified version of Kuppaswamy's classification, the kids in our research belonged to classes III, IV, and V. From the school records, information on socioeconomic status was gathered. It was shown that there was no statistically significant relationship between social economic position and diet ( $p > 0.05$ ). 171 (22.8%) of the 750 children were true vegetarians, whereas 579 (77.2%) of the youngsters enjoyed a mixed (non-vegetarian) diet.

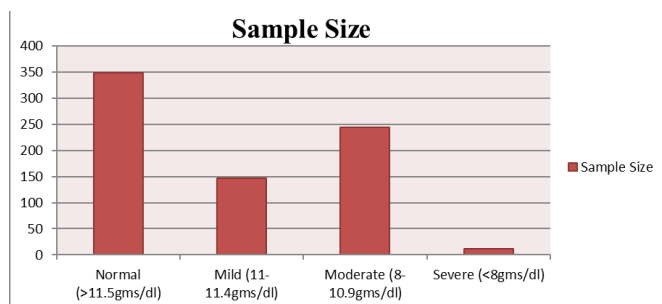
According to WHO guidelines, anaemia was taken into account in this study when haemoglobin levels for both male and female children aged 6 to 12 were less than 11.5 gm%. 53.6% of children aged 6 to 12 years had anaemia overall. In the study group, anaemia was found in 46.6% of the men and 62.4% of the women. Girls were more likely than boys to have anaemia. The significance of this was statistical.

According to table 3, there was statistically significant correlation between the incidence of anaemia in diet and sex. Men (47.4%) and women (74.7%) who are vegetarians are more likely to have anaemia. Males (46.1%) and females (57.6%) who are non-vegetarians have a high prevalence of anaemia. Compared to the non-vegetarian group of children (51%), the vegetarian group of children (62.5%) had a higher prevalence of anaemia.

The frequency of anaemia in SES and sex were shown to be statistically unrelated, according to table 4. According to the modified Kuppaswamy classification, children in class III had a lower prevalence of anaemia than those in class IV and class V. The socioeconomic level significantly affects the likelihood of anaemia. Anaemia was present in 69.2% of female children and 34.6% of male children in class III socioeconomic category. Compared to 48.4% of male children, anaemia affected 61.7% of female children.

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

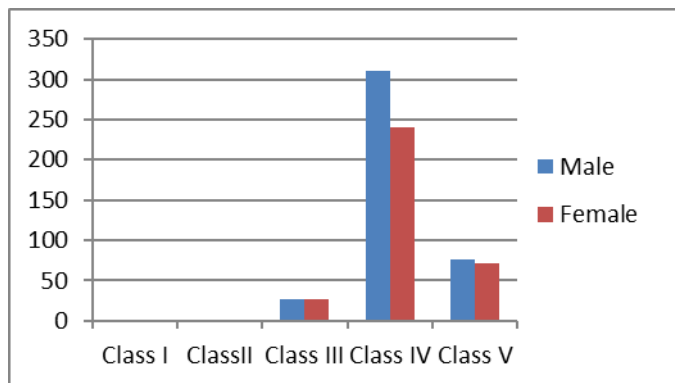
Grade	Total
Normal ( $>11.5$ gms/dl)	348 (46.4%)
Mild (11-11.4gms/dl)	146 (19.5%)
Moderate (8-10.9gms/dl)	244 (32.5%)
Severe ( $<8$ gms/dl)	12 (1.6%)



