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Discussion:

In the present study the prevalence of anemia has been reported among school children with single species infected with these parasites especially *G. intestinalis* have shown a significant low hemoglobin level. However, several investigators have reported anemia in the children with *G. intestinalis* infections, Scott, 1982, Dacie and Lew , 1984, especially for older children. United nation Relief and works Agency (Yip *et al*, 1990) reported the high prevalence rate of iron deficiency anemia due to deficiency of iron intake and parasitic infection among infants and young children in west-bank and Gaza Strip. Hammouda *etal* (1986) showed the highest prevalence of both *G. intestinal* and anemia among children in Saudi Arabia. Anemia among school going children in Gaza Strip could be attributed to single as well as double parasitic infection similarly in Arab Gulf countries medical surveys revealed that the prevalence of anemia among school children could be attributed to parasitic infection and low intake of iron (Musaiger,1990). Post-treatment results of the present study indicated that following treatment with metronidazole had showed that significant improvement in the hemoglobin level of most of the children with single and double infections protozoan and helminthes parasites.

In conclusion, the prevalence of the disease associated with parasites infections has been shown to have a negative impact on iron status of school children in these population.

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post treatment

After one month following antiprotozoan treatment with metronidazole blood samples were collected from all the infected children . Mean hemoglobin values of boys and girls after one month post treatment are presented in (Table 2&3). In general the mean hemoglobin after treatment showed rise and the difference in the mean hemoglobin values of pre and post-treatment children was found to be significant($t= 3.41, p<0.05$).

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

sex	Pre treatment Mean $\pm$ SD	Total Mean	Post- treatment Mean $\pm$ SD	t-calculation & Probability
Male (n)	11.8 $\pm$ 2.49 (5)	11.15 $\pm$ 1.6 (7)	12.6 $\pm$ 1.34	1.26
Female (n)	10.50 $\pm$ 0.71 (2)		13.0 $\pm$ 1.41	2.24**

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

However , there was a gradual increase in the hemoglobin levels from the first month. After treatment ,mean hemoglobin levels, of boys and girls were 12.71 ± 0.76 g/dl and 12.75 ± 1.04 g/dl respectively (Table 2) . Similarly the group of children with double infection with helminthes and protozoan infections , only females have shown a significant statistical difference between the pre and post-treatment ($t= 2.24, p<0.05$) Table 3 . There is no statistical difference in single infection of *E. histolytica* and *G. intestinal* in the hemoglobin concentrations of the children whereas only female infected with *G. intestinal* showed significant statistical difference in the hemoglobin concentrations after treatment ($t= 5.34, p<0.05$) Table 2 .

value 10.33 ± 0.58 and girls ($n=14$) showed mean 11.50 ± 0.71 g/dI (Table 2). 21% of the children had anemia. Among children infected with *G. intestinalis* mean hemoglobin values was 12.16 ± 1.22 g/dI and 19% of children had anemia. The mean hemoglobin values of boys and girls were 12.71 ± 1.25 g/dI and 11.62 ± 1.19 g/dI respectively (Table 2). Children exhibited double infection with protozoan and helminth parasites have shown mean hemoglobin values 11.5 ± 1.6 g/dI and 25% of children had anemia.

**Table(2) Pre and post treatment mean hemoglobin value $\pm$ SD
in protozoan infection in school children of Gaza strip.**

Study group	sex	Pretreatment Mean $\pm$ SD	Total Mean	Post- treatment Mean $\pm$ SD	t-calculation & Probability
E. histolytica	Male (n)	10.33 ± 0.58 (12)	10.91 ± 0.64 (26)	10.67 ± 0.58	1.0
	Female (n)	11.5 ± 0.71 (14)		12.0 ± 0.00	1.0
G.intestinalis	Male (n)	12.71 ± 1.25 (7)	12.16 ± 1.22 (15)	12.71 ± 0.76	0.00
	Female (n)	11.62 ± 1.19 (8)		12.75 ± 1.04	5.34*

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

Within this group, boys ($n=5$) showed a mean of 11.8 ± 2.49 g/dI and girls ($n=2$) showed only 10.50 ± 0.71 g/dI (Table 3). However, different in the mean hemoglobin level between those harbouring single protozoan infections didn't show any statistical significance, whereas children harbouring double infection have shown statistical significance.

