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Artículos originales

Prevalencia de anemia en niños de la población rural del estado norteño de la India

Prevalence of Anemia in Children of Rural Population of Northern State of India

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Conflict of interests

The authors declare no conflict of interest.

Resumen

Introducción: India soporta la mayor carga de anemia, especialmente en niños y mujeres. Hay menos datos disponibles sobre la prevalencia de anemia en niños en crecimiento de 10 a 14 años. Es importante intervenir temprano y rastrear a este grupo. El objetivo del presente estudio fue estimar la prevalencia de anemia y su correlación con la edad, sexo e índice de masa corporal en niños del área rural de Ghaziabad, Uttar Pradesh, India.

Método: Se incluyó un total de 600 niños de entre 5 y 13 años. Se utilizó un cuestionario detallado para recopilar datos de salud de los niños y el estado socioeconómico de los padres. Se midió peso talla y se calculó el índice de masa corporal. Se midió la hemoglobina mediante analizador calibrado.

Resultados: La prevalencia de anemia según los estándares de la OMS en estos niños fue de 57,67%. Los resultados revelan que la anemia en esta región es más prevalente en las niñas (68%) en comparación con los niños (47,3%). Sin embargo, la asociación entre el índice de masa corporal y la hemoglobina no fue estadísticamente significativa en el presente estudio.

Conclusiones: Nuestros resultados sugieren que el aumento de la prevalencia de anemia en los niños del área rural está asociado con múltiples deficiencias de nutrientes. Las intervenciones nutricionales, la evaluación de los factores de riesgo predisponentes y una mayor cobertura del programa de suplementación son medidas recomendadas que se pueden adoptar para controlar la anemia en los niños.

Palabras clave: anemia, hemoglobina; índice de masa corporal; niños

Abstract

Introduction: India carries the highest burden of anemia, particularly in children and women. Children at the growing stage are at the risk of nutrition depletion, hence anemia. Fewer data are available on the prevalence of anemia in growing children of age 10-14 years. It is important to intervene early and track this group. The objective of the present study was to estimate the prevalence of anemia and its correlation to age, gender and body mass index in children of rural area of Ghaziabad, Uttar Pradesh, India.

Method: Total 600 children of 5-13 years age group were included in this study. A detailed questionnaire was used to collect the health details of the children and socioeconomic status of the parents. Hemoglobin was determined by the calibrated Hemoglobin analyzer. Body mass index values were calculated based on the measurements of weight and height of the children.

Results: Prevalence of anemia as per WHO standards in these children was 57.67%. Results of the study population reveal that anemia in this region is more prevalent in girls (68%) when compared to boys (47.3%). However, association between body mass index and hemoglobin was not statistically significant in the present study.

Conclusions: Our results suggest that increased prevalence of anemia in the children of rural area is associated with multiple nutrient deficiencies. Nutritional interventions, evaluation of predisposing risk factors and increased coverage of supplementation programme are recommended measures that can be adopted to control anemia in children.

Keywords: Anemia; hemoglobin; body mass index; child

Introducción

Anemia in children is one of the major health challenges with global impact, especially in developing countries.⁽¹⁾ Globally, anemia affects 1.62 billion people, almost 24.8% of the world population. The highest prevalence is in pre-school age children i.e. 47.4%. However, 25.4% of school age children suffer from anemia.⁽²⁾ A person is said to be anemic if there is less hemoglobin level as per age and sex. Iron deficiency is observed as main cause of anemia globally^(3,4) The other common causes of anemia are inadequate feeding, frequent infections, micronutrients deficiency and hemoglobinopathies.⁽⁵⁾ Few studies have indicated that anemia among school children of 7-14 years age group is also impacted by socioeconomic, nutritional, physical and life style factors.⁽⁶⁾ Intestinal parasitic infections and school non-enrollment were also identified as key factors responsible for anemia among young children.⁽⁷⁾ Anemia in children is a grave problem because it can lead to stunted growth, weakness, impaired cognitive development and other health complications if left untreated.⁽⁸⁾

