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Original Research Article

Clinical study of anemia in rural school children of Mangalore, Karnataka, India

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ABSTRACT

Background: The study was conducted to know the prevalence of anemia in rural school children located within 15km radius of Yenepoya Medical college hospital, Mangalore and to study the risk factors associated with anemia also to correlate the detection of anemia by clinical examination and by lab estimation of hemoglobin.
Methods: A total of 550 children in the age group of 6-15 years were included in this study. Parental informed consent was obtained. A preplanner questionnaire was used to collect the health and socio demographic details. Blood was collected by venepuncture method and haemoglobin was determined by automated sysmex machine. Diagnosis of anemia was made according to WHO cut off value of Hb.
Results: Out of 550 children 114(20.6%) were anemic. There was no significant difference between age and sex. Anemia was found to be more prevalent in children with h/o passing worms, undernourished, pica and low socio-economic status. Out of 550 children 174 children had conjunctival pallor on clinical examination. Among that 58 (33.3%) children had anemia on hemoglobin estimation. Majority of the children 116 (66.7%) who had pallor on clinical examination was found as non-anemic on hemoglobin estimation. On kappa co efficient, statistics showed that two examinations to detect anemia was 18.47 %, which indicates poor agreement.
Conclusions: The overall prevalence of anemia among rural population is variable depending upon the region. Major factors which influence the prevalence of anemia were nutrition, socioeconomic status, pica and worm infestation. Clinical diagnosis by examination of pallor is poorly correlated by estimation of haemoglobin, hence anemia cannot be diagnosed by detection of pallor alone and it requires lab haemoglobin estimation to prevent wrong diagnosis of anemia.

Keywords: Anemia, Hb, Pallor

INTRODUCTION

The health of children is of fundamental importance in every country. The population of school children approximate one-fifth of the total population and forms the future hope of the nation.[1] The school age period is nutritionally significant because this is the prime time to build up body stores of nutrients in preparation for the rapid growth associated with adolescence. Anaemia, a major public health problem and one of the most common nutritional disorders worldwide have major consequences for human health, economic and social development.[2] Anaemia, has been defined as reduction of the hemoglobin concentration or RBC volume below the range of values occurring in healthy persons.[3] The world health organization (WHO) has estimated that, globally, 1.62 billion people are anemic, among that 305 million (25.4%) are school aged children. The highest prevalence of anaemia is (47.4%) among preschool-aged children.[2] According to the third national family health survey

(NFHS3), 79% of Indian children were anemic and were found more in rural areas.[4] Majority of India's population (72.2%) live in rural areas.[5] Iron deficiency is believed to be the most important cause of anemia among school children in India and is attributable to poor nutritional iron intake and low iron bioavailability.[6] In adolescence, the overall iron requirement of the body increases because of rapid growth and in girls repeated menstrual blood loss also adds to iron deficiency. Other factors including folate and vitamin B_{12} and another vitamin deficiencies, Infections like malaria, parasitic infections and hemoglobinopathies are also associated with childhood anemia.[7,8] Anemia affects the physical and mental development of children leading to decreased working capacity, which in turn affects the development of the country. Iron deficiency along with anemia causes impaired growth, behavioral abnormalities and impaired cognitive function leading to poor school performance.[9] The children of rural community due to their low socio-economic status, poor hygiene and poor awareness are more vulnerable to anemia.[1] Studies are mainly conducted on the prevalence of anemia on infants and pre-schoolers. Available data are limited regarding the biological, nutritional and socioeconomic etiologies of anemia in rural areas where the prevalence is more. Hemoglobin analysis is one of the most simple and economical laboratory parameters to assess anemia and is thus used quite frequently in population studies.[10] Another simple method for diagnosing anemia where laboratory facilities are few or not available is the physical exam, which aims to identify skin or mucous membrane pallor as a clinical sign of anemia which is being followed by many economically backward countries. Anatomical segments such as the conjunctiva, palm, nail bed, lips and tongue have been used to identify anemia.[10,11] So there is a need for more studies related to anemia in rural school children. Thus, the present study was conducted to assess the prevalence of anemia in rural school children of Mangalore and also to determine whether hemoglobin estimation is required, or only clinical examination is sufficient to detect anemia.

