Research Article

Correlation of pallor with hemoglobin levels and clinical profile of anemia in primary and middle school children of rural Telangana

Divya Regina, Sudharshan Raj C.*, Raghav Rao

Department of Pediatrics, MediCiti Institute of Medical Sciences, Ghanpur, Medchal, Hyderabad, India

*Correspondence:
Dr. Sudharshan Raj C.,
E-mail: neelimasudharshan@gmail.com

ABSTRACT

Background: The World Health Organization (WHO) estimates that about 2 billion individuals or about 40% of the world's population suffer from anemia. The population groups with the highest prevalence of anemia are: pregnant women and the elderly (about 50%), infants and children 1 to 2 years (48%), school children (40%), non-pregnant women (35%), and preschoolers (25%).
Methods: The study was conducted at MediCiti Institute of Medical Sciences. 1007 children were screened clinically and their blood samples collected and analyzed by hemocue instrument. A complete physical examination was done for all these children.
Results: The maximum number of subjects belongs to the nine year old category. Boys constituted 46% of the study population while girls constituted 54% of the study population. Anemia is more prevalent in female subjects than males. In the present study, clinical pallor was present in 16.48% of the subjects. In specific, conjunctival pallor was noted in 9.43%, generalized pallor of skin noted in 4.96% and palmar crease pallor was noted in 1.88% of subjects. The sensitivity and specificity of clinical pallor in diagnosing anemia is 94.02% and 93.71% respectively. The sensitivity and specificity of palmar pallor in diagnosing severe anemia is 100% and 98.21% respectively.
Conclusions: The clinical finding of pallor in a child is a reliable indicator of anemia. The presence of clinical pallor in any of the body sites (conjunctival pallor, skin pallor, palmar pallor) is a reliable indicator of anemia. The presence of palmar crease pallor is a good indicator of severe anemia in children. By effective implementation of mid-day meal scheme, the incidence of anemia could be brought down effectively.

Keywords: Anemia, Children, Clinical pallor, Palmar crease pallor

INTRODUCTION

The World Health Organization (WHO) estimates that about 2 billion individuals or about 40% of the world's population suffer from anemia. The population groups with the highest prevalence of anemia are: pregnant women and the elderly (about 50%), infants and children 1 to 2 years (48%), school children (40%), non-pregnant women (35%), and pre-schoolers (25%).[1-3]

At a meeting of the International Nutritional Anemia Consultative Group (INACG, 1999), it was stated that school children aged 5 to 14 years must be recognized as a high risk group because the percentage of anaemic children is as high as that of the pregnant women.[4] In the study conducted by the Nutrition Foundation of India (1999), including 520 urban and 185 adolescent girls (aged 11- 19 years), nearly 17% of the rural and 9.6% of the urban adolescent girls had Hemoglobin (Hb) levels <10g/dl.[5]

This study was conducted to identify clinical pallor in school children between 6-11 years and to correlate with the blood hemoglobin levels, in the rural district of Medchal. This district has got the mid-day meals programme well implemented in the schools. Hence, it was also a motive to identify the impact of mid-day meal programme in preventing the anemia in this high risk age group.

METHODS

The study was conducted at MediCiti Institute of Medical Sciences, Ghanpur, Medchal, Hyderabad, India from October 2014 - September 2015.

An outreach programme was conducted for children between 6-11 years. An informed consent was obtained from all study participants before enrolling them in the study. 1007 children were screened clinically and their blood samples were also collected and analyzed by hemocue instrument. A complete physical examination was also done for all these children.

An observer sequentially examined conjunctiva, tongue, skin, palm and nail bed of each study patient.

The conjunctiva was considered pale, if the anterior rim of the lower palpebral conjunctiva looked as pale as the deeper posterior rim. The tongue pallor was assessed on the dorsum of the tongue. Palmer pallor was assessed by the intensity of the palmar creases. Nail bed was assessed by the color of the nail.

Clinical grading of pallor[6]

Mild: pallor of conjunctiva and/or mucous membrane.

