Anemia among School Children in a Rural Area in Kollam District, Kerala

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ABSTRACT

Published on 28th March 2014

Introduction: Anemia is the world's second leading cause of disability and thus one of the most serious global public health problems.[1] Iron deficiency is the most common cause of anemia. Iron deficiency anemia affects aerobic fitness, endurance capacity and efficiency of work.[9] It has adverse impacts on cognition by a decrease in the activity of iron containing brain enzymes.[10] Iron deficiency is also associated with decreased phagocytosis, decreased response to cytokines and mitogens, decreased cell mediated immunity and suppressed skin test response.[11] Iron deficiency has been linked to behavioral and learning problems among children and adolescents.[12] All these factors may adversely affect learning and scholastic performance of school going children.

Objectives: Properly conducted studies focusing on prevalence of anemia among school children is lacking from the state of Kerala. The current study included secondary data analysis from a health project for screening all school children for anemia.

Materials and Methods: The screening was done during January- March 2013. Hemoglobin was tested for all school children studying in the classes from 1 to XII, from all the 17 schools in the area. Anemia status was decided as per WHO guidelines; less than 11.5g/dl for children less than12 years; less than 12 g/dl for girls from 12 to 18yrs and boys less than 14 years and less than 13 g/dl for boys from 15 to 18 yrs of age. Severe anemia included hemoglobin less than 7g/dl and moderate anemia included hemoglobin between 7.1 and 10g/ dl.[16] Age group 6-11 years was considered as primary school age and 12-17 years as secondary school age for statistical purposes.

The data was entered using the software Epi Info 2001 version 3.2.2 and analysis was done using Statistical Package for Social Sciences (SPSS) for Microsoft windows version 12. Descriptive statistics, univariate and multivariate analysis for factors associated with anemia was done.

Conclusion: A properly conducted research study on the prevalence of anemia among adolescents in Kerala using a standardized technique for hemoglobin estimation, along with estimation of iron stores, is the matter of the hour. Such a study will help to formulate policies on iron supplementation programs at schools and also it would form a baseline for evaluating the anemia control interventions.

Keywords: School children, Anaemia, Iron supplementation.

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Anemia is the world's second leading cause of disability and thus one of the most serious global public health problems.[1] Iron deficiency is the most common cause of anemia. It remains as a major nutritional problem among children and adolescents in India.[2-8] This is despite of the fact that decades of nutritional interventions are in place in the country.

Iron deficiency anemia affects aerobic fitness, endurance capacity and efficiency of work.[9] It has adverse impacts on cognition by a decrease in the activity of iron containing brain enzymes.[10] Iron deficiency is also associated with decreased phagocytosis, decreased response to cytokines and mitogens, decreased cell mediated immunity and suppressed skin test response.[11] Iron deficiency has been linked to behavioral and learning problems among children and adolescents.[12] All these factors may adversely affect learning and scholastic performance of school going children.

Properly conducted studies focusing on prevalence of anemia among school children is lacking from the state of Kerala. The current study included secondary data analysis from a health project for screening all school children for anemia. The health project was funded by the Local Self Government and implemented through the primary health centre in the area. The project

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involved screening of all school going children from classes' I-XII in Chithara panchayat area in Kollam district, Kerala

METHODOLOGY

Chithara Panchayat is situated in south east part of Kollam district with a population of 42,206 sharing its border with Thiruvananthapuram district. Scheduled tribes constitute 0.6% of the population. The rural village is bounded by mountains and forest on Eastern side.

The screening was done during January- March 2013. Hemoglobin was tested for all school children studying in the classes from 1 to XII, from all the 17 schools in the area.

Necessary permissions were obtained from the school authorities and the parents. The blood samples were taken after obtaining free and informed verbal consent/ ascent of the students. Those students with chronic illness or receiving long-term drugs and needing hospitalization in the last two weeks before the study were excluded.

20 iL capillary blood was collected by finger prick for estimation of hemoglobin by Sahli's method.[13] The hemoglobin tube (STD 14.5gm =100% concentration) was filled with N/10 hydrochloric acid (HCL) up to 2 gm marking. This graduated tube was placed in Sahli's hemoglobin meter (Comparator with Brown glass). The blood and acid are mixed with glass stirrer and allowed to stand for 5 minutes for acid haematin formation. Drop by drop distilled water was added to dilute the acid haematin compound color till it matches with the standard color plates of the comparator. Visual matching was done by taking the reading facing the window, with daylight behind the scale. Results were read as g/dl present on the hemoglobin tube. All precautions described by WHO were taken while estimating the hemoglobin value.[13]

The age of children was ascertained from school registers. Nutritional status was evaluated using World health organization (WHO) recommended age specific cut-off points of body mass index (BMI).[15] Each child's height and weight were measured in the metric system, using standardized techniques. Astadiometer (measuring rod) capable of measuring to an accuracy of 0.1 cm was used to assess height of the subjects. A portable balance with an accuracy of 100 g was used to record the weight of the subjects.