The aim and objectives of this study is to know the prevalence of anemia in rural school children located within 15km radius of Yenepoya Medical College hospital, Mangalore; to study the risk factors associated with anemia; to correlate the detection of anemia by clinical examination and by lab estimation of hemoglobin.

METHODS

It was a school based cross sectional study, duration was from January 2015 to July 2016. The study was conducted in randomly selected rural school children, located within 15km radius of Yenepoya Medical College Hospital in Mangalore, Karnataka. Two rural schools within 15km radius of Yenepoya Medical College Hospital were randomly selected and a total of 550 children from were included in the study.

Inclusion criteria

- Children aged between 6 to 15 years from randomly selected rural schools within 15 km radius of Yenepoya Medical College Hospital.

Exclusion criteria

- Children whose parents did not give consent for collection of blood sample
- Those who were suffering from chronic illness or on any medication
- Children with haemorrhagic diseases.

After obtaining Institutional Ethical Committee clearance, permission and data regarding the list of schools in rural area of Mangalore within 15 km of YMCH was collected from DDPI office. Out of these schools, schools were selected based on simple random sampling (Lottery method). Permissions were taken from the respective school authorities. All the children from randomly selected two rural schools within15 km radius of present hospital in Mangalore were studied. Subject data and an informed consent for the collection of blood were obtained from the parents in a pre-designed proforma. Relevant history and complete physical examinations were done. Clinical signs for pallor were looked for in the nail bed, conjunctiva, and palmar creases. Other signs of anemia such as glossitis, koilonychias, and knuckle pigmentation were also observed. Other data such as age, sex, religion, nutritional status, dietary intake, socioeconomic status, H/O pica and H/O worm infestation was also noted in the proforma.

About 2ml of venous blood was collected by standard veni-puncture technique. Hemoglobin estimation was done in all the children using SYSMEX automated machine on the same day of clinical examination. Correlation of clinical examination and laboratory values of haemoglobin was done. Subject diagnosed to having anemia (according to WHO criteria 2) were referred for further evaluation and management. Anemia was diagnosed and graded into mild, moderate and severe based on WHO criteria.

Statistical analysis

The data was analysed using SPSS version 20.0. Descriptive statistics in terms of frequency and percentage was used for categorical variables and mean and SD for continuous variables.

Logistic regression, chi square test was used to assess the association of various socio-demographic variables and risk factors with hemoglobin levels of study participants. Kappa correlation was used to assess the correlation between laboratory findings of hemoglobin and clinical evaluation of anemia. A p-value of <0.05 with 95% confidence interval was taken as a level of significance.

RESULTS

A total of 550 children in the age group of 6-15 years were studied. Children which belonged to 5 to <12 years were 237 (43.1%) and ≥12 to <15 years were 313(56.9%) 52.9% were males and 47.1% were females.

Table 1: Age-wise distribution.

Age category	Gender	Frequency	%
5 to < 12 years	Male	128	54.0
	Female	109	46.0
	Total	237	100.0
≥12 to <15 years	Male	163	52.1
	Female	150	47.9
	Total	213	100

Among 237 children who belonged to 5 to <12 years of age 54% (128) were males and 46 % (109) were females.

Among children who belonged to ≥12 to <15 years of age 52.1%) (163) were males and 47.9 % (150) were females.

Table2: Socio-economic status distribution.

Socio economic status	Frequency	%
Class 1	0	0
Class 2	76	13.8
Class 3	311	56.5
Class 4	163	29.60
Class 5	0	0
Total	550	100

Out of the 550 children studied, majority 56.5% (311) belonged to class III (lower middle), with 29 .60 % (163) belonged to class IV (upper lower) and 13.8% (76) belonged to class II (upper middle) SES according to Modified Kuppuswamy classification.