Moderate: pallor of conjunctiva and/or mucous membrane + pallor of skin.

Severe: pallor of conjunctiva and/or mucous membrane + pallor of skin + pallor of palmar creases.

Statistical analysis

Descriptive and inferential statistical analysis was carried out in this study. Results on continuous measurements were presented on Mean+Sd and results on categorical measurements were presented in number (%).

Significance was assessed at 5% level of significance. The following assumptions on data were made –

1. Dependent variables should be normally distributed
2. Samples drawn from the population should be random.

Student t test was used to find the significance of study parameters on continuous scale between two groups on metric parameters. Levene's test for homogeneity of variance was performed to assess the homogeneity of variance.

Statistical software: SAS 9.2, SPSS 15.0, STATA 10.1, Medcalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for data analysis.

RESULTS

Table 1: Age wise distribution of subjects.

Age in years	Anemia present	Anemia absent	Total
6	21	98	119(11.8%)
7	23	129	152(15.1%)
8	24	180	204(20.3%)
9	18	204	222(22%)
10	21	181	202(20.1%)
11	10	98	108(10.7%)
	117	890	1007

A total of 1007 subjects belonging to 6-11 years were included in this study. The maximum numbers were 9 years old (22%, 222) (Table 1).

Out of 1007 subjects, 463 were males, and 544 females. Anemia was found among 117 subjects (11.6%) and was more prevalent in females (76, 64.95%) which was found to be statistically significant (p=0.015).

Table 2: Comparison of haemoglobin levels with various clinical grades of pallor.

Hb Values (g/dl)	Clinical pallor at various body sites				P value		
	No pallor	Conjunctival pallor	Pallor of skin	Palmar pallor	Conjunctival pallor vs No pallor	Skin pallor vs Conjunctival pallor	Palmar pallor vs Skin pallor
Mean	13.08	11.63	10.74	9.11	<0.001	<0.001	<0.001
SD	0.82	0.70	0.72	0.88			
Numbers	843	95	50	19			

Hindus, Christians and Muslims constituted 55.0%, 26.9% and 18.1% of the study population respectively. There is no statistically significant difference in the prevalence of anemia among the subjects belonging to various religions mentioned above (p=0.2741).

61.96% subjects belonged to class IV, while 38.04% belonged to class V of updated socio economic classification of Prasad, used for rural areas.no significant association was observed between socio-economic status and prevalence of anemia (p=0.1562).

There is a strong statistical significance between hemoglobin levels and clinical pallor at various body sites (p <0.001).

Table 3: 2 X 2 tables between clinical pallor and anemia.

		Anemia		Total
		Present	Absent	
Clinical pallor	Present	110	56	166
	Absent	7	834	841
Total		117	890	1007

The sensitivity and specificity of clinical pallor in diagnosing anemia is 94.02% and 93.71% respectively. (fig.1) the positive and negative likelihood ratios of clinical pallor in diagnosing anemia are 14.94% and 0.064% respectively.
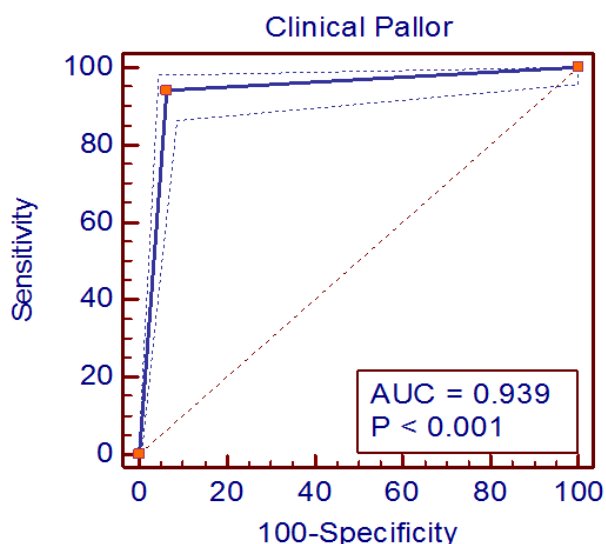

Figure 1: ROC curve showing the sensitivity and specificity of diagnosing anemia with clinical pallor.

