

## A Hospital Based Study on Anemia Prevalence in Children of an Indian Island

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### Abstract

**Background:** Anemia is a major public health problem in India, affects all age groups but children and women in childbearing age group are the most vulnerable. However, data from hospital patients of Indian islands are not available. We aimed to study the prevalence of anemia among children aged 2-12 years of age attending a tertiary care hospital (India).

### Materials and Methods

A total of 444 children aged 2-12 years were enrolled in the study over six months from August 2015 to Jan 2016. A complete blood count was obtained by taking 2ml of blood using fully automated MINDRAY Hemat analyser-BC5800. Anemia was diagnosed according to the World Health Organization (WHO) standard for the given age. The data was analyzed and interpreted using descriptive and inferential statistics.

**Results:** Overall prevalence of anemia among the children 2-12 years of age was 32.21%. Severity wise, mild Anemia was the commonest (56.64%), while severe Anemia was rare. The prevalence of Anemia was slightly more among girls compared to boys although not statistically significant ( $p>0.05$ ). Both Anemia and mean Hemoglobin (Hb) was significantly associated with age ( $p<0.05$ ), however, they had no significant association with other demographic variables including gender or education of parents ( $p>0.05$ ).

### Conclusion

At current study, Anemia is common among the children of Andaman Nicobar (India), and affects boys and girls equally. Although mild anemia is very common, it remains asymptomatic and therefore goes unnoticed and untreated.

**Key Words:** Anemia, Children, India, Prevalence.

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## 1- INTRODUCTION

Anemia is a major public health problem all over the world. It occurs in almost all physiological age groups but preschool children, pregnant and lactating women are more severely affected. According to World Health Organization (WHO), globally, the highest prevalence of Anemia is in preschool children (47.4%). The prevalence of Anemia, in preschool children (0 to 4.9 years) in various WHO regions are variable with Africa (67.6%), and Southeast Asia (65.5%) occupying the top of the list. It is estimated that about 18 to 38 percent of the under 5 years old Iranian children are anemic (1). In India, 89 million preschool age children suffer from Anemia (2). As per the World Bank data, the prevalence of anemia among under 5 children, in India is 59 in 2011 (3). According to National Family Health Survey (NFHS-4) data, prevalence among children less than five years of age was reported to be 60% (4).

In developing countries, the most common cause of Anemia is nutritional; however, other factors like low birth weight, early cord clamping, maternal anemia, high rates of infectious disease including malaria, *Helicobacter pylori*, helminth infection, poverty, poor access to iron-rich foods and other nutritional deficiencies plays a role. The early years of life are one of the most critical stages of human development and any physical or psychological damage that causes sustained effects on other stages of human development (5-9). Iron deficiency anemia continues to be an overwhelmingly major cause of anemia in the early childhood and a major global health challenge (10, 12). Anemia in children has significant impact. Longitudinal studies consistently indicate that children who were anemic in infancy continue to have poorer cognition, school achievement and more behavior problems into middle childhood (13). As far as we know, there had been no such study on prevalence of

anemia in Andaman and Nicobar Islands (one of the seven union territories of India, are a group of islands at the juncture of the Bay of Bengal and Andaman Sea), so this study was done to know the burden of disease in these islands which will help us to create awareness among people about the problems of Anemia and health care providers in further management.

## 2- MATERIALS AND METHODS

The present prospective study was conducted after obtaining the approval from the Institute Ethical Committee. This study was conducted in the pediatrics outpatient department (OPD) of a teaching hospital located in a remote island of India over a period of 6 months (Aug 2015 to Jan 2016). The children (2-12 years age group), and their parents, who attended the OPD, were informed about the purpose and the method of the research and the voluntary nature of participation in the study verbally and in written form.

The children who returned after recovery from minor illness, for enrolment in the study were included. Informed written consent was obtained from the parents of each child after the study objective was explained. Information of socio-demographic particulars was obtained from the subject's mother using a pretested validated questionnaire. The details regarding social class, family income, occupation, education of the parents, birth order, birth interval and number of siblings was collected. The children who suffered from chronic illnesses and those below 2 years and above 12 years were excluded from the study. A total of 444 children of either sex were included. A 2 ml non-fasting blood sample was collected from each child from the antecubital vein into a heparinized Vacutainer by a trained phlebotomist. The sample was analyzed within 4 hours of blood sampling. A complete blood count was measured using fully automated MINDRAY Hemat

analyser-BC5800 (Mindray Medical International Limited, Shenzhen, China). Anemia was diagnosed as per the WHO cut off of Hemoglobin (Hb) level. Hb <11g/dL in 6-59 months, <11.5g/dL in 5-11years, and <12g/dL in 12-14 years age group. It was further classified into mild (if Hb-10-10.9g/dL in 6-59 months, 11-11.4g/dL in 5-11 years, 11-11.9g/dL in 12-14 years), moderate (if Hb-7-9.9g/dL in 6-59 months, 8-10.9g/dL in 5-14 years), and severe (if Hb < 7 g/dL in 6-59 months and < 8 g/dL in 5-14 years) (14). In order to study the association between Anemia and various demographic variables; Chi square test was applied. The mean Hb, was compared in different age groups using one way ANOVA test and a p- value < 0.05 was considered significant (IBM SPSS Statistics 23.0).

