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PREVALENCE OF ANEMIA IN RURAL AREAS CHILDREN OF VARANASI DISTRICT, UTTAR PRADESH

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ABSTRACT: Anemia is a global public health problem affecting both developing and developed countries which is an indicator of poor nutrition and poor health with major consequences for human health, as well as for the social and economic development of a population. Anemia is a common problem throughout the world and iron deficiency is the most prevalent nutritional deficiency in the world. It affects mainly the poorest segment of the population. The study aims to assess the prevalence of anemia among rural areas school-going children in Varanasi district, India. This study was conducted among rural areas school children of Varanasi district, Uttar Pradesh, India. Total 246 children, aged 6-16 years, were selected through a single-stage cluster sampling method. The students and school authorities were assured of the confidentiality of their responses. The analysis of the obtained data was based on the objective of the study. Descriptive and inferential statistics were used for data analysis and data interpretation. Results of the study revealed that 37.4% of the samples are males and 62.6% of the samples are female, and out of males 38% males were anemic and out of females 70% females were anemic. The overall incidence of anemia amongst females and males was found to be 58%. In developing countries, the prevalence of anemia tends to be three to four times higher than in developed countries. Hence, improvement in dietary habits related to the consumption of green leafy vegetables should be included in the diet plan. Health education, seminars on menstrual hygiene, and Iron Folic Acid supplementation should be conducted at regular intervals.

Keywords: Anemia, Prevalence, Hemoglobin, Anthropometry.

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1. INTRODUCTION

Anemia (from the ancient Greek, anemia meaning ‘lack of blood’) is defined by a decrease in the total amount of hemoglobin or the number of red blood cells [1]. Iron deficiency anemia is a form of anemia due to the lack of sufficient iron to form normal red blood cells. Iron deficiency anemia is typically caused by inadequate intake of iron, chronic blood loss, or a combination of both. It is the most common cause of anemia in the world [2-6]. Iron deficiency results in anemia, impaired neurobehavioral performance, and decreased physical work capacity. In iron deficiency, there are no mobilizable iron stores, and in which signs of a compromised supply of iron to the tissues including the erythron are noted. The more severe stage of iron deficiency is associated with anemia. Because anemia is the most common indicator to screen iron deficiency the terms anemia and iron deficiency anemia are sometimes used interchangeably [7]. Anemia is a global public health problem that affects both developing and developed countries and it is an indicator of poor nutrition and poor health with major consequences for human health, as well as for the social and economic development of a population [8-12]. Globally, anemia affects 1.62 billion people, which corresponds to 24.8% of the population [13]. Anemia is one of India's most common health problems, which is much more prevalent in the rural than in the urban areas [14-15]. Anemia is a nutrition problem worldwide and its prevalence is higher in developing countries when compared to developed countries [16-17]. Young children and pregnant women are the most affected, with an estimated global prevalence of 43% and 51% respectively [18]. Anemia prevalence among children of school-going age is 37.70%, among non-pregnant women 35%, and among adult males 18% [19]. Anemia was defined according to World Health Organization (WHO) cut-offs as Hb level <12 mg/dl for children under 16 years old. Mild anemia was defined as a hemoglobin level of 11-11.9 mg/dl, moderate anemia was defined as hemoglobin ranges from 8-10.9 mg/dl, and severe anemia as hemoglobin less than 8 mg/dl [20]. Numerous studies among children have shown that the prevalence of anemia ranges from 52% - 96% in India. Iron Folic Acid supplementation remains the main strategy for combating anemia and improving the hemoglobin status of young children and nutritional supplements are a complementary strategy to improve it. The most important way to prevent anemia is to take a good diet rich in iron. Adding vitamin C or foods rich in vitamin C should also be provided for children, which can improve the absorption of

iron. The main objective of this study is to evaluate the incidence and prevalence of anemia in rural areas school children of Varanasi district, Uttar Pradesh

2. MATERIALS AND METHODS

Study Design

The study was carried out within the rural region school of the Kashi-Vidyapeeth block of Varanasi district, Uttar Pradesh, India. The overall 246 school children from age 06 to 16 years were chosen as a portion of our study. According to Charan J et al, the test estimate was calculated for our study design. The choice of study subjects was based on the single-stage cluster sampling method. Written informed consent was obtained from the parent/guardian and head of the school authorities. The study protocol and techniques were reviewed and endorsed by the institutional ethical committee of Banaras Hindu University, Varanasi.

Inclusion Criteria

- School children of both gender age range 06 to 16 years were included in the study.