Anemia status was decided as per WHO guidelines; less than 11.5g/dl for children less than12 years; less than 12 g/dl for girls from 12 to 18yrs and boys less than 14 years and less than 13 g/dl for boys from 15 to 18 yrs of age. Severe anemia included hemoglobin less than 7g/dl and moderate anemia included hemoglobin between 7.1 and 10g/ dl.[16] Age group 6-11 years was considered as primary school age and 12-17 years as secondary school age for statistical purposes.

The data was entered using the software Epi Info 2001 version 3.2.2 and analysis was done using Statistical Package for Social Sciences (SPSS) for Microsoft windows version 12. Descriptive statistics, univariate and multivariate analysis for factors associated with anemia was done.

RESULTS

Out of 5600 school children on roll, 4813 (86%) students were screened. The other children were either absent (721), excluded as per criteria (19) or did not give consent/ascent (47). The general characteristics of the children were shown in Table 1. Among the students, 49.7% were males and 60.9% were from a government school. 10.7% had severe malnutrition as evidenced by a BMI of <-3SD.

Among the study children, the prevalence of anemia was 72.3%. Among the subjects, 2.5% had severe anemia, 46% had moderate anemia and 26.3% had mild anemia. Among the female students, 77.5% were anemic while among the males 67% were anemic ($p<0.05$). Among the female children the prevalence of severe, moderate and mild anemia was 2.4%, 50%

Table 1. Characteristics of the study children (N=4813)

Characteristics	Categories	Number	Percentage
Age group	5-10 years	1975	41.0
	11-14 year	1482	30.8
	>=15 years	1356	28.2
Gender	Male	2393	49.7
	Female	2420	50.3
Type of School	Government	2930	60.9
	Private	1883	39.1
Nutritional status-BMI	Severe malnutrition (< -3SD)	514	10.7
(Z score)	Malnourished (<-2SD-3SD)	715	14.9
	Normal (-2SD-+1SD)	3124	64.9
	Over weight	352	07.3
	Obesity (>2SD)	108	02.2

Table 2. Anemia by age and gender

	Femal			Male		
	5-10 years	11-14 years	>=15 years	5-10 years	11-14 years	>=15 years
No Anemia	199 (20.4%)	128 (17%)	217 (31.4%)	218 (21.8%)	212 (29.1%)	359 (54.1%)
Mild Anemia	172 (17.7%)	209 (27.7%)	209 (27.7%)	162 (16.2%)	227 (31.2%)	269 (40.5%)
Moderate anemia	552 (56.7%)	414 (54.9%)	414 (54.9%)	560 (55.9%)	285 (39.1%)	36 (5.4%)
Severe anemia	51 (5.2%)	01 (0.4%)	03 (0.4%)	61 (6.1%)	04 (0.5%)	-

and 24.2% while among the males the figures were 2.7%, 36.8% and 27.5% respectively. The prevalence of anemia by gender and age group is shown in table 2.

The results of univariate and multivariate analysis of factors associated with any anemia were shown in Tables 3 and 4. In the final logistic regression model, females had higher prevalence of anemia as compared to males (Adjusted OR 1.7295% CI 1.51-1.97). The odds of being anemic in the 11-14 years were 2.9 (95% CI 2.484-3.203) times higher than the odds of being anemic at 15-19years. The undernourished children (BMI <2SD) had1.30 (95% CI 1.117-1.526) times higher odds of being anemic as compared to the normal BMI category.

Table 3. Univariate analysis of factors associated with anemia (N=4813)

Characteristics	Categories	Number of children in each category (%)		Odds Ratio (95 % CI)
		Anemia	No Anemia	
Gender	Female	1876 (77.5)	544 (22.5)	1.69 (1.49-1.92)*
	Male	1604 (67.0)	789 (33.0)	
Age group	5-10 years	1588 (78.9)	417 (21.1)	2.75 (2.36-3.21)*
	11-14 years	1142 (77.1)	340 (22.9)	2.48 (2.10-2.91)*
	>=15 years	780 (57.5)	576 (42.5)	1 (Reference category)
Type of school	Government	2154 (73.5)	776 (26.5)	1.16 (1.02-1.32)*
	Private	1326 (70.4)	557 (29.6)	
Nutritional status	Under nourished (BMI Z score <-2SD)	870 (70.8)	359 (29.2)	0.88 (0.71-1.02)
	Normal	2291 (73.3)	833 (26.7)	1 (Reference category)
	Overweight/ Obesity (BMI Z Score >1SD)	319 (69.3)	141 (30.7)	0.82 (0.66-1.01)