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

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

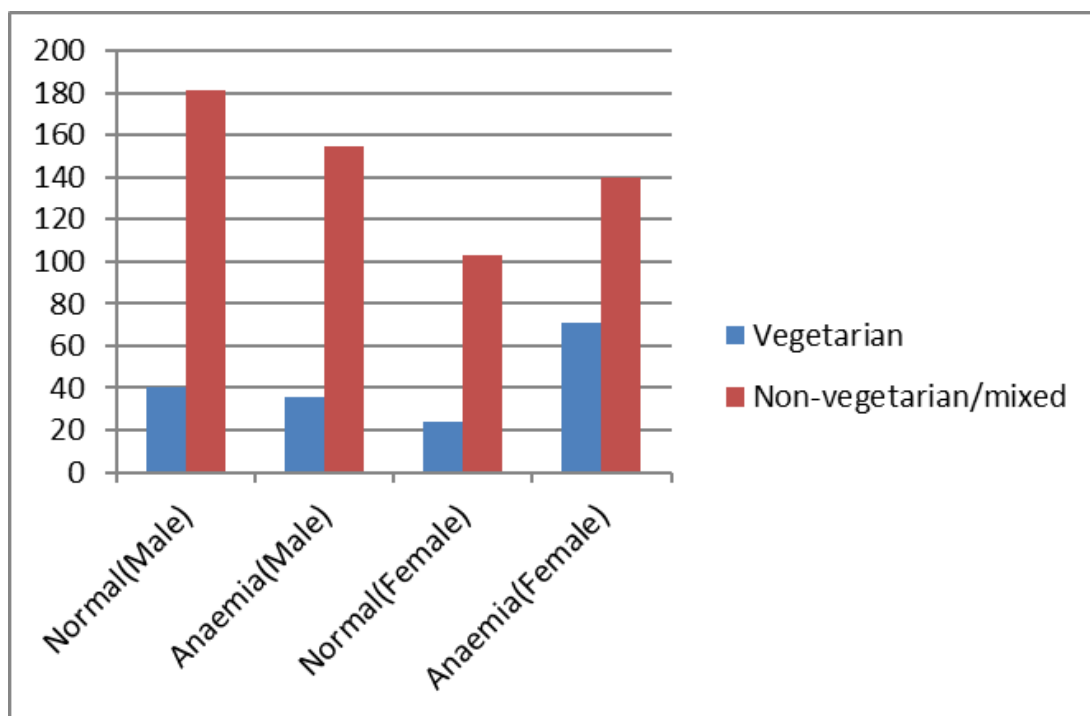
SES	Sex		Total
	Male	Female	
Class I	0	0	0
ClassII	0	0	0
Class III	26 (6.3)	26 (7.7)	52 (6.9)
Class IV	310 (75.2)	240 (71.0)	550 (73.3)
Class V	76 (18.5)	72 (21.3)	148 (19.7)
Total	412 (100.0)	338 (100.0)	750 (100.0)



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

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

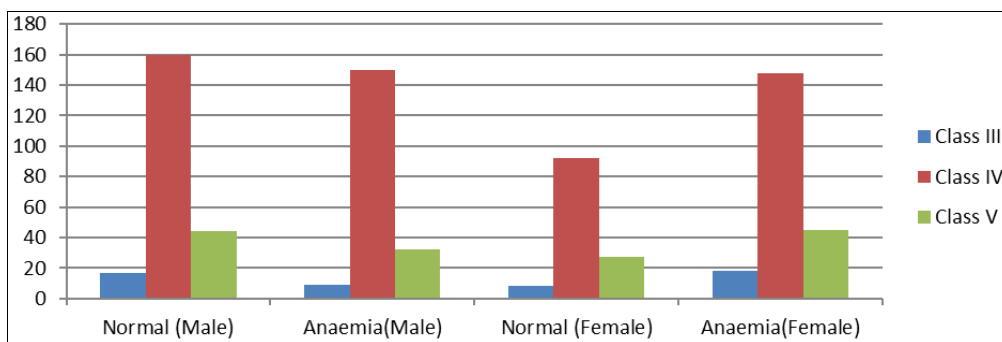
Diet	Male			Female			Prevalence in %
	Normal	Anaemia	Total	Normal	Anaemia	Total	
Vegetarian	40(52.6)	36(47.4)	76(100)	24(25.3)	71(74.7)	95(100)	62.5
Non-vegetarian/mixed	181(53.9)	155(46.1)	336(100)	103(42.4)	140(57.6)	243 (100)	51
total	221(53.6)	191(46.4)	412(100)	127(37.6)	211 (62.4)	338 (100)	



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

**Table 4:** Prevalence of anaemia cases according to SES 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



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

A total of 750 patients were examined; of these, 452 (or 60.3%) had a normal cytic normochromic (NN) image, 161 (or 21.5%), a normal cytic hypochromic (NH) picture, 135 (or 18.0%), a microcytic hypochromic (MH) picture, and 2 (or 0.3%), a dimorphic anaemia picture. 44 (9.7%) of the 452 normocytic normochromic individuals had moderate anaemia, 77 (17%) had mild anaemia, and 331 (73%) had no anaemia. 49 (30.4%) of the 161 Normocytichypochromic patients had moderate anaemia, whereas 14 (or 8.7%) had no anaemia. 98 people (60.9%) had mild anaemia. Of the 135 microcytic hypochromic patients, 3 (2.2%) had no anaemia, 20 (14.8%) had a light case, 100 (74%) had a moderate case, and 12 (8.1%) had a severe case. Two kids who had significant anaemia displayed dimorphic images.

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 goal of the current study was to determine the prevalence of anaemia in school-age children as well as the relationship between anaemia and different lifestyle choices, including food, sex, and socioeconomic position.

