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Impact of Giardiasis on Hematological Profile of Infected Children

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Giardiasis is a gastrointestinal disease caused by protozoan parasite *Giardia intestinalis*. It is known to infect a wide range of mammals including humans. The present study was carried out to study the impact of Giardiasis on hematological parameters of children in district Anantnag of Kashmir valley, India. The study was carried out on 268 children of both gender whose stool samples were processed through Direct Smear method and Formol Ether concentration technique. After confirming their results for Giardiasis, certain examinations of blood parameters were then carried out for 44 children which included total leukocyte count, differential leukocyte count, Hemoglobin and hematocrit values. Hemoglobin value and hematocrit values were estimated by Sahli's Acid Hematin method and Wintrobe's method, respectively. The white blood cell (WBC) count was done with the help of hemocytometer and differential counting was done by using Leishmann's staining method. Finally data was analysed by Minitab software and Student's t-test was used to determine the significance of difference between mean values in each group. The results showed a significant decrease in mean values of hemoglobin from 11.15 ± 1.23 to 10.05 ± 2.04 in males and 11.36 ± 1.15 to 10.08 ± 0.80 in females. The mean values of hematocrit also showed a decrease in their values between infected and uninfected children from 36.2 ± 1.72 to 32.6 ± 2.80 in males and 36.14 ± 1.19 to 32.22 ± 1.62 in females. In case of WBC count, a significant increase in the total number of WBCs was observed in case of infected children from 7.96 ± 0.33 to 9.38 ± 0.61 . With respect to differential leukocyte count, eosinophils showed a marked increase in their number in infected individuals (5.0 ± 0.71) in comparison to uninfected ones (3.2 ± 0.44) while slight differences were noticed in case of other white blood cells which were not statistically significant. The results showed that Giardiasis is responsible for decrease in hemoglobin and hematocrit values and increase in total leukocyte count in infected children.

Key words: Giardia, hematology, hematocrit, leukocyte count, anaemia

INTRODUCTION

Giardiasis is considered a disease of public health concern due to its common occurrence as well as due to its nutritional consequences¹. It causes a self limiting disease, with most of the infections being asymptomatic. However, in symptomatic individuals it is associated with malabsorptive diarrhea². It causes malabsorption of carbohydrates, fats and vitamins which may be partly responsible for failure to thrive^{3,4}. It causes poor cognitive and psychomotor development in children by causing micronutrient deficiencies like those of iron, zinc etc⁵. *Giardia* is known to cause iron-deficiency anaemia in children by causing vitamin B12 and foliate deficiencies⁶. In Kashmir valley, the epidemiological studies on the prevalence of *Giardia* have been carried out by various workers⁷⁻⁹ but its impact on various hematological parameters of infected children has not been yet evaluated here. The present study aims to fully characterize the effect of Giardiasis on some erythrometric and leucometric parameters of infected children like hemoglobin value, packed cell volume, total leucocyte count and differential leucocyte count. Thus the findings of this study will help in strengthening the information available so far and encourage policy makers to formulate effective to design effective strategies to combat *Giardia* infection in study area.

MATERIALS AND METHODS

The present study was carried out from August, 2014 to July, 2015. A total of 268 stool samples were collected from children aged 5-15 years belonging to both the gender and processed by Direct Smear method¹⁰ and Formol Ether concentration technique¹¹. About 1.5 mL of blood were drawn with the help of sterile disposable syringes and collected in labeled sterile EDTA tubes from 44 children (22 infected and 22 uninfected) after ascertaining their positive and negative results for Giardiasis through stool examination. Examination of blood was done to estimate Hb value, PCV, TLC and DLC. Estimation of Hb value and hematocrit was done by Sahli's acid hematin method and Wintrobe's method¹², respectively. The WBC count was done with the help of hemocytometer¹³ (Sigma Aldrich, St. Louis, Mo, USA) and differential counting was done by using Leishmann's staining method¹³.

Statistical analysis: Data was analyzed using a Minitab statistical program. The differences were considered to be significant when the p-value obtained was found to be less than 0.05.

RESULTS

Realizing the burden of Giardiasis on human health, the effect of such parasitism on various hematological parameters like Hemoglobin value, TLC, DLC and was studied. The results revealed that there is decrease in hemoglobin and hematocrit values in infected children while there is increase in total leukocyte count in infected children. The data on hematological values of infected and uninfected children is shown in Table 1-2.

Hemoglobin and hematocrit value: The mean values of hemoglobin and hematocrit were found to be significantly ($p < 0.05$) lower in infected children than in uninfected ones (Table 1). The reason for this decrease is probably due to the fact that *Giardia* adheres to intestinal cells and causes malabsorption of various vitamins and essential nutritional elements required for formation of various blood constituents^{14,15}.