According to WHO estimates, India is one of the countries with highest prevalence of anemia. Though the prevalence of anemia reduced by 10% during the time period between NFHS-3 (69.4%) and NFHS-4 (58.4%), but continued to be higher among rural children.⁽⁹⁾ Both malnutrition and anemia are frequently present together in pediatric populace of India.^(10,11) Anemia is considered to be late manifestation of nutritional deficiency. Severe malnutrition can be root cause of mortality among young kids aged 5-14 years old.⁽¹²⁾ Body Mass Index (BMI) has been used as indicator for measuring the malnutrition and to find the association of BMI with anemia.^(13,14)

There is need for localized studies to understand the prevalence pattern and associated risk factors among children in rural region of India. On this line, the current study was aimed to investigate the prevalence of anemia among children of 5-12 years' age group in rural areas of Ghaziabad district, Uttar Pradesh and an attempt was also made to evaluate its relationship with body mass index (BMI).

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Methods

Study setting:

The cross-sectional study was conducted among children of rural region of Ghaziabad district of Uttar Pradesh from September 2018 to 2019. Children of desired age groups were randomly selected as subjects from the families residing in the study village.

Subject inclusion criteria:

About 600 children both boys as well as girls in the age group of 5-13 years were included in the study after obtaining consent from the parents. Children aged 14 years and above and those suffering from any illness were excluded from the study.

Sample size:

The sample size was determined by the standard formula $n = z^2 p(1-p)/d^2$.⁽¹⁵⁾ Considering the prevalence of anemia as 50%, z- value at 95% confidence (1.96), desired precision (d) of 5% with an anticipated attrition of 20%, the sample size of 461 was calculated. More than required number was taken to minimize the permissible errors.

Anaemia screening:

Children were categorized in 3 age groups: Group-I children of 5-7 years age group, Group-II children of 8-10 years age group, Group-III children of 11-13 years age group. Portable Hemocue Hb 201+ analyzer was used for screening of Anemia. Safety lancets were used to collect blood by finger prick method. The first drop of blood was wiped off with a cotton wool, while the second drop was collected using a microcuvette. The blood sample was loaded in the calibrated Hemoglobin analyzer and Hb concen-

tration read to the nearest 0.1g/dL. Children with Hb level <11 were considered anemic and graded as mild (10.0-10.9 g/dL), moderate (7.0-9.9g/dL) and severe (<7g/dL). WHO standards were used to detect anemia in children. Parents were informed about the results of anemia screening and the children who was found to have severe anemia (a hb level below 7.0 g/dl) were referred to a health center for further evaluation and treatment. A detailed questionnaire was used to collect the health details of the children, dietary habits of the children and socioeconomic status of the parents.

BMI measurement:

Weight and height of each child was measured using standardized procedures. Body mass index (BMI) for each child was calculated based on the ratio of weight (kg) to height in square meters. After BMI is calculated, the BMI number is plotted on the CDC BMI-for-age growth chart to obtain a percentile ranking. The percentile indicates the relative position of the child's BMI number among children of the same age and sex. Children whose weight were less than 5th percentile consider as underweight. Healthy children have a BMI percentile ranging between 5th percentile to 85th percentile. The children whose weight were more than 85th to less than 95th percentile was considered as overweight and obese who were equal to or greater than the 95th percentile.⁽¹⁶⁾

Ethics:

The study has got ethical approval from institutional review board. Consent of parents were taken before sampling.

Statistical analysis:

The data was collected and computed for all statistical analysis by Microsoft Excel 2016. Mean, standard deviation and percentage were performed for each parameter separately. The independent t-test with Bonferroni adjustment was performed to test the significance of difference in mean values between groups, with level of significance set at $p < 0.05$. The correlation between hemoglobin and BMI was assessed by calculating the Pearson's correlation coefficient (r) and the significance of correlation (p).