The sensitivity and specificity of conjunctival pallor in diagnosing mild anemia is 48.39% and 94.53% respectively. The positive and negative likelihood ratios of conjunctival pallor in diagnosing mild anemia are 8.85% and 0.55% respectively.

The sensitivity and specificity of skin pallor in diagnosing moderate anaemia is 17.39% and 95.33% respectively. The positive and negative likelihood ratios of skin pallor in diagnosing moderate anemia are 3.72% and 0.87% respectively.

The sensitivity and specificity of palmar pallor in diagnosing severe anaemia is 100% and 98.21% respectively. The positive and negative likelihood ratios of clinical severe pallor in diagnosing severe anemia are 55.89% and 0% respectively.

DISCUSSION

The study analyses the various socio demographic variables with prevalence of anemia. 9 year old subjects formed the majority (22 %) of the study subjects. Singh C conducted a similar community based study in Reddy R district in school children, in which 11 year olds (26.5%) formed the majority of the study subjects followed by 10 year old subjects.[7] however the study subjects are homogenous in distribution and it doesn't affect the results by bias.

Males and females constituted 46% and 54% respectively in the present study. The distribution of the subjects is homogenous as there is no statistical significance between the two groups.

In the study by Mohapatra et al, out of the 385 subjects in the less than 12 years category, 62% were males and 38% were females.[8]

In the study by Jain N et al, out of the 113 subjects in the 5 years to 16 years category, 33.4% were males and 66.6% were females.[9]

In the study by Gupta S et al, out of the 172 children in the 6 years to 16 years category, 58.13% were males and 41.86% were females.[10]

In the study by Singh C et al, out of the 412 subjects in the 6 years to 11 years category, 43.9% were males and 56.1% were females.[7] This study is very unique and comparable to the present study as the subjects in the study fall into the same age group as the present study. Moreover the study has originated from the same region i.e.) Hyderabad, Telangana.

Anemia is more prevalent in females than males in our study (p=0.015). Jain N and Jain VM have found out in their study that anemia is more prevalent in females than males in their study from school children of Rishikesh; Uttarakhand.[9] Soma Gupta et al have also identified the similar finding in their study in school children of Midnapore, West Bengal that the anemia prevalence is more common in females than males.[10] Interestingly, in the study by Muthayya et al , conducted in Bangalore with around 2030 school children, with a lesser anemia prevalence of 13.6% comparable to the present study, it was concluded that anemia prevalence is more in females than males.[11] On the contrary, Singh C et al in his study with 412 subjects from rural school children from the region of Hyderabad, Telangana has concluded that the prevalence of anemia is not more in females than males.[7]

Hindus, Christians and Muslims constitute 55%, 26.9% and 18.1% respectively in the present study. The study by Singh C had Hindus, Christians and Muslims in percentages of 59.7%, 26.9% and 13.3% respectively.[7] The study by Mohapatra et al with 385 subjects had Hindus, Christians and Muslims in percentages of 53%,

42% and 5% respectively.[8] There is no statistical significance in the prevalence of anemia among subjects of various religions (p= 0.2741) in the present study. None of the above mentioned studies too have documented increased prevalence of anemia in any of the religions.

There is no statistical significance in prevalence of anemia between upper lower and lower groups of study subjects (p= 0.1562). In fact, in studies by Singh C and Deshpande et al, the results have shown more prevalence of anemia in lower socioeconomic class.[7,12] this difference in results would have been due to the place where the study was conducted. In the present study, the group is homogenous with all the subjects belonging to either lower or upper lower class and none of them belong to upper or middle class.