Total leukocyte count and differential leukocyte count: The total leukocyte count showed a positive correlation with the prevalence of infection.

The total leukocyte count increased significantly ($p = 0.02$) in infected children (9.38 ± 0.61) in comparison to uninfected children (7.96 ± 0.33) so as to combat the infection (Table 2). While studying the differential leukocyte count, significant increase ($p = 0.009$) in the number of eosinophils was observed in infected individuals (5.0 ± 0.71) compared to uninfected ones (3.2 ± 0.44). The number of neutrophils and basophils also showed a slight increase. While lymphocytes and monocytes showed a slight decrease in their number. The increase in different leukocytes may be due to the natural immune response generated against the infection and the greater increase in eosinophils is probably due to the fact that they are primarily involved in dealing with parasitic infections. Giardiasis is known to cause the zinc deficiency which results in decline in the number of lymphocytes^{16,17}.

DISCUSSION

Parasitic infections and nutritional deficiencies caused by them are the major public health problems in developing countries. So this study was aimed to evaluate the impact of *Giardia* infection on various hematometric and leucometric parameters in infected children. The study revealed a decrease in hemoglobin values in children infected with Giardiasis and these results are in conformity with that of Hegazy *et al.*¹⁸,

Table 1: Mean values ($\pm$ SD) of Hemoglobin and hematocrit in infected and uninfected children

Types	Hb value (g dL ⁻¹)		PCV (%)	
	Male	Female	Male	Female
Uninfected	11.15 $\pm$ 1.23	11.36 $\pm$ 1.15	36.2 $\pm$ 1.72	36.14 $\pm$ 1.19
Infected	10.05 $\pm$ 2.04	10.08 $\pm$ 0.80	32.6 $\pm$ 2.80	32.22 $\pm$ 1.62
p-value	0.04		0.02	

Table 2: Leukocyte count in infected and uninfected children

	Uninfected (mm ⁻³)	Infected (mm ⁻³)
TLC (x10 ³)	7.96±0.33	9.38±0.61
Neutrophil (%)	55.60±1.94	56.00±0.71
Lymphocyte (%)	35.60±1.81	33.80±1.92
Monocyte (%)	4.40±0.54	3.80±0.84
Eosinophil (%)	3.20±0.44	5.00±0.71
Basophil (%)	1.20±0.44	1.40±0.54

who noticed a significant decrease ($p<0.05$) in mean values of hemoglobin in case of children suffering from parasitosis in Damanhur, Egypt as compared to uninfected ones. Alzain and Sharma¹⁹ also reported a significant hematological disturbance among children suffering from protozoan infection and after anti-protozoan treatment there was a significant increase in hemoglobin values of infected children. These results are also in good agreement with those of Hama and Rahemo²⁰, who showed that the mean values of Hb and hematocrit were significantly lower in children infected with protozoan parasites with the lowest values in those infected with *Blastocytis hominis* and *Giardia lamblia*. Oguntibeju²¹ also noticed a significant association between parasitic infection and various hematological parameters (Hb, PCV, MCHC) from his studies in Lesotho, South Africa.

The findings regarding leukocyte counts are supported by Al-Haboobi *et al.*³, who noticed an increase in the number of WBCs in children infected with different intestinal protozoa with the highest increase among the children infected with *Giardia lamblia* trophozoite. Among the various types of WBCs, eosinophils showed a significant increase in their number in infected children which is in conformity with our results. Al-Mosa and Al-Taie²² reported a significant increase in the number of WBCs and eosinophils among the patients infected with different intestinal parasites compared to the standard normal values. Onochie and Ekwunoh²³ on comparing the hematological parameters of pregnant women infected with various intestinal parasites noticed a significant increase in the number of eosinophils and platelets in infected ones. Tabatabaie *et al.*²⁴ noticed a significant decrease in the number of monocytes and lymphocytes in case of children infected with Giardiasis, however, no significant difference was observed in case of overall WBC count and other white cells between infected and uninfected ones.

CONCLUSION AND FUTURE RECOMMENDATION

The study revealed that the Giardiasis is responsible for decrease in hemoglobin and hematocrit values in infected children. There is also increase in total leukocyte count especially eosinophil count during the infection. Giardiasis is responsible for altering the hematology of infected children, thus causing health consequences.

The findings of this study should serve to re-emphasize the need to support and implement the programmes which are aimed at control of gastrointestinal protozoan parasites in different localities.

SIGNIFICANCE STATEMENT

This study discovers that Giardiasis results in decrease in hemoglobin and hematocrit values in infected children, thus reveal its negative impact on their growth. The findings of this study shall serve to re-emphasize the need to support and implement the programmes which are aimed at control of gastrointestinal protozoan parasites in different localities including the present study area.

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