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Original Research

Prevalence of iron deficiency anemia in school going children

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***ABSTRACT*:**
Background: Iron deficiency is recognized as the primary cause of anemia worldwide, but the etiology of anemia is multifactorial, including nutritional habits, bioavailability of micronutrients, parasitic infections (e.g., malaria and helminth infections), inflammation, and genetic factors. **Aim of the study:** To study prevalence of iron deficiency anemia in school going children. **Materials and methods:** The present study was conducted in the Department of Pediatrics of the medical institution. For the study, we selected subjects from the local government schools. A total of 900 students within the age group of 5-14 years were enrolled in the study. The haemoglobin concentration of each student was measured by taking a finger-prick blood sample using a Hemocuehaemoglobinometer (Hemocue, angelholm, Sweden). **Results:** We observed that 59.45 % of subjects did not have anemia, 20.1 % subjects had mild anemia, 14.45 % subjects had moderate anemia and 6% subjects had severe anemia. The maximum no. of subjects were found in the age of 6 years (n=132) followed by 14 years (n=108). Boys comprised of 40% of the study population and girls comprised of 60 % population. Severe anemia occurred in 33 boys and 21 girls. Moderate anemia occurred in 46 boys and 84 girls. Mild anemia occurred in 71 boys and 110 girls. **Conclusion:** Within the limitations of the present study, it can be concluded that about 40 % of school children from the study population had anemia.
Keywords: Anemia, iron deficiency, anemic students

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INTRODUCTION

It is currently estimated that anemia affects one-quarter of the world's population. Most of this burden occurs in developing countries, particularly among pre-school–aged children and women of reproductive age. [1] Iron deficiency is recognized as the primary cause of anemia worldwide, but the etiology of anemia is multifactorial, including nutritional habits, bioavailability of micronutrients, parasitic infections (e.g., malaria and helminth infections), inflammation, and genetic factors. [2] In addition to tiredness and impaired cognitive performance, the consequences of anemia include reduced educational achievement and work capacity, increased mortality and morbidity from infectious

diseases, and poor pregnancy outcomes. [3] The pathophysiology of anemia is diverse and often multifactorial, and possible causes include genetic mutations in hemoglobin genes, acute and chronic blood loss, inadequate nutrients intake, and infectious processes. Of them, iron deficiency is assumed to be the major one. [4, 5] Previous studies have demonstrated that anemia was associated with adverse effects on individuals' well-being, and if left untreated, could cause impaired tissue oxygen delivery and may lead to fatigue, lethargy, concentration difficulty, impaired physical capacity, poor work performance, and even mental disorders. [6] Hence, the present study was conductedto study prevalence of iron deficiency anemia in school going children.

MATERIALS AND METHODS:

The present study was conducted in the Department of Pediatrics of the medical institution. The ethical clearance for the study was approved from the ethical committee of the hospital. For the study, we selected subjects from the local government schools. A total of 900 students within the age group of 5-14 years were enrolled in the study. Hemoglobin determination was done by laboratory technicians for the selected students in the school compound. The haemoglobin concentration of each student was measured by taking a finger-prick blood sample using a Hemocuehaemoglobinometer (Hemocue, angelholm, Sweden). A prick was made on the tip of the middle finger after the site was cleaned with disinfectant. The first drop of blood was cleaned off and the second drop (0.05 ml) was collected to fill the microcuvette which is then placed in the cuvette holder of the device (HemoCueHb 301+) for measuring hemoglobin concentration. The displayed hemoglobin value was then recorded. The technique is recommended by WHO for use in field surveys. The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

RESULTS

Table 1 shows the prevalence of anemia in children on the basis of age. We observed that 59.45 % of subjects did not have anemia, 20.1 % subjects had mild anemia, 14.45 % subjects had moderate anemia and 6% subjects had severe anemia. The maximum no. of subjects were found in the age of 6 years (n=132) followed by 14 years (n=108). Table 2 shows the prevalence of anemia in children on the basis of sex of children. Boys comprised of 40% of the study population and girls comprised of 60 % population. Severe anemia occurred in 33 boys and 21 girls. Moderate anemia occurred in 46 boys and 84 girls. Mild anemia occurred in 71 boys and 110 girls. The results on comparison were seen to be statistically significant ($p<0.05$).

Table 1: Prevalence of anemia in study population

Age (in years)	No anemia	Mild anemia	Moderate anemia	Severe anemia	Total
6	107	10	9	6	132
7	87	9	6	3	105
8	56	18	11	9	94
9	37	15	12	3	67
10	36	27	9	3	75
11	44	11	24	5	84
12	43	30	15	9	97
13	47	26	18	2	93
14	60	20	20	8	108
15	18	15	6	6	45
Total	**535 (59.45 %)**	**181 (20.1%)**	**130 (14.45%)**	**54 (6%)**	**900 (100%)**

DISCUSSION

In the present study, we observed that 59.45 % of subjects did not have anemia, 20.1% subjects had mild anemia, 14.45% subjects had moderate anemia and 6% subjects had severe anemia. The anemia was more commonly seen in girls as compared to boys. On comparing the results, we observed that the results were statistically non-significant. The results were compared with previous studies and results were consistent with previous studies.Achouri I et al [7] estimated the prevalence of anaemia among school children in Kenitra. The sample represents school

children of all educational levels and age ranged between 6-15 years. The level of hemoglobin, haematocrit, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration was measured in a group of 271 school children.