### 3- RESULTS

Two hundred seventeen of the children (48.87%) were male and 227 (51.13%) were female. A higher proportion (48.87%) of children was in the age group of 2-6 years. The children were distributed into various age groups as depicted in **Table.1**. A total of 143 (32.21%) children

were anemic and mild, moderate, and severe Anemia was found in 56.64%, 41.96%, and 1.40%, respectively (**Table.1**). The degree of Anemia based on sex distribution showed that both mild and moderate Anemia was more prevalent in girls (19.38% and 14.54%) compared to boys (17.05% and 12.44%) (**Table.2**); but the differences was not statistically significant. The highest prevalence of Anemia (43.9%) was in the 2-4 years age group. There was a significant association of Anemia with age;  $P < 0.01$  (**Table.3**).

No significant difference was found with regard to gender or parents' education and the prevalence of anemia. The mean Hb in boys and girls was found as 11.606 (1.064) g/dL and 11.584 (1.088) g/dL, respectively (**Table.4**). The mean Hb was lowest (11.017g/dL) in the 2-4 years age group and it progressively increased with increasing age, with the highest value of (12.171 g/dL) in the 10-12 years age group. The mean Hb, when compared in different age groups using one way ANOVA, showed a significant difference;  $p < 0.01$  (**Table.5**).

**Table-1:** Frequency distribution of anemia and demographic variables in the participants

Variables	Groups	Number (%)
Gender	Male	217 (48.87%)
	Female	227 (51.13%)
Age, year	2-4	107 (24.10%)
	4-6	110 (24.77%)
	6-8	94 (21.17%)
	8-10	81 (18.24%)
	10-12	52 (11.71%)
Anemia	No Anemia	301 (67.79%)
	Anemia	143 (32.21%)
	Mild Anemia	81 (56.64%)
	Moderate Anemia	60 (41.96%)
	Severe Anemia	2 (1.40%)
Education of Father	Illiterate	41 (9.23%)
	Literate	403 (90.77%)
Education of Mother	Illiterate	45 (10.14%)
	Literate	399 (89.86%)

**Table-2:** Frequency of Anemia in participants in the study by gender

Gender	Anemia				Total
	Absent	Mild	Moderate	Severe	
	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Male	152 (70.05%)	37 (17.05%)	27 (12.44%)	1 (0.46%)	217 (100)
Female	149 (65.64%)	44 (19.38%)	33 (14.54%)	1 (0.44%)	227 (100)
Total	301(67.79%)	81 (18.24%)	60 (13.51%)	2 (0.45%)	444 (100)

**Table-3:** Association between Demographic Variables and Anemia

Variables		Anemia		Total (n=400)	Chi-square	P-value
		No Anemia (n=301)	Anemia (n=143)			
Gender	Male	152 (70.0%)	65 (30.0%)	217	0.987	0.320
	Female	149 (65.6%)	78 (34.4%)	227		
Age, year	2-4	60(56.1%)	47 (43.9%)	107	18.368	0.001
	4-6	76(69.1%)	34 (30.9%)	110		
	6-8	58 (61.7%)	36 (38.3%)	94		
	8-10	64 (79.0%)	17 (21.0%)	81		
	10-12	43(82.7%)	9 (17.3%)	52		
Education of father	Illiterate	28 (68.3%)	13 (31.7%)	41	0.005	0.943
	Literate	273 (67.7%)	130 (32.3%)	403		
Education of mother	Illiterate	26 (57.8%)	19 (42.2%)	45	2.300	0.129
	Literate	275 (68.9%)	124 (31.1%)	399		

Association between demographic variables and Anemia was tested using Chi-square test. The results indicates that age was significantly associated with the Anemia ( $p < 0.01$ ). The other demographic variables such as gender, education of father and education of mother are not significantly associated with the Anemia ( $p > 0.05$ ).

**Table-4:** The comparison of Mean Hb (g/dL) values according to the various demographic characteristics in participants

Variables		Number (%)	Mean (standard deviation)	P-value
Gender	Male	217(48.87%)	11.606 (1.064)	0.831
	Female	227(51.13%)	11.584(1.088)	
Education of father	Illiterate	41(9.24%)	11.510(1.286)	0.597
	Literate	403(90.76%)	11.603(1.053)	
Education of mother	Illiterate	45(10.13%)	11.344(1.489)	0.100
	Literate	399(89.86%)	11.623(1.017)	

Comparison of Mean Hb (g/dL) values according to the various demographic characteristics using independent samples t-test. Gender, education of father and mother shows no significant difference in the mean Hb (g/dL) values ( $p > 0.05$ ).