100 ml blood after 5 minutes. School children with hemoglobin level below 12 gm/ 100 ml were considered anemic (WHO,1975). Data was analyzed using T–test to calculate the prevalence of anemia and parasite and probability level was fixed at 1% , 5% .

Result

post treatment

Forty one children out of the 85 infected cases with different intestinal parasites harbored protozoan infections show hemoglobin values ranged from 9.0 to 12g/dl with mean 11.51 ± 0.93 g/dl . Within this group boys (n=19) showed a mean value 11.5 ± 0.91 g/dI whereas girls discerned mean value 11.4 ± 0.95 g/dI (Table 1). Thus 63% of the children showed normal hemoglobin level and 37% were found to be anemic. The sex did not however , show any statistical significant difference in mean hemoglobin levels .

Table(1) Pretreatment mean hemoglobin values $\pm$ SD in the overall uninfected and infected children with protozoan parasites in Gaza strip.

Mean hemoglobin $\pm$ SD (g/dI)			
	Boys(n)	Girls(n)	Total
Study group	11.91 ± 1.75 (130)	11.51 ± 1.51 (120)	11.53 ± 1.63 (250)
Uninfected Children	12.1 ± 1.83 (86)	11.95 ± 1.21 (79)	12.02 ± 1.52 (165)
Infected Children	11.47 ± 0.91 (19)	11.56 ± 0.95 (22)	11.51 ± 0.93 (41)

26 children out of 41 children infected with protozoan parasites, carried single infection with *E. histolytic* showing mean hemoglobin value 10.91 ± 0.64 g/dI. Between this group, boys (n=12) showed a mean hemoglobin

school going children are major. In Gaza Strip, the high risk groups for anemia were defined as pre-school children (Abed Y. 1993). Anemia studies focused mainly on the estimation of the prevalence of anemia among this sector of Gaza strip population (Abed, 1979 ,Yip *et al* 1990). Few unpublished studies describe the prevalence of parasites as one of the risk factors for anemia. Thus, it is evident that there exists dearth information on anemia in relation to protozoan infection among school children in Gaza Strip.

The present study therefore

focuses on the effect of the two common protozoan parasitic infections (*E. histolytic* and *G. intestinalis*) on hemoglobin concentration among school children of Gaza Strip. The study design allowed assessment of hemoglobin levels before and after treatment.

Material and methods:

Blood samples were collected from the study population of 250 school children ranging in age from 11 to 17 years, comprising 41 infected with protozoan parasites and 165 uninfected subjects. Samples were collected before and after anti protozoan treatment. The consent of the school teachers, ministry of Education , health authorities and parents was obtained before undertaking the study, each child was interviewed, height and weight and laboratory investigation of blood and stool samples were recorded. Post-treatment blood samples were taken into sterile EDTA tubes, mixed and processed within 1-2 hours . Hemoglobin concentration was measured by Sahli's hemoglobinometer with a standard of 12 gm/

Biochemical Estimation of Hemoglobin Level in protozoan Infected and Treated School Children in Gaza strip – Palestine.

Abstract : Two hundred fifty school going children aged (11-17) years old were examined for intestinal parasites. Forty eight (19.2%) children were infected with protozoan parasites (*Entamoeba histolytica* and *Giardia intestinalis*). Pretreatment and post-treated blood samples were collected from the same population of the infected children for the estimation of hemoglobin levels. Hemoglobin was estimated using Sahli's hemoglobinometer. *Giardia* infected female children showed statistical significant difference in the pre and post treatment mean hemoglobin levels. The higher infection rate of commensally strongly suggests the presence of potentially infections and a public health problem. This relationship remained after controlling the range of socio-economic variables. Protozoan infected children were frequently found to have lower blood hemoglobin concentration than uninfected children, but this relationship could not be attributed to protozoan infections alone.

Keywords: Hemoglobin Concentration, School Children, *E. histolytic*, *G. intestinalis*.

Introduction:

Human protozoan parasites can lead to structural and functional abnormalities of the proximal small intestinal (Tewari and Tandon,1974). However, several studies have recorded that the most common mineral deficiency in nutrition anemia is iron deficiency (Hercberg *etal*,1988). It is a serious public health problem and most prevalent in world population (WHO,1975). Establishment of a reference for the iron-deficiency anemia caused by protozoan parasitic infections in Gaza Strip especially among

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