

Hemoglobin Levels and Protozoan Parasitic Infection in School Children of Udaipur City (India)

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Abstract: A total of 220 healthy school children aged 12-18 years in Udaipur, were subjected to laboratory investigation of stool and hemoglobin blood levels. Low mean hemoglobin concentration was observed among 57 (25.9%) of the children who were positive for intestinal protozoan parasites. The higher infection rate suggests the presence of infection from environmental sources and a public health problem. *Entamoeba histolytica* was the commonest pathogenic parasite followed by *Giardia intestinalis* and their high infection rate seemed to be associated with lower hemoglobin level. The study design allowed the assessment of hemoglobin levels before and after treatment with metronidazole. It was concluded that screening for parasitic infection especially among anemic children is necessary as a part of the general health care program.

Keywords: Protozoan parasites, school children, hemoglobin concentration.

Introduction

Iron-deficiency anemia is a major public health problem all over the world, particularly in the developing countries [1]. Malnutrition in addition to infection with protozoan or helminth parasites alone or the combination of both is generally regarded as the major underlying factors. It was shown that severe infection, with *Giardia intestinalis* is associated with iron-deficiency anemia [2]. However several studies have recorded that the most common mineral deficiency in nutritional anemia is iron deficiency [3-4]. Iron deficiency anemia is considerably more prevalent in developing countries than in the industrialized world, and young children are more affected than adults with an estimation global prevalence of 43% [5]. There is some evidence that a number of protozoan parasites can interfere with the absorption of some nutrients particularly if the worm burden is high [6]. Contrary to this, some investigators have reported no significant hematological alterations due to single protozoan infection, but only in case of major structural and functional abnormalities of the small intestine [7-8]. Epidemiological studies dealing with iron-deficiency anemia caused by protozoan parasites are few among school children in India. In India, few studies made so far mainly deal with helminthes parasites [9-11]. Thus, evidently there is dearth in information about anemia in relation to

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protozoan infection among school children in India.

The present study is undertaken to focus on the effect of the three common infectious species namely: *E. histolytica*, *G. intestinalis* and *E. coli* in relation to hemoglobin concentration among school children of Udaipur.

Materials and Methods

Two hundred twenty school children ranging in age from 12 to 18 years comprised of 137 boys and 83 girls were recruited for stool and blood examination. Stool samples were examined microscopically by the direct smear method with physiological saline and Lugol's iodine staining. A minimum of one negative specimen from every 10 samples was taken at random and examined by formal ether concentration method. From the infected and non infected children, one blood sample was collected prior and post-treatment with metronidazole (an anti-protozoan drug). The consent of the health and education authority, school teachers and parents were obtained before undertaking the study. Each child was interviewed, sex, age, socio economic status and laboratory investigation of blood and stool. pre- and post treatment blood samples were collected in sterile EDTA tubes, mixed and processed within 1-2 hour. Hemoglobin concentration was measured by Shale's hemoglobin meter, standardized at 12 g/dl blood after 5 minutes. School children with hemoglobin level below 12 gm/100 ml were considered anemic [1]. Data was analyzed using t – test to calculate the prevalence of anemia and parasite, thus probability level was fixed at 1%, 5%.

Result

Pretreatment:

The overall mean hemoglobin values among 220 school children were lower (10.50 ± 0.97 g/dl) than the recommended values, (12 g/dl) [1]. In uninfected children (n=162) the mean hemoglobin level was 10.90 ± 0.92 g/dl whereas in the group infected (n=48) with protozoan parasites, the mean hemoglobin value was 10.61 ± 0.71 g/dl (Table 1). From the above data there is evidence that even uninfected children have low hemoglobin level and there was difference in the hemoglobin levels of infected and uninfected children.

Among the different protozoan infection, 21 children infected with *E. histolytic* showed mean hemoglobin value of 9.52 ± 0.83 g/dl (Table 2), within this group boys (n=7) showed a mean of 9.50 ± 0.90 g/dl and girls (n=14) 9.55 ± 0.76 g/dl (Table 2). 15% of the children had anemia. Children infected with *G. intestinalis* have shown a mean hemoglobin level of 11.90 ± 0.44 g/dl and 12% of the children had anemia. However, the children harboring *E. Coli* showed mean hemoglobin level of 10.55 ± 0.57 g/dl and

10.26±1.16 g/dl in boys and girls respectively. In the case of mixed protozoan infection the mean hemoglobin value for boys was 9.42 ± 0.47 g/dl and for girls was 8.46 ± 1.07 g/dl (Table 2). 70% of the children were anemic. Among the children harboring double infection (protozoa + helminthes) the mean hemoglobin values was 8.96 ± 0.96 g/dl (Table 3). 75% of children in this group were anemic children harboring mixed protozoan infection (Table 2) as well as double infection (Table 3) showed a statistically significance decrease in the mean hemoglobin values.