In the study by Singh C et al, though the study was conducted in the rural schools, it took into account of government, private and minority institutions also. Hence, they managed to get the subjects from various strata of the population and prove that the prevalence of anemia is more in the lower socio economic class than the upper socio economic class.[7]

In another study by Jain N et al, with 113 subjects conducted in Rishikesh, Uttarakhand it was identified that the prevalence of anemia is more in the lower socio-economic status than the upper socio-economic status.[9]

In our study, there is no significant difference in BMI between the subjects with various grades of anemia. (p= 0.987).

In the study conducted by Singh C[44] with 412 subjects in rural school children, the prevalence of anemia is high in subjects with low BMI.[7] Moreover in the present study the prevalence of anemia is 11.61% compared to 52.7% prevalence in study conducted by Singh C[44].

In the study by Gandhi S et al, with 900 subjects from the rural schools in the age group of 8-16 years, in Kattankulathur region in the outskirts of Chennai, with the anemia prevalence of 52.88%, reported that the prevalence rate increases with low BMI values.[13]

Mohapatra et al, in a study from Bhubaneswar, Odisha, in the age group of less than 12 years, found a prevalence of anemia of 79%.[8] Jain N et al, in a study from Rishikesh, in the age group of 5 years to 16 years, found a prevalence of anemia of 56.5%.[9] Gupta S et al, in a study from West Bengal, in the age group of 6 years to 16 years, found a prevalence of anemia of 80.2%.[10] Bhoite et al, in a study from Vadodara, Gujarat, in the age group of 5 years to 12 years, found a prevalence of anemia of 73%.[14]

All the above mentioned studies have got a very high prevalence rate of anemia. The possible explanation may be due to the states from which the studies have been conducted. Moreover the implementation of the mid-day meal scheme is not as good as in the southern states of India. To support this finding, a study conducted by Muthayya et al from Bangalore, Karnataka in school children identified anemia in 13.6% of children.[11] Bangalore has got the mid-day meals scheme implemented in the schools and provides the best nutrition to the school aged children.

Table 4: Comparison between various statistical values.

Variable	Sensitivity	Specificity	Positive likelihood ratio	Negative likelihood ratio
Pallor Vs Anemia	94.02%	93.71%	14.94	0.064
Conjunctival pallor Vs Mild Anemia	48.39%	94.53%	8.85	0.55
Skin pallor Vs Moderate Anemia	17.39%	95.33%	3.72	0.87
Palmar pallor Vs Severe Anemia	100%	98.21%	55.89	0

This study from Bangalore can be compared to the present study very closely because the prevalence of anemia is 11.61% which is still lesser. The children in the present study are from Medchal district where Mid-day meal programme is well implemented.

Moreover, the nutritional awareness programme conducted by MediCiti Institute of Medical Sciences in the surrounding districts has sensitized the people about the anemia and food stuffs to be taken to prevent anemia.

Hence it is very evident that apart from nutritional supplementation, awareness about the nutrition is equally important to improve the health status of a community.

The primary health care in the Ghanpur District is also a major contributing factor in reducing the anemia prevalence, by conducting regular school health check – ups. Therefore with all the above mentioned services the children in the rural schools of Medchal District have a lesser prevalence of anemia amidst the lower socio economic strata they belong to.

In the present study, clinical pallor was present in 16.48% of the subjects. In specific, conjunctival pallor was noted in 9.43%, generalized pallor of skin noted in 4.96% and palmar crease pallor was noted in 1.88% of subjects.

In a similar study by Singh C et al, clinical pallor was noted in 52.7% of subjects. In specific, conjunctival pallor was noted in 44.4%, generalized pallor of skin noted in 30.5% and palmar crease pallor was noted in 8.3% of subjects.[7]

From Table 4, it is very evident that the diagnosis of severe anemia can be made by the presence of pallor of palmar creases (severe pallor), whereas the sensitivity of conjunctival pallor and generalized pallor of skin in diagnosing mild and moderate anemia is very low. This result is exactly similar to the study conducted by Singh C.[7]

The sensitivity and specificity of clinical pallor in diagnosing anemia ranged from 19 to 70 % and 70 to 100% respectively in various studies and it is 94.02% and 93.71% respectively in the present study.[15,16] The possible explanation for a good sensitivity and specificity in the present study is due to the fact that a well-trained post graduate student was the principal investigator and hence bringing down the observer bias.