Exclusion criteria

- Not willing to participate/ give written consent.
- Having any history of medical illness or drug history which influences the data.
- Age below 6 years and above 16 years were excluded from our study

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

Experimental study

Schools of rural areas of Kashi-Vidyapeeth block are screened and randomly a school has been selected for our study. Prior taken permission for the health camp in the school premises. All the participants and their parents/guardians and head of the school authorities were informed and explained the aim of our study. The written informed consent was taken for willingness to participate in the health camp. All the participants were physically examined to rule out the pallor status, any history of medical illness, all the information were filled in the pre-prepared case-sheet proforma containing history and symptom of pandu-roga (Anemia) anthropometry (Height and Weight) for BMI was calculated for the growth chart, family history for socioeconomic status, drug history, diet history for nutritional status and personal hygiene. All the participants were encouraged to provide their blood samples for the related study. Each participant's height and weight were taken by using a standard height and weight scale and the history of food which they take in their daily life were noted. Under strict aseptic precaution, the venous blood sample was collected from the participant and transferred into the EDTA (Ethylene Di-amine Tetra-acetate) anticoagulant containing vial for analysis of hematological parameter to assess anemia. A tongue-shaped blood film was prepared on a glass slide which was stained by the Leishman stain (Ramanowsky stain) to perform the General Blood Picture (GBP) for the morphology of the blood

Statistical analysis

All the data were entered in Microsoft excel and exported to SPSS software statistical tool version 20 for further analysis. Descriptive statistics were used to express mean \pm SD, Chi square test were done for compare proportion and p value < 0.05 was used for statistical significance.

3. RESULTS AND DISCUSSION

Two hundred forty-six school children were screened for anemia. Out of them, 37.4% are boys and 62.6% are girls **Table - 1**. The study has been performed in the school-going children of rural areas aged from 6 – 16 years.

Table 1: Gender wise distribution of study participants (n=246)

Study Participants	Total subjects	Percentage %
Male	92	37.4
Female	154	62.6
Total	246	100

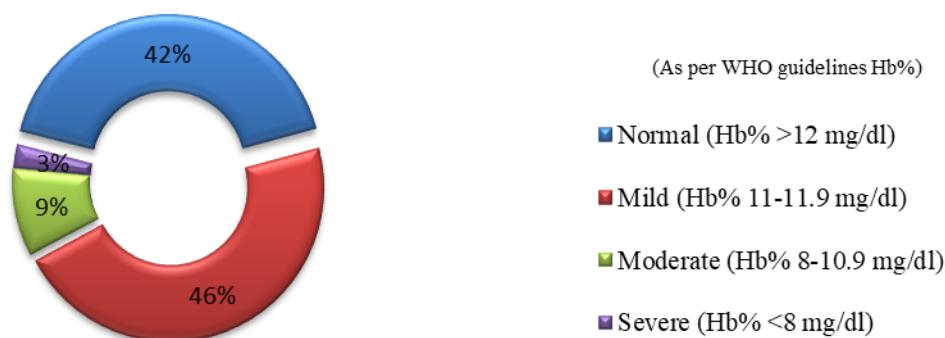
As per WHO recommended guidelines, when Hb% (hemoglobin) is less than 12mg/dl is considered as anemia. The blood samples were screened for Hb% to evaluate the anemia. It has been observed that the prevalence of anemia is 38 % in the male group and 70 % in female participants. Overall the prevalence of anemia in our studied subject was found to be 58 % (**Table-2**).

Table 2: Prevalence of anemia in school children

Anemia	Male n=92		Female n=154		Total n=246	
	No.	%	No.	%	No.	%
Present	35	38	108	70	143	58
Absent	57	62	46	30	103	42
Total	92	100	154	100	246	100

Table - 2 shows the variations among the male and female populations in our study where females are more prevalent than males.

As per WHO guidelines, grading of anemia in our study showed 42% healthy and normal participants with Hb% >12 mg/dl, and 58% were found to be anemic. Out of anemic subjects, 46% participants have a mild grade of anemia (Hb% ranges from 11mg/dl to 11.9 mg/dl) while 9% showed moderate anemia (Hb% was 8mg/dl to 10.9 mg/dl), and the severity of anemia was found to be 3% (Hb% < 8 mg/dl) Fig.1.

Fig.1 Grading of Anemia in the study cohort

The stained slides were focused under the microscope at 40x to observe the Red Blood Cells morphology and interpretation was done with normocytic normochromic, normocytic hypochromic, and microcytic hypochromic.

Table 3: Morphological study of the Red Blood Cell in study subject (n=246)

GENDER	Morphology of RBC			Total
	Normocytic Normochromic	Normocytic Hypochromic	Microcytic Hypochromic	
Male (n=92)	69(75%)	19(20%)	4(5%)	92 (100%)
Female (n=154)	64(41%)	56(36%)	34(23%)	154 (100%)
Total (n=246)	133(54%)	75(30%)	38(16%)	246 (100%)

Out of males, 75% were having normocytic normochromic (NN) while 20% and 5% were having normocytic hypochromic (NH) and microcytic hypochromic (MH) cellular morphology respectively. When compared to females the ratio was increased of the affected proportion 36% in normocytic hypochromic and 23% in microcytic hypochromic. It shows that severity was higher in females as compared to males. However, when all the population was taken the cumulative values are 54%, 30%, and 16% followed by NN, NH, MH respectively Table - 3.