This prospective study was carried out between January 2022 to June 2022. There were 750 kids studied in total. During medical and health camps, kids from both government (four) and private (two) schools were chosen at random. In my research, which focused on school-age children between the ages of 6 and 12, the total frequency of anaemia was 53.6%. Anemia is more common in men (46%), as it is in women (62.4%). It is statistically significant that this frequency is higher in female children than male children in the 6 to 12 year age range. Anemia is more common in the 62.5% vegetarian group of children compared to the 51% non-vegetarian group of children. Anemia is more common in lower socioeconomic levels, and among children in these classes, females were more likely than men to be anaemic. Children attending public schools had a higher frequency of

anaemia than those attending private schools. There are 750 peripheral smears in all, of which 452 are normocytic normochromic, 161 normocytic hypochromic, 135 microcytic hypochromic, and 2 dimorphic. Microcytic hypochromic smears characterize all severe anemias.

## 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.* [8] study. In Verma *et al.* [8] 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).

In my study, like in Verma *et al.* study, anaemia was more common in females than in males. According to the Verma *et al.* [8] study, anaemia is more common in vegetarian children than in non-vegetarian children. The prevalence of anaemia declines as socioeconomic level rises. The only classes represented by the kids in our study were Class III, Class IV, and Class V. Because there are more children in class IV in our research, there is a higher prevalence of anaemia there.

Comparing our study to Sundareshan *et al.* study on Tamilnadu, where the age range of the children included was 8–16 years as opposed to our study's range of 6–12 years. In both studies, the prevalence of anaemia is essentially the same. In Sundareshan *et al.* [9] study, anaemia prevalence was higher in females, which also occurred in my study.

Comparison with Delhi's Sethi V *et al.* [10] Study Anemia was found to be prevalent in elementary school students (6 to 11 years old) in Delhi, the nation's capital, in 66.4% of cases, according to a research including 393 kids.

The heterogeneity of the investigated population, dietary practises, varying nutritional status, and incidence of worm infestation in a certain geographic location can all be used to explain variances in anaemia prevalence.

## Comparative analysis with the WHO global data-based research

33% of school-age children had anaemia, according to a WHO survey. In our study, anaemia was more common than it was in the WHO survey of schoolchildren throughout the world. The cause may be because whereas the WHO prevalence of anaemia included children globally from developed and developing nations, cities and rural regions, slums and wealthy society, we only included students from Government and Private schools in Hyderabad's metropolitan area. 53.6% of urban Hyderabad schoolchildren aged 6 to 12 had anaemia overall, which the WHO considers to be a serious public health issue.

Verma *et al.*, Sundareshan *et al.*, and Rupali *et al.* from various regions of India observed similar incidence among school-aged children. Our study clearly shows that a sizable

percentage of youngsters who appear healthy really have anaemia. This could be a result of bad eating habits, a rise in the intake of junk food, and unhealthy snacking behaviors, which are deficient in micronutrients like iron. Similar to earlier research, girls had a much greater prevalence of anaemia than boys. This may be because families traditionally provide boys more nourishing food than they do girls, according to norms and beliefs. In addition, menstrual blood loss in girls who have already reached menarche may be caused by hormonal changes that occur around the time of menarche's commencement. Children who are vegetarians have a much greater prevalence of anaemia, which is caused by reduced intakes of dairy products, green leafy vegetables, and haem iron obtained from animal foods, as well as poor dietary iron bioavailability. Cereals and roots, which are more prevalent in poor nations like India but are less conducive to iron absorption than meat and fish, make up a large portion of the diet.

As more kids from lower socioeconomic backgrounds were added in my study, the frequency and volume of non-vegetarian food intake among the included group decreased significantly. Red meat consumption regularly lowers the risk of anaemia, according to a Riyadh (Saudi Arabia) research. The fortification of iron in the majority of the regional foods may be responsible for North America's low frequency of anaemia. 12 Intestinal parasites, vitamin B12 and folate insufficiency, inadequate vitamin C consumption, and other factors may also lead to anaemia in my research (Useful for iron absorption). **CONCLUSION**

In our nation, anaemia continues to be a serious health concern. Children in schools aged 6 to 12 still have a severe public health issue with childhood anaemia. The age range of 6 to 12 years was evaluated in a total of 750 cases. 45.1% of children were female, while 54.9% were boys. Children aged 6 to 12 years had a 53.6% anaemia prevalence. In the study, anaemia was present in 46.6% of the men and 62.4% of the women. According to our study, the prevalence of anaemia was higher in the vegetarian group than the non-vegetarian group. Children from lower socioeconomic class are more likely to have anaemia than children from higher socioeconomic status. Among all socioeconomic sectors, anaemia was more common in young girls. Compared to students in private schools, government school students had a higher prevalence of anaemia. Most children who are anaemic have moderate-grade anaemia. For those who are diagnosed and at risk, we advise regular deworming. To address the issue of anaemia at the gross root level, government measures should be developed to reinforce iron with wheat, salt, oil, and other foods.

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