*p <0.05

Table 4. Multivariate analysis of factors associated with anemia

Characteristics	Adjusted odds Ratio	95% CI
Gender (Female)	1.72	1.51-1.96*
Age groups		
5-10 years	1.15	0.98-1.36
11-14 years	2.90	2.48-3.20*
>=15 years	1 (Reference category)	
Type of school (government)	1.06	0.93-1.22
Nutritional status		
Under nourished (BMI <-2SD)	1.30	1.11-1.52*
Normal	1 (Reference Category)	
Overweight/ Obesity (BMI >1SD)	1.20	0.96-1.49

*P<0.05

DISCUSSION

School age is considered as a dynamic period of growth and development because children undergo physical, mental, emotional and social changes. In other words the foundations of good health and sound mind are laid during the school age period. Anemia is likely to compromise physical work capacity and cognitive functions of children and adolescents in the pubertal phase of development. Further, even mild anemia can have a deleterious effect on these functions. The adverse impact is especially aggravated if both under nutrition and anemia are present.

Adolescent girls are found to be at a higher risk for anemia in the current study. There was no gender difference noticed in the prevalence of anemia till the age of 11. The burden of menstrual blood loss, normal or abnormal, might be precipitating the crises. The age group of 11-15 is having higher risk of developing anemia, as demand for iron would be more during the period due to rapid growth spurt. A number of factors might influence both weight status and iron deficiency, including socioeconomic variables, physical activity and diet.

Iron status is a continuum from iron deficiency with anemia, to iron deficiency with no anemia, to normal iron status with varying amounts of stored iron. Iron deficiency anemia represents the extreme low end of the spectrum of iron status. The hemoglobin concentration is a surrogate indicator of the amount of iron in circulation which is available for new RBC synthesis. Prevalence of anemia of 25–95% was seen in several studies across the Indian subcontinent among adolescents of 11-18 years age group.[2-8,17,18]

Several studies have found differences in the hemoglobin results estimated by different methods. Sahli's method of hemoglobin estimation has been used since long. The International Nutritional Anemia Consultive Group (INACG) and International Committee for Standardization in Hematology (ICSH) have recommended the Drabkins as the method of choice and have suggested that all other methods should be adjusted to be comparable to this method.[19] The principle in Sahli's method involves the conversion of hemoglobin to acid hematin and comparing visually the color developed with that of standard tinted glass. Hemoglobin value is directly read from the graduated hemoglobin tube. The Sahli's method has many disadvantages including subjective visual color comparison. It is not sufficiently accurate because it shows wide scatter in inter observers and intra observer results distribution.[20,21] Sahli's method had good sensitivity in detection of anemic individuals, but low specificity and high rate of false positive results, which may leads to diagnosing healthy individuals as anemic.[21,21]

Various studies showed that Sahli's method had lower haemoglobin values than the hemoglobin cyanide method. In a study by Kapil et al Sahli's method compared to Hemocue had underestimated hemoglobin concentration by 1.06gms/ dl.[22] Natarajan S et al had also found that results of lower hemoglobin by 0.386 gms/dl in capillary blood on comparing Sahli's method with the coulter auto analyzer.[23]

All the samples were processed by an experienced laboratory technician ensuring all precautions recommended for using Sahli's method. However due to the lack of specificity of the Sahli's method for diagnosing anemia, it would not be appropriate to comment on the higher prevalence of anemia obtained in the study.

WHO / UNICEF strongly advocate that when there is a prevalence of anemia above 40%, a universal supplementation is required and it is not cost-effective to screen children for anemia. This is in light of the fact that iron deficiency is almost universal when dealing with this magnitude of anemia. The findings from the current study justify the universal Weekly Iron and Folic Acid supplementation program for the school children in Kerala.

A properly conducted research study on the prevalence of anemia among adolescents in Kerala using a standardized technique for hemoglobin estimation, along with estimation of iron stores, is the matter of the hour. Such a study will help to formulate policies on iron supplementation programs at schools and also it would form a baseline for evaluating the anemia control interventions.

END NOTE

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Conflict of Interest: None declared

Cite this article as: Rakesh SR, Ashimsha A, Shanavas A, Surendran VE, Rakesh PS, Subhagan S, Salila K. Anemia among School Children in a Rural Area in Kollam District, Kerala. Kerala Medical Journal. 2014 Mar 25;7(1):4-8

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