Hence it can be concluded that the presence of clinical pallor in any of the body sites (conjunctival pallor, skin pallor, palmar pallor) is a reliable indicator of anemia. The presence of palmar crease pallor is a good indicator of severe anemia in children. However, this is just a pilot study and further studies are required in the following arena in an extensive manner to validate the results of the present study.

This can serve as a basis for conducting a study in all the districts of the state which can give a wonderful glimpse of the health status of the children, who are our future citizens. This will also render an insight into the implementation of mid-day meal scheme, which plays a vital role in the health status and nutrition of the school going children.

CONCLUSION

The clinical finding of pallor in a child is a reliable indicator of anemia.

The absence of clinical finding of conjunctival pallor in a child can be useful to rule out the presence of mild anemia in the child rather than its presence in diagnosing mild anemia.

The absence of clinical finding of generalized skin pallor in a child can be useful to rule out the presence of moderate anemia in the child rather than its presence in diagnosing moderate anemia.

The clinical finding of palmar crease pallor in a child is a reliable indicator of severe anemia.

The presence of clinical pallor in any of the body sites (conjunctival pallor, skin pallor, palmar pallor) is a reliable indicator of anemia. The presence of palmar crease pallor is a good indicator of severe anemia in children.

By effective implementation of mid-day meal scheme, the incidence of anemia could be brought down effectively.

REFERENCES

1. Malnutrition, the Global Picture, World Health Organization, Geneva, 2000.
2. Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia, International Nutritional Anemia Advisory Group, Washington, DC, 1988.
3. Fourth Report on the World Nutrition Situation, ACC/SCN/IFPRI, Geneva, 2000.
4. International Nutritional Anemia Consultative Group Symposium, Durban, March 12, 1999.
5. Awate RV, Ketkar YA, Somaiya PA. Prevalence of nutritional deficiency disorders among rural primary school children (5-15 years). J Indian Med Assoc. 1997;95(7):410.
6. Differential Diagnosis in Pediatrics- 5th edition. Gupte S, Jaypee Publishers. p. 90-91.
7. Singh CS. Prevalence of Nutritional Anemia in Primary School Children in Urban Slums Areas of Hyderabad, Andhra Pradesh, India. Advanced Biomedical Bulletin. 2014;2(1):147-54.
8. Mohapatra S. Prevalence of anemia among school going children (< 12 years of age) in selected slum schools of Bhubaneswar, Odisha." IOSR Journal of Nursing and Health Science. 2014;3(6):42-6.
9. Jain N, Jain VM. Prevalence of anemia in school children. Indian Medical Practice and Review. 2012;3(1):1-4.
10. Gupta S. Silent burden of anemia in school age children: A community based study in West Bengal. Indian journal of medical sciences. 2012;66(7):163.
11. Muthayya S. Anemia prevalence in school-aged children in Bangalore, South India: possible effect of school health initiatives. European journal of clinical nutrition. 2007;61(7):865-9.
12. Deshpande NS, Karva D, Agarkhedkar S, Deshpande S. Prevalence of anemia in adolescent girls and its co-relation with demographic factors. Int J Med Public Health. 2013;3:235-9.
13. Sudhagandhi B, Sundaresan S, Ebenezer William W, Prema A. Prevalence of anemia in the school

children of Kattankulathur, Tamil Nadu, India. International Journal of Nutrition, Pharmacology, Neurological Diseases. 2011;1(2):184-8.

14. Bhoite R, Iyer U. Magnitude of malnutrition and iron deficiency anemia among rural school children: An appraisal. Asian J Exp Biol Sci. 2011;2(2):354-61.

15. Sheth T. The relation of conjunctival pallor to the presence of anemia. Journal of general internal medicine. 1997;12(2):102-6.

16. Isabela Martins B. Accuracy of anemia diagnosis by physical examination. Sao Paulo Medical Journal 2007;125(3):170-3.