Results

We determined BMI and Hb value of 600 children of age group 5-13 years in rural area of Ghaziabad. Children were categorized in 3 age groups: Group –I children of 5-7 years age group, Group –II children of 8-10 years age group, Group –III children of 11-13 years age group. This study revealed that overall prevalence of anemia among children in the age between 5 to 13 years was 57.67% (346/600).

Table 1: Prevalence of anaemia in children of rural area of Ghaziabad district.

SEX	NO.	NORMAL		TOTAL ANEMIA	
		NO.	%AGE	NO.	%AGE
MALE	300	158	52.67	142	47.33
FEMALE	300	96	32	204	68.00
OVER ALL	600	254	42.33	346	57.67

Anemia is found to be more prevalent in girls (68%) when compared to boys (47.3%) in the age group of 5 to 13 years.

Table 2: Correlation of age with mean hemoglobin (g/dL) in children of rural area of Ghaziabad district.

AGE IN YEARS	SEX	TOTAL NO.	HEMOGLOBIN	P VALUE
			(g/dl) mean + SD	
5 TO 7 (GROUP I)	BOYS	100	10.41 ± 1.48	0.02926
	GIRLS	100	9.942 ± 1.50	
8 TO 10 (GROUP II)	BOYS	100	11.50 ± 1.63	0.00018
	GIRLS	100	10.64 ± 1.55	
11 TO 13 (GROUP III)	BOYS	100	11.19 ± 1.99	0.00021
	GIRLS	100	10.18 ± 1.78	

Our study showed that Mean Hb concentration was 10.65± 1.75 and is significantly higher in boys in all age groups than those of girls. (p < 0.05)

On multiple comparison between groups by Bonferroni arrangement, we found that mean Hb value of boys in group I (10.41 ± 1.48) was significantly lower than mean Hb value of group II (11.50 ± 1.63) and group III (10.64 ± 1.55, p=0.001). The difference in mean Hb values of girls between group I (9.942 ± 1.5) and group II (10.64 ± 1.55) was highly significant (p=0.003). Our results indicated that the highest prevalence of anemia was present in the age group of 5 to 7 years for both the sexes and minimum frequency was seen in the age group of 8-10 years. Children participated in our study did not show any symptoms like easy fatigue, loss of appetite, pallor or dizziness.

Table 3: Prevalence of different grades of anemia in children of age 5-13 years using the WHO classification

AGE IN YEARS	SEX	% prevalence of different grades of anemia.				
		NORMAL (%)	MILD ANE-MIA	MODERATE	SEVERE ANEMIA	% ANEMIC
5 TO 7 (GROUP I)	Boys	35	30	33	2	65
	Girls	22	31	43	4	78
8 TO 10 (GROUP II)	Boys	63	22	15	—	37
	Girls	42	31	27	—	58
11 TO 13 (GROUP III)	Boys	59	15	25	1	41
	Girls	32	23	42	3	68

The occurrence of moderate anemia cases (53%) was higher than that of mild anemia (43.8%) and severe anemia cases (2.9%). Severity of anemia was present mostly in girls.

Table 4: Mean ±SD BMI in children of rural area of Ghaziabad district.

AGE IN YEARS	BMI (kg/m2)		
	5 TO 7 (GROUP I)	8 TO 10 (GROUP II)	11 TO 13 (GROUP III)
MALE	16.97 ± 4.29	15.12 ± 2.48	15.81 ± 3.23
FEMALE	15.37 ± 2.33	15.14 ± 2.01	15.13 ± 1.64

From the results it was revealed that mean value of BMI (15.69 ± 2.81) of study population was within the normal range. Based on the CDC BMI percentile scale, it has been determined that 60.33% children (187 boys, 175 girls) were of normal weight having a BMI percentile ranging between 5th percentile to 85th percentile. 30.7% (99 boys, 85 girls) were underweight having BMI less than 5th percentile, 7.33% children (19 boys, 25 girls) whose weight were more than 85th percentile and less than 95th percentile, were considered as overweight and 1.67% (3 boys, 7 girls) were obese. 52.2% children with normal BMI were found to be anemic. However, a negative correlation was found with BMI and hemoglobin concentration in this study.