**Table-5:** The comparison of Mean Hb (g/dL) among various age groups in participants

Age (years)	Mean (standard deviation)	Range	P-value
2-4	11.017( 1.142)	6.80 – 13.40	0.001
4-6	11.527(1.017)	7.10-14.90	
6-8	11.641(0.929)	9.30-13.40	
8-10	12.023(0.926)	8.30-14.10	
10-12	12.171(0.925)	10.00-14.20	

Mean Hb (g/dL) was compared among various age groups using one-way ANOVA. The result indicates that there is significant difference in the mean Hb(g/dL) among various age groups ( $p < 0.01$ ).

#### 4- DISCUSSION

In the present study the prevalence of Anemia in the 2-12 years old children, was estimated as 32.21%. DeMaeyer et al. (15) reported the worldwide prevalence of Anemia in 5-12 years old children to be 37%. Comparable values of 39.1% and 36.4% were reported in studies conducted in 271 children (7-14 years) in Asendabo town, Southwest of Ethiopia (16), and in Vietnamese (17) school age children. Zimmermann et al. reported a prevalence of 35% among rural school aged children in Morocco (18), while a high prevalence of 62.3% was found among 3,595 school children from Pemla Island and Zanzibar (19). The prevalence of anemia among pregnant women is 52 percent in developing countries and 22.5 percent in developed countries (20).

The various studies on prevalence of anemia, from India show values ranging from 41% to 66% (21-24). The variations in the prevalence of Anemia in different studies could be due to heterogeneity of the studied population, dietary habits, different nutritional status and incidence of worm infestation in a defined geographical area. The prevalence of Anemia, in this study was 43.9% in the 2-4 years age group and 30.9% in the 4-6 years age group. This corroborates with the WHO report of 47.4% prevalence in preschool children worldwide; while in Africa and Asia, the prevalence is estimated at 64.6%

and 47.7%, respectively (2). Iron deficiency anemia impairs the concentration of adolescent girls and reduces the academic achievement, self-efficacy and physical strength and increases the risk of infections. As per the National Family and Health Survey-4 (NFHS) (conducted during 2015-2016) data, the prevalence of Anemia in India; in children aged 6-59 months is 58.4%. In Andaman and Nicobar Islands (India) it is 49%. The higher prevalence of Anemia in preschool children may be attributed to poor maternal iron stores during pregnancy and lactation, rapid growth, delayed initiation of complementary foods and poor dietary intake of iron.

The most prevalent conditions were moderate and mild Anemia, probably because mild and moderate Anemia is usually asymptomatic, and may remain undetected and untreated (25, 26). This study showed a higher prevalence (43.9%) of Anemia, in the 2-4 years age group followed by 30.9% in the 4-6 years age group. A significantly higher prevalence of Anemia in the 1-3 years age group compared to 3-5 years age group was also reported in a study done on rural preschool children in Maharashtra (27). The prevalence of Anemia in males in this study was 30% and slightly higher 34.4% in females. A similar higher prevalence (54.4%) of Anemia in girls has been reported in a study done on adolescent school children in urban Kathmandu,

Nepal (28). In a study on prevalence of Anemia in school children of Kattankulathur, Tamil Nadu, a higher prevalence of Anemia was found in girls (29). Basu et al. also found a high prevalence of Anemia among girls in Chandigarh (30). The higher prevalence reported in the above studies is due to subjects in the adolescent age group who had increased iron requirement during the growth period and also recurrent menstrual blood loss. Although the literacy% among men and women, in these islands, is high at 84.1% and 88.5%, respectively (NFHS-4 data), the prevalence of Anemia among children is moderately high. Similar findings of no significant relationship of Anemia with literacy of parents, was also found in studies by Sabale et al. and Verma et al. (31, 32). The mean hemoglobin values were significantly ( $p < 0.01$ ) different between different age groups, however, no gender differentials were observed in the present study.

This study was limited with the fact that it is a descriptive study which reported the overall prevalence of Anemia and its severity. It included only the children who attended the Pediatric OPD during the study period and whose parents gave consent for enrolment. Secondly, being a cross sectional study, no causal effect relationship could be established. Chronically ill children were also not included which might have undermined the values. Further studies, to know the etiology of Anemia and appropriate interventions including awareness among people about diet rich in iron, folate and other micronutrients is needed.

## 5- CONCLUSION

The problem of Anemia, especially mild and moderate Anemia is common among the children of Andaman Nicobar Islands. It should be investigated further and appropriate health care delivery steps should be initiated which might help in the

improvement of cognition and learning process in children.

## 6- CONTRIBUTORS

RS, AD: planned the study; RS, NR wrote study protocol; RS, AD: collected the data; PV, NR, SR: analyzed and interpreted the data; NR, RS: wrote first draft of the manuscript. All authors approved the final draft.

**7- CONFLICT OF INTEREST:** None.

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