Table 3: Anaemia frequency in relation to age-wise distribution.

Age	Anemia	Frequency	%	Chi square	P value
6 to < 12 years	Present	56	23.6	2.134	0.144
	Absent	181	76.4		
	Total	237	100.0		
≥12 to <15 years	Present	58	18.5		
	Absent	255	81.5		
	Total	313	100.0		

Table 4: Anaemia frequency in relation to socio-economic status.

SES	Anemia	Frequency	%	Chi-square	P- value	Odds ratio
Class II	Present	10	13.15	6.055	0.048	1
	Absent	66	86.85			
	Total	76	100.0			
Class III	Present	61	19.6			1.505
	Absent	250	80.4			
	Total	311	100.0			
Class IV	Present	43	26.3			2.110
	Absent	120	73.7			
	Total	163	100.0			

Table 5: Anaemia frequency in relation to nutritional status.

Nutritional status	Anemia	Frequency	%	Chi-square	P-value	Odds Ratio
	Present	76	26.11	5.292	0.021	1.547
Undernourished	Absent	215	73.89			
	Total	291	100.0			
Non	Present	44	16.6			1
Undernourished	Absent	221	83.4			
	Total	265	100			

The overall prevalence of anemia in the study group (6-15) years is 20.7% (114), of which the prevalence in 6 to <12 years age group was 23.6% (56) and ≥12 to <15-year age group was 18.5% (58). There was no significant difference between both the age group. The prevalence of anemia in children belonging to class II is 13.5% (10),

class III is 19.6% (61) and 26.3% (43) in class IV as per modified Kuppuswamy classification, which was statistically significant (P value <0.048). Out of 291 children who are undernourished, 26.11% (76) had anemia compared to the other group. There was significant relation between anemia and national status (p-0.021).

Table 6: Correlation between clinical examination and hemoglobin estimation using Kappa co-efficient (k).

		Lab investigation		Total	
		Present	**Absent**		
Clinical examination to detect anemia	Present	58	116	174	p1
	Absent	56	320	376	q1
Total		114	436	550	N
		p2	q2		

Kappa co-efficient = 18.47%

The two examinations to detect anemia agreed on 18.47% of the readings, indicating poor agreement. Among 550 students, 174 (31.6%) children had clinical pallor by clinical examination but only 58 (33.3%) had anemia on hemoglobin estimation. The rest 116 (66.7%) were non-anemic after hemoglobin estimation. Agreement of both examinations was done by Kappa co-efficient statistics which showed poor agreement (18.47%).

Table 7: Prevalence of anemia according to Hb distribution.

Anemia	Frequency	Percentage
Present	114	20.7
Absent	436	79.3
Total	550	100

DISCUSSION

The present study was undertaken to know the prevalence of anemia in school going children of rural Mangalore 15 km around present hospital, to find out the risk factors associated with anemia and also to correlate detection of anemia by clinical examination and by lab estimation.

This is a prospective cross-sectional study was conducted from Jan 2015 to June 2016. Total of 550 students, of two rural schools in Mangalore were studied.

The age group studied was 6-15 years of age, among that 56.9% belonged to ≥12 to <15 years and 43.1 % belonged to 5 to < 12 years of age.

Male and female distribution was 52.9 % and 47.1% respectively, males being slightly predominant in number.

Prevalence of anemia

The prevalence of anemia in present study was 20.7% among 550 school children aged between 6-15years of age. The result of study was consistent with findings of Djokic et al, that the prevalence was 18 % among 525 school children aged between 4-15 years of age.[12] Almost similar result was found in a study done by Bekele et al, with a prevalence of anemia being 23.66%.[13] A study conducted in Kattankulathur by Sudhagandhi et al, found the prevalence of anemia to be 52.88%.[9] Similarly 37.6% prevalence of anemia was found in Assefa et al.[14] In present study prevalence rate was lesser than the latter two studies, the reason being regular deworming and Iron and Folic acid supplementation by the school authorities.