Table 4: Factors correlated with the morphology of RBC (n=246)

Factors	Morphology of smear			Total
	NN	NH	MH	
Anemia	30 (12%)	75 (31%)	38 (15%)	143 (58%)
Normal	103 (42%)	0	0	103 (42%)
Total	133 (54%)	75 (31%)	38 (15%)	246 (100%)

In the normal group (Non-Anemic group) 42% were having normocytic normochromic, however in the anemic group 12% were normocytic normochromic, 31% were found to be normocytic hypochromic and 15% were microcytic hypochromic. Overall, the total study subjects, 54% were normocytic normochromic while 31% and 15% were normocytic hypochromic and microcytic

Table 5: Hematological Parameter of the study participants

Indices	Normal	Anemia	P – Value
	Mean±SD (n=103)	Mean±SD (n=143)	
Hb%	12.78±0.57	10.49±1.04	< 0.0001
RBC	4.81±0.25	3.81±0.46	< 0.0001
HCT	38.12±1.69	31.22±3.05	< 0.0001
MCV	82.33±5.83	79.35±3.60	< 0.0001
MCH	27.66±1.98	26.60±1.22	< 0.0001
MCHC	33.53±0.45	33.60±0.55	< 0.0001

As per **Table – 5** the mean Hemoglobin (Hb%), Red Blood Cells (RBC), Hematocrit (HCT), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), and Mean Corpuscular Hemoglobin Concentration (MCHC) were significantly lower among anemic subjects compared to normal subjects.

The present study was undertaken to know the prevalence of anemia among school-going children. A total of 246 children were selected randomly during medical health camps. In this study, anemia was considered when Hemoglobin was less than 12mg/dl for both boys and girls of 6-16 year's age based on WHO criteria. The overall prevalence of anemia in 6-16 years of age was 58%. Anemia was seen in 14% of males and 44% of females in the study group. The prevalence of anemia was more in girls than boys. This was statistically significant.

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

The prevalence of anemia in my study is almost similar to Jhansi Rani P et al [21]. In Jhansi Rani P et al the anemia was considered when Hb level was < 12 g/dl (According to recent WHO guidelines) same as in our study. The prevalence of anemia is more in girls compared to boys in our study as in Jhansi Rani P et al study. Comparison with Unnikrishnan SR et al [22] study age group of children was 10-16 years and in our study, we have taken children of age group 6-16. The Prevalence of anemia is nearly equal in both studies. In Unnikrishnan SR et al study prevalence of anemia is more in girls, which was the same as in our study. Similarly, the study was done by Rahman M.H.U. et al [23] where the age of children was 5-9 years, the prevalence of anemia is quite similar to our study.

The variations in the prevalence of anemia could be explained based on the Heterogeneity of the studied population, dietary habits, different nutritional statuses, and incidence of worm infestation in a defined geographical area. In grading of anemia the present study shows that the prevalence of mild grade anemia was higher with 46% moderate with 9% and severity with 3%. A study was conducted in kerala by John et al [24] the prevalence of mild grade of anemia was 51.2% moderate

with 43.9% and severity with 4.9% and similar study was done by Siva et al [25] the prevalence of mild grade anemia was 19.1% moderate with 1.9% and severity was not found.

Comparison with worldwide study – WHO global data-based study

According to WHO study, the prevalence of anemia in school-going children was 33%. The prevalence of anemia in our study is more than the prevalence of anemia by WHO worldwide study in school children [26]. WHO prevalence of anemia has included children worldwide developed as well as developing countries, cities as well as rural areas, slums as well as affluent society. The overall prevalence of anemia in school children of 6-16 years in the rural areas of Varanasi was found to be 58%, which is of severe public health magnitude according to WHO. A similar prevalence was reported by Jhansi Rani P et al, and Unnikrishnan SR et al study from different parts of India in school children. Our study shows 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. The prevalence of anemia is significantly higher in girls when compared to boys, similar to other studies [29-30]. This may be due to customs and believes in the families to provide nutritious food to boys than girls. And maybe due to hormonal changes which occur at the time of onset of menarche and loss of menstrual blood in girls who already attained menarche. 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 [27]. The additional factor that may contribute to anemia in our study could be intestinal parasites, vitamin B12 and folate deficiency, low intake of vitamin C (Useful for iron absorption).

4. CONCLUSION

Anemia is still prevalent among children in India and requires urgent attention. The study aimed at determining the prevalence of anemia with special reference to iron status. Childhood anemia still continues to be a significant public health problem in school children between 6-16 years. A total of 246 cases was studied in the age group of 6-16 years. 37.4% were boys and 62.6% were girls. The prevalence of anemia in children of 6-16 years of age was 58%. Anemia was seen in 14% of boys and 44% of girls studied. In anemic children, most of them have mild grade anemia. A combination of nutritional supplementation and food fortification programs, as well as maternal anemia reduction efforts with alleviation of family poverty, may translate into optimal improvement in the hemoglobin levels of the children. Government policies should be made to fortify iron with flour, salt, oil, etc., in order to tackle the problem of anemia at the grass-root level.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was taken from Institute Ethical Committee, Institute of Medical Sciences,

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Banaras Hindu University, Varanasi, Uttar Pradesh, India (No. Dean/2018/EC/851 dated
14.11.2018). Written informed consent was taken from each participant and their parents for
willingness to participate in the study.

HUMAN AND ANIMAL RIGHTS

Approved by Human Ethical Committee.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

The author confirms that the data supporting the findings of this research are available within the
article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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