Table 2: Prevalence of anemia in children on the basis of sex of children

Sex	No anemia	Mild anemia	Moderate anemia	Severe anemia	Total
Boys	210	71	46	33	360 (40 %)
Girls	325	110	84	21	540 (60 %)
Total	**535 (59.45 %)**	**181 (20.1%)**	**130 (14.45%)**	**54 (6%)**	**900 (100%)**

The seric iron was assessed and anaemia was defined when hemoglobin < 11.5 g dL(-1). A questionnaire was developed to obtain information about the daily food consumption and socio-economic conditions. The prevalence of anaemia was 16.2%. The mean hemoglobin concentration was 12.53 g dL(-1) in boys and 12.52 g dL(-1) in girls. The results suggested that iron deficiency is an important determinant of anaemia in this population. There was a significant relationship between education of the mother and anaemia in children but not with the family income. They concluded that improving the economic status of the family, women education and health education about balanced animal and plant food consumption are recommended strategies to reduce the burden of anaemia. Hashizume M et al [8] et al investigated the prevalence of anaemia and iron deficiency and vitamin A status among school-aged children in rural Kazakhstan. Socio-economic and anthropometric information was collected from 159 school-aged children living in the Kzyl-Orda region of Kazakhstan. Blood samples were collected and the concentrations of haemoglobin (Hb), serum iron, serum ferritin (SF), erythrocyte protoporphyrin (EP), serum retinol and beta-carotene, total iron binding capacity (TIBC), transferrin saturation (TS) and other haematological indices were measured. Among the 159 children, the prevalence of anaemia and iron deficiency defined by the multiple criteria model (SF, TS and EP) was 27% and 13%, respectively. Nine per cent had iron-deficiency anaemia and 21% had serum retinol value < 1.05 micromol l(-1). Mean SF and serum iron concentrations and TS were significantly lower in anaemic children than in their non-anaemic peers, while TIBC and EP were significantly higher in children with anaemia. Hb was significantly correlated with serum iron and retinol concentrations. Serum retinol and SF concentrations and mean corpuscular volume were significantly correlated with Hb by multiple regression analysis. They concluded that anaemia among school-aged children in rural Kazakhstan appears to be related to iron indices and vitamin A status.

Abalkhail B et al [9] identified the nutritional habits and the prevalence of anaemia among school students in Jeddah. Data were collected from a sample of Saudi school children in Jeddah City from 42 boys' and 42 girls' schools during the month of April 2000. Data collection was done by an in-person interview to collect socio-demographic factors, nutritional habits, weight and height. Haemoglobin was measured in a sample of 800 students selected at random from both genders and different age groups. Anaemia was defined according to the new WHO cut-off levels for haemoglobin as: blood haemoglobin<11.5 g/dl for the 5-11 years boys and girls; <12.0 g/dl for 12-14 years boys and girls; <12.0 g/dl for 15+ girls and <13.0 g/dl for 15+ years boys. Anaemia was reported among 20.5% of school students. Anaemia was more prevalent among students of at least 12 years as compared to the younger age group. Also, anaemia was more marked among governmental school attendees and those born to low-educated mothers. Menstruating girls were at around double the risk of being anaemic than non-menstruating girls. Anaemia was associated with negative impact on school performance and was more marked among those who failed their exams as compared to students with excellent results. Skipping breakfast was reported by 14.9% of students and this habit did not differ by age, sex, body mass index or social class. Skipping breakfast was more marked among students with poor school performance as compared to those with very good or excellent results. Only

34.1% of anaemic school students were aware of being anaemic. Awareness was nearly equal in all age groups and social classes but girls were more aware of their anaemic status than boys. Iron deficiency anaemia appears to be prevalent among school students. At age 12 years and over, low social class and menstruating girls constitute the high-risk groups. Screening is recommended for high-risk groups and school health programs are crucial to improve students' nutritional habits, knowledge and awareness. Yang Z et al [10] estimated the prevalence of anemia among 9-, 12-, and 14-year old Chinese children and investigated the associated factors of anemia. Data was collected from a cross-sectional survey conducted in 26 provinces and 4 municipalities in mainland China. A total of 48,537 children aged 9, 12, and 14 years old were included in data analyses. Anthropometric measurements were conducted to obtain information about height and weight. Capillary blood was collected from the fingertip, and hemoglobin concentration was tested by HemoCue201+. Information about sleep duration, daily consumption of eggs, milk, and breakfast were obtained from a self-administrated questionnaire. The mixed-effects logistic regression model was applied to estimate the association between selected variables and risk of anemia. A total of 8.4% of participants were identified as being anemic; and the prevalence was higher in girls and rural children. Mixed-effects logistic regression analysis showed that children who were overweight, obese, and consumed eggs and milk every day had a lower risk of anemia. Spermarche, overweight/obesity, and having milk every day were associated with lower risk of anemia in boys, while menarche was found to be a risk factor and eating eggs every day to be a protective factor of anemia in girls. They concluded that anemia among 9-, 12-, and 14-year-old children is still high. Intervention programs of adding egg and milk into school daily diet might contribute to reducing anemia in Chinese school aged children, especially for those living in rural areas or girls with menarche.

CONCLUSION

Within the limitations of the present study, it can be concluded that about 40 % of school children from the study population had anemia.

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