Risk factors

Age

In present study 23.6% of anemic children belonged to 5-12 year of age and 18.5% children belonged to >12-15 year of age, which was not statistically significant. Similar result was found in study done by Assefa et al.[14] In a study conducted by Bekele et al, higher prevalence of anemia was found to be 25.95% in 5-12year, 13.5% in >12-15 year among 5-11 year of aged school children.[13]

Sex

In present study there was no significant difference between the prevalence of anemia in males (18.55%) and females (22.8%). Study done by Assefa et al, found similar results in their study which can be attributed to the improvement in nutritional status of females because of provision of meal at school without any partiality and also to the fact that girls are more compliant to iron and folic acid supplementation in spite of menstrual loss of blood.[14] Another study done by Djokic et al, found that the prevalence of anemia was higher in male children.[12]

Other studies done by Sudhagandhi et al, and Bekele et al, found that the prevalence of anemia was higher in females.[9,13] Socioeconomic Status: present study showed that incidence of anemia was high in class IV (upper lower) children (26.3%) followed by class III (lower middle) children (19.6%) and class II (upper middle) children (13.5%). Similar finding was recorded by Jain et al, in a study done in Uttarakhand which showed that anemia was more common in lower socio-economic class (90.6%) and 37.5% in class III and Class II.[15]

Incidence of anemia was found to be more in lower socioeconomic class than upper socioeconomic class by Bekele et al, and Ullah I et al.[13,16]. This high incidence is because of low level of educational status which may affect the nutrition status negatively. Low income limits the type of amount of food available and higher incidence of infections among them.

Nutritional status

It was found that prevalence of anemia was more in undernourished children (26.11%) Study done by Sudhagandhi et al, Djokic et al and Bekele et al, also found that incidence of anemia was more in undernourished children than normal nourished even though the incidence was more compare to present study.[9,12,13] This shows that anemia is influenced by nutritional status of the children. It can be due to the poor availability and intake of high nutrient diet and rising trend of consuming junk and snack food which supplies fewer calories.

Correlation of clinical examination and lab estimation

In present study of 550 children 174 children had conjuctival pallor on clinical examination. Among that 58 (33.3%) children had anemia on hemoglobin estimation. Majority of children 116 (66.7%) who had pallor on clinical examination was found as non-anemic on hemoglobin estimation. On Kappa co efficient statistics showed that two examinations to detect anemia was 18.47 % which indicates poor agreement. Zeeshan B et al, conducted a study in Lahore to determine the accuracy of pallor of conjunctiva, nail bed and palm in detecting mild and severe anemia. He found that absence of pallor at nail bed, conjunctiva, and palm did not rule out mild anemia. All sites had modest accuracy for detecting severe anemia.[17] Similar statement was made by Kalanthri A et al, in their study of accuracy and reliability of pallor in detecting in anemia among 390 children.[18] In this study it was revealed that presence of pallor can modestly raise the probability of severe anemia while its absence can rule out severe anemia.

Limitation of the study: study lacks the detailed investigation to differentiate nutritional and non-nutritional cause of anemia. Stool test was not done to diagnose intestinal parasitic infection that contributes to anemia. There was insufficient history about the Iron and folic acid intake.

CONCLUSION

The overall prevalence of anemia among rural population is variable depending upon the region. Major factors which influence the prevalence of anemia were nutrition, socioeconomic status, pica and worm infestation. Clinical diagnosis by examination of pallor is poorly correlated by estimation of hemoglobin, Anemia cannot be diagnosed by detection of pallor alone and it requires lab hemoglobin estimation to prevent wrong diagnosis of anemia.

Recommendations

A regular health checkup should be organized along with lab estimation of Hb % to screen anemia in school children and appropriate measures should be taken up by school authorities in coordination with parents. Further evaluation of anemia is needed to detect nutritional deficiencies and other treatable etiologies to prevent the anemia. Mid-day meal programme with proper balanced dietary supplements as part of school health programmed to improve nutritional status and regular deworming is required to decrease the prevalence of anemia among rural school children.

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