The socioeconomic status and dietary habits of the subjects were studied and indicated that 90% of the study population belonged to lower socio-economic status.

Table 5: Association of Anemia and feeding habits.

Variable	Subjects (n)	% with Anemia	p-value
Meat			
Consumed	105	62	0.6
not consumed	495	57.1	
Vegetables			
Consumed	174	23	0.001
not consumed	426	72	
Fruits			
Consumed	53	18	0.001
not consumed	547	61.4	
Milk			
Consumed	490	63.1	0.001
not consumed	110	30	
Rice			
Consumed	532	63.9	0.001
not consumed	68	8.9	
Fat&oil			
Consumed	422	64.9	0.003
not consumed	178	40.9	

The feeding habits of these children shown in table 5 indicates that daily intake of fruits and vegetables was very less while rice and milk were main component of their diet, both of which are deficient in iron. This may be a possible reason for prevalence of anemia in the study population. Feeding habits were found to be significantly associated with anemia among these children ($p < 0.05$)

Discussion

In this cross-sectional study, 600 children of rural area of Ghaziabad between the ages of 5 to 13 years were screened for anemia, 57.6% of children found to have anemia. The prevalence of anemia in girls (68%) was significantly higher than in boys (47.3%). The result of this study corroborated the findings of Bulliyya G et al., that the prevalence of anemia in school-age children (6-12 years) of rural area of Odisha was 68.9%, of which 27.4% were mildly, 23.6% were moderately, and 17.9% were severely ane-

mic.⁽¹⁷⁾ A similar study done at pediatric hospital, in a suburb of Chennai covering children between the age group of 4 months to 12 years showed a prevalence of 70% of anemia.⁽¹⁸⁾ Sundaresan S et al. has reported anemia in 52.88% children of 8-16 years age group.⁽¹⁹⁾ In his study the prevalence of anemia in girls (67.77%) was higher than in the boys (35.55%) which was also observed in our findings. Study conducted by Jhansi RP et al also showed higher incidence of anemia in female children.⁽²⁰⁾ The occurrence of moderate (53%) and mild anemia (43.8%) cases in was still higher in our study.

Based on BMI, the results of present studies showed that higher percentage of children are of healthy weight while a low percentage of them were underweight. On comparing the anemia among BMI groups, it was observed that anemia in this population is not related to BMI. This in contrast with the studies elsewhere.⁽²¹⁾

The predominance of parasitic infestations and other risk factors for anemia were not studied in this population so we stipulate that the higher frequency of anemia in the age group of 5-7 years could be because of inadequate diet and poor access to health services. Consuming cereal-based diet by majority of the children can be the cause of iron deficiency among them. All these factors might have contributed to development of anemia in these children. Kalaivani K et al analyzed data from six different national surveys and results of hb mean of 5-9 age group was comparable to our study.⁽²²⁾

Between 2006 and 2016, India made considerable progress in reducing anemia.⁽²³⁾ Comparative outcomes were stated in the study conducted by Menon et al which showed that improvement in nutrition and health interventions are the strongest driver of anemia reduction in children.⁽²⁴⁾ To tackle anemia in India, the Anemia Mukh Bharat (AMB) program was launched by the Government of India in March 2018. Target is to reduce anemia by 3% per year to attain a goal of malnutrition free India by 2022.^(25,26)

Conclusion

Despite improvement over a decade, India still continues to be the country with highest prevalence of anemia in the world. The prevalence of anemia in young children is still a matter of concern. This study, however, is subject to certain limitations. The potential impacts of associated risk factors are not presented at large in this study. It can be concluded that less intake of iron rich food and nutritional diet are the leading cause of anemia in the rural children. Anemia is common not only among under-nourished persons but also in normal and over-nourished individuals Various strategies of increasing iron intake through dietary diversification, use of iron-fortified iodized salt, promoting healthy diets through nutrition education programs and early detection of anemia among children will accelerate the pace of reduction in anemia and enable the country to achieve the target for reduction in anemia.

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