Table (1): Pretreatment mean hemoglobin values ± SD in the overall infected and uninfected children with protozoan parasites in Udaipur.

Mean hemoglobin ± SD (g/dl)			
	Boys(n)	Girls(n)	Total
Study group	11.01 ± 1.01 (137)	10.02 ± 0.95 (83)	10.5 ± 0.97 (220)
Uninfected Children	10.85 ± 0.91 (109)	10.95 ± 0.93 (53)	10.9 ± 0.92 (162)
Infected Children	10.35 ± 0.70 (23)	10.87 ± 0.72 (25)	10.61 ± 0.71 (48)

Post treatment:

In general, the mean hemoglobin level was shown a rise after treatment and the difference in the mean hemoglobin levels between pre-treatment and post-treatment were found to be significant (Table 2&3). One month after treatment with metronidazole, blood samples were collected from all infected children. After treatment the hemoglobin level of children became almost normal (Table2&3). The mean hemoglobin level before treatment was significantly lower than in individuals treated with metronidazole ($t=2.31$, $p<0.05$) and the difference in hemoglobin concentration between pre-treatment and post-treatment was statistically significant in all children for the group with single protozoan infections, significant statistical differences between pre-treatment and post-treatment hemoglobin level concentration were observed only children with *E. histolytic*, ($t=3.05$ and 6.1 , $p<0.05$) as well as males infected with *G. intestinalis* ($t=2.45$, $p<0.01$) (Table2).

However, with mixed protozoan infections there was significant statistical differences in hemoglobin level concentration between pre-treatment and post-treatment ($t=5.23$ and 6.48 , $p<0.05$) (Table2). Among the group with double helminthes and protozoan infections only in case of males there was

a significant statistical difference in the hemoglobin level concentration ($t=5.64$, $p<0.05$) (Table3).

Table (2): Pre and post treatment mean hemoglobin values \pm SD in protozoan infection in school children of Udaipur

Species	Sex	Pre treatment Mean \pm SD	Total Mean	Post-treatment Mean \pm SD	t-calculation & Probability
<i>E.histolytica</i>	Male (n)	9.5 \pm 0.90 (7)	9.52 \pm 0.83 (21)	11.5 \pm 1.15	3.05**
	Female (n)	9.55 \pm 0.76 (14)		11.65 \pm 1.03	6.13**
<i>E. coli</i>	Male (n)	10.55 \pm 0.57 (4)	10.40 \pm 0.85 (7)	12.10 \pm 0.97	2.38
	Female (n)	10.26 \pm 1.16 (3)		12.33 \pm 1.03	1.88
<i>G. intestinalis</i>	Male (n)	11.0 \pm 0.64 (6)	11.9 \pm 0.44 (11)	11.73 \pm 0.18	2.45*
	Female (n)	12.8 \pm 0.24 (5)		12.5 \pm 0.70	0.83
Mixed protozoan infection	Male (n)	9.42 \pm 0.47 (6)	8.94 \pm 0.77 (9)	12.18 \pm 0.78	5.23**
	Female (n)	8.46 \pm 1.07 (3)		12.46 \pm 0.61	6.48**

*, ** Significant at 5% and 1% level respectively

Table (3) Pre and post treatment mean hemoglobin values \pm SD in double infection with helminthes and protozoan parasites among school children of Udaipur

sex	Pre treatment Mean \pm SD	Total Mean	Post- treatment Mean \pm SD	t-calculation & Probability
Male (n)	8.93 \pm 0.93 (6)	8.96 \pm 0.96 (9)	11.7 \pm 0.75	5.64**
Female (n)	0.9 \pm 1.0 (3)		11.0 \pm 0.1	2.0

*, ** Significant at 5% and 1% level respectively

Discussion

The present study showed that children suffering from protozoan parasitic infection have significant hematological disturbance, as manifested by the low hemoglobin level indicating the presence of anemia, compared to control subjects. However, several investigators have reported lower levels of hemoglobin among young children [12-13]. They showed that children infected with pathogenic intestinal parasites in different age groups and on the whole have an apparent higher prevalence of anemia than those of non infected children. An association between the high prevalence of *E. histolytica* and *G. intestinal* with anemia was observed in school children. It was reported that patients with giardiasis and children harboring mixed protozoan infection as well as double infection (protozoan + helminthes) showed comparatively low hemoglobin level than those having single infection [14-15]. The anemia in this present study could be attributed to double and mixed parasitic infections. The prevalence of anemia in children under three years of age was found to be 70 % in Punjabi and 62.8 % in India [16]. The present study indicated that following anti-protozoan treatment significant improvement was reported in the hemoglobin levels of most of the children with single and mixed protozoan infection.

The health status of school children of Udaipur was very poor as illustrated by 65% of children having anemia. However, the low hemoglobin levels which were found in both the infected and non-infected children probably indicate nutritional anemia rather than anemia of parasitic origin. Similarly, it was reported 62% of school children in Zanzibar have anaemia due to iron deficiency [17].

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